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REPORT ON THE PREPARATORY ASSISTANCE
WITH A VIEW TO ESTABLISHING
AN AFRICAN IRON AND STEEL ASSOCIATION*

Prepared by

Jacques E. Astier
UNIDO Consultant

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MISSION REPORT ON THE PREPARATORY ASSISTANCE WITH
A VIEW TO ESTABLISHING AN AFRICAN IRON AND STEEL ASSOCIATION

INTRODUCTION

This report summarizes the main conclusions of a UNIDO survey in eight African countries (details given in annex 1). It should be read in conjunction with the general survey on IRON MINING AND THE IRON AND STEEL INDUSTRY IN AFRICA (1) which was the preparatory document for this mission.

The present report is subdivided into three parts:

- Appraisal of the disquieting situation of iron mining and the iron and steel industry in Africa;
- Examination of the various technical and economic possibilities available for the development of the iron and steel industry in Africa;
- Grounds for closer co-operation between the mining and iron and steel enterprises in Africa in order to assist development in this sector, particularly by the establishment of an African Iron and Steel Association.

I. SITUATION OF IRON MINING AND THE IRON AND STEEL INDUSTRY
IN AFRICA

This situation, which is examined or referred to in a wide range of UNIDO surveys (2), (3), (4), (5), (6), (7), (8), (9) and (10) and summarized in the document covered by the report (1), may be characterized in general terms by the following four points, starting downstream, i.e., iron and steel products and their use, and working upstream, i.e., raw materials and, specifically, iron ores:

1. CONSUMPTION OF IRON AND STEEL PRODUCTS IN AFRICA is, on average, very low (see figure 1 and table I) and is rising only very slowly, with "dips" which are often considerable. This reflects the slow rate of economic development in Africa. Although we shall not dwell on these well-known facts at this point, we shall return to them in connection with the possibilities that may arise (chapter II) and the solutions that may be recommended (chapter III).

2. STEEL PRODUCTION IN AFRICA is itself far lower than steel consumption, as can be seen from figure 1 and table I. Furthermore, despite the clear upswing, the levels achieved are still very low. Africa is thus a net importer of iron and steel products. It should also be noted that production is distributed as follows (1987, million tons):

Algeria	1,400	
Egypt	1,600	
Zimbabwe	<u>597</u>	
	3,597	i.e. 89 per cent for three countries

Followed by

Tunisia	188	
Nigeria	<u>184</u>	
	3,969	i.e. 98 per cent for five countries

And all others	<u>75</u>	
	4,044	

3. Consideration of production capacity indicates that it currently amounts to nearly 8.5 million tons, which clearly confirms the impression that most installations are not running at full capacity. An effort is thus required to increase production and enhance productivity in such facilities. It is interesting to note that the capacity can be broken down as follows:

- The four conventional integrated plants:

SIDER Algeria	2.0	
HADISOLB Egypt	1.5	
ZISCO Zimbabwe	1.0	
ELFOULADH Tunisia	<u>0.2</u>	
	4.7	i.e. 55 per cent of the total

- The three plants based on direct reduction:

ANSDK Egypt	0.75	
WARRI Nigeria	1.00	
MISURATA Libya	<u>1.30</u>	(currently starting up)
	3.05	i.e. 36 per cent of the total

- And all mini-plants 0.75 i.e. 9 per cent of the total
8.50

4. IRON ORE PRODUCTION, only a small part of which is intended for local use, IS DECREASING, indicating a reduction in Africa's share of the world trade in iron ore (see figure 2). Even though the latter has scarcely increased for some 10 years past, this relative reduction is worrying. It should also be noted that the commissioning of direct reduction units (particularly in North Africa), means that Africa is importing iron ore.

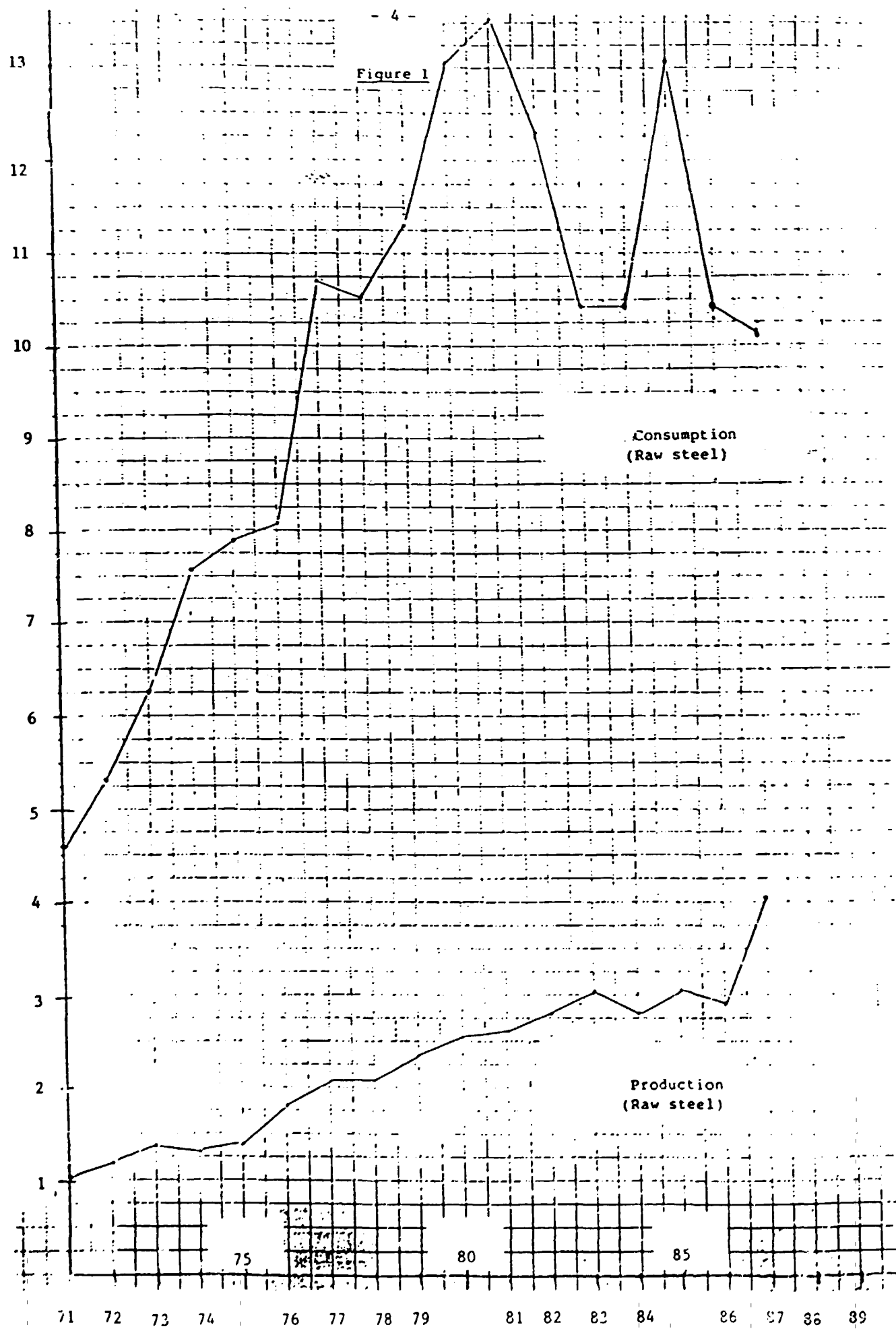
Table I

Comparison of population and steel production and consumption in Africa, India, Latin America, China and the rest of Asia*

	Africa	India	Latin America	China	Rest of Asia
Area (million km ²)	30.3	3.3	22.5	10	20
Population (millions)					
in 1987	600	800	450	1 100	990
by 2025	1 540	1 234	865	1 450	1 500
Steel consumption in 1987					
(million tons)	10.3	15.5	32.1	78.1	48.6
(kg/head)	17	19	71	71	49
Steel production in 1987					
(million tons)	4.0	13.1	39.6	56.0	31.0
(kg/head)	6.7	16.4	88	51	31.3

* I.e. excluding India and China, indicated separately, and also excluding Japan and Siberia (USSR).

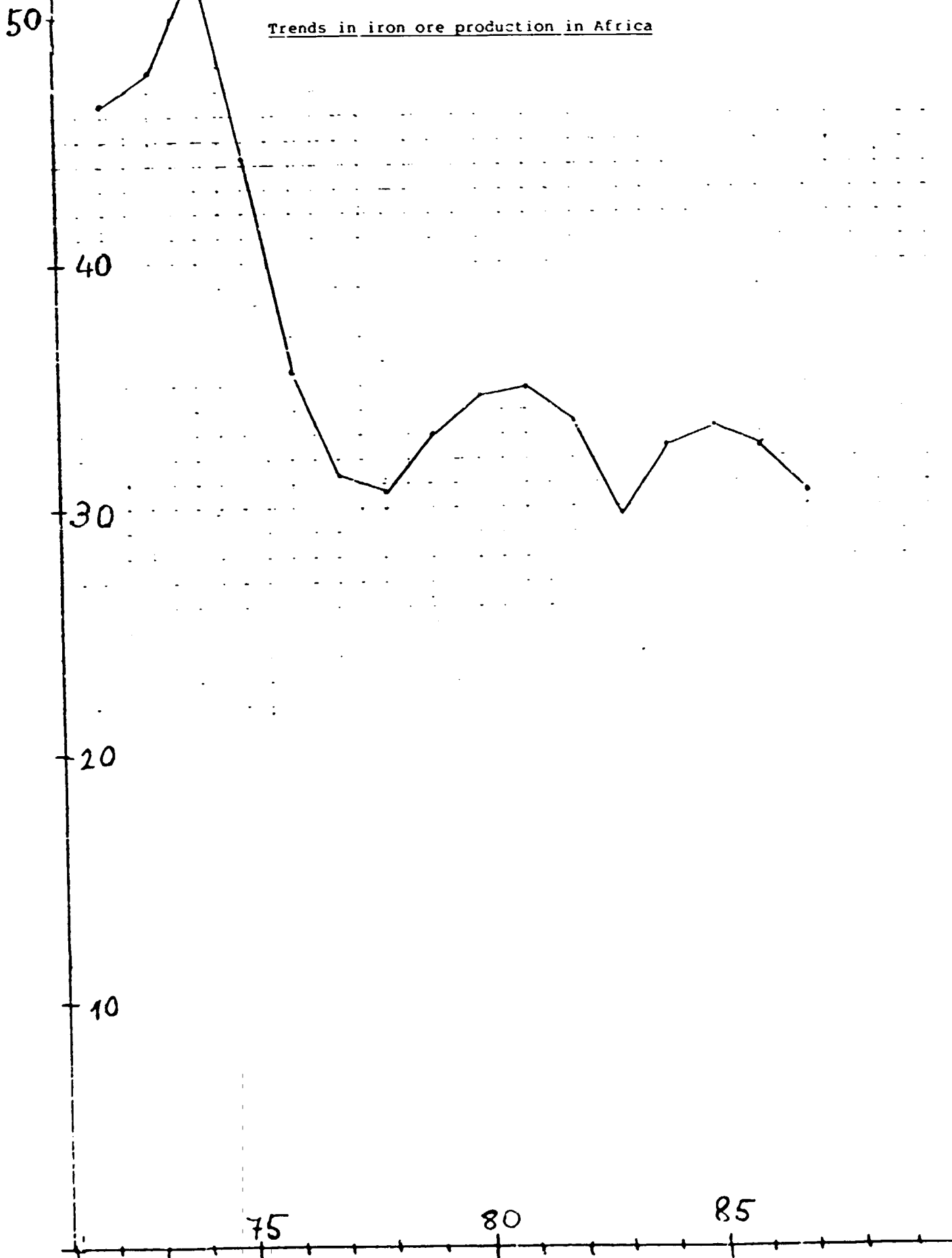
Figure 1



million tons
ore/year

Figure 2

Trends in iron ore production in Africa



II. THE VARIOUS TECHNICAL AND ECONOMIC OPTIONS OPEN TO THE IRON AND STEEL INDUSTRY IN AFRICA

The disquieting situation found, to varying extents, in every African country, must be examined in the constantly changing world context of iron ore mining, the iron and steel industry and the use of iron and steel products. It can be broken down into the following four components:

1. THE EVER ESSENTIAL ROLE OF IRON AND STEEL PRODUCTS in economic development is confirmed. There is increasing competition between steel and other materials but it is apparent that, although iron and steel products are being deprived of certain applications, they are finding alternative uses. In other words, there seems to us to be nothing to contradict the important role of steel in African development, as elsewhere.

This finding gives grounds for stressing the need, in Africa as in other places, to study the properties of iron and steel products with a view to improving them and better adapting them to their purposes. Such studies require considerable documentation and information on what is being done worldwide in this field.

2. The areas of steel production or, more accurately, iron and steel products are very varied and figure 3 clearly shows, in a highly schematic fashion, how a country or a given region may be supplied with iron and steel products on the basis of:

- Specifically, iron and steel products purchased abroad but processed or finished locally;
- Semi-finished products (bloom or billets) for rerolling;
- Primary metal (scrap, cast iron or reduced ore) in the case of what is known as a "semi-integrated" plant;
- Finally, iron ores in an integrated plant.

All these procedures which have, incidentally, been applied in various African locations, deserve the most careful investigation and comparison. However, what greatly concerns us here is that they offer numerous opportunities for regional co-operation and exchanges of products, semi-finished products or primary metals.

Furthermore, in future projects account must be taken of all these possibilities, particularly so as to avoid establishing patterns that are too cumbersome and too rigid and to promote flexible approaches that offer scope for development.

3. In these various approaches, THERE IS GREAT VARIETY IN IRON AND STEEL PROCESSES AND PARTICULARLY IN THEIR RAW MATERIAL REQUIREMENTS (especially ore and energy). Figure 4 offers a very general outline which shows that the two principal types of existing steel plant, designed around the oxygen converter and the electric furnace respectively, dictate the supply of primary metal, i.e.:

- Integration with molten cast iron production in the case of oxygen steel plants;
- A different choice of "solid" primary metals, such as scrap and reduced ores, even solid cast iron (in the form of pig or crystalline iron) in the case of electric steel plants.

This has considerable repercussions on the choice of metallurgical system and, above all, its future development if large-scale expansion is to be envisaged. However, all this must also be viewed against the background of the rapid development of iron and steel processes. We will only mention here the work done:

- In continuous casting, to produce slabs and, more generally, semi-finished products in a form as close as possible to that of the finished products;
- In the steel plant, to develop "mixed" processes using different proportions of cast iron and scrap (EOF, KS, etc.) and even to smelt scrap iron (or reduced ores?) without the need for electricity;
- In the field of direct reduction, particularly with hot briquetting, which makes it possible to transport reduced ores easily and safely;
- In the processing of cast iron, the attractiveness of the use of charcoal under certain conditions and, in addition, the new simultaneous reduction and fusion processes, such as COREX.

4. Finally, when we turn to IRON ORES, we find that there are two points of view which may be contradictory or complementary:

- Export of iron ore on the world market, as in the case of Mauritania or Liberia;
- Local use of iron ore for steel production, as in the case of Algeria, Egypt or Zimbabwe.

The common ground between these two viewpoints is that certain African iron and steel enterprises (see figure 5) are becoming iron ore importers.

To summarize, it is evident that existing or future African enterprises are faced with numerous possibilities and we believe it essential that they be well informed thereof with a view to their possible co-operation. In this connection one should note the role - well-known but always worth recalling - of the world market or, rather, markets for all the types of product we have mentioned. By way of example, figure 6 shows the position of a number of African enterprises, and indeed it extends to the iron and steel industry the data contained in figure 5 regarding iron ores.

Figure 3

Transformation and end-use of iron and steel products

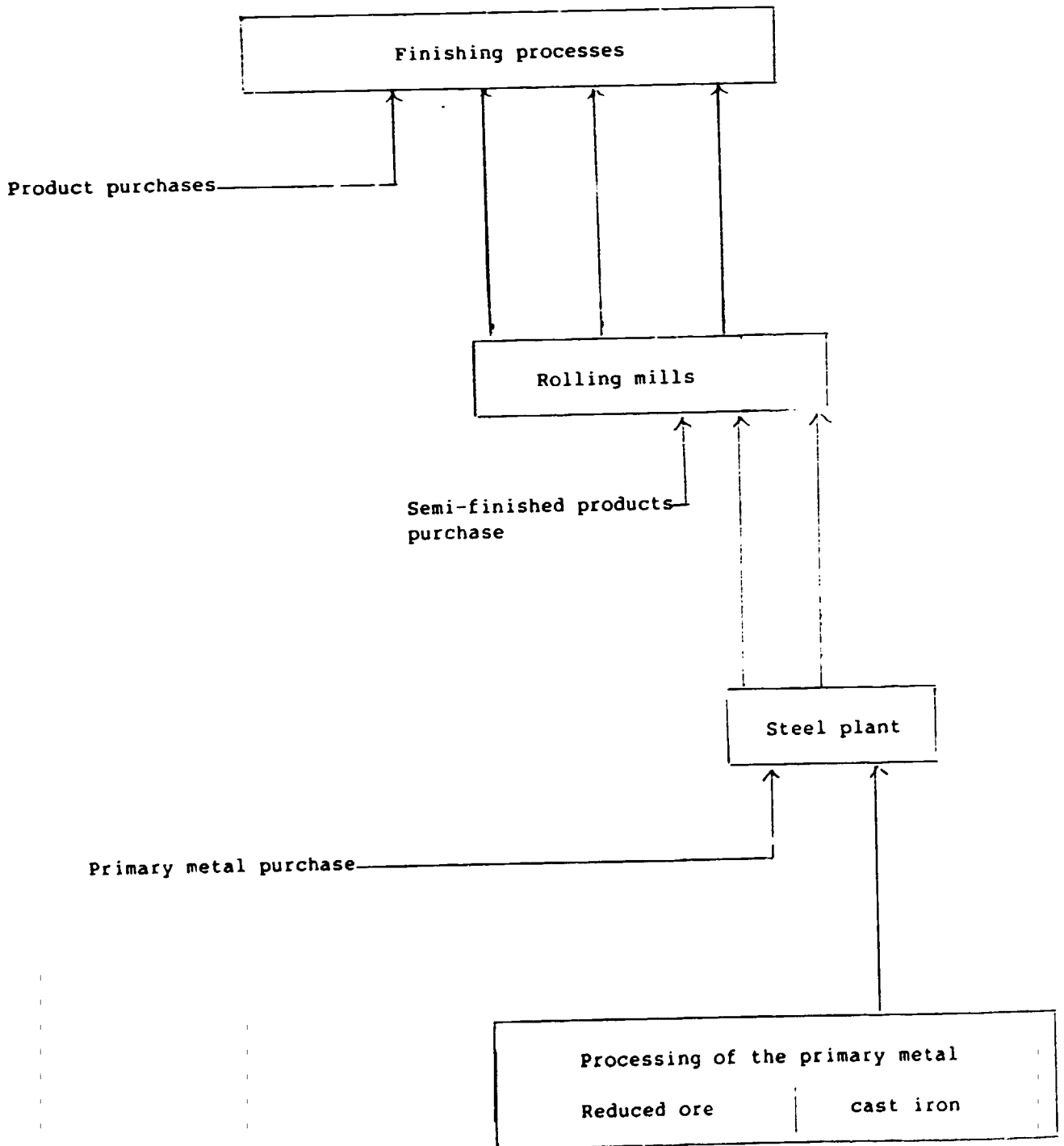


Figure 4

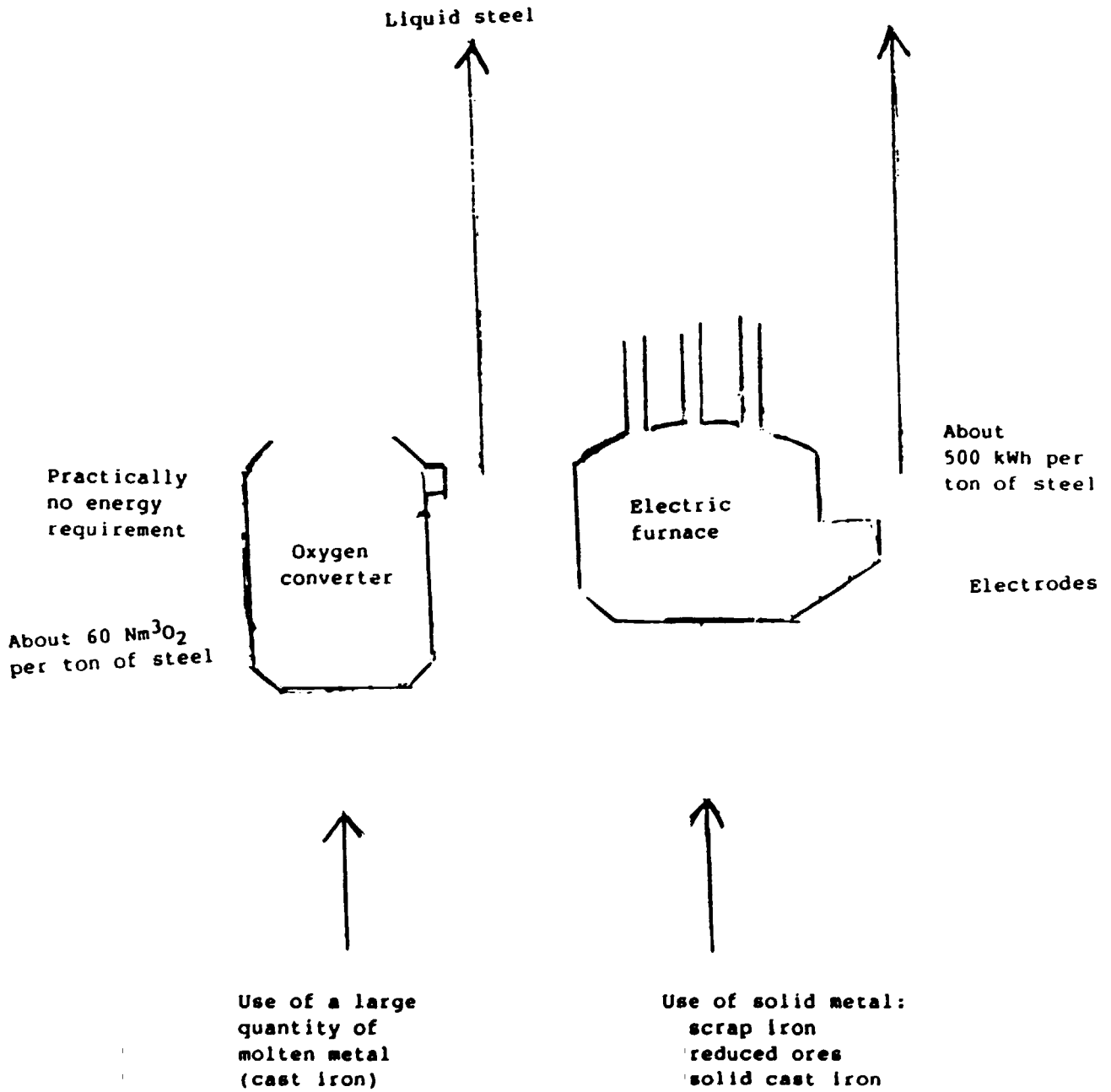
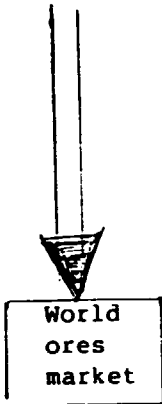


Figure 5

Iron ore exporters

SNIM (Mauritania)
LAMCO (Liberia)
BONG (Liberia)



Self-sufficient

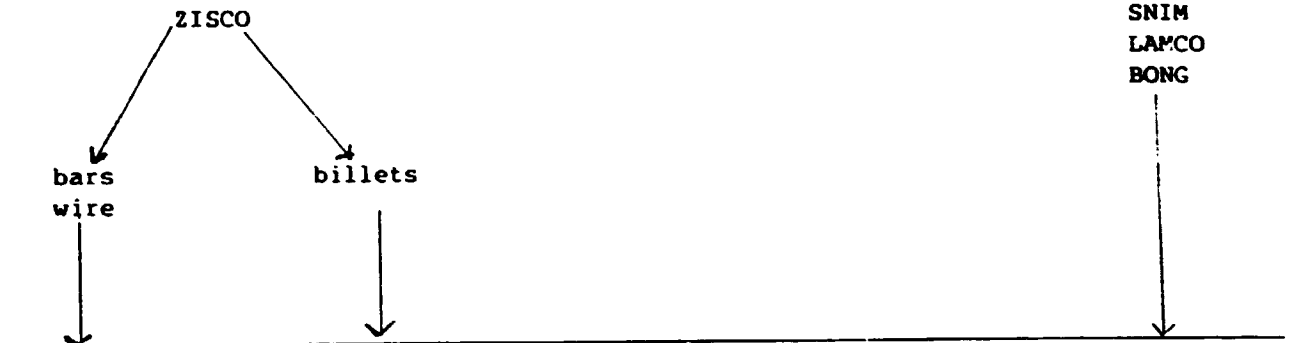
OUENZA - SIDER (Algeria)
BAHARYA - HADISOLB (Egypt)
BUCHWA) ZISCO (Zimbabwe)
RIPPLE CREEK)

Iron ore importers

ANSDK (Egypt)
LSC (Nigeria)
MISURATA (Libya)

Figure 6

Exporters



World market

Iron and steel products

Semi-finished products:
slabs
blooms
billets

Primary metal:
cast iron
reduced ore
scrap

Iron ore

Importers

SOLADO
TOGO
KENYA

KENYA

ANSDK

DSC

MISURATA

III. VALUE OF INTER-AFRICAN CO-OPERATION AND THE ESTABLISHMENT OF AN AFRICAN IRON AND STEEL ASSOCIATION (AISA)

The situation we have briefly recalled and the various options open to existing or planned iron and steel enterprises in Africa show the value of co-operation between such enterprises. Let us repeat that here we include not only the iron and steel industry itself, but also iron ore mining, on the one hand, and installations for the rerolling, finishing and conversion of iron and steel products on the other.

In this chapter, which forms the essence of our mission report, we shall focus on the following findings accruing from our investigations:

- The need to establish such an association (AISA);
- The objectives or purposes to be assigned to AISA;
- An appraisal of funding problems;

Finally, an indication of how AISA could be organized.

It is not our intention here to recount in detail our discussions in each of the States visited during the mission (they are described in the annexes), although we wish to emphasize the very favourable reaction to the proposal to establish an African Iron and Steel Association. The list of enterprises, government authorities and regional organizations visited is given in figure 7.

III.1. The need to establish an African Iron and Steel Association (AISA)

This need became apparent during all discussions, and several persons with whom we talked even went so far as to say that it was a pity that it had not already been set up. In other words (we shall come back to this later), the general view seemed to be that AISA should be established as soon as possible.

We were asked almost everywhere how similar organizations had come into being and how they operated. Without going into what exists in the industrialized countries (which should be examined in order to extract useful pointers), it is worth mentioning that three large regions or continents in which developing countries are located have established an institute or association for regional co-operation. These (11) are:

- Latin American Iron and Steel Institute;
- South-East Asia Iron and Steel Institute;
- Arab Iron and Steel Union.

We think that it would be useful to circulate this report (11), if possible in French and in English, to the people we met during our mission because it answers many of the questions they put.

III.2. Proposed objectives of the Association

These may be defined in three stages, in chronological order:

- It is generally felt that priority should be given to INFORMATION;
- This could be followed, as quickly as possible, by CO-OPERATION;
- And, finally, PROMOTION of iron and steel products and the corresponding industry.

We envisage each of these three operations as follows (see figure 8):

(a) The aim of INFORMATION is to furnish everyone with technical, economic and commercial data. It should be stressed that the provision of such information by the Association to its members implies "feedback" in that each member of the Association should provide all possible information about his enterprise and country. The lack of data, in particular the lack of accurate statistics on consumption and production of steel in Africa, is indeed an obstacle to co-operation between African States and enterprises.

(b) CO-OPERATION in fact begins, as we have just said, with information and can be extended to cover numerous aspects, including:

- Co-operation on all human factors, above all personnel training and the management of iron and steel units and whole plants. The exchange of experience between African enterprises seems to be an essential area of co-operation.
- Co-operation in the exchange of raw materials and semi-finished and finished products between African enterprises is another very promising area, and in figures 5 and 6 we present some material which may be of value.

(c) The PROMOTION of activities and new products is a further obvious field of action which we merely mention here so as not to overload this report.

III.3. Funding

We shall begin our examination of the "modus operandi" for establishing such an Association with the financial aspect, because this is clearly fundamental, particularly in view of the fact that some of the organizations already mentioned have large budgets, of the order of:

- US\$6 million for the Arab Iron and Steel Union;
- US\$1 million for the Latin American Iron and Steel Institute (members are pressing for a reduction in this budget);
- US\$0.5 million for the South-East Asia Iron and Steel Institute.

On the other hand, we also have to highlight the often difficult position of the enterprises, whether public or private, visited by us, together with the financial problems of all the States concerned. Without labouring these aspects, we think it essential that the Association envisaged must be able to operate with as small a budget as possible.

It should be pointed out that, in contrast to the Arab Iron and Steel Union, which continues to grow with a large budget and staff (82 permanent and 60 consultants), carrying out engineering and management work on behalf of its members, the Latin American Iron and Steel Institute and the South-East Asia Iron and Steel Institute are currently trying to compress their expenditure and reduce their staff. For 1989, the South-East Asia Iron and Steel Institute (SEAISI) has fixed the following membership dues (in United States dollars):

- Associate members	400
- Affiliate members	250
- Individual members	100
- Individual members of SEAISI member companies	50

III.4. Organization

We would like to stress at the outset that, with the funding difficulties we have just mentioned and which can legitimately be expected, it would seem dangerous to envisage a "big body" with extensive headquarters (tending to encourage lengthy discussions) and a large administrative staff.

In order to press ahead and restrict funding requirements, it seems useful to explore the following avenues:

(a) In the first place, to take account of the successful experience of the "networks", such as those created by UNIDO in the Far East for mini-hydroelectric power stations and the Regional Engineering Network;

(b) With this in mind, to seek a "focal point", possibly on a temporary basis, to "launch" the Association. Our discussions lead us to envisage four possibilities:

- Nigeria, on the basis of Delta Steel Co.;
- Zimbabwe, on the basis of ZISCO;
- Nairobi (which we were unable to visit through lack of time), on the basis of the significant mini-plants in Kenya;
- Addis Ababa, on the basis of the United Nations Economic Commission for Africa (in the same way as the Latin American Iron and Steel Institute is supported by ECLAC in Santiago).

(c) Using this "focal point", to draft the statutes along the lines of the model in the annex to this report and to start up the Association, probably by means of a general meeting of the initial interested parties (the "founder members"), with the assistance of other African regional organizations such as those we contacted:

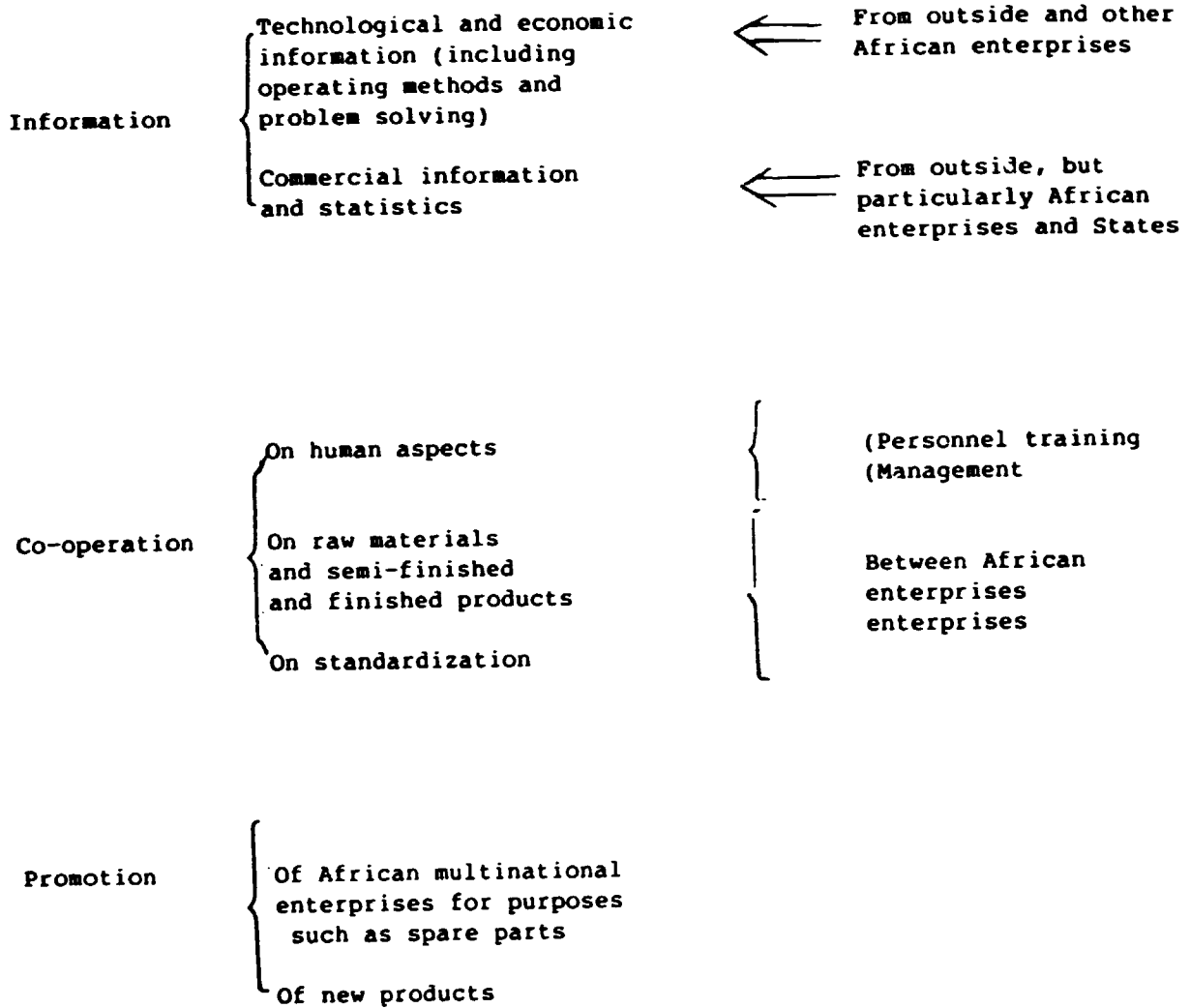
- The Arab Iron and Steel Union, with reference to the iron and steel industries in northern Africa;
- ECOWAS, with reference to western Africa;

Figure 7

Principal iron and steel enterprises, government authorities and regional organizations visited during our mission

	Enterprises	Government authorities	Regional organizations
Algeria	SIDER (FERPHOS)	Ministry of Heavy Industry	AISU
Côte d'Ivoire	TOLE IVOIRE EUROFIND-SOTACI	Ministry of Industry and Planning	ADB
Nigeria	Delta Steel Company	Ministry of Steel, Mines and Power	ECOWAS
Cameroon	SOGLADO	SNI (Ministry of Mines)	-
Gabon	COMILOG ELF	Ministry of Mines General Planning Commissariat	ECCAS
Zambia	INDECO (ZCCM)	Ministry of Mines	PTA
Zimbabwe	ZISCO MMCZ	Ministry of Industry and Technology	-
Ethiopia	NMW Corp. EISF Spare parts plant	Ministry of Industry OSCFER ONCCP	ECA OAU

Figure 8



CONCLUSIONS

An initial conclusion to be drawn from all these facts and all our discussions is that there is a need for an African Iron and Steel Association (AISI) and indeed that as one minister said during our visit, it should have been set up a long time ago, like the Latin American Iron and Steel Institute, the South-East Asia Iron and Steel Institute and the Arab Iron and Steel Union.

This leads to a second conclusion, namely that it would be preferable to act "quickly" and "small" rather than to waste more time in setting up a cumbersome and costly institution. The concept of "network" therefore merits close examination and could usefully form the basis for the establishment of AISA at the earliest opportunity.

In an attempt to specify precisely how AISA could be established, three points should be stressed:

- The ideas mentioned in this report (as well as the background paper (1) and the draft statutes of AISA) should be reviewed and refined during the planned meeting at UNIDO in Vienna but, in order to take advantage of the presence of African iron and steel men and to be able to provide them with these documents in advance, it seems advisable to postpone the meeting for about two months and hold it in April instead of late February.
- The findings of this meeting could then be passed on to the meeting of African Ministers of Industry, which we understand is to be held in Harare (Zimbabwe) from 29 May to 2 June 1989 (experts) and 5 June to 8 June 1989 (ministers).
- If all this is approved and promoted, a first meeting of the principal interested parties, i.e., a number of African iron and steel men acting as "founder members" of the association, could take place at a location to be chosen in Africa during the second half of 1989. We see the purpose of the meeting as follows:
 - To draft and approve the statutes of the Association;
 - To select a provisional "focal point" (our discussions lead us to think initially of Nigeria, Zimbabwe or Addis Ababa);
 - To have someone in authority from DSC, ZISCO or ECA at the focal point to launch activities;
 - To determine an initial budget, which should be as small as possible, for the first year of operations. Some UNIDO assistance during start-up would certainly be welcome, but we stress that AISA should seek to operate on the basis of its members' annual dues. The activities to be envisaged should be similar to those indicated in chapter III and mentioned in table II.

Table II

Priority activities envisaged for AISA

1. To draw up a list of African enterprises concerned with iron ore mining and the iron and steel industry, and also with the processing and use of iron and steel products. For each enterprise or organization, the main items of data could be:

- Enterprise name and full address, telephone, telex, telecopier, etc.;
- Status (public or private ... with some details if possible);
- Names of the senior managers;
- Principal activities and basic equipment;
- Raw materials used;
- Products: quantities, types, grades.

2. To send AISA members this list and a quarterly bulletin containing the following principal items of information:

- New developments worldwide, based, for example, on information requested from organizations such as UNIDO, the United Nations ECE Steel Committee in Geneva, UNCTAD, IISI, the Latin American Iron and Steel Institute, the Arab Iron and Steel Union, the South-East Asia Iron and Steel Institute and similar institutions in various countries;
- New developments in Africa, collected from members of AISA or African regional and national institutions and organizations. This material should include:
 - Technical or economic articles;
 - Statistics, particularly regarding the production and consumption of raw materials, steel and finished products;
 - Announcement of courses, meetings and congresses that may be of interest to AISA members.

3. To organize an annual congress, in a different country on each occasion, with:

- Technical, economic and even commercial reports;
- A round table on a specific topic chosen by agreement between AISA members;
- Visits to mining or iron and steel installations in the region where the congress is being held.

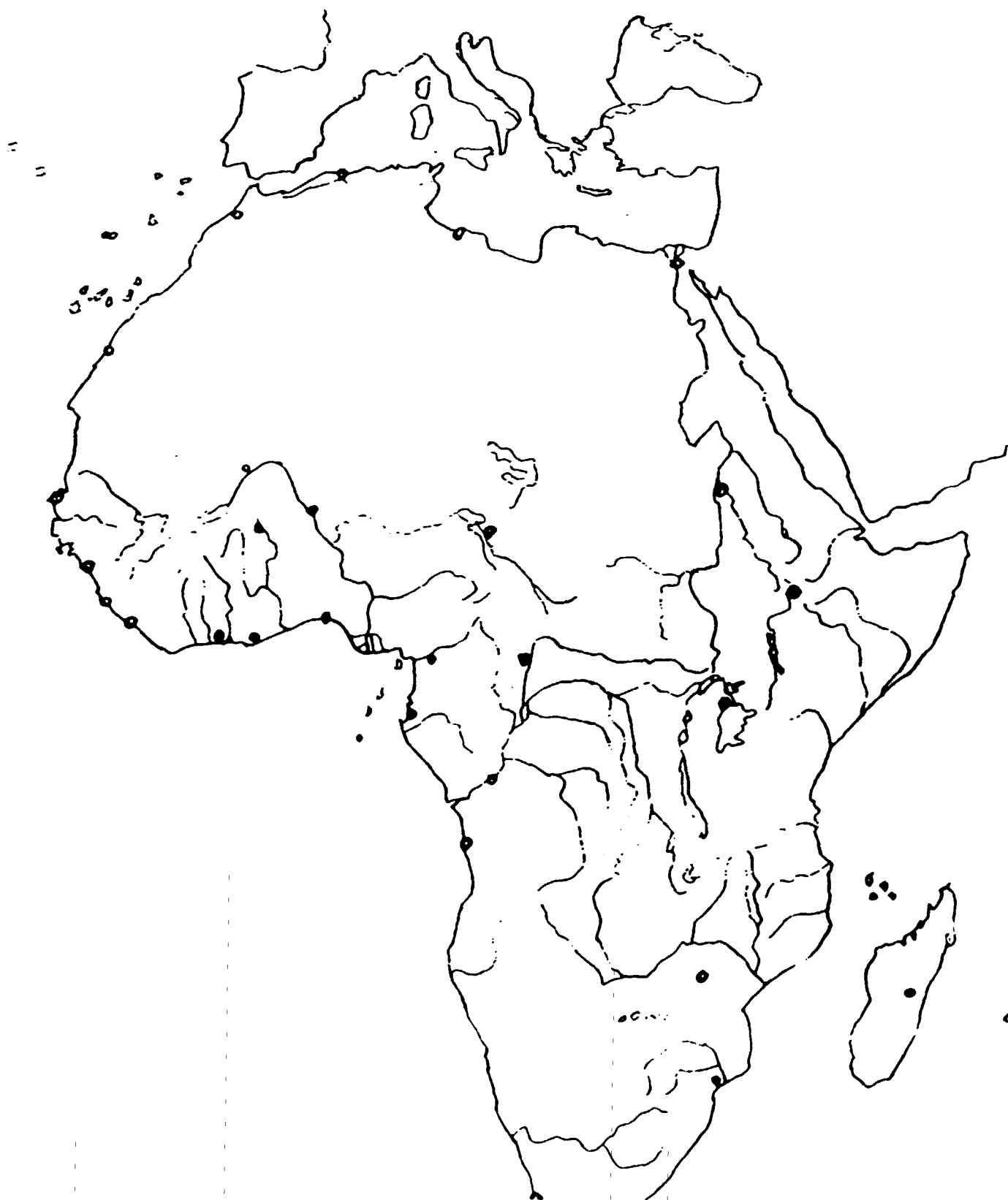
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Model statutes for an Association of African Iron and Steel Makers.

Figure 1

Africa



IRON MINING AND THE IRON AND STEEL INDUSTRY IN AFRICA

In preparation of a survey and the possible establishment of an African Iron and Steel Association, the present report is intended to indicate the relative importance of the African continent as regards iron ore and the iron and steel industry. With this in mind we shall use the map in figure 1, giving the geographical framework for the present survey,* and table I, indicating population trends in AFRICA according to data supplied by the United Nations, in order to examine:

- Iron ore deposits and mines in Africa
- Iron and steel industries in Africa.

* This survey excludes the Republic of South Africa.

Figure 2



Regional subdivisions established
by the United Nations (1).

The boundaries shown on this map do not imply official endorsement
or acceptance by the United Nations Industrial Development Organization.

Table I

POPULATION TRENDS IN AFRICA AND WORLD-WIDE
(millions of persons)

YEAR	1960	1970	1980	1990	2000	2025
WORLD	3 037	3 595	4 434	5 244	6 121	8 199
AFRICA	275	355	470	635	853	1 544
including:						
Eastern	77	100	134	183	250	478
Central	35	42	53	70	91	162
Northern	65	83	109	144	186	296
Southern	20	25	33	44	58	101
Western	79	104	141	195	267	505

Source: United Nations (1).

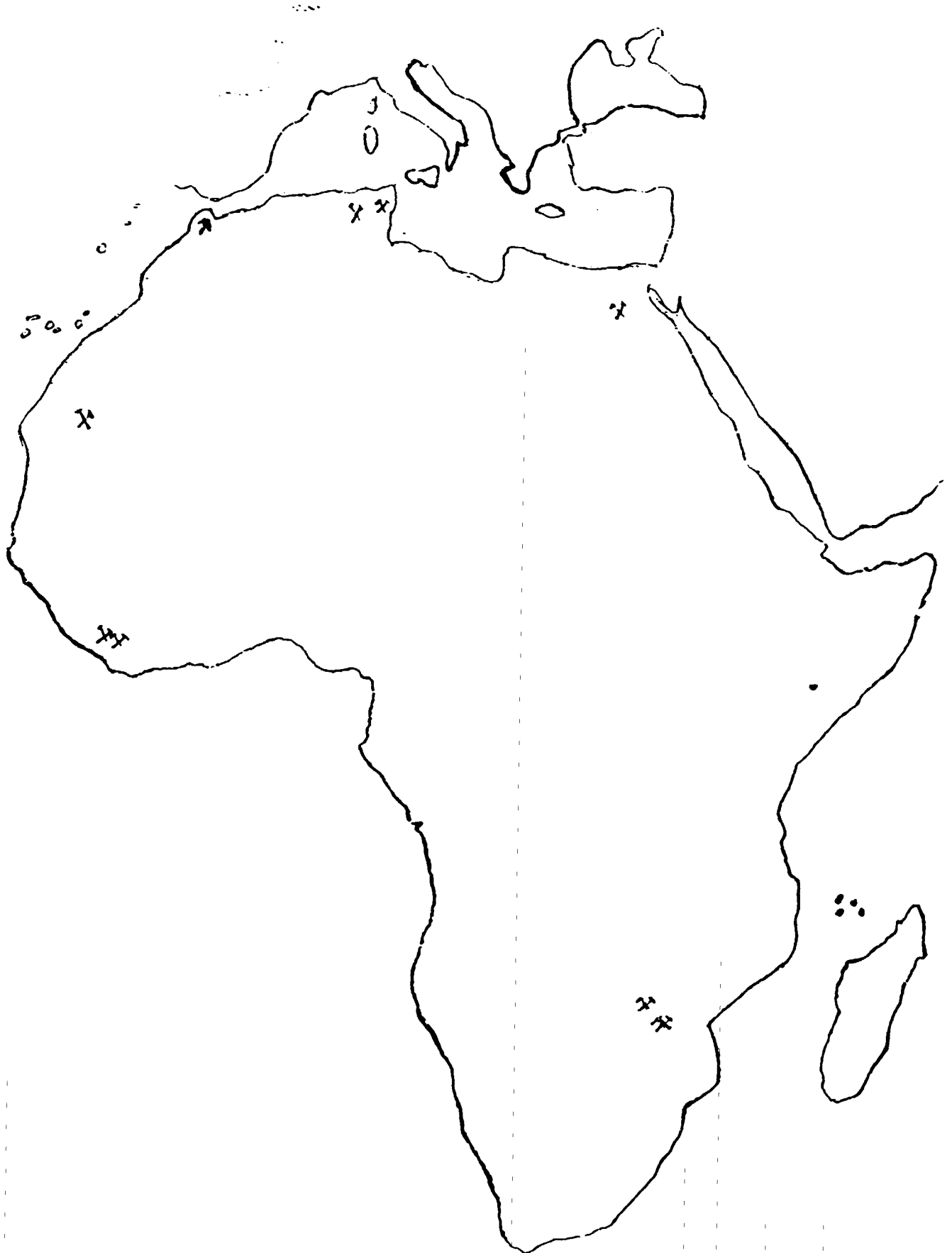
Table II
POPULATION TRENDS IN THE REGIONS AND COUNTRIES OF AFRICA
(thousands of persons)

REGION	COUNTRY	YEAR	
		1985	2025
EASTERN AFRICA	BRITISH INDIAN OCEAN TERRITORIES	2	2
	BURUNDI	4 824	13 310
	COMOROS	414	1 016
	DJIBOUTI	354	711
	ETHIOPIA	35 631	93 633
	KENYA	20 210	82 343
	MADAGASCAR	10 037	26 438
	MALAWI	7 290	22 997
	MAURITIUS	1 041	1 568
	MOZAMBIQUE	12 013	36 260
	REUNION	563	825
	RWANDA	5 631	19 566
	SEYCHELLES	72	133
	SOMALIA	5 588	13 418
	UGANDA	15 478	51 888
	UNITED REPUBLIC OF TANZANIA	21 057	63 598
	ZAMBIA	6 819	21 777
ZIMBABWE	8 805	28 435	
CENTRAL AFRICA	ANGOLA	8 073	23 643
	CENTRAL AFRICAN REPUBLIC	2 593	7 399
	CHAD	4 954	12 195
	CONGO	1 760	5 204
	EQUATORIAL GUINEA	411	1 129
	GABON	591	1 152
	SAO TOME AND PRINCIPE	87	93
	UNITED REPUBLIC OF CAMEROON	9 553	23 421
	ZAIRE	32 648	87 935
NORTHERN AFRICA	ALGERIA	22 583	62 880
	EGYPT	47 240	94 933
	LIBYAN ARAB JAMAHIRIYA	3 611	10 934
	MOROCCO	23 869	59 297
	SUDAN	21 211	54 435
	TUNISIA	7 156	13 072
	WESTERN SAHARA	155	365
SOUTHERN AFRICA	BOTSWANA	946	3 432
	LESOTHO	1 519	3 732
	NAMIBIA	1 170	3 266
	SOUTH AFRICA	33 811	88 260
	SWAZILAND	647	1 863

Table II (continued)

REGION	COUNTRY	YEAR	
		1985	2025
WESTERN AFRICA	BENIN	4 127	13 927
	CAPE VERDE	351	524
	GAMBIA	686	1 970
	GHANA	13 755	42 007
	GUINEA	5 734	16 841
	GUINEA-BISSAU	628	1 432
	COTE D'IVOIRE	9 418	26 727
	LIBERIA	2 355	7 897
	MALI	7 994	24 979
	MAURITANIA	1 890	6 074
	NIGER	6 192	20 516
	NIGERIA	91 178	285 479
	SAINT HELENA	6	8
	SENEGAL	6 474	16 771
	SIERRA LEONE	3 997	10 675
TOGO	3 061	8 854	
UPPER VOLTA	7 900	20 465	

Figure 3



Principal iron mines in Africa

IRON DEPOSITS AND MINES

The iron ore reserves, estimated in millions of tons of crude iron ore, (2) are as follows:

	<u>Reserves</u>	<u>Basis of reserves</u>
WORLD	154,400	209,900
AFRICA	6,000	14,800

The iron ore deposits of Africa may be subdivided as follows:

- Table III and figure 3 indicate the location and size of iron mines in Africa, while table IV sets out the trends in these mines' production over the past 10 years, which is then shown graphically in figure 4;
- Table V and figure 5 give similar information regarding the principal deposits which have been extensively surveyed.

Table III

IRON ORE DEPOSITS IN AFRICA CURRENTLY BEING WORKED

Country	Name	Characteristics
Algeria	OUENZA	Open-cast working of "merchantable" ores, 3 million tons/year (t/y) for local use (SIDER)
Tunisia	DJERISSA	With some other small deposits production of about 0.3 to 0.5 million t/y for local use (ELFOUHADH)
Liberia	LAMCO	Open-cast working of merchantable ores in the region of 7 million t/y for export
	BONG MINING	Open-cast working to exploit low-grade ores concentrated in an enrichment plant with pelletization unit for 3 million t/y and 4.5 million t/y fines
Mauritania	SNIM Kédia Guelbs	Open-cast working for export of: merchantable ore low-grade ores concentrated in an enrichment plant designed for 6 million t/y
Zimbabwe	BUCHWA	Working of an open-cast deposit of merchantable ores, 1 million t/y for local use (ZISCO) coming to an end (about 1992)
	REDCLIFF	Open-cast working of a deposit which will be developed to replace BUCHWA, also for local use (ZISCO)
Egypt	BAHARYA	Open-cast working of merchantable ore, 2 million t/y for local use (HADISOLB)
Morocco	SEFERIF near Nador	Working of ores that may be calcined in a tank furnace or pelletized

Figure 4

Million tons/year

Trends in iron ore production in Africa

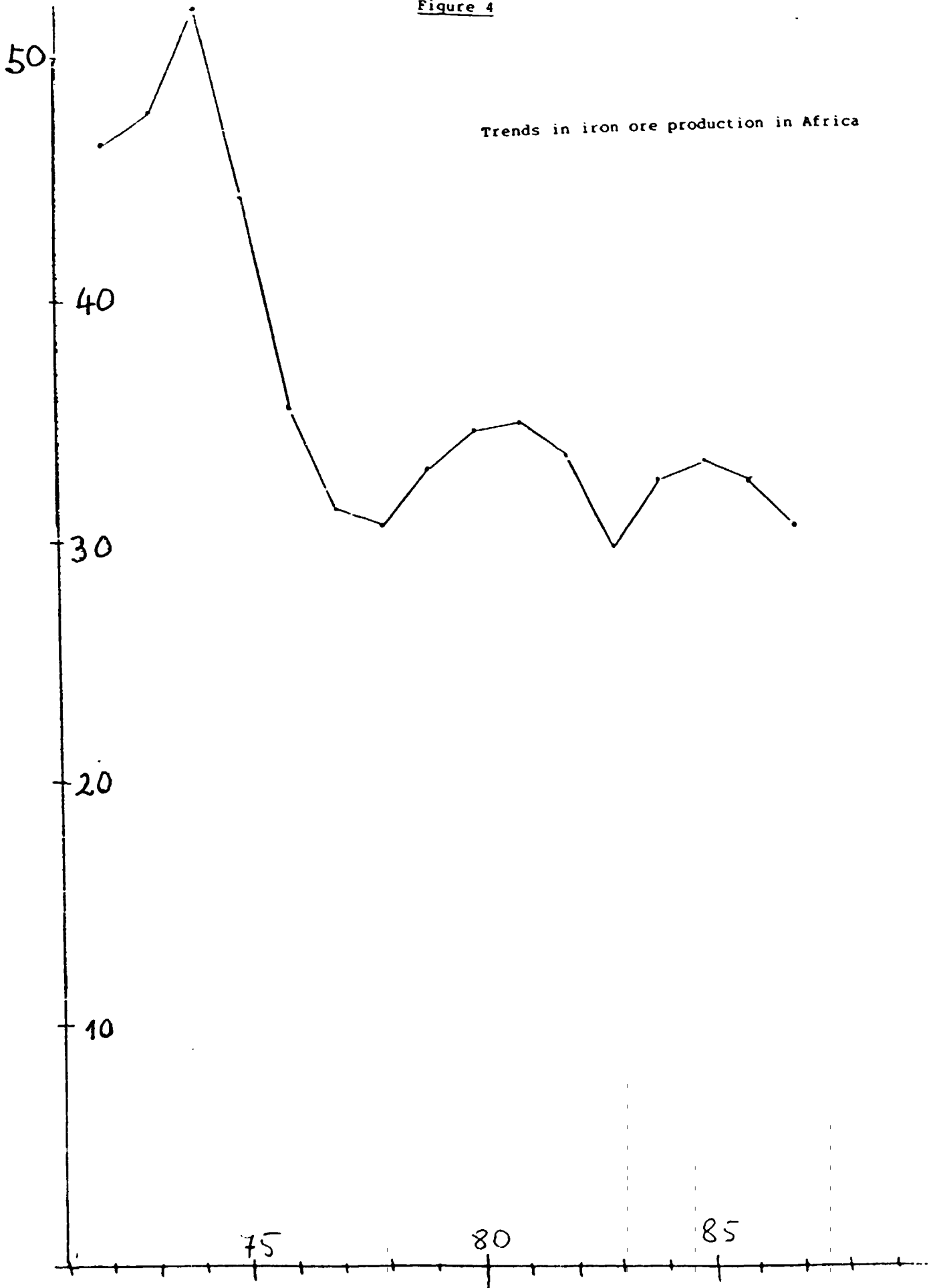


Table IV

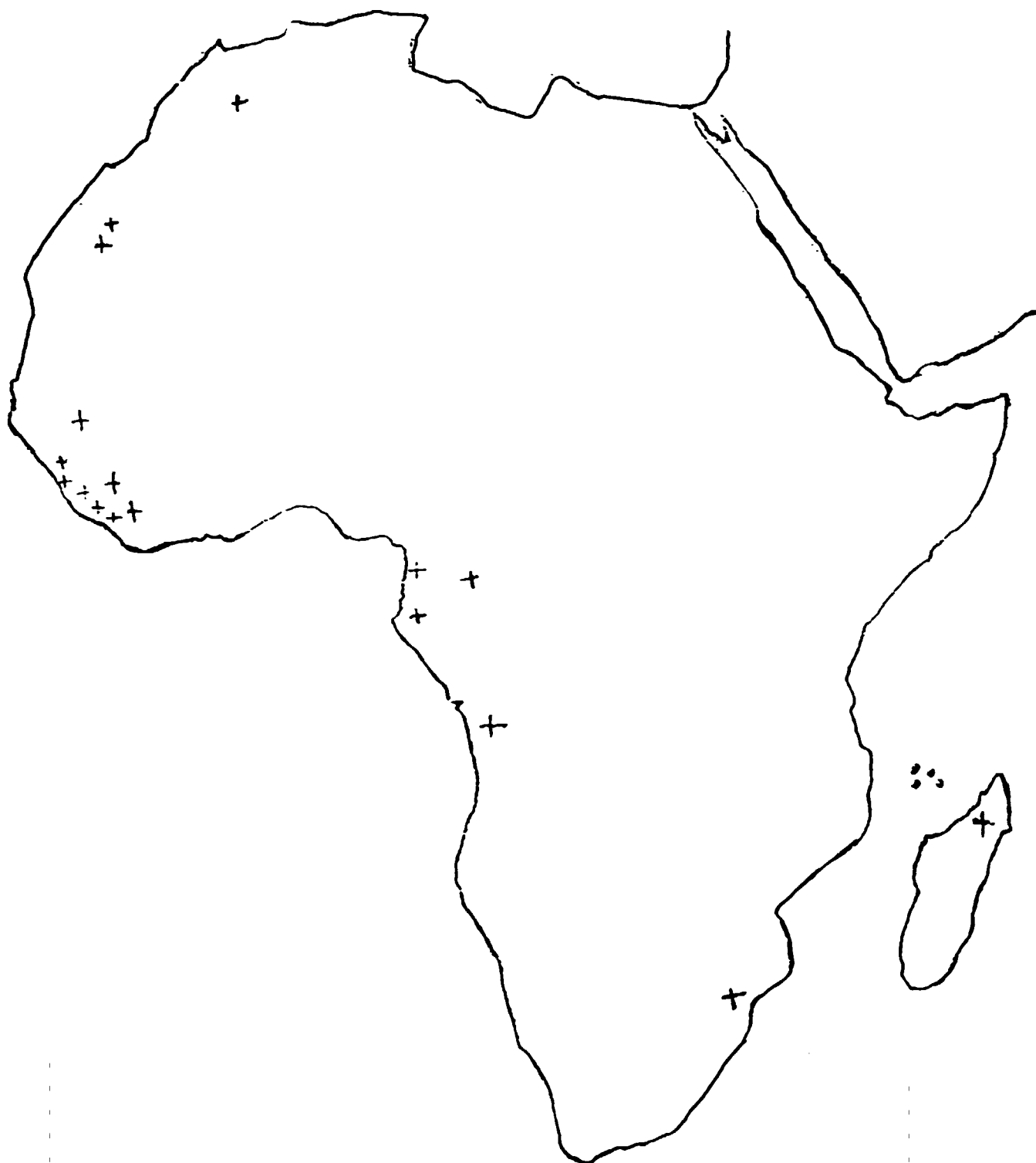
PATTERN OF IRON ORE PRODUCTION IN AFRICA
AND WORLDWIDE

Year	1977	1986	1987
WORLD	871.5	909.4	938.2
AFRICA	31.0	28.6	30.6
including:			
Liberia	18.1	15.6	13.8
Mauritania	7.3	9.2	9.0
Algeria	3.2	3.4	3.4
Tunisia	0.5	0.3	0.3
Morocco	0.4	0.2	0.2
Other African countries*	-	-	3.9

* Including, probably, Egypt, Zimbabwe ...

Source: IISI (3) for 1977 and 1986
APEF (4) for 1987

Figure 5



Principal iron ore deposits in Africa currently being worked

Table V

PRINCIPAL IRON ORE DEPOSITS THAT HAVE BEEN EXPLORED IN AFRICA

Country	Company and name	Basic characteristics
SENEGAL	MIFERSO, Palema	Large iron-rich ore deposit
GUINEA	MIFERGUI, Nimba Simandou	"
GABON	SOMIFER, Belinga Mekambo	"
MAURITANIA	SNIM, Mhaoudat	Medium-sized iron-rich ore deposit
LIBYA	WADI SHATTI	Large moderately iron-rich ore deposit
ALGERIA	GARA DJEBILLET	"
MAURITANIA	SNIM TAZIAT	Deposit of iron ore for concentration
COTE D'IVOIRE	MONT KLAHOYO	"
GABON	TCHIBANGA M'BILAM	"
LIBERIA	LAMCO Western Area WOLOGISI	"
CAMEROON	KRIBI	"
MADAGASCAR	SOALALA	"
NIGERIA	AM Corp. Itakpe Lakodja	Deposit of iron ore to be concentrated under construction
SIERRA LEONE	TONKOLILI	"
SUDAN	FODIKWAN	"
ANGOLA	CASSINGA II CASSALA	Moderately iron-rich ore Deposit of iron ore for concentration

Table V bis

PRINCIPAL IRON ORE DEPOSITS IN AFRICA NO
LONGER BEING WORKED

Country	Company and name	Basic characteristics
SIERRA LEONE	MARAMPA	Gravity concentration of a moderately iron-rich haematite ore
LIBERIA	MANO RIVER	Moderately iron-rich limonitic ore
GUINEA	CONAKRY	Moderately iron-rich lateritic ore
ANGOLA	CASSINGA	Haematite-based iron-rich ore
SWAZILAND		Haematite-based iron-rich ore

IRON AND STEEL INDUSTRY

To begin with we shall look at the pattern of consumption in AFRICA, as follows:

- In millions of tons raw steel, according to traditional trends, over a 10-year period in (table VI);
- In terms of finished products, which is more correct and reflects a recent trend, giving a better picture of the true situation in (table VII).

Following on these consumption levels, production is then indicated in Table VIII and Figure 6, enabling us to compare the patterns of consumption and production.

We shall then take a similar approach to iron deposits and mines:

- Table IX and Figure 7 give the locations and basic characteristics of conventional integrated iron and steel plants, i.e., those based on iron ores and blast furnaces with, increasingly, oxygen steel plants;
 - Table X and Figure 8 give the same information for integrated iron and steel plants based on direct reduction;
 - Table XI and Figure 9 give similar information for mini-plants, i.e., to iron and steel plants which, in general, are either of small capacity and use scrap or are electric steel plants (sometimes open-hearth plants);
 - Table XII and Figure 10 give data which are less detailed (because of their number and diversity) on plants for re-rolling semi-finished products (usually billets) or pipe lines, or else finishing installations.
- ECCAS, with reference to central Africa;
 - PTA and SADCC, with reference to eastern and southern Africa.

(d) Once the organization has been established with its "founder members", to develop it by:

- In the first instance a quarterly bulletin (which could become a journal, probably bilingual French/English);
- Preparing a list of its members who would receive the quarterly bulletin;
- Enlarging the membership to cover all interested African organizations or enterprises, which would make it possible to expand the above list into a proper directory of all African enterprises connected with iron ore, the iron and steel industry, the use of iron and steel products and all supplies to those industries;
- Beginning to recruit for the Association and its journal associate members (outside Africa or outside the iron and steel industry) and "individual" members;
- Beginning to organize the annual congresses.

Table VI

PATTERN OF STEEL CONSUMPTION IN AFRICA AND WORLDWIDE
(millions of tons raw steel)

<u>Year</u>	<u>1976</u>	<u>1986</u>	<u>1987</u>
WORLD	677.6	716.9	740.5
AFRICA	8.05	10.47	10.33
including:			
Egypt	1.27	2.30	2.50
Algeria	1.26	3.26	2.95
Nigeria	1.85	1.91	2.15
Morocco	0.65	0.49	0.51
Libya	0.75	0.33	0.41
Tunisia	0.19	0.50	0.51
Zimbabwe	0.61	0.42	0.21
Kenya	0.30	0.22	0.26
Tanzania	0.10	0.05	0.05
Zambia	0.04	0.03	0.002
Zaire	0.05	0.02	0.02
All others	0.97	1.00	0.758

Source: IISI.

Note: Excluding Republic of South Africa.

Table VII

PRODUCTION AND CONSUMPTION OF IRON AND STEEL PRODUCTS
IN AFRICA AND WORLDWIDE
(millions of tons finished products - 1986)

	Consumption	Local supply
WORLD	602.3	601.2
AFRICA	7.68	2.255
including:		
Egypt	1.886	0.769
Nigeria	1.643	0.154
Algeria	1.514	0.615
Morocco	0.453	0
Libya	0.435	0
Tunisia	0.366	0.140
Zimbabwe	0.295	0.518
Kenya	0.189	0.040
Tanzania	0.042	0
Zambia	0.024	0
Zaire	0.019	0
All others	0.818	0.018

Source: IISI.

Figure f

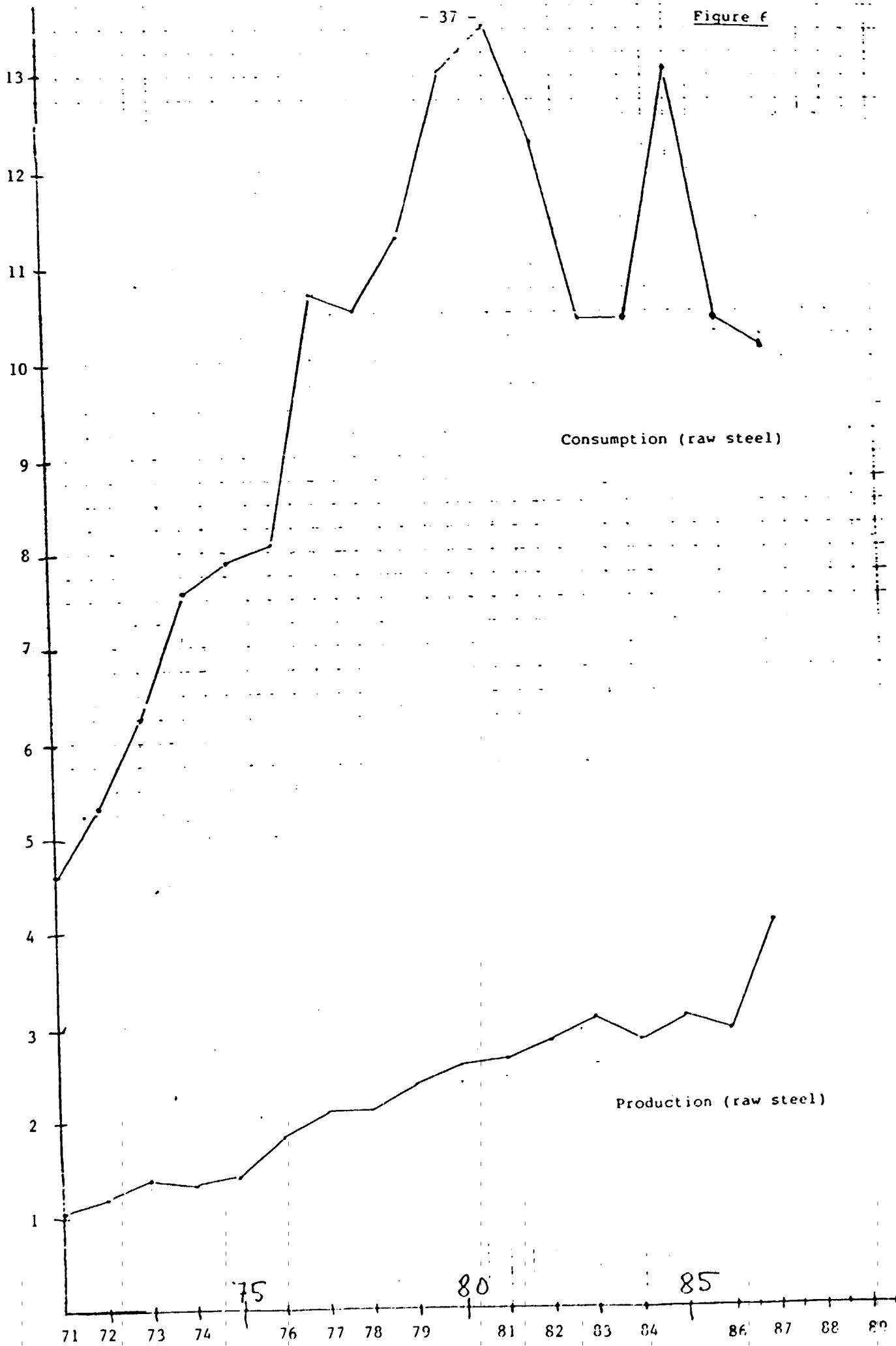


Table VIII

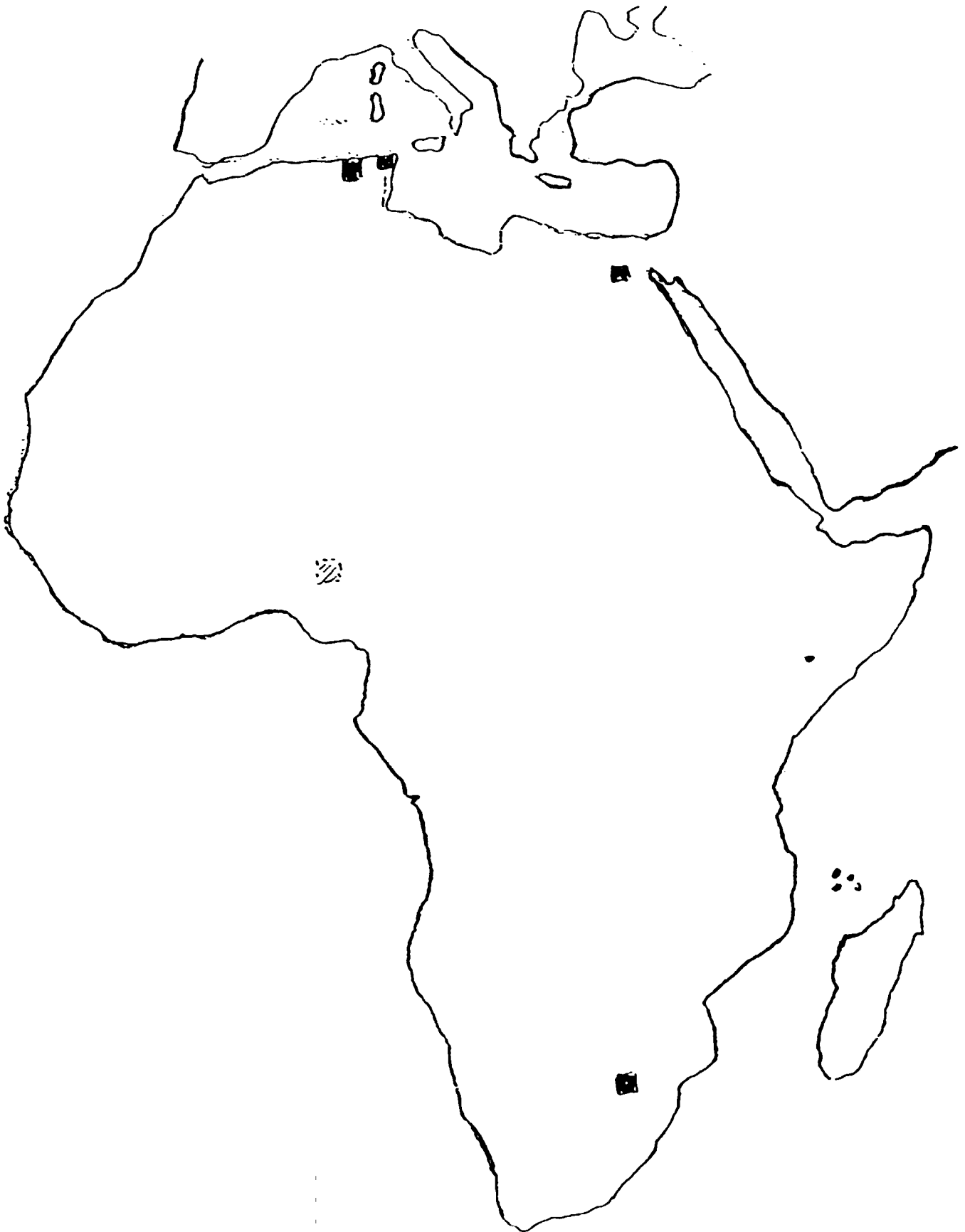
TREND IN STEEL PRODUCTION LEVELS IN AFRICA AND WORLDWIDE
(millions of tons raw steel)

Year	1976	1986	1987
WORLD	675.4	713.1	735.9
AFRICA	1.8	3.53	4.04
including:			
Egypt	0.70	1.00	1.60
Algeria	0.21	1.40	1.40
Zimbabwe	0.73	0.675	0.60
Nigeria	0.015	0.20	0.18
Tunisia	0.10	0.18	0.19
All others	0.06	0.075	0.07

Source: IISI.

Note: Excluding Republic of South Africa.

Figure 7



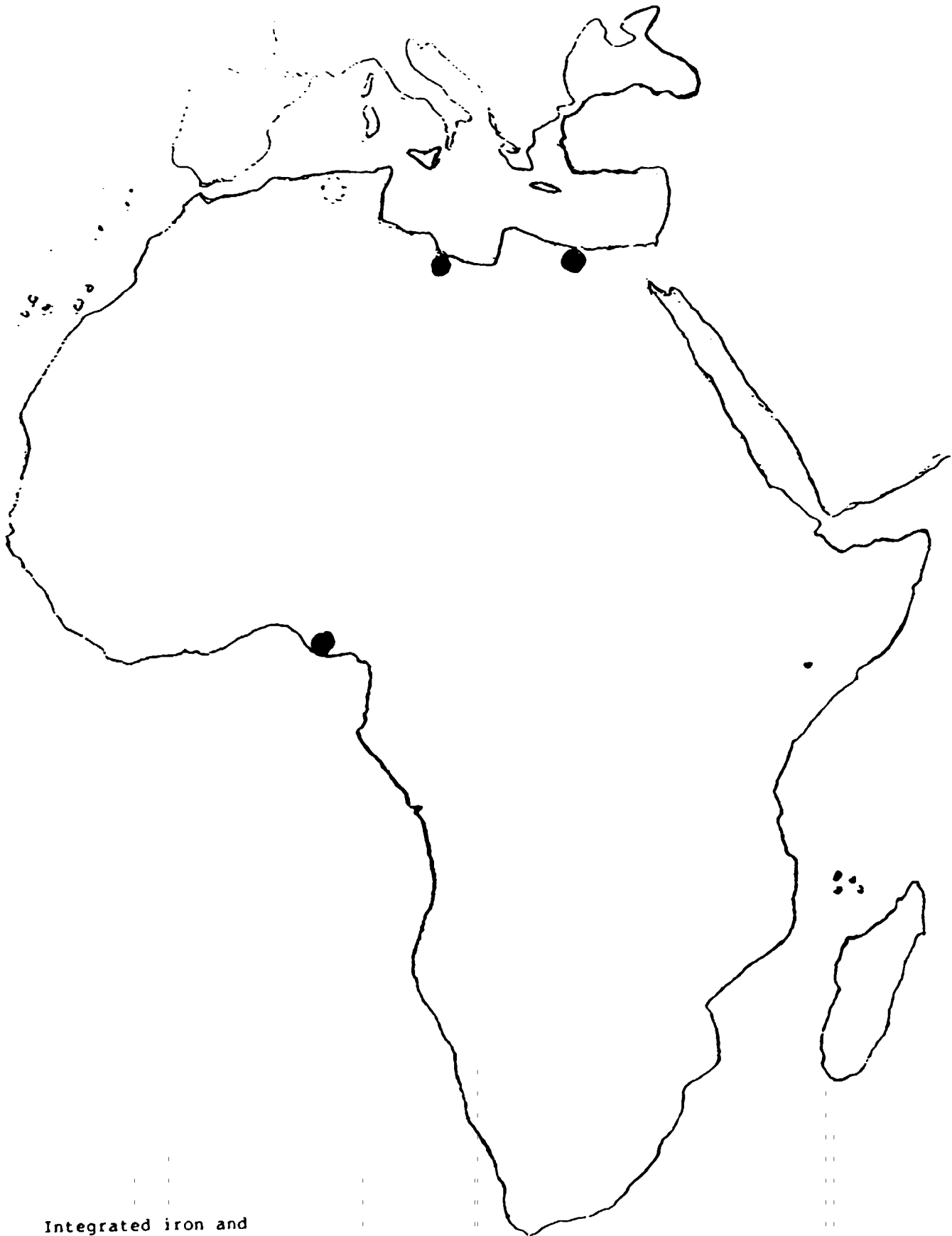
Conventional integrated iron and steel plants in Africa

Table IX

CONVENTIONAL INTEGRATED PLANTS (WITH BLAST FURNACES) IN AFRICA

COUNTRY	COMPANY AND PLANT	CHARACTERISTICS
Algeria	SIDER EL HADJAR	Start-up in 1969. Capacity 2 million t/y with 2 blast furnaces. 2 oxygen steel plants, continuous casting, hot strip mill and long-product mills.
Egypt	HADISOLB at HELWAN	Start-up in 1958. Capacity 1.5 million t/y with blast furnace, 2 steel plants (1 with oxygen) continuous casting, hot strip mill and long-product mills.
Tunisia	ELFOULADH at MENZEL BOURGUIBA	Start-up in 1966. Capacity 0.2 million t/y with 1 small blast furnace, oxygen steel plant and continuous casting, long- and light-product mill.
Zimbabwe	ZISCO at REDCLIFF	Start-up in 1950. Capacity 1 million t/y with 2 blast furnaces, 1 oxygen steel plant, chill casting and a continuous billet machine, long-product mill.
Nigeria	AJAKUTA STEEL CO.	Being completed. Capacity 1.3 million t/y with 1 blast furnace, 1 oxygen steel plant and continuous casting with blooming, long-product mill.

Figure 8



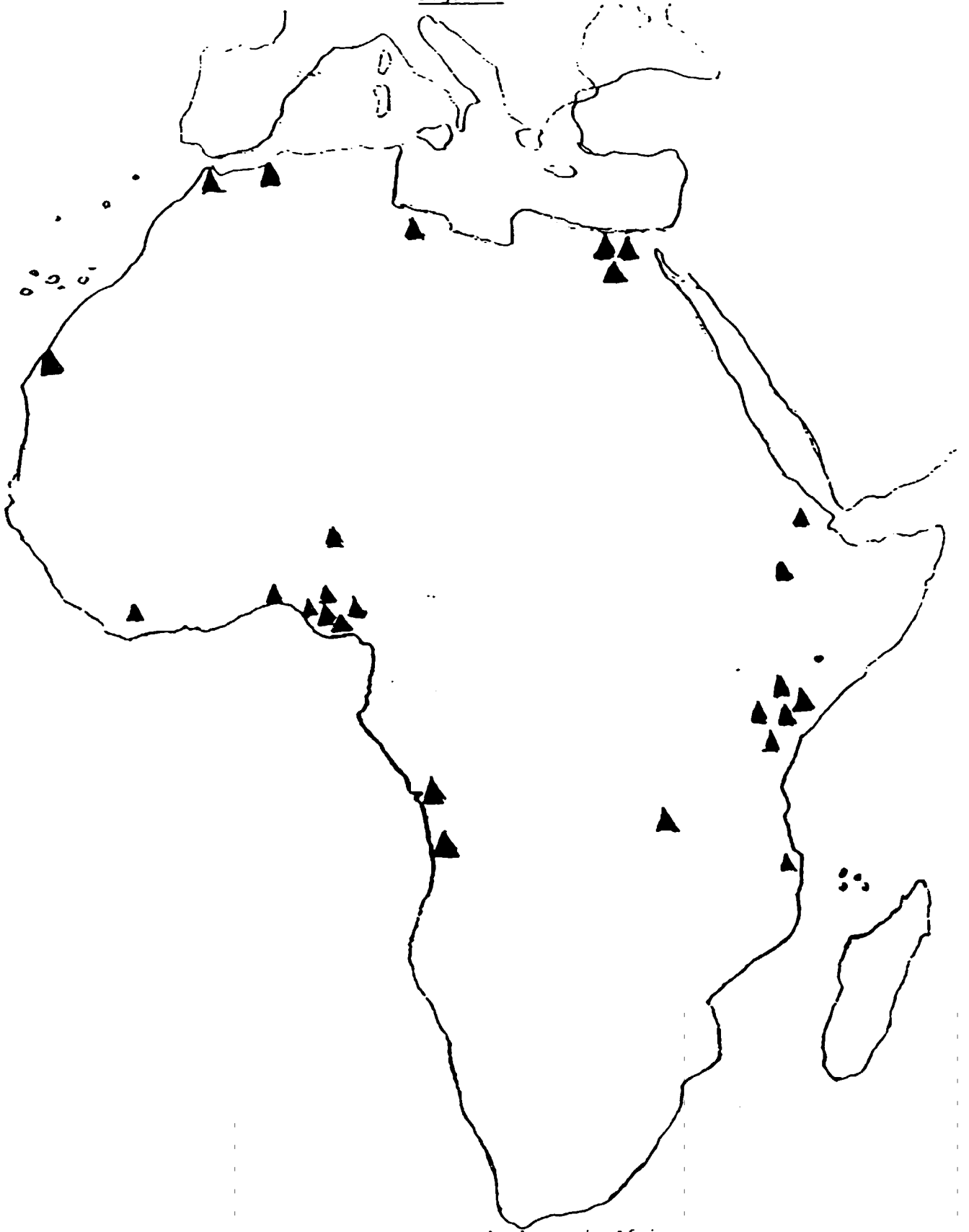
Integrated iron and
steel plants based on
direct reduction in
Africa

Table X

IRON AND STEEL PLANTS BASED ON DIRECT REDUCTION IN AFRICA

COUNTRY	COMPANY AND PLANT	CHARACTERISTICS
Egypt	A N S D K at EL DIKHELA	Midrex direct reduction (0.750 million t/y) Electric steel plant 4 x 70 t Continuous casting, 3 x 4 billet lines Bar train Wire mill
Nigeria	DELTA STEEL COMPANY at WARRI (ALADJA)	2 Midrex direct reduction (1 million t/y) Electric steel plant (1 million t/y) 4 x 110 t continuous casting, 3 x 6 billet lines Small-section rolling mill (0.4 million t/y)
Libya	LIBYAN GENERAL COMPANY FOR IRON AND STEEL at MISURATA	2 Midrex direct reduction (1 million t/y) 2 electric steel plants (1.3 million t/y) 3 x 90 t 1 continuous casting section (slabs) 1 continuous casting section (6 billet lines) Hot strip mill, long-product mill
Algeria	SIDER at BELLARA (JIJEL project)	Project for 1 million t/y (rising to 2 million t/y) Direct reduction Electric steel plant Continuous casting section (blooms and billets)

Figure 9



Mini iron and steel plants in Africa

Table XI

THE PRINCIPAL MINI-PLANTS IN AFRICA

COUNTRY	COMPANY AND PLANT	CHARACTERISTICS
ALGERIA	SIDER Oran	Open-hearth plant, continuous casting (billets), 1 bar train, 30,000 t/y steel
MOROCCO	SIDERURGIE DU MAROC at Tangier	1 arc furnace 30,000 t/y steel 50,000 t/y rolled products
LIBYA	At Tripoli	1 arc furnace 30,000 t/y steel 60,000 t/y rolled products
EGYPT	Delta Steel Mill	2 arc furnaces, 25 t (100,000 t/y) 1 continuous casting section, 1 bar train
	The Egyptian Copper Works	2 arc furnaces (25 and 50 t) (150,000 t/y) 1 continuous casting section, 1 bar train
	National Metal Ind. Co.	Open-hearth and electric steel plant (160,000 t/y) 1 bar train
MAURITANIA	SAFA at Nouadhibou	1 arc furnace (7 t), 1 bar train
ANGOLA	Siderurgia Nacional SINA at Luanda	1 arc furnace, 1 bar train
KENYA	Kenya United Steel Co. Ltd.	2 arc furnaces (5 t), continuous casting, 1 bar train and wire mill (30,000 t/y)
	EMCO Steelworks at Dandora	1 arc furnace (12 t) 25,000 t/y steel 60,000 t/y rolled products
	Steel Billet Castings Ltd. at Dandora	1 arc furnace (12 t) 1 continuous casting section with 2 lines 25,000 t/y billets
	City Engineering Works Ltd. at Dandora	1 induction furnace (1 t) 8,600 t/y steel 12,000 t/y rolled products
	Rolmil KENYA Ltd. at Nairobi	1 arc furnace (7 t) 15,000 t/y steel 13,500 t/y rolled products

Table XI (continued)

COUNTRY	COMPANY AND PLANT	CHARACTERISTICS
TOGO	Société Nationale de Sidérurgie	Electric steel furnace (currently shut down, 30,000 t/y), bar train, about 12,000 t/y rolled products
ZAIRE	Société Nationale de Sidérurgie at Maluku	1 arc furnace (50 t), continuous casting, 1 bar train, wire mill and small-section rolling mill, currently shut down
NIGERIA	Nigerian Spanish Kano at Kano (Kano State)	Capacity 36,000 t/y steel 188,000 t/y rolled products
	Universal Steel at Ikeja (Lagos State)	1 arc furnace (12 t), continuous casting, 1 bar train 50,000 t/y steel, 80,000 t/y rolled products
	Federal Steel at Ota (Ogun State)	Capacity 40,000 t/y steel 140,000 t/y rolled products
	CISCO Ltd. at Ikeja (Lagos State)	Capacity 60,000 t/y steel 150,000 t/y rolled products
	GSM at Asaba (Bendel State)	2 arc furnaces, 1 bar train Capacity 14,000 t/y steel 50,000 t/y rolled products
	Kew Metal at Ikorodu (Lagos State)	Capacity 9,000 t/y steel 20,000 t/y rolled products
GHANA	Tema steelworks at Tema	1 arc furnace, 1 bar train 35,000 t/y Current situation unknown
ETHIOPIA	Ethiopian Iron & Steel Foundry at Akaki	1 arc furnace (5 t), 1 bar train 5-10,000 t/y steel 15-30,000 t/y rolled products
	Ethiopian Iron & Steel Foundry at Asmara	1 arc furnace not installed 12,000 t/y steel? 34,000 t/y rolled products?
TANZANIA	Aluminium Africa Ltd. at Dar es Salaam	1 arc furnace (11 t) 1 continuous casting section 18,000 t/y billets
UGANDA	East African Steel Co. at Jinja	1 arc furnace (10 t) 24,000 t/y steel 30,000 t/y rolled products

Figure 10



Principal re-rolling plants in Africa

Table XII

PRINCIPAL RE-ROLLING PLANTS IN AFRICA

COUNTRY	COMPANY AND PLANT	CHARACTERISTICS
MOROCCO	Sonasid at Nador	Wire mill (420,000 t/y)
TUNISIA	Tunisacier	Skin-pass mill stand and sheet galvanization line (40,000 t/y)
KENYA	Steel Rolling Mills Ltd.	Bar train and small-section rolling mill
TANZANIA	Steel Rolling Mills Ltd.	Bar train
NIGERIA	JSRC Ltd. (JOS Steel Rolling Co.) at Jos (Plateau State)	1 bar train and wire mill (210,000 t/y)
	KRS Ltd. (Katsina Steel Rolling Co.) at Katsina (Kaduna State)	Idem
	OSRC (Oshogbo Steel Rolling Co.) at Oshogbo (Oyo State)	Idem
	QUA QUE Steel Products Ltd. (Cross River State)	1 bar train and wire mill (100,000 t/y)
	SELL METAL at Ikeja (Lagos State)	1 train (100,000 t/y)
	Allied Steel at Onitsha (Anambra State)	1 bar train (20,000 t/y)
	Major Eng. at Ikorodu (Lagos State)	1 bar train (228,000 t/y)
	KWARA Commercial at Ilorin (Kwara State)	1 bar train (40,000 t/y)
	Mandarin Industries Co. at Ilupeju (Lagos State)	1 bar train (25,000 t/y)

Table XIII

PRINCIPAL PIPE PLANTS IN AFRICA

COUNTRY	COMPANY AND PLANT	CHARACTERISTICS
ALGERIA	SIDER El Hadjar	Electric furnace (85 t) Weldless pipe mill
	SIDER Reghaia	Straight- and spiral-welded pipe mills
	SIDER Gardaia	Spiral-welded pipe mill
MOZAMBIQUE	IMA	Welded-pipe mill
NIGERIA*	Hoesch Pipe Mills (Nigeria) Ltd.	Welded-pipe lines (100,000 t/y) plus galvanization

* Note: In Nigeria, as in other countries of Africa, there are a considerable number of other welded-pipe plants which are not listed here.

Table XIV

PRINCIPAL PLANTS FOR THE FINISHING OF IRON AND STEEL PRODUCTS
IN AFRICA*

COUNTRY	COMPANY AND PLANT	CHARACTERISTICS
COTE D'IVOIRE	Tôle Ivoire at Vridi	Galvanization of imported sheets (35,000 t/y)
KENYA	Steel Africa	Galvanization of imported sheets
MOZAMBIQUE	IMA Industria Moçambicana do Aço Sarl	Galvanization of imported sheets
TANZANIA	Aluminium Africa Ltd. (ALUF)	Galvanization of sheets (34,000 t/y) and pipes (10,000 t/y)
TOGO	Société Togolaise de Galvanisation de Tôle (SOTOTOLES)	Galvanization of sheets
ZAIRE	Société Nationale de Sidérurgie	Galvanization of sheets
NIGERIA	KOLORKOTE Nigéria Ltd. at OTA (Ogun State)	Sheet colouring line
MOROCCO	PROMEGAL	Galvanization (18,000 t/y)

* Note: Here again it is difficult to give a complete list which would, in any case, go beyond the scope of the present survey; this table thus only indicates a number of examples.

PRESENT SITUATION - CONCLUSIONS

The present situation can be summarized under the following three headings:

IRON MINES

The curve in figure 4 clearly shows the deteriorating situation with:

- The drop in production and, in particular, in Africa's share, through its exports, of the world iron ore market; and
- The beginning of imports, particularly of "lumps" or "pellets" with high iron content, to supply plants operating by direct reduction, especially in Egypt, Nigeria and Libya.

STEEL CONSUMPTION

Study of the corresponding curve in figure 6 clearly shows the low levels of steel consumption in Africa, amounting to between

10 and 14 million tons per year

over recent years, expressed in terms of raw steel.

IRON AND STEEL INDUSTRY

The curves in figure 6 and the detailed figures given in tables VI, VII and VIII show both:

- The low level of steel consumption in Africa which had just been mentioned, as well as the striking local differences, i.e. between countries and between regions;
- The generally low level of production, albeit with local differences, which are also very appreciable as regards both production levels and plant types.

As against the consumption levels just indicated, production only reached 4.1 million tons in 1987, a figure which must be compared with production capacities, in millions of tons per year, which can be estimated as follows:

	<u>At present</u>	<u>With expansion under way and main projects</u>
Oxygen steel	4.700	6.000
Electric steel with direct reduction	2.400	4.050
Electric steel using scrap (mini-plants)	0.670	0.900
Open-hearth steel	0.200	0.200
TOTAL	7.970	11.150

REFERENCES

- (1) UNITED NATIONS: World population prospects as assessed in 1980 (United Nations, New York, 1982, ST/ESA/SER.A/78).
- (2) SALESSE (P.). Minerais et fondants. Les techniques de l'ingénieur, reference M 7040.
- (3) IISI Steel Statistical Yearbooks (Brussels).
- (4) UNCTAD Statistical Data (Geneva).
- (5) APEF (Association of Iron Ore Exporting Countries) Iron Ore Statistics (Geneva).

PROPOSED STATUTES FOR AN AFRICAN IRON
AND STEEL ASSOCIATION (AISA)

PART I

ESTABLISHMENT AND HEADQUARTERS

Article 1. An African Iron and Steel Association, abbreviated as AISA, is hereby established between the African iron ore and iron and steel producers and the processors of iron and steel products, in accordance with the present statutes.

AISA is an entity under international law in accordance with the legislation of the country in which its headquarters is located, with full and complete powers to achieve the objectives and carry out the work assigned to it.

Article 2. The headquarters of AISA is provisionally fixed at ... It is anticipated that there will be AISA representation in various African countries, in particular maintaining liaison with the African regional organizations.

PART II

OBJECTIVES

Article 3. General:

These objectives shall be classified into the following five categories:

- Structure of meetings (article 4)
- Technical and economic secretariat (article 5)
- Publication of a bulletin (article 6)
- Training and education (article 7)
- Co-operation and promotion (article 8),

with the overall aim of encouraging the development of the iron ore and iron and steel industries and also the use and processing of iron and steel products in Africa.

Article 4. Structure of meetings:

The Association shall encourage its members to meet for exchanges of information and for co-operation and promotional activities through the organization of periodic meetings. These meetings may be of two types:

- An annual general meeting, if possible in a different location in Africa on each occasion, to encourage technical visits and meetings;
- Specialized meetings, such as seminars on specific subjects.

It is intended to establish permanent committees on subjects of particular importance, such as:

- Combined electric steelworks - casting (continuous) - rolling, i.e. mini-plants;

- Iron ores;
- Metallurgy of steel and quality control;
- Maintenance and problems concerning spare parts;
- Commercial aspects;
- Management, etc.

To assist specifically in organizing these meetings, there are plans to publish and update a full list of all African enterprises involved in these matters.

Article 5. Technical and economic secretariat:

At the headquarters, provisionally fixed at ... (article 2) and acting as a focal point for starting up the activities of AISA, there shall be established a small organization, to be as lightly-staffed as possible, responsible for:

- Publishing the complete list (directory referred to in article 4);
- Organizing the annual general meeting in conjunction with the authorities issuing the relevant invitation;
- Organizing specialized meetings and committees (see article 4), endeavouring, on each occasion, to decentralize their organization and follow-up by the most closely-involved and competent personages;
- Publishing a quarterly bulletin or review to inform the members of the AISA (see article 6).

Article 6. Technical and economic bulletin of AISA:

This bulletin, addressed to all AISA members, could be sold on subscription or supplied in exchange for similar publications. It would contain, in principle:

1. General information of a technical, economic and commercial nature on the iron and steel industry worldwide. Such information would probably be collected not only from the specialist press but also from various organizations, such as:
 - United Nations ECE Steel Committee
 - UNIDO
 - UNCTAD
 - Arab Iron and Steel Union, Latin American Iron and Steel Institute and South-East Asia Iron and Steel Institute
 - International Iron and Steel Institute
 - National organizations in a number of countries;

2. Information on iron mines and the iron and steel industry in Africa with:
 - Statistical data
 - General information on African enterprises;
3. Information on vocational training and specialized educational activities (see article 7).

Article 7. Vocational training and education:

AISA shall not, in principle, undertake such activities, but rather shall seek to promote them and in particular shall inform its members thereof.

Article 8. Co-operation and promotion:

Initially at least, AISA shall not undertake co-operation and promotional work but shall endeavour to develop such activities by introducing potential partners to one another, particularly through its programme of meetings (article 4) and its bulletin (article 6), the whole being co-ordinated by its secretariat (article 5).

PART III

MEMBERS

Article 9. Active members:

The following may be active members: African enterprises engaged in the production of iron ores, iron, cast iron or steel, and also in the processing of iron and steel products.

Article 10. Associate members:

The following may be associate members:

- Non-African organizations or companies interested in the work, publications or meetings of AISA;
- African enterprises or organizations interested in AISA, although their activities are not focused on the iron and steel industry.

Article 11. Membership dues:

These shall be decided by the general meeting of the AISA and could comprise the following seven categories:

- Active member: integrated iron and steel company
- mini-plant (semi-integrated)
- iron mine
- re-rolling or finishing unit
- Associate member
- Member: individual
- individual belonging to the staff of an active member company.

PART IV
ORGANIZATION

Article 12. Organs:

The organs of AISA shall be:

- The meeting and its members
- A managing board of three members elected by the general meeting
- A secretary general.