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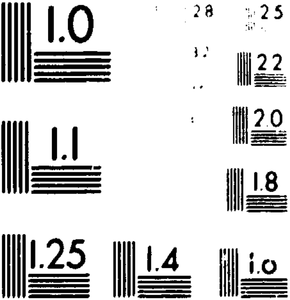

MICROCOPY RESOLUTION TEST CHART

ATLAS OF AFRICAN INDUSTRY
IRON AND STEEL

ATLAS OF AFRICAN INDUSTRY

IRON AND STEEL

United Nations Industrial Development Organization
Vienna, 1989

EXPLANATORY NOTES

The unit of currency used throughout the Atlas is the United ates dollar ($).
The term "billion" signifies a thousand million, and the term illion" a million million.
A dash (–) indicates that the amount is nil or negligible.
Bar charts throughout the Atlas are colour-coded according to the country's subregional group as shown in 1.1(b).

Reference sources for all tables, maps, bar charts and piecharts are listed at the end of the Atlas.

Unless specifically indicated, data do not include South Africa.

The following abbreviations have been used in this text:

rganizations

ISU	– Arab Iron and Steel Union
CA	– United Nations Economic Commission for Africa
CCAS	– Economic Community of Central African States
COWAS	– Economic Community of West African States
U	– Economist Intelligence Unit
ATT	– General Agreement on Tariffs and Trade
SI	– International Iron and Steel Institute
C	– International Trade Centre
AU	– Organization of African Unity
ECD	– Organisation for Economic Co-operation and Development
TA	– Preferential Trade Area for Eastern and Southern African States
ADCC	– Southern African Development Co-ordination Conference
N	– United Nations
NCTAD	– United Nations Conference on Trade and Development
NIDO	– United Nations Industrial Development Organization

nits of measurement

bl	– Barrel
Wh	– Gigawatt-hour
g	– Kilogram
Wh	– Kilowatt-hour
W	– Megawatt
3	– Cubic metre
n	– Metric ton (1,000 kg)

Commodities

Cb	– Columbium
Co	– Cobalt
Cr	– Chromium
Fe	– Iron
Mn	– Manganese
Ni	– Nickel
P	– Phosphorus
P_2O_5	– Phosphorus pentoxide
S	– Sulfur
SiO_2	– Silicon dioxide (silica)
Ta	– Tantalum
Ta_2O_5	– Tantalum pentoxide
Ti	– Titanium
TiO_2	– Titanium dioxide
V	– Vanadium
W	– Tungsten

Others

AVA	– Agricultural Value Added
BOF	– Basic oxygen furnace
EAF	– Electric arc furnace
GDP	– Gross Domestic Product
IDDA	– Industrial Development Decade for Africa
LD	– Linz-Donawitz Converter
LDC	– Least Developed Country
LNG	– Liquefied natural gas
MVA	– Manufacturing Value Added
N.A.	– Not available
V.M.	– Volatile matter

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In some tables and figures, the designation "least developed", "developed" and "developing" economies is intended for statistical convenience and does not necessarily express a judgement about the stage reached by a particular country or area in the development process.

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This publication has not been formally edited.

FOREWORD

In recognition of the critical and indispensable role of industry in the economic development of Africa, the 1980s were proclaimed as the Industrial Development Decade for Africa (IDDA). The IDDA has, among other things, helped to increase awareness in African countries and the world at large of the industrialization problems peculiar to the region and of the need to mobilize domestic and foreign resources towards the accelerated development of industry on the continent.

A critical review of Africa's industrial performance during the 1980s reveals that only minimal progress has been made since the proclamation of the IDDA, despite the policy measures and structural adjustment programmes carried out by several African countries. Thus, during the 1980s, Manufacturing Value Added (MVA) in the region has been growing by an average of just over 4 per cent and accounts for only about 1 per cent of global manufacturing output, as compared to the Lima minimum target of 2 per cent by the year 2000 and the mid-term target of 1.4 per cent by the year 1990.

This overall unsatisfactory performance has been due to the serious economic crises, natural disasters, mounting external debt and unfavourable external environment, that beset the continent and by the very low growth of Agricultural Value Added (AVA) which amounted to an average of only 0.9 per cent for the entire region, as compared to an average annual population growth rate of 3 per cent. Furthermore, MVA as a proportion of Gross Domestic Product (GDP) has not risen above 15 per cent in nearly 40 African countries and several factories are functioning at very low levels of capacity due, among other things, to gross shortages of imported raw materials, spare parts and technical skills.

As a consequence, the objectives of the IDDA are yet to be fully achieved. Plans are now underway for the proclamation of a second IDDA as well as an Africa Industrialization Day to continue the promotion of the continent's industrialization launched during the first IDDA. These plans are very timely in view of the fact that the only permanent viable solution to Africa's economic and aggravating debt crisis lies in the accelerated industrialization of the continent. The plans also recognize the far-reaching consequences for Africa of the dynamic changes taking place in global, political and economic relations.

The programme for the IDDA accords priority attention to the development of certain core industrial subsectors which are seen to offer the greatest potential for galvanizing rapid industrialization and regional subregional industrial co-operation and integration. In this regard, the African Ministers of Industry have repeatedly called for the production of a readily comprehensible reference document, in the form of an atlas, that would provide a reliable overview of industry in the entire region. This Atlas is UNIDO's first step in response to that request.

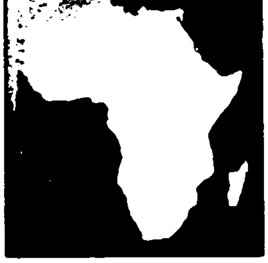
The iron and steel industry is a particularly important industrial subsector, not only by virtue of its great scope for backward and forward linkages, but also because of its potential for utilizing locally available natural endowments of minerals, energy and other resources. Planning the iron and steel industry in Africa has often suffered from a dearth of basic information on the status of the industry in the region as a whole and of data on those resources on which it is based. This first issue of the Atlas on the iron and steel industry is a contribution towards filling this gap.

It is hoped that, by providing data and information (in a form that can be readily understood by laymen) on the African iron and steel industry and on the availability and status of exploitation of those mineral and other resources on which the industry depends, the Atlas will be of use to industrial planners in both the iron and steel subsector and its downstream industries. It should also be of use to those formulating and implementing co-operation programmes and projects at the bilateral, subregional and regional levels. In a broader context, the Atlas should ultimately contribute to formulating and implementing technical assistance and investment projects, as well as to the selection of technology and the rehabilitation of iron and steel plants.

Acknowledgement

The basic data for the Atlas were collected by Basil U.N. Igwe through extensive missions to African countries and several international development agencies. UNIDO therefore wishes to acknowledge the valuable assistance and contribution made towards the production of this Atlas by all the countries and organizations, both within and outside Africa, that provided information and data on the iron and steel industry in Africa.

The *Atlas of African Industry: Iron and Steel* was prepared for publication by Nicholas Middleton, Environmental and Economic Development Consultants, School of Geography, Oxford, United Kingdom.



CONTENTS

INTRODUCTION

This Atlas of the African iron and steel industry is the first of a series presenting information on key subsectors of industry in Africa. The objective is to furnish data in a concise and visually attractive form so as to assist the reader in arriving at a general understanding of some of the major characteristics of the subsector.

Because the iron and steel industry is affected by the economic environment in which it exists (nationally, regionally and world-wide), it is relevant that any discussion of the industry should be prefaced by an understanding of general socio-economic factors. For this reason, the Atlas presents, in Section One, a number of key geographic, demographic and economic parameters which, directly or indirectly, impinge on the character and performance of the industry. Thus, such apparently peripheral issues as the growth (or otherwise) of the Gross Domestic Product per capita, population density and growth rate, and the external debt burden, all can potentially affect the development of the industry and the performance of enterprises within it.

It is also recognized that the steel consumption pattern exerts a major influence on any decision to enter into production. In an era in which foreign exchange needed to import foreign manufactured products (including steel) is limited, African countries are now looking inwards with a view to maximizing their degree of self-reliance through import reduction – an important step towards the development of their internal engines of growth.

Furthermore, knowledge of consumption patterns in several countries in a subregion could facilitate the formulation of joint projects. This is all the more important given the limited financial and other resources with which individual countries could invest, on their own, in such capital-intensive projects as iron steel.

Another major factor in any decision to undertake an iron and steel project is the local availability of the necessary raw material and energy resources. The Atlas thus presents, in Section Four, details of African reserves of iron ore, coal, petroleum and natural gas, and the important alloying minerals. To a large extent, much of the iron ore and coal resources remains unexploited. As for petroleum and natural gas, many African countries are already among world producers, although emphasis now needs to be shifted towards increased local processing prior to export.

Because steel production is highly energy-intensive, the ready availability of cheap power is a factor in favour of the industry. In particular, the mini mills that now dominate in Africa consume more electricity per unit of steel production than any other process. As such, the Atlas also presents, in largely qualitative terms, the hydro-potential of African countries as well as the status of exploitation in each country.

For the purpose of this Atlas, only those steel plants producing rolled steel products, starting with either (a) iron ore, pig iron, reduced iron or ferrous scrap (or a combination of these) or (b) semi-finished steel products such as billets, blooms, slabs and scrap have been considered. As such, foundries, forge-shops, corrugating and galvanizing mills which do not produce rolled products and/or are not consumers of the above material inputs have not been considered.

In compiling the data for this Atlas, considerable difficulty was encountered in obtaining proper up-to-date data and other economic information from African countries. In several cases, critical data were either not available or, where available, they were not properly organized and too out-dated to be of use to current planning. In most cases, the most recent data available were for 1985.

Similarly, the data on mineral and other resource endowments were several years old. In most countries, exploration of new resources had been brought to a standstill as a result of the severe economic difficulties encountered by African countries during the last decade. Actual quantities of most reserves could thus exceed the amounts recorded in the Atlas.

Finally, the Atlas does not reflect plant-level data. Information has not been included on such aspects as the patterns and structures of employment, energy consumption, plant ownership, technology and equipment sources which can best be obtained by plant-by-plant canvassing. It is hoped that future editions of the Atlas would incorporate these and other useful data for purposes of planning, technical assistance and rehabilitation.

For the purposes of this Atlas, Africa has been broken down into four geographical subregions as follows

NORTHERN AFRICA
The five Arab Mediterranean countries – Algeria, Egypt, Libyan Arab Jamahiriya, Morocco and Tunisia – plus Sudan.

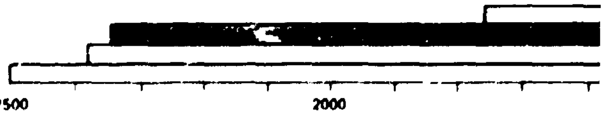
WESTERN AFRICA
The 16 member States of the Economic Community of West African States (ECOWAS): Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo.

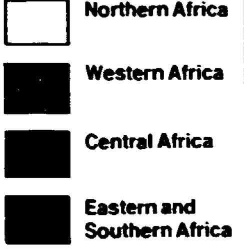
CENTRAL AFRICA
The 11 member States of the Economic Community of Central African States (ECCAS): Angola (which currently has an observer status but is expected ultimately to become a full member), Burundi, Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea, Gabon, Rwanda, Sao Tome and Principe, and Zaire;

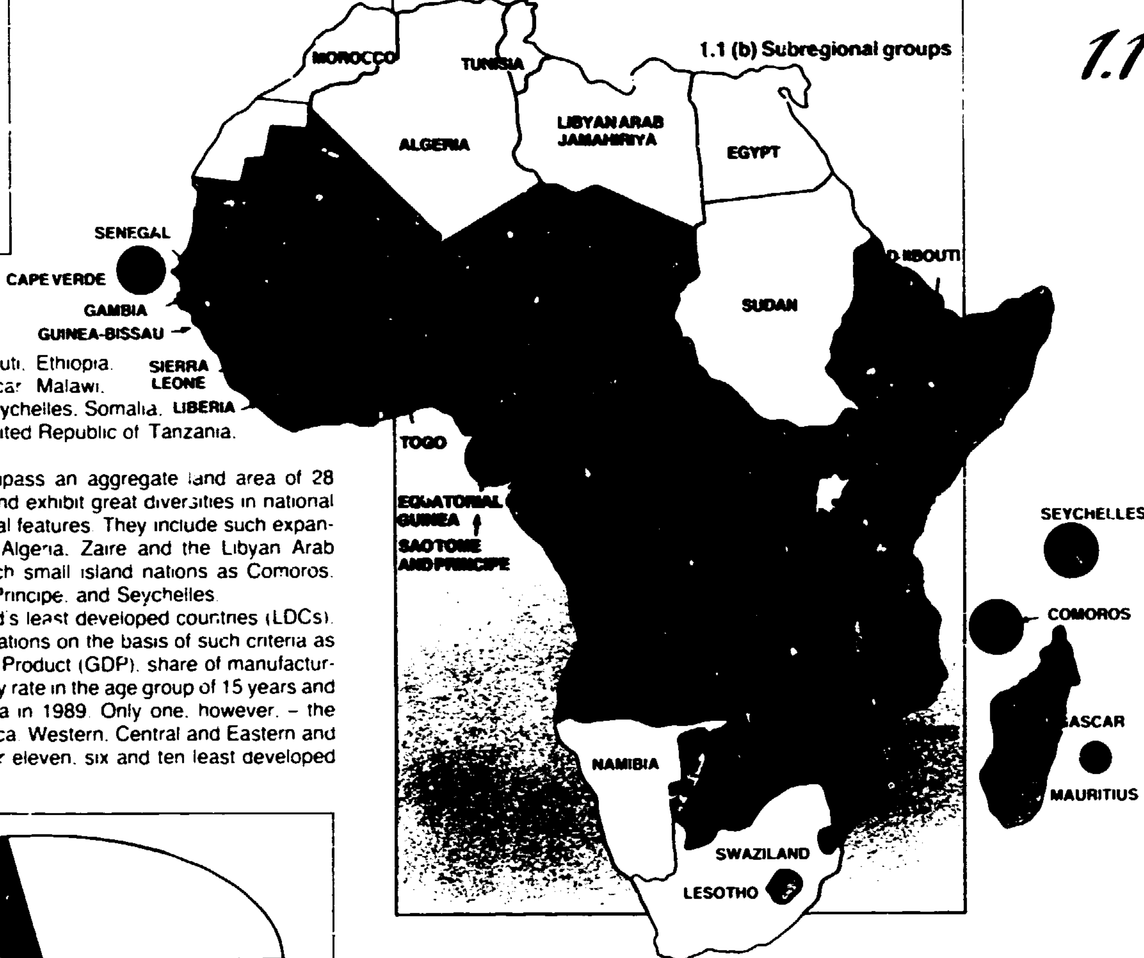
EASTERN AND SOUTHERN AFRICA
The 17 member States of the Preferential Trade Area (PTA) of Eastern and Southern Africa and/or the Southern African Development Coordination Conference (SADCC), (less Angola

1.1 (a) Countries in subregional groupings, with land area and capital cities

	Country	Land Area (thousand km²)	Capital City
Northern Africa			
	Algeria	2,382	Algiers
	Egypt	1,001	Cairo
	Libyan Arab Jamahiriya	1,760	Tripoli
	Morocco	447	Rabat
	Sudan	2,506	Khartoum
	Tunisia	164	Tunis
Western Africa			
	Benin	113	Cotonou
	Burkina Faso	274	Ouagadougou
	Cape Verde	4	Praia
	Côte d'Ivoire	323	Abidjan
	Gambia	11	Banjul
	Ghana	239	Accra
	Guinea	246	Conakry
	Guinea-Bissau	36	Bissau
	Liberia	111	Monrovia
	Mali	1,240	Bamako
	Mauritania	1,031	Nouakchott
	Niger	1,267	Niamey
	Nigeria	924	Lagos
	Senegal	196	Dakar
	Sierra Leone	72	Freetown
	Togo	57	Lomé
Central Africa			
	Angola	1,247	Luanda
	Burundi	28	Bujumbura
	Cameroon	475	Yaoundé
	Central African Republic	623	Bangui
	Chad	1,284	N'Djamena
	Congo	342	Brazzaville
	Equatorial Guinea	28	Malabo
	Gabon	268	Libreville
	Rwanda	26	Kigali
	Sao Tome & Principe	1	Sao Tomé
	Zaire	2,345	Kinshasa
Eastern and Southern Africa			
	Botswana	600	Gaborone
	Comoros	2	Moroni
	Djibouti	22	Djibouti
	Ethiopia	1,222	Addis Ababa
	Kenya	583	Nairobi
	Lesotho	30	Maseru
	Madagascar	587	Antananarivo
	Malawi	119	Lilongwe
	Mauritius	2	Port Louis
	Mozambique	802	Maputo
	Seychelles	1	Victoria
	Somalia	638	Mogadiscio
	Swaziland	17	Mbabane
	Uganda	236	Kampala
	U.R. of Tanzania	945	Dar-Es-Salaam
	Zambia	753	Lusaka
	Zimbabwe	391	Harare



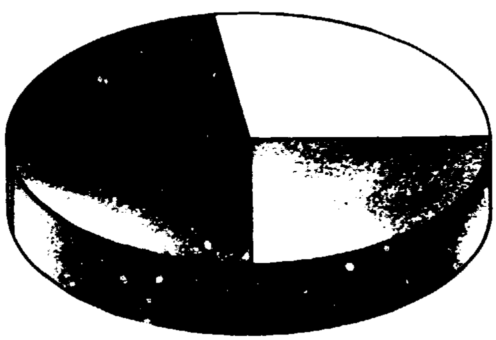




Burundi and Rwanda)
Botswana, Comoros, Djibouti, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Seychelles, Somalia, Swaziland, Uganda, the United Republic of Tanzania, Zambia and Zimbabwe.

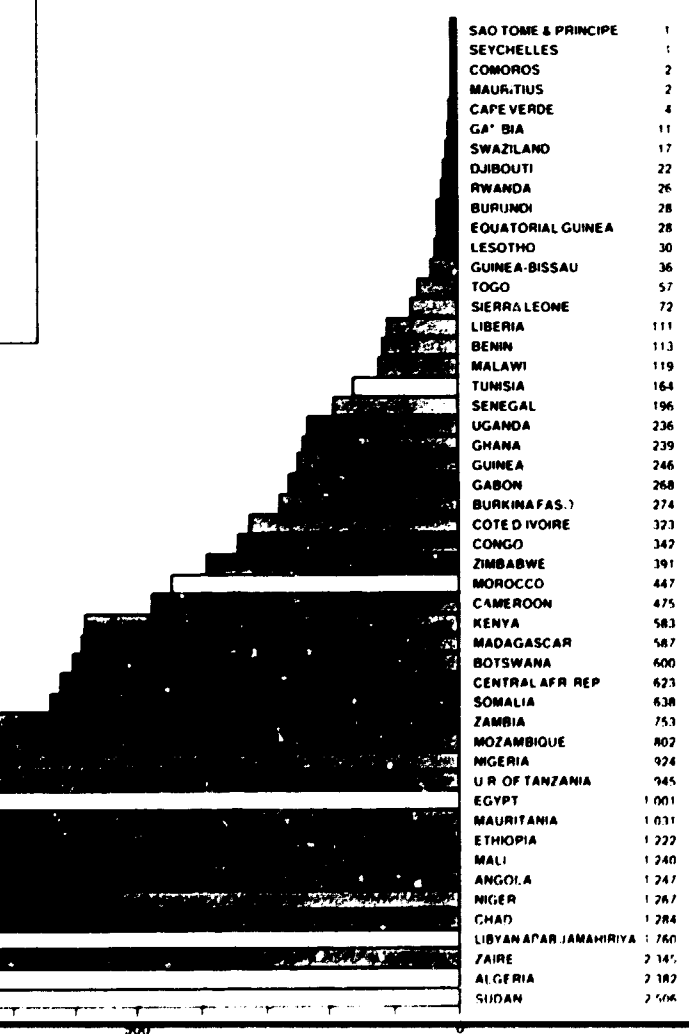
The 50 countries encompass an aggregate land area of 28 million square kilometres and exhibit great diversities in national land areas and geographical features. They include such expansive countries as Sudan, Algeria, Zaire and the Libyan Arab Jamahiriya, as well as such small island nations as Comoros, Mauritius, Sao Tome and Principe, and Seychelles.

Twenty-eight of the world's least developed countries (LDCs), as defined by the United Nations on the basis of such criteria as per capita Gross Domestic Product (GDP), share of manufacturing in total GDP, and literacy rate in the age group of 15 years and over, were located in Africa in 1989. Only one, however, – the Sudan – is in Northern Africa. Western, Central and Eastern and Southern Africa account for eleven, six and ten least developed countries, respectively.



Northern Africa	**8,260**
Western Africa	**6,136**
Central Africa	**6,667**
Eastern and Southern Africa	**6,950**

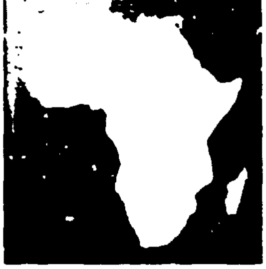
1.1 (c) Land area by subregion (thousand km²)



1.1 (d) Countries ranked by land area (thousand km²)

SECTION ONE

1.2



POPULATION

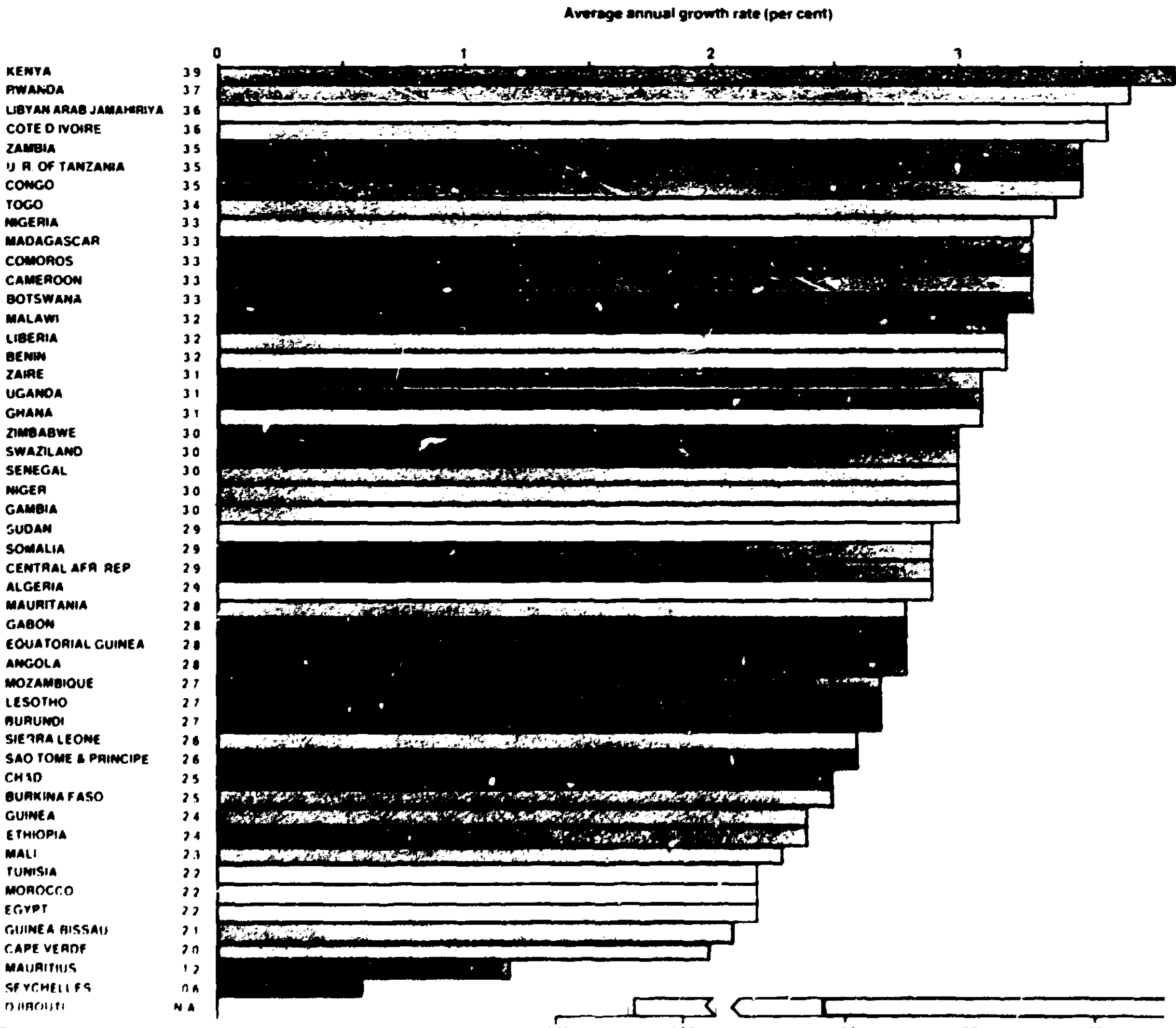
The mid-1987 total population of the four subregions was 556 9 million. disaggregated as follows

	(Millions)
NORTHERN AFRICA	132 0
WESTERN AFRICA	179 9
CENTRAL AFRICA	76 0
EASTERN AND SOUTHERN AFRICA	169 0

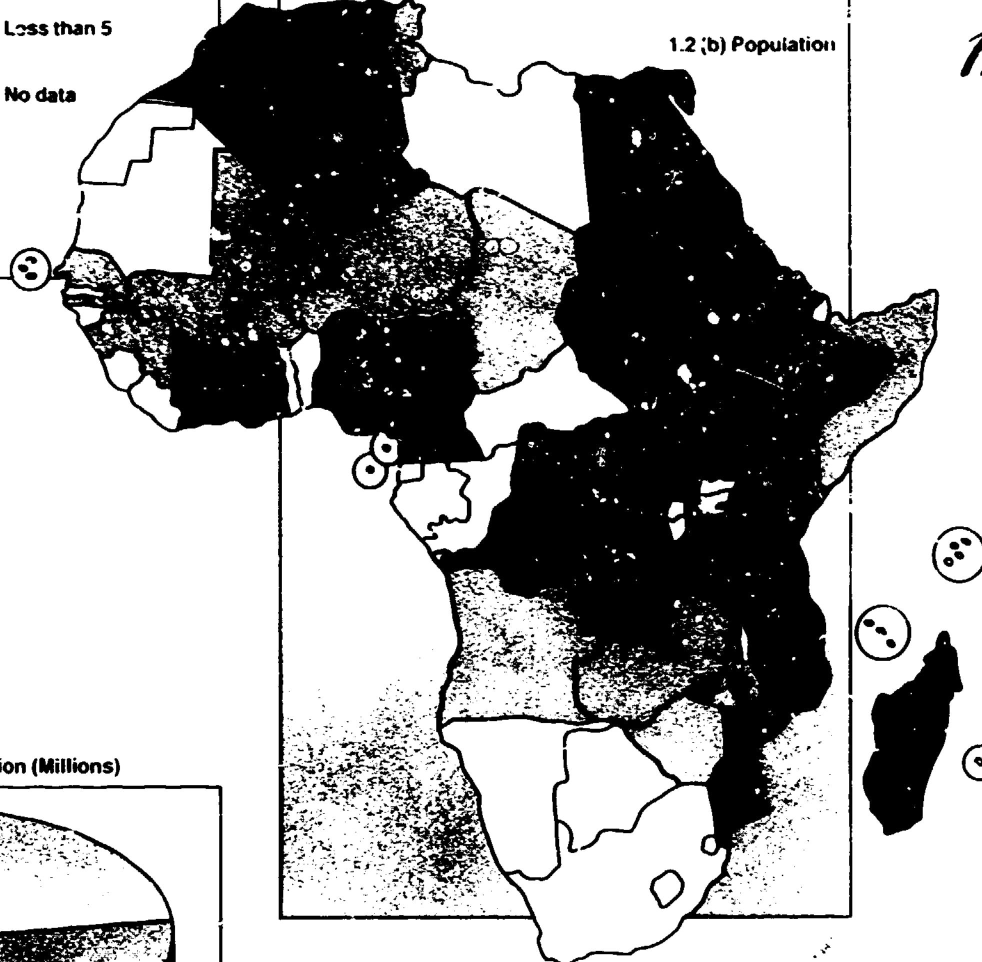
The average population density of 19.5 persons per square kilometre is not considered excessive *per se*. However. against the background of an explosive average annual growth rate of about 2 9 per cent. grossly underdeveloped social and physical infrastructures. an increasingly young population ratio. and massive rural-to-urban migration often exacerbated by natura and man-made disasters. the population factor becomes one o the most critical elements in the economic plight of many Africar countries.

Over the past decade. African countries have exhibited the highest population growth rates of any region in the world. with a least 24 countries registering 3.0 per cent per annum and above during the period 1980–1986 Accordingly. whatever increases were achieved in economic output were neutralized by eve higher increases in population. resulting in declining real incomes and standards of living for the majority of the population In a rea sense. it was. in part. the pressures of high population growth tha forced many countries to adopt policies focusing on presen consumption to the detriment of the industrial and other invest ments necessary for ensuring higher consumption in the future.

1.2 (a) Countries ranked by 1980–1986 population growth rates



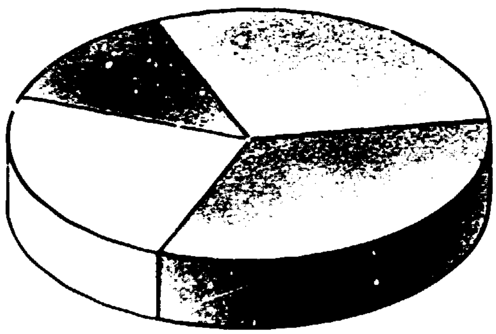
SECTION ONE



1.2 (b) Population

Population in millions (mid-1987)

1.2 (c) Mid-1987 population by subregion (Millions)

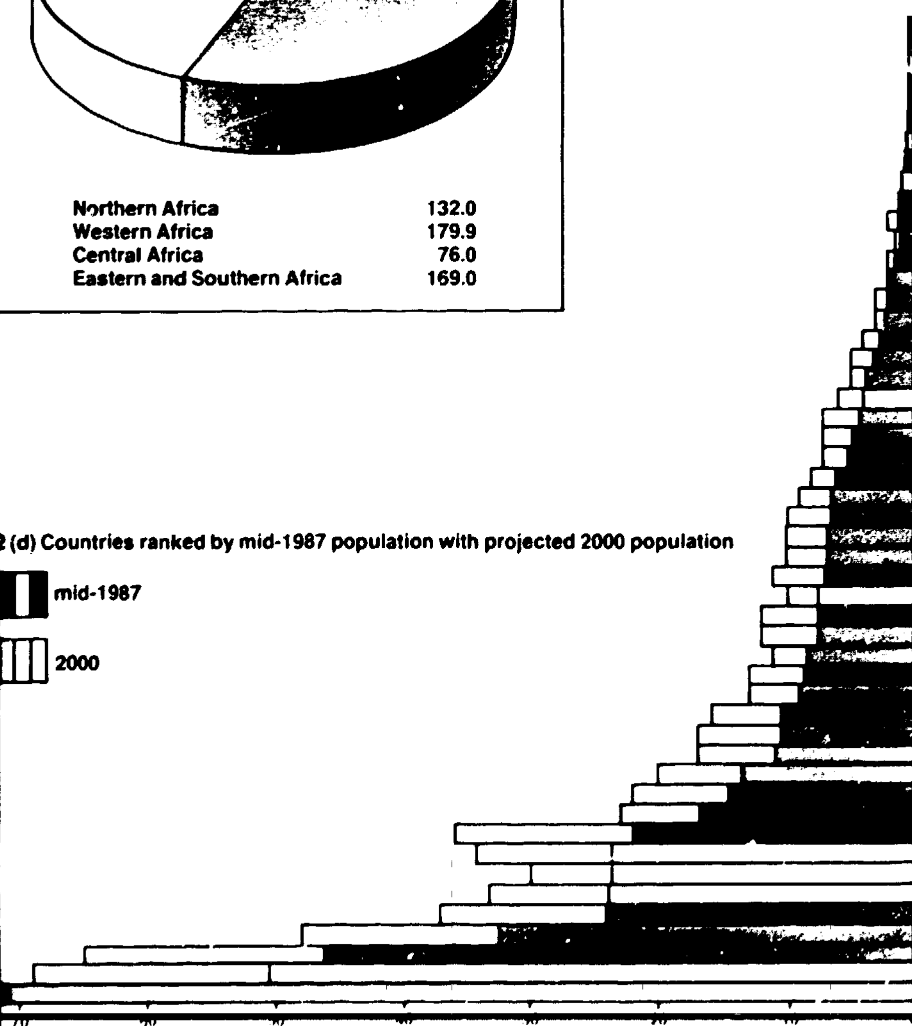


Northern Africa	132.0
Western Africa	179.9
Central Africa	76.0
Eastern and Southern Africa	169.0

1.2 (d) Countries ranked by mid-1987 population with projected 2000 population

mid-1987

2000



	Mid-1987	2000
SEYCHELLES	0 07	N A
SAO TOME & PRINCIPE	0 11	N A
CAPE VERDE	0 35	N A
DJIBOUTI	0 38	N A
EQUATORIAL GUINEA	0 43	N A
COMOROS	0 44	N A
GAMBIA	0 78	N A
SWAZILAND	0 80	N A
GUINEA-BISSAU	0 89	N A
MAURITIUS	1 1	1
BOTSWANA	1 2	2
GABON	1 4	1
LESOTHO	1 6	2
MAURITANIA	1 9	2
CONGO	2 1	3
LIBERIA	2 3	3
CENTRAL AFR REP	2 8	4
TOGO	3 2	5
SIERRA LEONE	3 8	5
LIBYAN ARAB JAMAHIRIYA	4 0	6
BENIN	4 3	7
BURUNDI	4 9	7
CHAD	5 3	7
SOMALIA	6 2	8
GUINEA	6 4	9
RWANDA	6 6	10
NIGER	6 9	10
SENEGAL	6 9	10
ZAMBIA	7 2	11
TUNISIA	7 5	10
MALAWI	7 5	12
BURKINA FASO	7 5	12
MALI	8 5	11
ZIMBABWE	8 7	13
ANGOLA	9 2	13
MADAGASCAR	10 6	16
CAMEROON	10 7	17
COTE D IVOIRE	10 9	17
GHANA	13 5	20
MOZAMBIQUE	14 5	22
UGANDA	16 8	21
KENYA	22 0	36
SUDAN	23 0	14
MOROCCO	23 1	30
ALGERIA	23 7	33
U R OF TANZANIA	24 2	37
ZAIRE	32 5	48
ETHIOPIA	45 8	65
EGYPT	50 [illegible]	69
NIGERIA	102 0	161

SECTION ONE

1.3

STRUCTURE OF PRODUCTION

GROSS DOMESTIC PRODUCT (GDP)

The decade of the 1980s has witnessed a major economic retreat by many African countries. In the face of a crushing debt burden, high interest rates, overvalued exchange rates, unpredictable deterioration in the prices of their exports, escalating prices of imports and effective out-transfer of net financial resources, only a few countries have barely been able to achieve, in 1986, per capita GDP levels equal to those of 1980. In most cases, there were stagnations or outright declines. Whereas in 1980, as the bar chart below shows, 15 African countries had GDP per capita of $300 or less (in constant 1980 prices), by 1986, the number had increased to 17. In fact, the average annual GDP growth rate was negative during the period in 13 countries. Unfortunately, indications are that decline and stagnation will probably continue for most African economies during the rest of the decade.

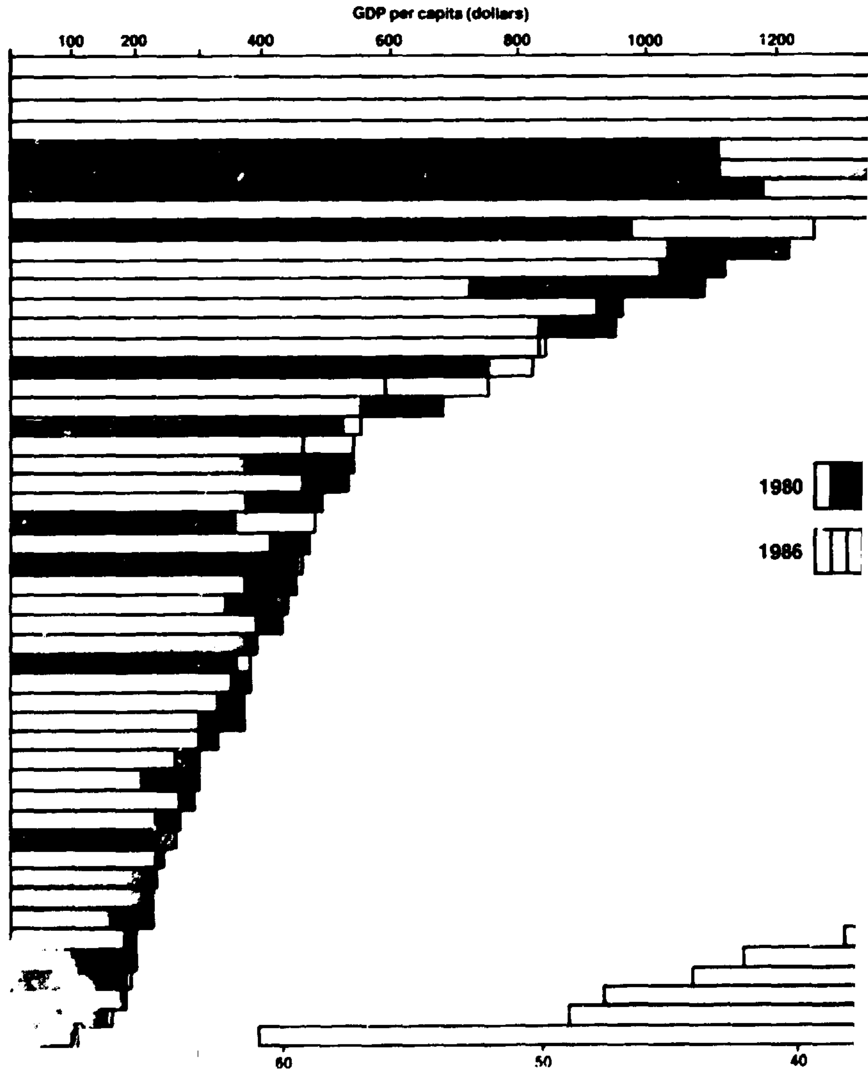
INDUSTRY AND MANUFACTURING

Industrial and manufacturing activities were both victims and culprits of the general economic malaise. Prior to the early 1980s, manufacturing growth rates in African countries were generally comparable to those in other developing countries. Africa's share of the world's MVA indeed rose from 0.7 per cent in 1970 to 1 per cent in 1982. Since then, however, industrial performance has deteriorated relative to other developing regions. Manufacturing capacity utilization rates have declined to well below 50 per cent for most subsectors. For heavy industries in particular (including the iron and steel subsector), values below 40 per cent have generally been the norm. The few exceptions have occurred in the Northern African subregion.

It is instructive to isolate the respective contributions of industry and manufacturing to GDP. Where industrial contribution has been high (above 40 per cent), it has generally reflected the impact of the mining and minerals subsector which is characterized by minimal domestic processing prior to export. Manufacturing contribution to GDP, on the other hand, did not exceed 24 per cent for any country in 1986. This is an unhealthy situation, given the fact that manufacturing can help in providing basic goods for the rapidly growing population. It can also assist in raising income levels, lowering unemployment, laying the foundation for technological progress, and providing inputs and equipment to other economic sectors, thus reducing import dependence.

1.3 (a) Countries ranked by 1980 GDP per capita, with 1986 GDP per capita and 1980–1986 average annual GDP growth rate

LIBYAN ARAB JAMAHIRIYA	11.692	7.146	3.1
GABON	5.305	3.776	0.9
ALGERIA	2.268	2.483	5.0
SEYCHELLES	2.302	2.281	1.4
BOTSWANA	1.126	1.590	11.3
CONGO	1.115	1.489	7.8
MAURITIUS	1.181	1.465	4.8
TUNISIA	1.369	1.460	3.8
CAMEROON	986	1.261	7.2
COTE D'IVOIRE	1.222	1.032	0.8
JIBOUTI	1.127	1.019	2.0
NIGERIA	1.095	723	3.5
SWAZILAND	960	926	2.4
UGANDA	948	831	0.8
MOROCCO	836	842	3.4
ZIMBABWE	750	816	3.8
EGYPT	590	755	6.7
ZAMBIA	677	548	0.1
SENEGAL	524	545	3.2
SUDAN	544	458	0.5
SAO TOME & PRINCIPE	543	376	4.5
MAURITANIA	534	463	0.4
LIBERIA	494	369	1.5
CAPE VERDE	351	476	7.8
NIGER	471	411	0.8
ANGOLA	449	463	3.4
GHANA	446	371	0.5
TOGO	443	337	1.2
KENYA	426	388	2.3
CENTRAL AFR REP	387	370	1.5
COMOROS	364	379	4.0
SIERRA LEONE	377	253	4.1
GAMBIA	373	332	1.2
MADAGASCAR	372	300	0.0
BENIN	333	294	0.5
SOMALIA	296	262	0.7
GUINEA	295	207	2.6
LESOTHO	285	267	1.7
U R OF TANZANIA	272	232	0.9
BURUNDI	232	260	4.[illegible]
MALI	238	227	1.4
ZAIRE	213	216	1.7
RWANDA	225	217	2.2
CHAD	224	164	3.2
MALAWI	203	186	2.6
MOZAMBIQUE	199	103	[illegible]
GUINEA-BISSAU	190	196	2
BURKINA FASO	185	181	1.2
EQUATORIAL GUINEA	157	162	2.5
ETHIOPIA	[illegible]6	101	0.2



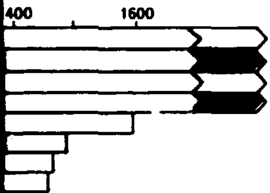
SECTION ONE

.3 (b) Contribution of industry to GDP (per cent)

More than 55%	10 – 25%
40 – 50%	Less than 10%
25 – 40%	No data

1.3 (c) Contribution of manufac

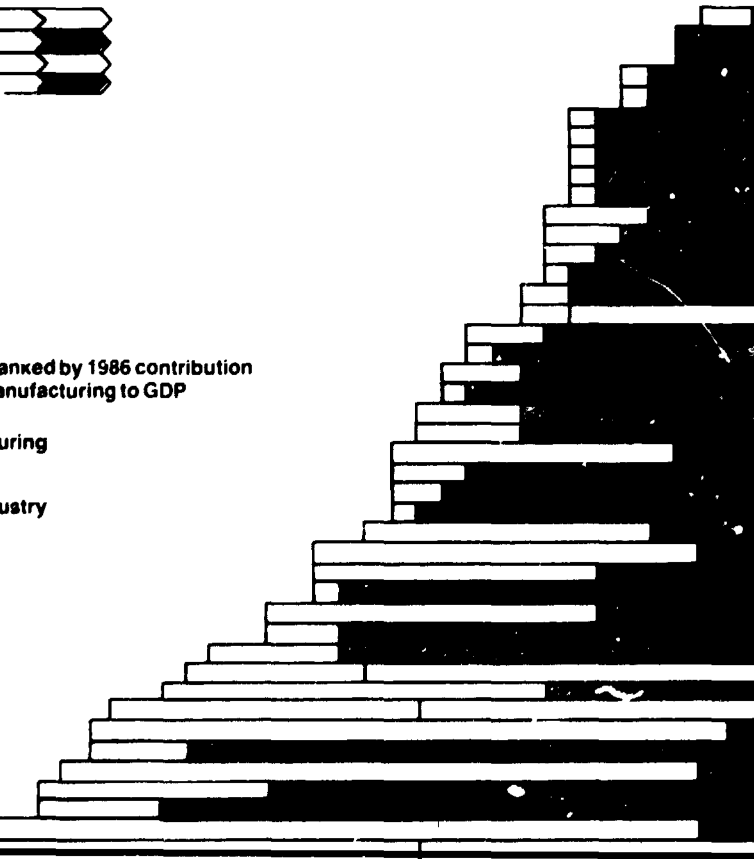
More than 20%
15 – 20%
10 – 15%



3 (d) Countries ranked by 1986 contribution industry and manufacturing to GDP

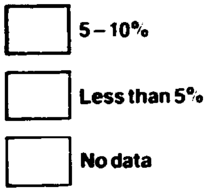
Manufacturing

Other industry



1.3

...ufacturing to GDP (per cent)



GUINEA-BISSAU	3	1
COMOROS	4	4
UGANDA	4	4
SOMALIA	6	5
EQUATORIAL GUINEA	6	5
BURUNDI	8	7
GAMBIA	8	7
GHANA	8	7
SEYCHELLES	8	7
U R OF TANZANIA	8	7
CAPE VERDE	9	5
MALI	9	6
BENIN	9	7
CHAD	9	8
LESOTHO	10	8
SUDAN	10	8
CENTRAL AFR REP	12	9
BURKINA FASO	12	11
DJIBOUTI	13	10
ETHIOPIA	13	12
COTE D IVOIRE	14	10
SAO TOME & PRINCIPE	14	10
NIGER	15	4
KENYA	15	12
MALAWI	15	13
MADAGASCAR	15	14
MAURITANIA	16	5
GUINEA	18	3
TOGO	18	7
RWANDA	18	17
SIERRA LEONE	20	7
MAURITIUS	20	17
SENEGAL	22	17
MOROCCO	23	16
LIBERIA	24	9
TUNISIA	26	14
ANGOLA	27	2
SWAZILAND	27	23
NIGERIA	28	1
ZIMBABWE	29	20
MOZAMBIQUE	29	24
ZAIRE	31	1
EGYPT	32	14
ZAMBIA	35	20
CAMEROON	38	13
ALGERIA	42	10
BOTSWANA	44	1
CONGO	48	9
GABON	49	7
LIBYAN ARAB JAMAHIRIYA	61	1

SECTION ONE

DEBT BURDEN

Both the volume and rapid growth of the external debt of African countries have resulted from the adverse economic conditions of the past ten years. They still continue to impede economic recovery and resumed growth.

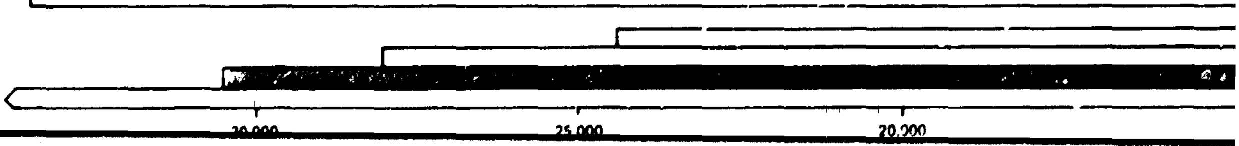
As at the end of 1987, the total external debt of the 50 countries stood at about $266,744 million, much of it incurred to meet the fall in export receipts. The subregional disaggregation was as follows.

	(Million Dollars)
NORTHERN AFRICA	120.997
WESTERN AFRICA	71.668
CENTRAL AFRICA	29.687
EASTERN AND SOUTHERN AFRICA	44.392

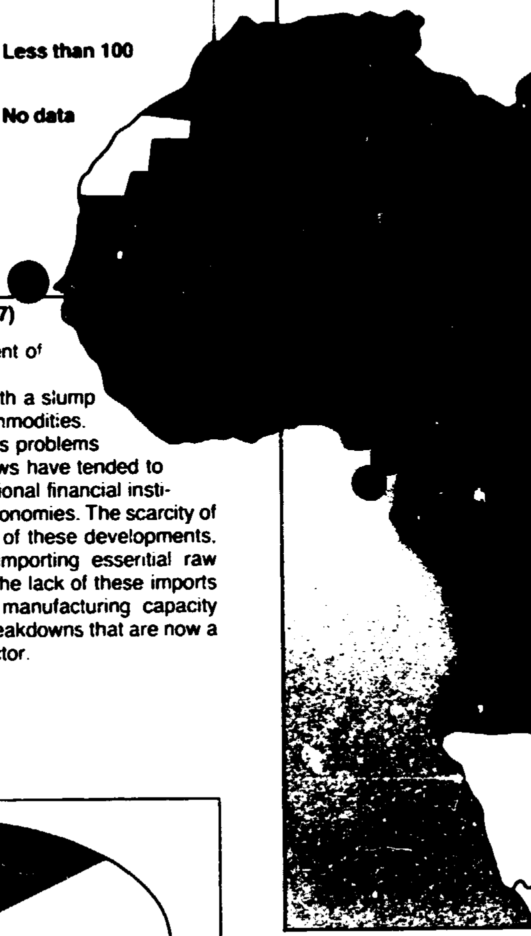
The economy of sub-Saharan Africa (which is least able to service and repay these debts) has been most adversely affecte[d] in that resources that would otherwise have been invested [in] productive economic activities have had to be diverted [to] servicing past (and not necessarily productive) consumptio[n]. Whereas, in 1982, sub-Saharan Africa had an external debt [of] $45.4 billion, by 1986 that figure had escalated to about $12[…] billion. The debt-service ratio increased, over the same perio[d] from 8.4 per cent to 10.8 per cent. In several countries, the ratio

1.4 (a) Total 1987 external debts, external debts per capita and debt services, by region and country

Region	Country	Total External Debt, 1987 (millions of dollars)	External Debt Per Capita 1987 (dollars)	Debt Service 1987 as Percentage of GNP	Debt Service 1987 as Percentage of Exports
Northern Africa	Algeria	28,035	1,214	7.5	46.8
	Egypt	43,565	859	5.1	14.8
	Libyan Arab Jamahiriya	3,200 (1985)	821 (1986)	N.A.	N.A.
	Morocco	24,459	1,049	8.4	24.2
	Sudan	12,346	534	0.8 (1986)	11.8 (1986)
	Tunisia	9,392	1,231	10.8	26.3
Western Africa	Benin	1,522	354	2.1	16.0
	Burkina Faso	1,247	149	1.6	10.1 (1986)
	Cape Verde	286	431	4.0	43.4 (1986)
	Côte d'Ivoire	14,576	1,119	15.6	40.8
	Gambia	452	570	7.2	13.0
	Ghana	4,350	265	3.7	17.1
	Guinea	2,381	329	5.4	–
	Guinea-Bissau	568	498	7.4	37.8
	Liberia	1,756	747	1.0	6.2 (1986)
	Mali	2,526	291	1.7	9.8
	Mauritania	2,651	1,425	9.9	18.2
	Niger	2,145	331	7.2	47.0
	Nigeria	30,486	298	3.9	11.7
	Senegal	4,484	690	6.3	22.1
	Sierra Leone	823	214	0.6	109.8 (1986)
	Togo	1,416	450	5.5	13.9
Central Africa	Angola	3,071 (1986)	341 (1986)	N.A.	N.A.
	Burundi	1,041	208	3.5	38.2
	Cameroon	5,136	475	4.8	27.8
	Central African Republic	706	282	2.1	11.9
	Chad	541	103	0.7	4.1
	Congo	5,341	2,903	10.3	18.7
	Equatorial Guinea	293	702	3.8 (1986)	23.1
	Gabon	2,482	2,528	2.3	5.1
	Rwanda	972	140	0.9	11.3
	Sao Tome & Principe	160	1,441	15.3	41.3
	Zaire	9,944	306	4.7	12.8
Eastern and Southern Africa	Botswana	775	662	6.4	3.7
	Comoros	200	572	0.6	4.0
	Djibouti	310	331 (1986)	2.0 (1986)	5.1 (1986)
	Ethiopia	3,906	86	3.6	25.9 (1986)
	Kenya	7,190	313	7.6	33.8
	Lesotho	424	282	2.3	4.5
	Madagascar	4,227	388	7.9	36.0
	Malawi	1,796	240	5.7	23.4
	Mauritius	644	644	5.3	9.0
	Mozambique	3,200 (1986)	225	N.A.	N.A.
	Seychelles	157	2,229	4.8	7.9 (1986)
	Somalia	3,036	446	0.6 (1986)	9.5 (1986)
	Swaziland	306	542	5.2	6.1
	Uganda	1,876	119	1.9	18.8
	U. R. of Tanzania	4,912	212	1.1 (1986)	23.7 (1986)
	Zambia	7,341	971	4.5 (1986)	9.7 (1986)
	Zimbabwe	3,436	380	6.4 (1986)	27.6 (1986)



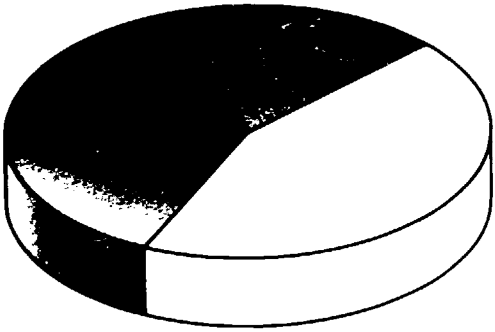
SECTION ONE



xternal debt per capita in dollars (1987)

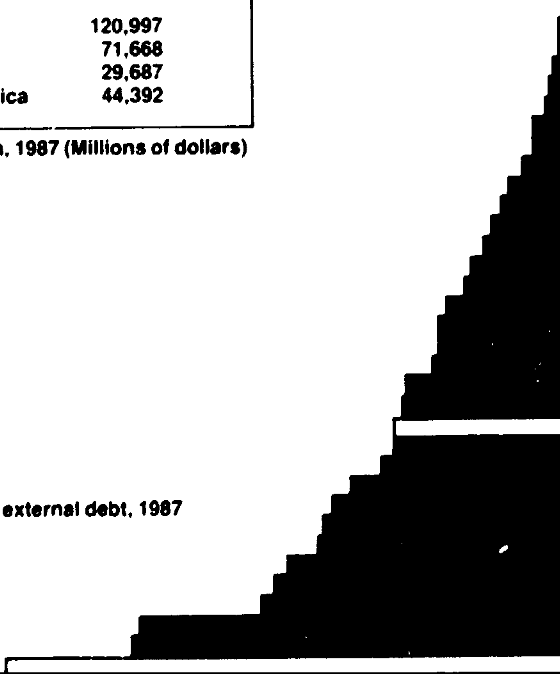
urrently running at more than 30 per cent of he annual export earnings.

This heavy debt overhang, coupled with a slump the global prices of many primary commodities, as created serious balance-of-payments problems r most countries. Moreover, capital flows have tended to ry up as investors, donors and international financial instiutions have lost confidence in African economies. The scarcity of oreign exchange, which is an outcome of these developments, as prevented many industries from importing essential raw aterials, equipment and spare parts. The lack of these imports as, in turn, led to the low rates of manufacturing capacity tilization and widespread equipment breakdowns that are now a eature of the African manufacturing sector.



Northern Africa	**120,997**
Western Africa	**71,668**
Central Africa	**29,687**
Eastern and Southern Africa	**44,392**

.4 (c) External debts by subregion, 1987 (Millions of dollars)



.4 (d) Countries ranked by size of external debt, 1987

1.4 (b) External debt

1.4

SEYCHELLES	157	
SAO TOME & PRINCIPE	160	
COMOROS	269	
CAPE VERDE	286	
EQUATORIAL GUINEA	293	
DJIBOUTI	310	
SWAZILAND	385	
LESOTHO	424	
GAMBIA	452	
CHAD	541	
GUINEA-BISSAU	568	
MAURITIUS	644	
CENTRAL AFR REP	706	
BOTSWANA	775	
SIERRA LEONE	823	
RWANDA	972	
BURUNDI	1.041	
BURKINA FASO	1.247	
TOGO	1.416	
BENIN	1.522	
LIBERIA	1.755	
MALAWI	1.796	
UGANDA	1.976	
NIGER	2.145	
GUINEA	2.381	
GABON	2.482	
MALI	2.526	
MAURITANIA	2.651	
SOMALIA	3.036	
ANGOLA	3.071	(1986)
LIBYAN ARAB JAMAHIRIYA	3.200	(1985)
MOZAMBIQUE	3.200	(1986)
ZIMBABWE	3.435	
ETHIOPIA	3.906	
MADAGASCAR	4.227	
GHANA	4.350	
SENEGAL	4.484	
U R OF TANZANIA	4.912	
CAMEROON	5.136	
CONGO	5.341	
KENYA	7.190	
ZAMBIA	7.341	
TUNISIA	9.392	
ZAIRE	9.944	
SUDAN	12.346	
COTE D IVOIRE	14.576	
MOROCCO	24.459	
ALGERIA	28.035	
NIGERIA	30.486	
EGYPT	43.565	

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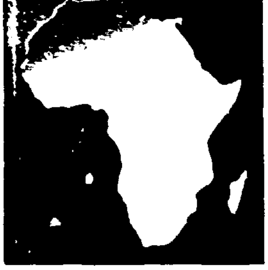
SECTION ONE



STEEL PRODUCTION AND CONSUMPTION

While the world's crude steel production increased by 15 per cent from 675 million tons in 1977 to 778 million tons in 1988 most of that increase occurred in non-EEC Western European countries. Eastern Europe. and the developing countries of Africa. Latin America, the Middle East and Asia.

Africa's steel output more than doubled from about 2 million tons in 1978 to over 4 million tons in 1987. Its share in the world's total has steadily increased from 0.29 per cent in 1978 to 0.56 per cent in 1987.

Although 15 African countries are producers of crude steel, the bulk of the output comes from five countries. – Algeria. Egypt. Nigeria. Tunisia and Zimbabwe. These countries usually account for more than 90 per cent of the annual output.

Local production is generally supplemented by imports to meet the domestic demand for steel. In this connection, Africa imports more finished and semi-finished steel products than it produces locally. As of 1981, imports had already exceeded 9 million tons. a[illegible]gh the economic stagnation and decline of the 1980s drove imports down to about 5.8 million tons by 1987.

The severity of import dependence may also be illustrated by the figures for apparent steel consumption (defined as domestic production plus imports less exports). Whereas local production of crude steel has never exceeded 0.56 per cent of the world total in any year, apparent consumption has consistently exceeded 1.39 per cent since 1978. In fact, a figure of 1.92 per cent wa[s] attained in 1981.

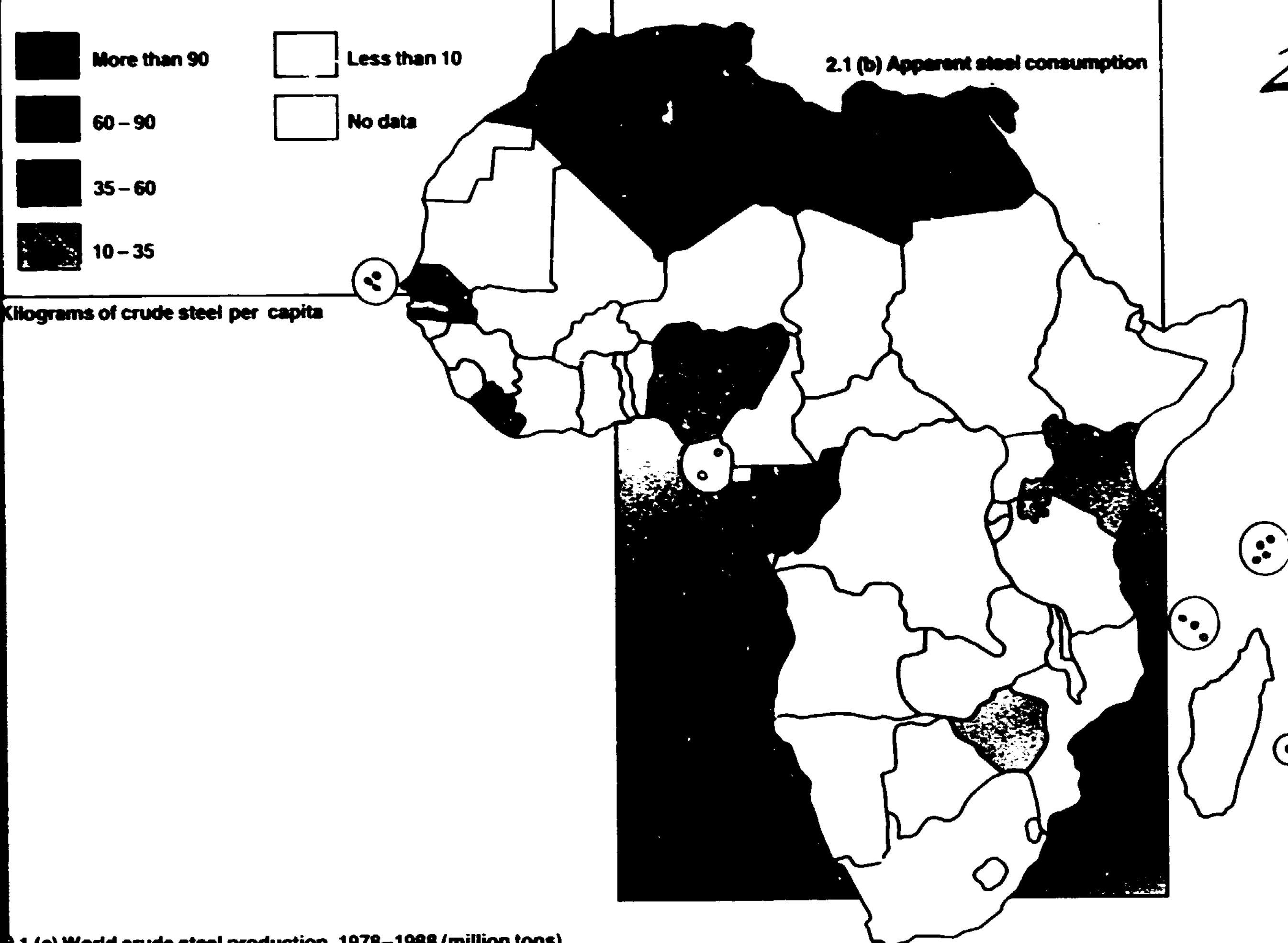
In terms of per capita apparent consumption, most Africa[n] countries are well below the 50 kg mark. The only exceptions ar[e] the North African Mediterranean countries: Algeria (127 kg i[n] 1987). Egypt (49 kg). Libyan Arab Jamahiriya (106 kg) an[d] Tunisia (66 kg). The figures for most sub-Saharan Africa[n] countries (except Gabon with 49 kg) are generally below 30 kg.

The importance of apparent per capita steel consumptio[n] derives from its empirical relationship to national technologica[l] take-off. Steel is an important technological material with linkage[s] to several industries and economic sectors. A high per capit[a] steel consumption generally suggests vigorous productive activi[-] ties especially in those economic sectors linked to industry. It i[s] reasoned that a threshhold per capita consumption of about 50 k[g] is necessary for meaningful technological take-off. The figures fo[r] some of the newly-industrializing countries tend to support thi[s] view. In 1987 for example, Brazil recorded 114 kg. Mexico 85 kg and the Republic of Korea 358 kg. As for the industrialize[d] countries of Europe. Asia and North America, their per capit[a] consumptions have for decades been well in excess of th[e] threshhold. Thus, in 1987, the United States of America recorde[d] 422 kg, the Federal Republic of Germany 454 kg. Japan [illegible]20 k[g] and the Union of Soviet Socialist Republics 577 kg.

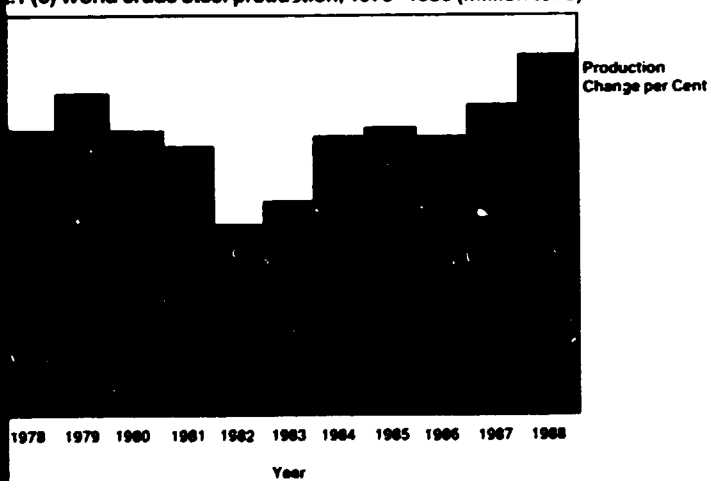
2.1 (a) African crude steel production in relation to world output, 1982–1987 (thousand tons)

Region Country A.	1982	1983	1984	1985	1986	1987
Algeria	858	950	1.080	1.414	1.400	1.400
Egypt	1.161	979	928	1.043	1.000	1.600
Nigeria	90	182	229	341	218	236
Tunisia	107	163	166	160	181	188
Zimbabwe	538	647	423	731	680	615
Other Africa*	70	75	75	75	75	75
Total Africa	2.834	2.996	2.901	3.764	3.554	4.114
European Community	125.084	123.214	134.407	135.650	125.844	126.654
Other Western Europe	19.206	20.726	22.674	23.266	23.963	24.700
Other Western Industrialized Countries**	193.977	199.863	218.540	215.327	202.244	209.363
Latin America	26.734	28.600	33.153	35.630	37.351	39.569
Middle East	1.982	2.227	2.812	3.139	3.017	3.423
Asia	29.279	29.892	31.863	34.589	36.602	40.622
Eastern Europe	203.450	210.016	214.267	214.077	221.649	224.366
Cuba, China, Dem. People's Rep. of Korea	43.261	46.485	50.157	53.624	58.916	63.175
World Total	645.807	664.019	710.774	719.066	713.140	735.986
Africa's Share	0.44%	0.45%	0.41%	[illegible]	[illegible]	[illegible]

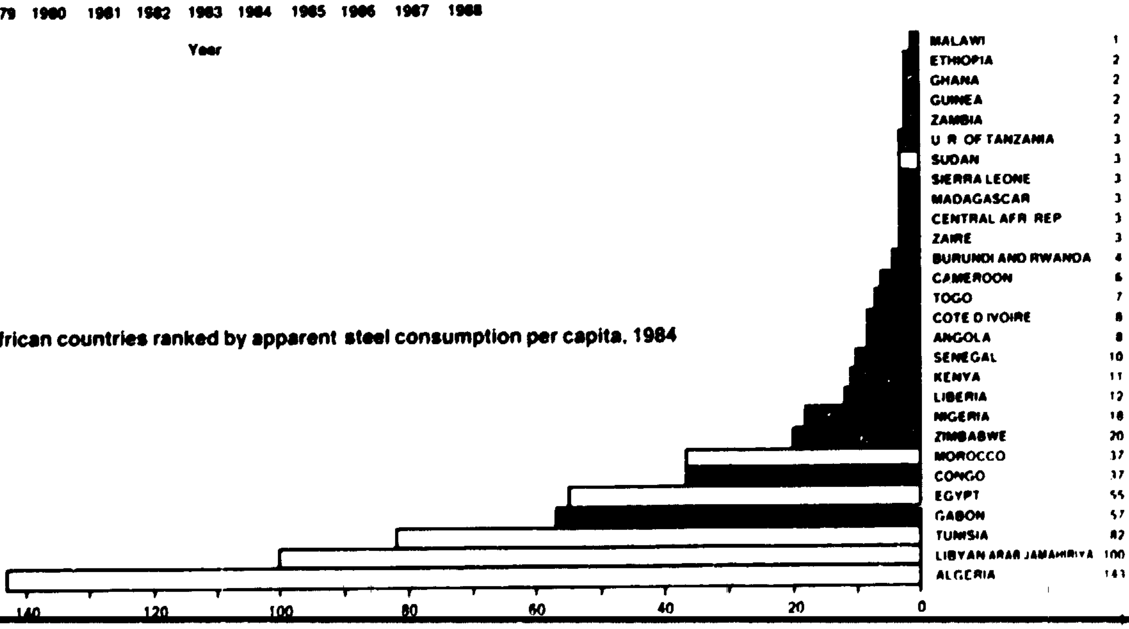
* IISI estimates.
** Australia, Canada, Japan, New Zealand, South Africa and the United States of America.



2.1 (b) Apparent steel consumption



2.1 (c) World crude steel production, 1978–1988 (million tons)



2.1 (d) African countries ranked by apparent steel consumption per capita, 1984

SECTION TWO

2.1 (e) Africa's imports of finished and semi-finished steel, 1982–1987, (thousand tons)

	1982	1983	1984	1985	1986	1987
Algeria	1,351	1,391	1,561	1,482	879	600
Angola	38	19	51	40	36	–
Congo	47	45	45	42	23	–
Cote d'Ivoire	–	63	57	81	72	–
Egypt	1,123	1,353	1,225	1,980	800	457
Ethiopia	–	53	52	21	28	81
Gabon	49	37	47	48	15	–
Ghana	–	19	17	18	30	–
Guinea	–	9	15	16	10	–
Kenya	133	158	188	215	142	231
Liberia	–	17	16	17	14	–
Libyan Arab Jamahiriya	375	551	309	490	282	361
Madagascar	–23	22	18	14	–	
Malawi	–	3	3	3	1	27
Mauritania	10	–	11	22	8	7
Morocco	629	536	683	649	425	449
Mozambique	–	7	18	15	8	37
Nigeria	3,342	1,527	1,219	2,148	1,489	1,725
Senegal	–	57	45	46	32	–
Sierra Leone	–	9	6	5	6	–
Sudan	50	63	51	32	26	20
Togo	–	11	13	14	14	–
Tunisia	403	427	323	292	282	280
Uganda	43	4	7	131	24	–
United Republic of Tanzania	65	69	58	56	42	88
Zaire	43	31	72	48	19	14
Zambia	9	7	11	7	24	81
Zimbabwe	126	102	62	109	113	80
Other Africa*	273	332	525	423	1,387	1,255
Total Africa	**8,180**	**6,923**	**6,712**	**8,488**	**6,246**	**5,783**

* Representing the estimated total for those countries not listed and or for which no data are available.

2.1 (f) Africa's apparent consumption of crude steel in relation to world consumption, 1982–1987 (thousand tons)

		1982	1983	1984	1985	1986	1987
Northern Africa	Algeria	2,524	2,684	3,015	3,250	3,257	2,948
	Egypt	2,473	2,619	2,580	3,237	2,304	2,488
	Libyan Arab Jamahiriya	447	650	382	568	324	411
	Morocco	750	632	798	753	488	511
	Sudan	106	68	61	–	–	–
	Tunisia	588	667	544	499	505	507
Western Africa	Cote D'Ivoire	130	85	78	81	–	–
	Ghana	26	24	23	21	–	–
	Guinea	15	15	14	16	–	–
	Liberia	24	24	26	17	–	–
	Nigeria	4,077	1,983	1,614	2,813	1,910	2,140
	Senegal	86	76	60	46	–	–
	Sierra Leone	10	10	12	5	–	–
	Togo	18	18	20	14	–	–
Central Africa	Angola	83	15	72	67	90	90
	Burundi and Rwanda	35	37	38	38	30	30
	Cameroon	51	61	80	85	86	90
	Central Afr. Rep.	9	6	7	10	8	8
	Congo	70	62	62	80	55	32
	Gabon	71	53	64	70	60	80
	Zaire	62	50	85	28	22	16
Eastern and Southern Africa	Ethiopia	54	70	80	–	–	–
	Kenya	115	198	210	–	–	–
	Madagascar	23	31	30	–	–	–
	Malawi	10	9	9	–	–	–
	United Republic of Tanzania	79	83	68	65	48	58
	Zambia	11	9	13	27	28	29
	Zimbabwe	267	280	158	378	418	207
	Other Africa*	300	287	547	966	869	728
	Total Africa	12,488	10,791	10,714	13,102	10,461	10,330
	European Community	102,836	97,868	103,027	101,761	103,094	103,222
	Other Western Europe	21,193	20,801	22,242	21,607	23,134	25,596
	Other Western Industrialized Countries	175,660	181,317	211,505	203,374	188,702	202,525
	Latin America	27,961	22,386	26,847	27,534	30,157	32,112
	Middle East	19,107	20,689	18,965	18,675	10,075	8,957
	Asia	43,459	44,013	43,444	46,889	49,932	55,229
	Eastern Europe	204,648	210,794	212,620	214,517	219,132	217,920
	Cuba, China, Democratic People's Dem. Rep. of Korea	46,048	59,613	68,210	79,824	82,224	86,636
	World Total	654,985	668,272	717,575	727,482	716,912	740,527
	Africa's Share	1.85%	1.62%	1.49%	1.80%	1.46%	1.39%

* Estimated totals for countries not listed and or for which reliable data are not available

SECTION TWO

2.1 (g) Africa's apparent per capita consumption of crude steel compared to other selected countries. 1982–1987. (kg)

Region	Country	1982	1983	1984	1985	1986	1987
Northern Africa	Algeria	127	130	143	148	145	127
	Egypt	56	57	55	67	46	49
	Libyan Arab Jamahiriya	134	[illegible]	100	158	187	106
	Morocco	37	30	37	34	22	22
	Sudan	5	3	3	–	–	–
	Tunisia	90	84	82	68	68	66
Western Africa	Cote D'Ivoire	15	9	8	–	–	–
	Ghana	2	2	2	–	–	–
	Guinea	3	3	2	–	–	–
	Liberia	12	12	12	–	–	–
	Nigeria	47	22	18	30	19	21
	Senegal	14	12	10	–	–	–
	Sierra Leone	3	3	3	–	–	–
	Togo	7	6	7	–	–	–
Central Africa	Angola	7	2	8	7	6	6
	Burundi and Rwanda	4	4	4	3	3	3
	Cameroon	6	5	6	9	8	9
	Central African Republic	4	2	3	4	3	3
	Congo	43	38	37	34	31	17
	Gabon	65	48	57	61	51	40
	Zaire	2	1	3	2	1	1
Eastern and Southern Africa	Ethiopia	1	2	2	–	–	–
	Kenya	6	10	11	–	–	–
	Madagascar	3	3	3	–	–	–
	Malawi	2	1	1	–	–	–
	United Republic of Tanzania	4	4	3	3	–	–
	Zambia	2	1	2	4	4	4
	Zimbabwe	35	36	20	45	50	24
Some Other Developing Countries	Brazil	82	62	77	82	111	114
	India	19	16	17	20	20	20
	Iran, Islamic Rep. Of	122	153	115	111	42	37
	Mexico	113	82	94	99	84	85
	Republic of Korea	194	216	262	275	293	358
	Saudi Arabia	665	576	453	473	248	217
	Venezuela	195	95	119	109	154	187
Western Industrialized Countries	Canada	371	516	471	478	508	
	Germany, Fed. Rep. of	436	486	489	48[illegible]	483	454
	France	318	276	276	258	254	258
	Japan	586	549	619	606	576	620
	United Kingdom	252	252	257	256	230	264
	United States of America	363	404	479	451	403	422
Eastern Europe and China	China	41	50	57	68	69	72
	Czechoslovakia	24	719	700	709	717	704
	German Democratic Rep.	569	550	536	572	569	581
	USSR	557	578	579	581	589	577

SECTION TWO

There are 69 installed steel plants in Africa. Included in this number are five plants that were not in production in late 1988 owing to either technical raw materials operational problems, civil strife or product market constraints. These are IMCI, Abidjan; Atlantic Steelworks, Monrovia; Societe Nationale de Siderurgie, Maluku (Zaire); Ethiosider Iron and Steel Foundry, Asmara (Ethiopia); and Steel Billet Castings, Dandora (Kenya). In numerical terms, the greatest concentrations of steel plants are in Nigeria and Kenya, with 21 and 10 plants, respectively.

The subregional breakdown of these plants, in terms of types, is as follows

3.1(a) Subregional breakdown of steel plants

	Northern Africa	Western Africa	Central Africa	Eastern and Southern Africa	Total
Number of steel plants	14	27	3	25	69
of which					
Integrated	5	2	–	1	8
Mini-mills	6	10	2	7	25
Meltshops	–	–	–	2	2
Rolling mills	3	15	1	15	34

Iron making

The regional iron-making capacity is 8.459 million tons per year. Five plants, with an aggregate production capacity of 5.354 million tons per year are located in Northern Africa: Algeria, Egypt (2), Libyan Arab Jamahiriya and Tunisia. The Libyan plant is one of two commercial scale plants in Africa based on the gas-fueled Midrex direct reduction process.

The two integrated iron-making plants in Western Africa are located in Nigeria, at Aladja where the only (Midrex) direct reduction plant in sub-Saharan Africa has been in operation since 1982, and at Ajaokuta where a blast-furnace-based complex is due to be commissioned in 1991.

The only integrated iron-making plant in Eastern and Southern Africa is the 40-year old Zimbabwe Iron and Steel Company (ZISCO) steelworks at Redcliff, with a pig iron production capacity of 735,000 tons per year. It is currently undergoing rehabilitation involving the relining of its coke ovens and blast furnaces and the installation of by-product, desulfurization and power plants.

Steel making

The aggregate regional crude steelmaking capacity is 10.41 million tons per annum.

Million tonnes

NORTHERN AFRICA: – 6.636

Consisting of:	Algeria	– 2.18
	Egypt	– 2.932
	Libyan Arab Jamahiriya	– 1.304
	Morocco	– 0.03
	Tunisia	– 0.19

WESTERN AFRICA: – 2.618

Consisting of:	Ghana	– 0.05
	Mauritania	– 0.012
	Nigeria	– 2.556

CENTRAL AFRICA: – 0.150

Consisting of:	Angola	– 0.03
	Zaire	– 0.12

EASTERN AND SOUTHERN AFRICA: – 1.0045

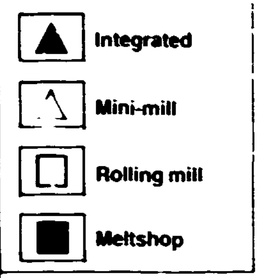
Consisting of:	Ethiopia	– 0.024
	Kenya	– 0.0955
	Uganda	– 0.025
	United Republic of Tanzania	– 0.02
	Zimbabwe	– 0.84

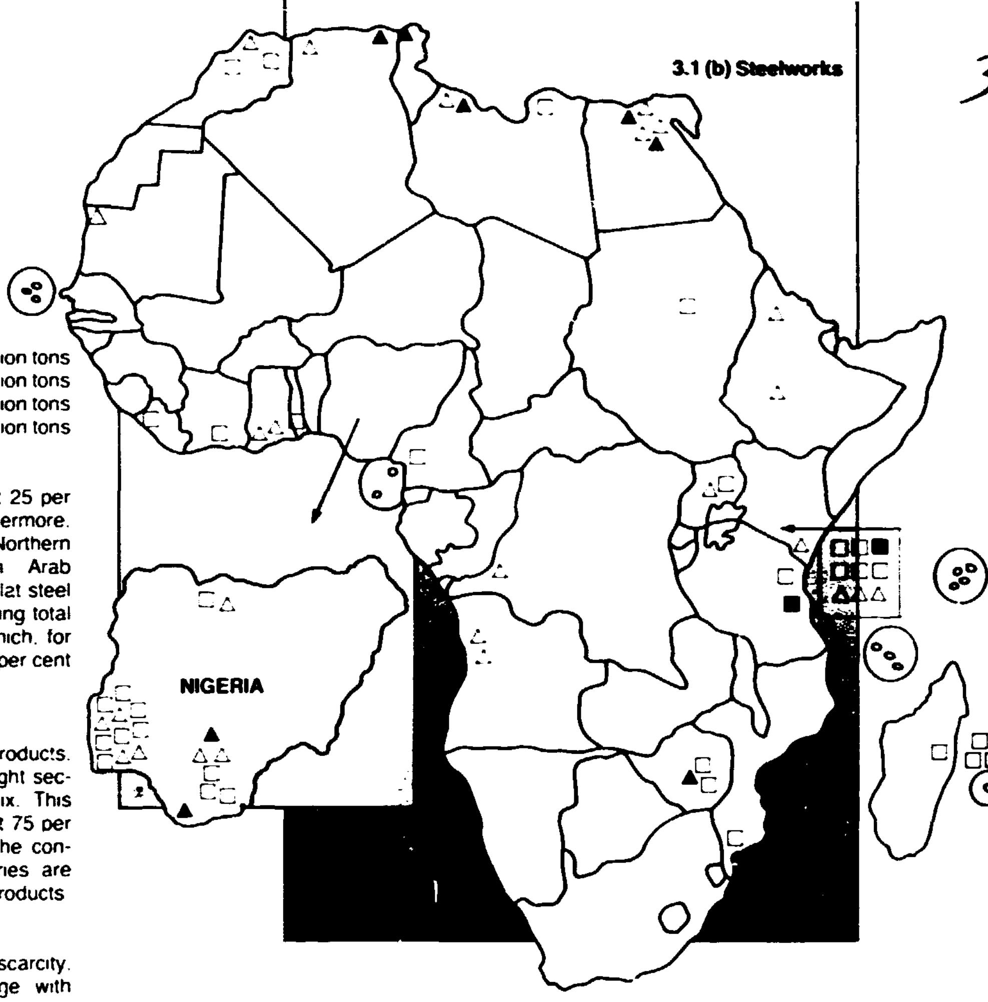
Eighty-seven per cent of the crude steel capacity (equivalent to 9.06 million tons per year) is obtained from the large integrated steelworks, the balance coming from the smaller and (usually) electric arc furnace-based mini-mills and meltshops.

3.1 (c) Africa's installed steel plants, their processes and capacities

Northern Africa

Country	Plant Location	Type of Plant	Ironmaking Process and Capacity (per year)	Steelmaking Process and Capacity (per year)
Algeria	**i) ENTPL, Oran**	**Mini-mill**	**–**	**3 30-ton Open-Hearth furnaces; 100,000 tons**
	ii) SIDER, El Hadjar	**Integrated**	**2 Blast furnaces; 1.69 million tons**	**3 90-ton & 3 60-ton LD converters; one 80-ton EAF. Total capacity 2.08 million**
Egypt	**i) Egyptian Iron & Steel Co., Halwan**	**Integrated**	**4 Blast Furnaces; 1.70 million tons**	**4 17-ton Bessemer converters; 3 80-ton Halwan LD converters; 2 12-ton EAF. Total capucity 1.55 million**
	ii) Delta Steel Mill, Mostorod Cairo	**Mini-mill**	**–**	**2 3-ton EAF; 1 12-ton EAF; 1 18-ton EAF; Cairo 2 25-ton EAF. Total capacity of 100,000 t.**
	iii) Egyptian Copperworks, Alexandria	**Mini-mill**	**–**	**1 5-ton and 1 25-ton EAFs; 2 25-ton and 1 50-ton Siemens-Martin furnaces. Total capacity of 192,000 t.**
	iv) National Metal Industries, Cairo	**Mini-mill**	**–**	**2 35-ton EAFs; 2 35-t. Siemens-Martins furnaces. Total capacity 250,000 tons.**
	v) Alexandria National Iron & Steel Co., Dikheila	**Integrated**	**One Midrex Direct Reduction furnace, 704,000 tons**	**4 70-ton EAFs; 840,000 tons**
Libyan Arab Jamahiriya	**i) Libyan Metal Industr., Tripoli**	**Mini-mill**	**–**	**2 5-ton und 1 10-ton EAFs; Total capacity 40,000 tons**
	ii) Executive Board Iron and Steel Co. (EBISCO), Misurata	**Integrated**	**2 Midrex Direct reduction furnaces; 1.1 million tons**	**6 90-ton EAFs; capacity 1.264 m. tons**
	iii) General Pipe Co. (Benghazi) Ltd.	**Rolling mill**	**–**	**none**





NORTHERN AFRICA	7.177 million tons
WESTERN AFRICA	2.869 million tons
CENTRAL AFRICA	0.190 million tons
EASTERN AND SOUTHERN AFRICA	1.386 million tons

Of this, only 2.99 million tons (or about 25 per cent) are devoted to flat products. Furthermore, all the flat rolling capacity is located in Northern Africa: Algeria, Egypt and Libyan Arab Jamahiriya. In other words, there is no flat steel production in sub-Saharan Africa, implying total import dependence for flat products which, for most countries, accounts for at least 50 per cent of steel demand.

Product mix:
There is a clear predominance of long products, particularly reinforcing bars, rods and light sections, in the region's steel product mix. This category of products accounts for about 75 per cent of the installed rolling capacity. The construction and light engineering industries are usually the major consumers of these products.

Operational status (1987 88):
The combination of raw materials scarcity, severe limitations on foreign exchange with which to import essential supplies and spare parts, poor equipment maintenance, and market constraints brought on by the depression in the construction and light engineering industries has resulted in gross under-utilization of installed steelmaking and rolling capacity. Exceptions are apparent in Northern African countries and Zimbabwe where levels of capacity utilization often exceeding 65 per cent were registered in 1987. The higher levels of technological skills prevalent in these countries, coupled with a higher degree of self-reliance for materials and supplies, must have contributed to their good performance record. In other countries, capacity utilization below 30 per cent was common in 1987 and 1988.

Casting Process	Rolling Capacity (per year)	Product Mix	Operational Status (1988)
One 3-strand continuous caster	80,000 tons long products	Bars and rods	80% capacity utilization
4-strand for billets; two 1-strand for slabs	540,000 tons for long products; 1,450,000 tons for flat products	Bars; rods; coils; plates; welded and seamless pipes	63% capacity utilization for long and 45% for flat products
4-strand for billets; 2 2-strand for slabs	380,000 tons for long products; 822,000 tons for flat products	Bars, rods, sections, plates	57% capacity utilization for long and 50% for flat products
3-strand continuous caster for billets	140,000 tons [illegible] products	Bars, rods, sections	79% capacity utilization
Ingots	72,000 tons long products	Bars, rods	7[illegible]% capacity utilization
3-strand for billets	180,000 tons long products	Bars, rods	94% capacity utilization
4-strand for billets	750,000 tons long products	Bars, rods	80% capacity utilization
One 2-strand for billets	60,000 tons long products	Bars and rods	Below 50% capacity utilization
2-strand for billets; 1 2-str. for slabs	520,000 tons for long products; 730,000 tons flat products	Bars, rods, sections; hot and cold-rolled sheets	Commenced production 1987; operated at below 10% of capacity
none	20,000 tons (from three rolling mills)	Horizontally welded; spirally welded steel pipe; welded Aluminium pipe	60% capacity utilization

3.1

SECTION THREE

Region	Country	Pl
Northern Africa Cont.	Morocco	
	Sudan	
	Tunisia	
Western Africa		
	Cote d'Ivoire	
	Ghana	
	Liberia	
	Mauritania	
	Nigeria	
	Togo	
Central Africa		
	Angola	
	Cameroon	
	Zaire	
Eastern and Southern Africa		
	Ethiopia	
	Kenya	

t Location	Type of Plant	Ironmaking Process and Capacity (per year)	Steelmaking Process and Capacity (per year)
ciété Nat. de llurgie (SOMETAL), ablanca	Rolling mill	–	–
ociété Nat. de rurgie (SONASID), or	Rolling mill	–	–
ociété Sidérurgie du oc, Tangiers	Mini-mill	–	EAF; 30,000 tons
anese Steel ducts, Khartoum	Rolling mill	–	–
iété Tunisienne de irurgie, El Fouledh	Integrated	One 4-m hearth blast furnace: 160,000 tons	2 20-ton LD Converters; one ton EAF. Total capacity 190,0 tons
l, Abidjan	Rolling mill	–	–
IHOC Steelworks Co., a	Mini-mill	–	2 EAFs; total capacity 30,000 tons
AHOME Steel Co., a	Mini-mill	–	1 EAF; 20,000 tons
ntic Steelworks, rovia	Rolling mill	–	–
iété Arabe du Fer et cier (SAFA), adhibou	Mini-mill	–	1 5-ton EAF; capacity 12,000 tons
jaokuta Steel Co. Ltd., okuta	Integrated	Blast furnace; capacity 1.35 m. ton	LD converters; capacity 1.3 m. t.
lliance Steel Co., dan	Rolling mill	–	–
Allied Steel Co., baha	Rolling mill	–	–
Asiatic Mandarin Ind., ja	Rolling mill	–	–
Continental Iron & el Co., Ikeja	Mini-mill	–	1 20-ton EAF; 60,000 tons
Delta Steel Co., Aladja	Integrated	2 Midrex 800-series Direct Reduction furnaces; capacity 1.02 m.t.	4 110-ton EAFs; capacity 1.0 m. tons
Federated Steel lustry, Otta	Mini-mill	–	1 12-ton EAF; capacity 40,000 tons
) General Steel Mills, aba	Mini-mill	–	1 6-ton EAF; 14,000 t.
Jos Steel Rolling Co., s	Rolling mill	–	–
Katsina Steel Rolling ., Katsina	Rolling mill	–	–
KEW Metal Industries, orodu	Mini-mill	–	–
) Kwara Commercial, tal and Chemical lustries, Ilorin	Rolling mill	–	–
) Mayor Eng. Co., orodu	Rolling mill	–	–
) Metcombe Steel Co., werri	Rolling mill	–	–
) Nigerian-Spanish g. Co., Kano	Mini-mill	–	1 20-ton EAFs; 72,000 tons
) Nigersteel Co., ugu	Mini-mill	–	1 12-ton EAF; 20,000 tons
i) Oshogbo Steel Co., hogbo	Rolling mill	–	–
ii) Qua Steel Products, et	Rolling mill	–	–
) Selsametal, Otta	Rolling mill	–	–
) Union Steel Co., rin	Rolling mill	–	–
) Universal Steel Co., ja	Mini-mill	–	2 12-ton EAFs; capacity 50,0 tons
ciété Nationale de érurgie, Lome	Rolling mill	–	–
iderurgia Nationale E, Luanda	Mini-mill	–	1 18-ton EAF; capacity 30,00 tons
Fabrica de Tubos de gola (FATA)	Mini-mill	–	30,000 tons EAF
LADA, Douala	Rolling mill	–	–
ciété Nationale de érurgie, Maluku	Mini-mill	–	1 50-ton EAF; capacity 120,000 tons
Ethiopian Iron and el Foundry, Akaki	Mini-mill	–	1 5-ton EAF; capacity 12,00 tons
Ethiosider Iron and el Foundry, Asmara	Mini-mill	–	1 5-ton EAF; capacity 12,00 tons
City Engineering rks, Dandora	Mini-mill	–	1 1-ton medium frequency induction; 5,500 tons
EMCO Steel Works, ndora	Mini-mill	–	1 12-ton EAF; capacity 24,000 tons
Iron Int'l	Rolling mill	–	–
Kenya United Steel ., (KUSCO), Mombasa	Mini-mill	–	2 5-ton EAF; capacity 25,000 tons
Morris and Co., irobi	Rolling mill	–	–
ROLMIL Kenya, irobi	Mini-mill	–	1 7-ton EAF; 15,000 tons
Special Steel Mills, iru	Rolling mill	–	–
) Steel Billet stings, Dandora	Meltshop	–	1 12-ton EAF; capacity 26,000 tons
Steel Rolling ls, Kikuyu	Rolling mill	–	–

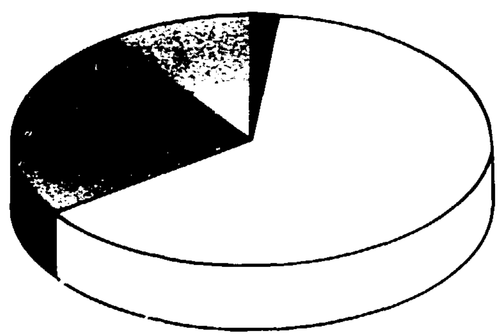
3.1

Casting Process	Rolling Capacity (per year)	Product Mix	Operational Status (1988)
–	35,000 tons long products	Bars, rods	70% capacity utilization
–	480,000 tons long products	Bars, rods	60% capacity utilization
Ingots	50,000 tons long products	Bars	55% capacity utilization
–	70,000 tons long products	Bars; rods	50% capacity utilization
3 4-strand for billets	180,000 tons long products	Bars; rods	90% capacity utilization
–	30,000 tons long products	Bars	Not in operation
ngots	30,000 tons long products	Bars	Below 10% capacity utilization but planned for rehabilitation
ngots	20,000 tons long products	Bars; rods	Commissioned in 1989
–	5,000 tons long prod. (based on ship-breaking scrap)	Bars	Commissioned 1987, closed down 1988
ngots	36,000 tons long products	Bars	12.5% capacity utilization
4-strand for blooms	540,000 tons long products	Bars, rods, light sections	Iron and steelmaking plants due for commissioning 1991; configuration may be altered to also produce flats; about 5% capacity utilization (1987)
–	20,000 tons long products	Bars	15% capacity utilization (1987)
–	20,000 tons long products	Bars	10% capacity utilization (1987)
–	60,000 tons long products	Bars; sections	10% capacity utilization (1987)
ngots	150,000 tons long products	Bars; sections	33% capacity utilization (1987)
6-strand for billets	320,000 tons long products	Bars; rods; sections	14% capacity utilization; non-availability of iron ore
ngots	140,000 tons long products	Bars; sections	30% capacity utilization (1987)
ngots	50,000 tons long products	Bars	15% capacity utilization (1987)
–	210,000 tons long products	Bars, rods	10% capacity utilization (1987)
–	210,000 tons long products	Bars, rods	15% capacity utilization (1987)
ngots	20,000 tons long products	Bars; sections	28% capacity utiliation (1987)
–	40,000 tons long products	Bars	6% capacity utilization (1987)
–	228,000 tons long products	Bars; sections	6% capacity utilization (1987)
–	10,000 tons long products	Bars	5% capacity utilization (1987)
2-strand for billets	188,000 tons long products	Bars; sections	13% capacity utilization (1987)
ngots	40,000 tons long products	Bars	10% capacity utilization (1987)
–	210,000 tons long products	Bars; rods	19% capacity utilization (1987)
–	60,000 tons long products	Bars, sections	10% capacity utilization (1987)
–	100,000 tons long products	Bars	5% capacity utilization (1987)
–	20,000 tons long products	Bars	13% capacity utilization (1987)
ngots	80,000 tons long products	Bars, sections	45% capacity utilization (1987)
–	32,000 tons long products	Bars (from used rails)	40% capacity utilization
ngots	50,000 tons long products	Bars	12% capacity utilization
ngots	25,000 tons long products	Reinforcing bars	30% capacity utilization
–	40,000 tons long products	Bars	75% capacity utilization in 1987
4-strand for billets	100,000 tons long products; 150,000 tons for cold rolling and corrugation	Bars, rods, cold-rolled hoop and strip	Sporadic operation since 1986; 2% capacity utilization
ngots	30,000 tons long products	Bars, wire	40% capacity utilization (1987)
ngots	34,000 tons long products	Bars; rods, wire	Operations suspended since early 1980s
ngots	6,000 tons long products	Bars, sections	45% capacity utilization (1987)
ngots	36,000 tons long products	Bars;	33% capacity utilization (1987)
–	40,000 tons long products	Bars,	Started production in 1988
1-strand for billets	30,000 tons long products	Bars; rods; sections	80% capacity utilization (1987)
–	30,000 tons long products	Bars, sections 53% capacity utilization (1987)	
ngots	20,000 tons long products	Bars, sections	40% capacity utilization (1987)
–	50,000 tons long products	Bars; rods; sections	60% capacity utilization (1987)
2-strand for billets	–	Billets	Went into receivership 1987; scrap scarcity
–	44,000 tons long products	Bars; sections	27% capacity utilization (1987)

SECTION THREE

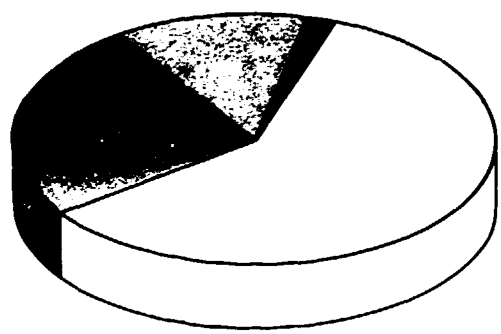
Eastern and Southern Africa
Cont.

Country	Plant Location	Type of Plant	Ironmaking Process and Capacity (per year)	Steelmaking Process and Capacity (per year)
Kenya Cont.	x) Steelmakers, Eldoret	Rolling mill	–	–
Madagascar	Toamasima Steelworks, Toamasima	Rolling mill	–	–
Mauritius	i) Desbro Int'l, Port Louis	Rolling mill	–	–
	ii) R.M. Industries, Port Louis	Rolling mill (using scraps)	–	–
	iii) Sections Rolling, Port Louis	Rolling mill	–	–
	iv) Shipbreaking and Steel Inds., Port Louis	Rolling mill	–	–
Mozambique	Cia Industrial Fundicao e Laminagem (CIFEL), Maputo	Rolling mill	–	–
Uganda	i) East African Steel Corp., Jinja	Mini-mill	–	1 10-ton EAF; capacity 25,000 tons
	ii) Jinja Steel Rolling Mill, Jinja	Rolling mill	–	–
U.R. of Tanzania	i) Steelcast Ltd (Div. of ALAF), Dar-Es-Salaam	Meltshop	–	1 12-ton EAF: 20,000 tons
	ii) Steel Rolling Mills, Tanga	Rolling mill	–	–
Zimbabwe	i) Zimbabwe Iron and Steel Co., (ZISCO), Redcliff	Integrated	One 5.5 m. and one 8.75 m. blast furnaces, combined capacity 735,000 tons	2 50-ton LD coverters, capacity 840,000 tons
	ii) Lancashire Steel, Kwe- Kwe	Rolling mill	–	–
	iii) Tor Steel	Rolling mill	–	–



Northern Africa	6,636,000
Western Africa	2,618,000
Central Africa	180,000
Eastern and Southern Africa	1,004,500
Total Africa	10,438,500

3.1 (d) Crude steel production capacities by subregion (Tons/year)



Northern Africa	6,549,000
Western Africa	2,869,000
Central Africa	215,000
Eastern and Southern Africa	1,386,000
Total Africa	11,019,000

3.1 (e) Rolling capacities for flat and long products by subregion (Tons/year)

3.1

Casting Process	Rolling Capacity (per year)	Product Mix	Operational Status (1988)
–	30,000 tons long products	Bars, sections	56% capacity utilization (1987)
–	6,000 tons long products	Bars; sections	33% capacity utilization (1987)
–	40,000 tons long products	Bars, sections	42% capacity utilization (1986)
–	3,000 tons long products	Bars, sections	26% capacity utilization (1986)
–	17,000 tons long products	Bars, sections	41% capacity utilization
–	17,000 tons long products	Bars, sections	21% capacity utilization
–	80,000 tons long products	Bars; rods; sections	10% capacity utilization
ngots (Plans to install 2-strand caster)	30,000 tons long products	Bars; rods; sections	6% capacity utilization
–	10,000 tons long products	Bars; sections	6% capacity utilization
12-ton EAF, 20,000 tons	–	Billets	55% capacity utilization (1987)
–	24,000 tons long products	Bars; sections	40% capacity utilization
2-strand for billets; plus ingots	750,000 tons long products	Bars, sections rods, rails	77% capacity utilization, under rehabilitation and expansion to 1m. tons
–	52,000 tons long products	Rods; wire	90% capacity utilization
–	7,000 tons seamless tubes	Seamless tubes	86% capacity utilization

SECTION THREE

IRON ORE

The United States Bureau of Mines estimates that Africa (including South Africa) accounts for about 7 per cent (or 14.832 million tons) of the world's iron ore reserves which amount to about 210.000 million tons. However, a country-by-country analysis of available data suggests that the region's reserves could well be in excess of 34.111 million tons of ore, not all of which is necessarily economically or technically exploitable.

The distribution of these resources is as follows:

	(Million tons)
NORTHERN AFRICA	6.964
WESTERN AFRICA	13.633
CENTRAL AFRICA	8.360
EASTERN AND SOUTHERN AFRICA	5.154

While the data on reserves in most countries are still subject to confirmation, indications are that the largest known reserv[es] occur in the following areas:

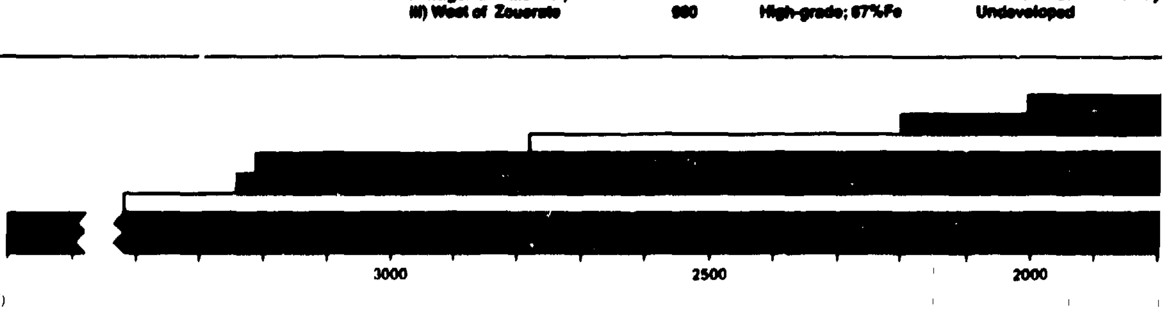
- Kilomoto haematite deposit in Zaire, 5.000 million tons.
- Manesi range low-grade deposit in Zimbabwe, 3.300 milli[on] tons.
- Gora Djebilet deposit in Algeria, 3.025 million tons.

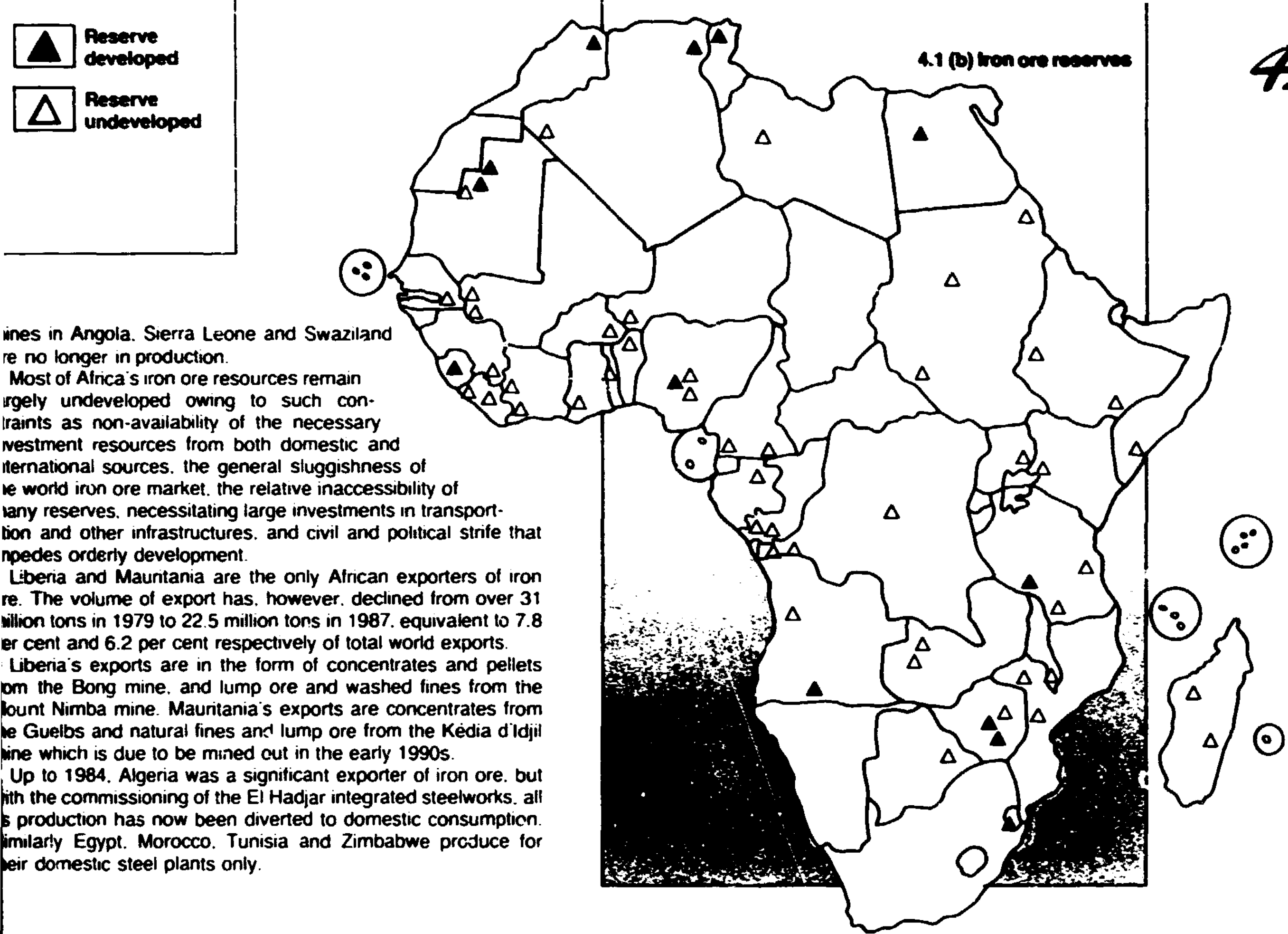
Other large deposits occur in Côte d'Ivoire, Libyan Arab Jam[a]hiriya, Mauritania, Liberia and Sierra Leone.

Notwithstanding Africa's extensive resource base, only a f[ew] deposits are being commercially exploited. Thus, only Alge[ria,] Egypt, Liberia, Mauritania, Morocco, Tunisia and Zimbabwe ra[nk] among the world's iron ore producers. Nigeria's production is o[n] on a semi-commercial basis pending the commissioning [of] necessary beneficiation facilities and the completion of inf[ra]structural and other projects at the Ajaokuta steelworks. T

4.1 (a) Africa's iron ore reserves

Region	Country	Reserve Location	Reserve Size (million tons)	Reserve Characteristics	Development Status
Northern Africa	Algeria	i) Ouenza Boukhadra	194	55.5% Fe	Open-cast mines (capacity 4 million t/y) now produce over 75% of Algeria's iron ore output for the El Hadja[r] Steelworks.
		ii) Gara Djebilet	3,025	High phosphorus; 57% Fe; 0.7% P	Largest deposit in the Ara[b] world; undeveloped.
	Egypt	El-Djadida, Assouan Baharia and El-Ghozali	389	44–58.5% Fe; 0.50–1.90%P	Baharia mine in productio[n] capacity of 3.3 million t/y.
	Libyan Arab Jamahiriya	Wadi Shatti	2,575	3 horizons of magnetites/ haematites, siderites/ chlorites/sulfides, and oxides, 35–55%Fe, 0.9%P	Planned for development t[o] feed M'tsurata steelworks, but contingent on 900km r[ail] link to Mitsurata
	Morocco	Melilla (in the Rif region	34	Magnetite; 54–60%Fe	Mine commissioned 1971; capacity of 0.4 million t/y
	Sudan	Scattered reserves in the Red Sea and Central Desert areas and at Bahrel Ghazal	735	60–69% Fe (Red Sea and Central Desert); 0.21%P	Undeveloped
	Tunisia	Scattered reserves in the Djerissa, Tamera, Ganara and Mali Douaria areas	12	47–53% Fe;	Mine in operation pre-1360 rated at 0.4 million t/yr
Western Africa	Benin	Loumbou-Loumbou	286	50–55% Fe; 3–16% SiO_2	Undeveloped
	Burkina Faso	Say	50	58% Fe; 12% SiO_2	Undeveloped
	Cape Verde	–	–	–	
	Côte d'Ivoire	i) Monogaga-Victory	140	42% Fe; oolitic	Undeveloped
		ii) Man	2,870	33–45% Fe	Undeveloped
	Gambia	–	–	–	–
	Ghana	Oppong Manel	40	38–40% Fe	Undeveloped
	Guinea	Mount Nimba	600	High-grade; 67% Fe	Planned for development 4.5 million t/y of ore in ear[ly] 1990s
	Guinea-Bissau	–	–	–	–
	Liberia	i) Nimba Tokadeh	1,836	High-grade; 62% Fe	In production since 1963; capacity of 4 million t/y
		ii) Bong range	371	Haematite, 36.6% Fe	In production since 1965; rated at 7.2 million t/y
	Mali	i) Bafing-Makana	150	36–37% Fe	Undeveloped
		ii) Falémé	8	Not available	Undeveloped
	Mauritania	i) Kédia d'Idjil	54	High-grade 65–66% Fe	Deposit due for exhaustio[n] in early 1990s.
		ii) The Guelbs (El Rhein, Oum Arwagen and Mertzet)	2,010	37%Fe	In production since 1985; mine rated at 4 million t/y
		iii) West of Zouerate	980	High-grade; 67%Fe	Undeveloped





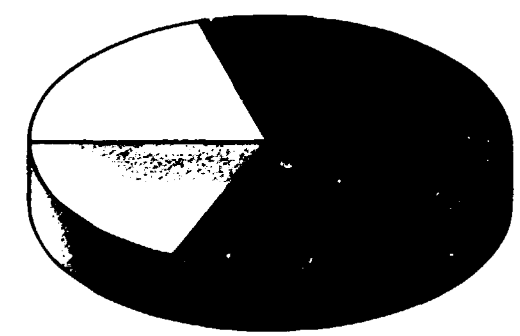
...ines in Angola, Sierra Leone and Swaziland ...re no longer in production.

Most of Africa's iron ore resources remain ...rgely undeveloped owing to such con-...traints as non-availability of the necessary ...vestment resources from both domestic and ...ternational sources, the general sluggishness of ...e world iron ore market, the relative inaccessibility of ...any reserves, necessitating large investments in transport-...tion and other infrastructures, and civil and political strife that ...npedes orderly development.

Liberia and Mauritania are the only African exporters of iron ...re. The volume of export has, however, declined from over 31 ...illion tons in 1979 to 22.5 million tons in 1987, equivalent to 7.8 ...er cent and 6.2 per cent respectively of total world exports.

Liberia's exports are in the form of concentrates and pellets ...om the Bong mine, and lump ore and washed fines from the ...ount Nimba mine. Mauritania's exports are concentrates from ...e Guelbs and natural fines and lump ore from the Kédia d'Idjil ...ine which is due to be mined out in the early 1990s.

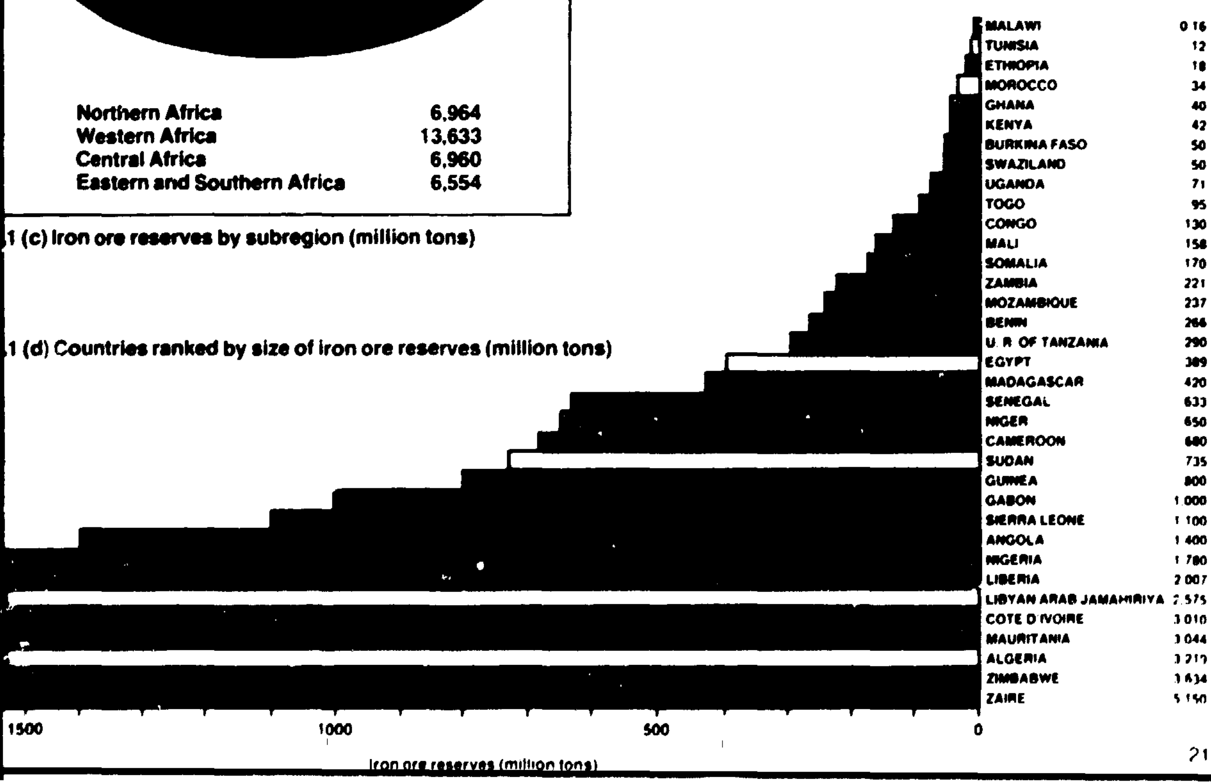
Up to 1984, Algeria was a significant exporter of iron ore, but ...ith the commissioning of the El Hadjar integrated steelworks, all ...s production has now been diverted to domestic consumption. ...imilarly Egypt, Morocco, Tunisia and Zimbabwe produce for ...eir domestic steel plants only.



Northern Africa	**6,964**
Western Africa	**13,633**
Central Africa	**6,960**
Eastern and Southern Africa	**6,554**

...1 (c) Iron ore reserves by subregion (million tons)

...1 (d) Countries ranked by size of iron ore reserves (million tons)



SECTION FOUR

Region	Country	Reserve Location	Reserve Size (million tons)	Reserve Characteristics	Development Status
Western Africa Cont.	Niger	Say	650	Low-grade oolitic haematite, 48–53% Fe	Undeveloped but commercially viable
	Nigeria	i) Itakpe	600	38% Fe; 43% SiO_2	Being developed to produce up to 8.7 million t/y for Ajaokuta Steelworks
		ii) Agbaja	1,000	Low-grade; high P (4.2% P_2O_5)	Undeveloped
		iii) Ajabanoko and Choko-Choko	130	Low-grade	Undeveloped
	Senegal	Falémé (near the Mali border)	633	High-grade; 62–67% Fe	Proposed for development along with rail links to Dakar and port facilities
	Sierra Leone	Marampa; Tonkolili and Bagala Hill	1,100	38–54% Fe	Production terminated in 1985, pending recruitment of new management.
	Togo	Bassari	95	Not available	Undeveloped.
Central Africa	Angola	i) Kassinga	100 (48% Fe cutoff) 1,000	Limonite, haematite, martite 30–34% Fe	Mine rehabilitated 1986 but mining not yet resumed due to internal political problems.
		ii) Kassala-Kitungo	300	Low-grade titano-magnetite; 30–35% Fe	Undeveloped
	Burundi	–	–	–	–
	Cameroon	i) Kribi (in the Mamelle belt)	240	30–40% Fe	Studied but undeveloped
		ii) Mbalam area	440	High-grade; 60% Fe	Studied but undeveloped
	Chad	–	–	–	–
	Central Afr. Rep.	–	–	–	–
	Congo	i) Zanaga	100	43% Fe; 28% SiO_2	Undeveloped
		ii) Mayoko	30	50% Fe; 8.8% SiO_2	Undeveloped
	Equatorial Guinea	–	–	–	–
	Gabon	Haut-Ivindo on the border with Congo	1,000	High-grade; 64% Fe with high P(<0.07%)	Undeveloped; exploitation tied to Transgabonaise railway from Booué
	Rwanda	–	–	–	–
	Sao Tome & Principe	–	–	–	–
	Zaire	i) Kisenge; Kambove and Kamunka	50	56% Fe	Undeveloped
		ii) Kilomoto	5,000	45–65% Fe	Undeveloped
		iii) Luebo	100	35% Fe	Undeveloped
Eastern and Southern Africa	Botswana	Matsiloje Hills	Unquantified	Not available	Undeveloped
	Comoros	–	–	–	–
	Djibouti	–	–	–	–
	Ethiopia	i) Bikilal (Wellega Province)	18 (provable)	28% Fe; 14–15% TiO_2	Undeveloped
		ii) Dello (Bale Province)	Unquantified	Not available	Undeveloped
	Kenya	Scattered deposits in the Mrima, Burtura, McCander Mine and Uyoma areas	Aggregate of about 42	Low-grade	Undeveloped
	Lesotho	–	–	–	–
	Madagascar	i) Soalala	400	High-grade, 60%Fe	Under study for possible development
		ii) Ambatovy-Analamay	20	Medium-", 50% Fe	Undeveloped
	Malawi	Scattered deposits north of Blantyre	0.16	Banded haematite magnetite gneiss	Undeveloped
	Mauritius	–	–	–	–
	Mozambique	i) Monte Muende (in Tete Province)	200	High quality (60% Fe)	Undeveloped
		ii) Honde	37	Meta-itaberites	Undeveloped
	Seychelles	–	–	–	–
	Somalia	Bur and Kisimaio areas	170	Low-grade 30–38% Fe	Undeveloped
	Swaziland	Ngwenya area	50	45% Fe	Ngwenya mine closed in 1978, not yet reopened.
	Uganda	Muko and Sukulu Hills	71	High-grade 62–68%Fe	Undeveloped
	U.R. of Tanzania	i) Liganga	200	51% Fe, 12.8% Ti 0.67% V	Undeveloped
		ii) Chunya	50	Low-grade, 32%Fe Titaniferous	Deposit being mined.
		iii) Hundusi	8	Titaniferous Magnetite. 40% Fe	Undeveloped
		iv) Mbalala	32	Magnetite, 28–32% Fe	Undeveloped
	Zambia	i) Nambala	220 (available) of which 60 is 62–64% Fe	Haematite-magnetite 8–10% SiO_2, 0.07–0.2%P	Being evaluated for proposed direct reduction project
		ii) Mwombeshi	1.4	60% Fe, 9%SiO_2	Undeveloped
	Zimbabwe	i) Buchwa	134	High-grade 61.5%Fe	To be mined out by 1995.
		ii) Ripple Creek	200	53.4%Fe	Being developed to supply ZISCO requirements.
		iii) Manesi range	3,300	Low-grade. 40%Fe	Undeveloped.

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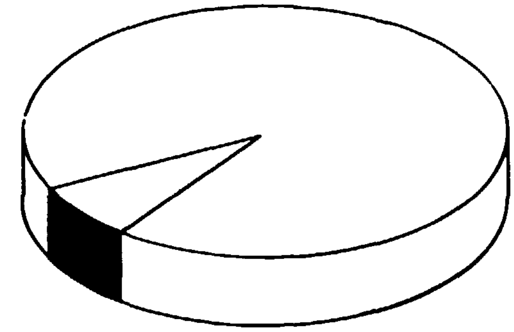

	Per cent
Africa	7
Asia	9
Europe	34
North America	24
Oceania	17
South America	9

(e) Africa's share of world's iron ore reserves

Region	Reserve Crude Ore	Base Iron Content
Africa	14.832	9.651
Asia	17.981	9.244
Europe	71.416	30.578
North America	51.098	16.152
Oceania	34.540	21.130
South America	19.708	13.206
World Total	209.575	99.961
Africa's Share	7.08%	9.65%

* The United States Bureau of Mines defines reserve base as the quantity of in-place demonstrated (measured plus indicated) resource that meets specified minimum physical and chemical criteria related to current mining and production practices including those for grade quality thickness and depth. The reserve base includes those resources that are currently economic (i.e. reserves) marginally economic (marginal reserves) and some of those that are currently sub-economic (sub-economic resources)

4.1 (f) Africa's share (as of 1 January 1984) of world's iron ore reserve base* (million tons)

1 (g) Africa's iron ore production in relation to world production (Thousand tons)

Africa		1979	1981	1983	1985	1987
	Algeria	3,120	3,481	3,684	3,376	3,382
	Egypt	1,701	2,015	2,007	2,000	2,000
	Liberia	18,350	19,540	15,410	16,120	13,810
	Mauritania	8,910	8,270	6,600	9,200	9,000
	Morocco	60	50	300	140	200
	Nigeria	-	-	-	-	208
	Sierra Leone	-	-	360	70	50
	Tunisia	390	400	300	310	291
	Zimbabwe	1,201	1,096	924	1,098	1,328
	Total Africa	33,822	34,852	29,585	32,314	30,269
	European Community	49,154	34,187	24,814	22,512	16,766
	Other Western Europe	41,613	38,384	29,318	36,649	37,074
	Other Western Industrialized Countries	261,459	238,766	158,647	209,249	209,346
	Latin America	130,163	133,993	116,840	163,457	171,325
	Asia	40,454	42,267	38,345	44,988	49,215
	Eastern Europe	248,834	248,751	251,147	253,992	256,661
	China, Dem. People's Rep. of Korea	127,260	112,590	121,660	139,500	165,500
	World Total	932,759	883,990	770,356	902,661	936,156
	Africa's Share	3.6%	3.9%	3.8%	3.6%	3.2%

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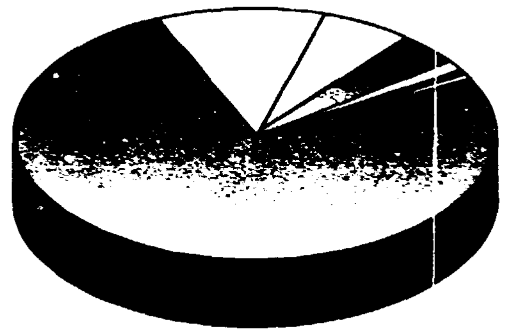

Liberia	13,810
Mauritania	9,000
Algeria	3,382
Egypt	2,000
Zimbabwe	1,328
Tunisia	291
Nigeria	208
Morocco	200
Sierra Leone	50

4.1 (h) African iron ore producers ranked by 1987 production (thousand tons)

ACTIVE MINES AND PRODUCTION CAPABILITY (tons per year)	
Algeria	Ouenza (4 million)
Egypt	Bahariya (3.30 million)
Liberia	Bong Mining Co. (7.20 million); Mt. Nimba (4 million)
Mauritania	Kedia (8.20 million)
Morocco	Seferif (0.4 million)
Nigeria	Itakpe (0.35 million)
Sierra Leone	–
Tunisia	Djerissa (incl. Tamera and Dousri 0.4 million)
Zimbabwe	Buchwa (1.44 million); Ripple Creek (0.42 million)

4.1 (i) Africa's iron ore exports in relation to world exports, 1979–1987 (thousand tons)

Africa		1979	1981	1983	1985	1987
	Algeria	2.484	1.507	1.302	7	13
	Egypt	–	–	–	–	–
	Liberia	19.348	20.670	15.358	16.126	13.539
	Mauritania	9.313	8.609	7.402	9.333	9.002
	Morocco	–	–	–	–	–
	Nigeria	–	–	–	–	–
	Sierra Leone	–	–	355	80	50
	Tunisia	–	–	–	–	–
	Zimbabwe	–	–	–	–	–
	Total Africa	31.145	30.786	24.417	25.546	22.554
	European Community	12.301	7.798	6.237	6.790	5.855
	Other Western Europe	12.301	21.243	17.255	20.820	13.292
	Other Western Industrialized Countries	150.569	136.296	113.469	134.823	123.596
	Latin America	100.788	105.427	85.107	111.369	118.718
	Asia	27.970	23.927	22.001	28.840	29.001
	Union of Soviet	44.504	43.453	42.805	43.880	43.000
	China, Dem. People's Rep. of Korea and other Eastern European Countries			Not available		
	World Total	397.001	368.930	311.361	372.068	366.066

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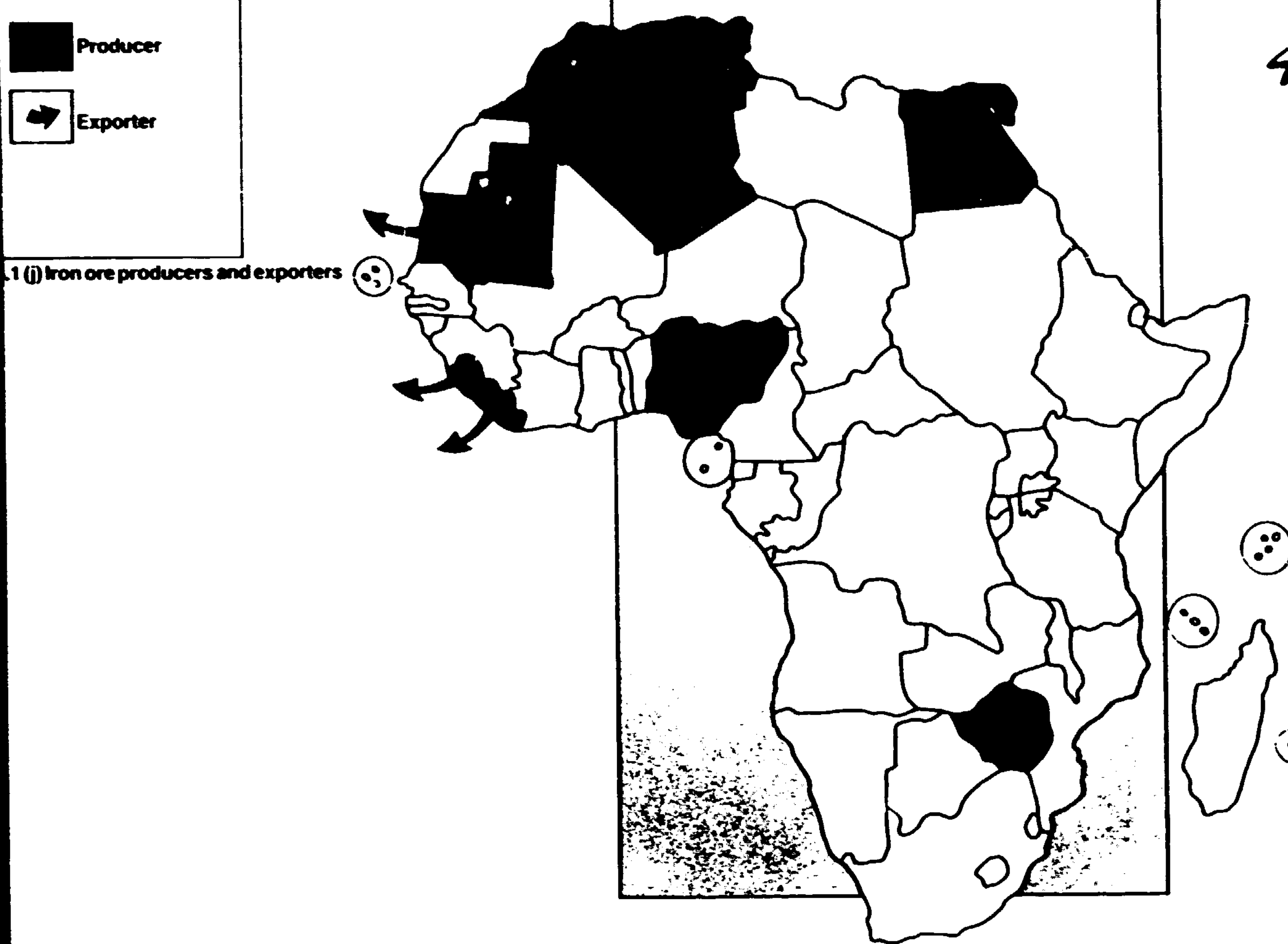
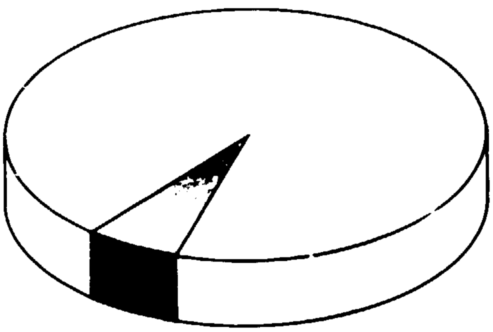


.1 (j) Iron ore producers and exporters



Africa	6
European Community	2
Other Western Europe	5
Other Western Industrialized Countries	34
Latin America	32
Asia	8
Union of Soviet Socialist Republics	12
China, Democratic People's Republic of Korea and other Eastern European Countries	1

.1(k) Africa's iron ore exports compared to other regions
f the world, 1987 (Per cent)

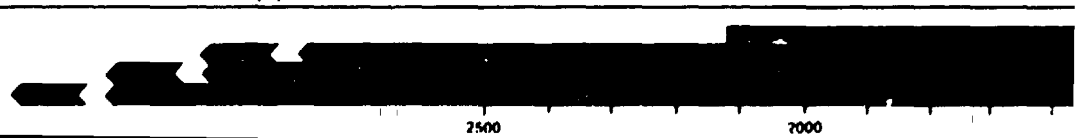
According to estimates by the International Energy Agency, Africa accounts for about 6 per cent of the world's coal accessible in significant reserves. This amounts to about 34,600 million tons out of a world total of 581 000 million tons.

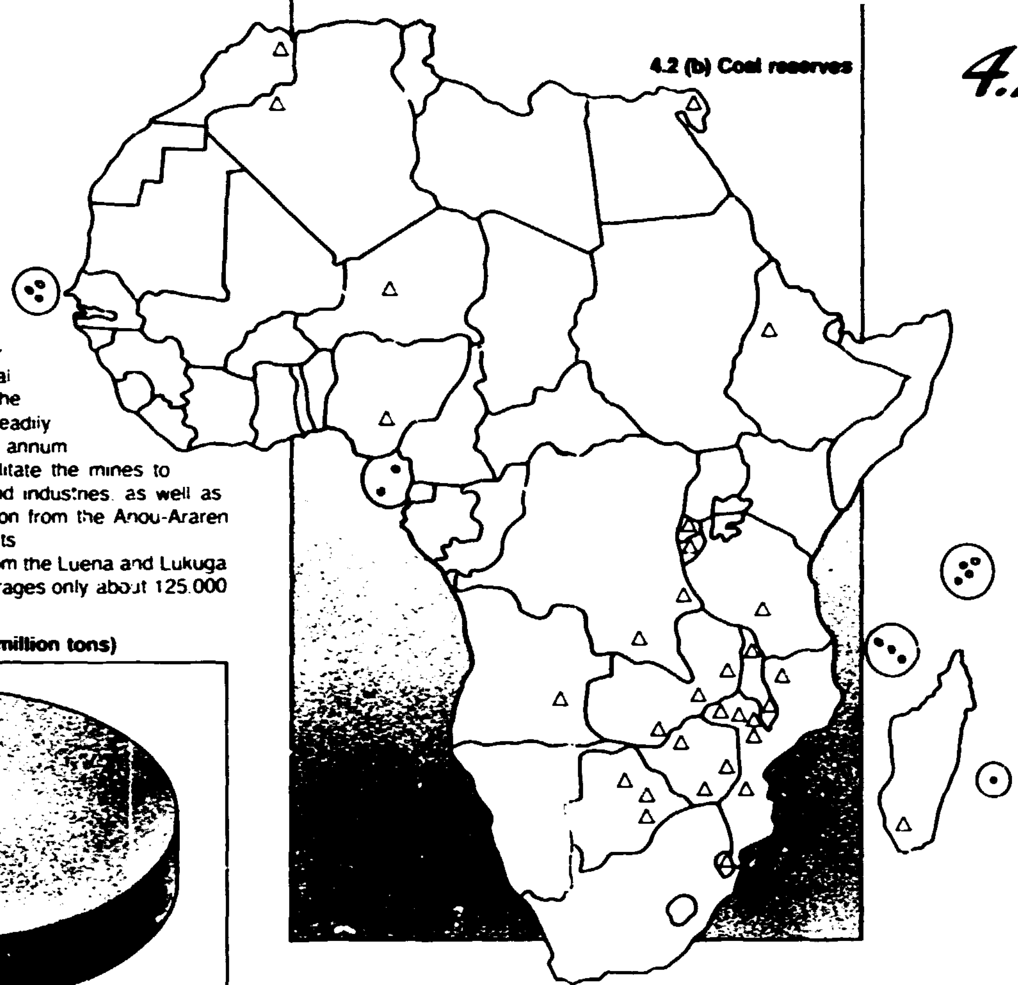
The bulk of Africa's coal reserves occur in Southern Africa, Botswana and Zimbabwe being endowed with the most extensive deposits. Botswana's coalfields contain up to 17 000 million tons of washable steam coal, of which at least 3.500 million tons can be recovered. The Morupule mine is in production and has the capacity to produce up to one million tons per year. Zimbabwe's coal output comes from the Hwange coalfields. It is the sourc metallurgical coal for the ZISCO steelworks. Other coal produ in Southern and Eastern Africa are Malawi (from the Kazwi mine), Mozambique (whose reserves include up to 2.5 billion coking coal), Swaziland, the United Republic of Tanzania Zambia (from the Maamba mine).

Algeria, Egypt and Morocco are significant coal producer Northern Africa. The Maghara mine in Egypt has been rece rehabilitated so as to enable it to achieve an output of 600 tons per annum. In Morocco, the Jerada mine has the capaci

4.2 (a) Africa's coal reserves, 1987

	Reserve Location	Reserve Size (million tons)	Reserve Characteristics	Status of Exploitation
Northern Africa				
Algeria	The Gara Becher, Mazarif and Gara Antar deposits.	100	Significant anthracite and hard coal with good coking properties and medium volatility (22–35%); high sulfur (2.24–2.78%).	Kenadza mines are in production.
Egypt	Near Suez and in the Sinai (including Maghara)	80	Maghara brown coal contains high sulfur (up to 4.9%)	Maghara mine rehabilitated and targeted to produce 600,000 tons in 1988.
Morocco	The Jerada basin	120	Anthracite; 40 mill. tons recoverable; low ash (3–4 %), low volatiles (5–6%).	Jerada mine production approaching one million tons per year.
Western Africa				
Niger	Anou-Araren deposit	6	—	Anou-Araren mine supplies coal to fuel power plant at site.
Nigeria	Deposits around Enugu (in Anambra State) and in Benue and Plateau States	Estimated between 650 and 1,500	Sub-bituminous and lignite with high-ash (6–22%) and high volatiles (36–43%); generally non-coking.	Mines in Anambra and Benue States being rehabilitated; output of 117,000 tons in 1987.
Central Africa				
Angola	Scattered small reserves	Up to 600 (estimated)	Low-quality brown coal in thin seams, and lignite.	Undeveloped.
Burundi	Peat reserves	About 1.0	—	On-going 6-year study of exploitation potential.
Rwanda	Peat reserves	2,116 (estimated)	—	Undeveloped.
Zaire	Luena and Lukuga in Shaba Province	720	Average to low quality bituminous with high-ash and low calorific value.	Production from Luena at about 100,000 tons/year, and from Lukuga at about 25,000 tons/year.
Eastern and Southern Africa				
Botswana	Morupule, Mojabana, Mmamabula, Letlhakeng and Dutlwe fields	17,000 (of which 3,500 is recoverable)	High-ash medium-volatile steam coal; washable to yield product with about 12% ash and less than 1% S.	Morupule mine in production, with production capacity of 1 million tons/year.
Ethiopia	Small deposit near Chilga in Gondar Province	Unquantified	Lignite.	Undeveloped.
Madagascar	Sakoa and Imaloto fields	Up to 810	Sub-bituminous and bituminous steam coals; 15–30% ash and 1.4–2.4% S.	Undeveloped.
Malawi	The Livingstonia coal fields, and in the south near Chiromo	800	Sub-bituminous and bituminous steam coal, with 15–30% ash and 1.4–2.4% S.	Kaziwiziwi mine in production since 1986; produced 18,500 tons in '87 (half of domestic consumption).
Mozambique	The Moatize, Mucanha-Vuzi, Minjova, Senangoe, Metangula and Espungabera basins.	Over 7,500	Up to 2.5 billion tons coking grade, 20% ash and 30% volatile matter; balance medium-to-high ash steam coal (20% ash, 26% volatile matter, 6,800 kcal/kg).	Moatize basin being mined, although civil strife has depressed production to only 20,000 tons in 1986.
Swaziland	North-to-south basin in Eastern Swaziland running the length of the country.	Up to 1,000	Moderate to good quality low-volatile to anthracite (cokable) coal in the lower zone; inferior anthracite in upper zone.	Production of 165,000 tons in 1987 for domestic use and exports.
United Republic of Tanzania	Mchuchuma reserves	Up to 1,500	Steam coal, 20.8% ash, 25% volatiles, and 0.48% sulfur.	Mining at Ilima in Mbeya region; below 10,000 tons output in 1986.
Zambia	The Zambezi, Luangwa, Luano and Lukusashi valleys, and the Western Zambia trough system.	90	Non-coking sub-bituminous steam coal with high ash (17%) and low volatiles (19%).	Maamba mine in the mid-Zambezi valley is the only active mine, with output of 463,000 tons in 1987.
Zimbabwe	23 fields located mainly in the Mid-Zambezi and Sabi-Limpopo basins.	Up to 30,000	Over 2 billion tons of coking grade.	Current production only from Hwange coalfield in the mid-Zambezi basin.

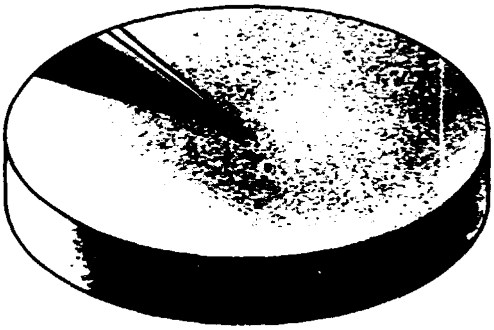




roduce up to one million tons per year
Nigeria and Niger are the only coal roducers in Western Africa Since the arly 1970s, Nigeria's output had steadily eclined to less than 50 000 tons per annum fforts are now being made to rehabilitate the mines to roduce for domestic power plants and industries as well as or the export market Niger's production from the Anou-Araren ine is consumed by local power plants

In Central Africa coal is produced from the Luena and Lukuga ines in Zaire Annual output now averages only about 125 000 ons

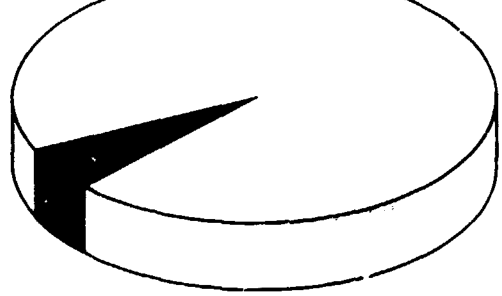
.2 (c) Coal reserves by subregion (million tons)



Northern Africa	**300**
Western Africa	**656–1,506**
Central Africa	**3,437**
Eastern and Southern Africa	**58,700**

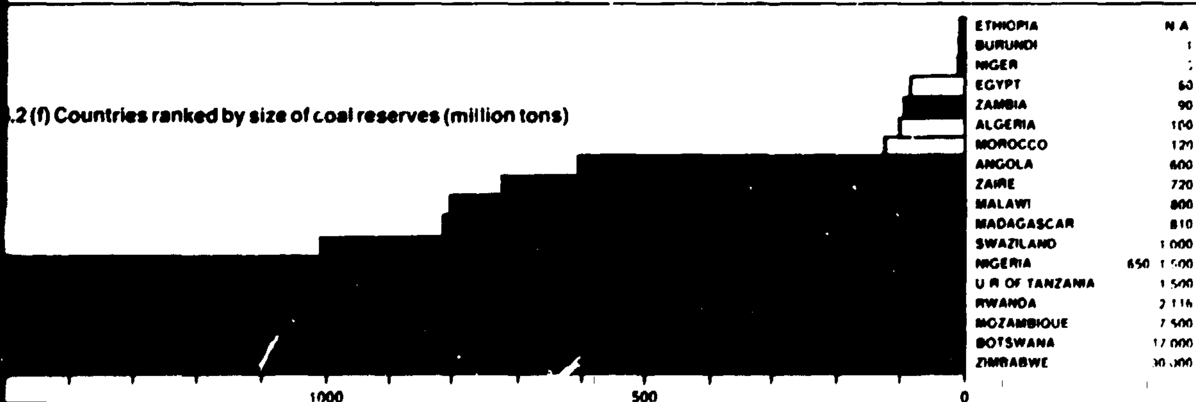
.2 (d) Africa's share of world's accessible coal in significant coalfields (million tons)

Region Country	Bituminous coal and Anthracite	Sub-bituminous Coal	Brown coal Lignite	Total
OECD	106.456	39.350	53.938	199.794
Africa	34.319	231	62	34.612
Asia	92.023	387	2.267	94.677
USSR	73.830	21.043	77.375	172.248
Eastern Europe	37.600	5.750	24.420	67.770
Central & South America	6.103	5.224	20	11.347
Total World	351.051	71.985	158.132	581.168
Africa's share	9.78%	0.32%	0.04%	5.96%



4.2 (e) Africa's share of world's accessible coal reserves

.2 (f) Countries ranked by size of coal reserves (million tons)



4.3

PETROLEUM

In 1987, Africa accounted for 6.5 per cent of the world's proven petroleum reserves. In general, this ratio has been declining since 1981 when a figure of 8.21 per cent was recorded. This trend apparently stems from the collapse of petroleum prices on the international market, coupled with the diminished tempo of new exploration in most African countries.

The largest petroleum reserves are in the Libyan Arab Jamahiriya (25.9 billion barrels), Nigeria (18 billion barrels) a Algeria (8.5 billion barrels). These three countries, along w Gabon (1.02 billion barrels), are members of the Organization Petroleum Exporting Countries (OPEC). Non-OPEC Afri producers of crude oil include Angola, Benin, Cameroon, Con Côte d'Ivoire, Egypt, Tunisia and Zaire.

4.3 (a) Africa's petroleum reserves

Region	Country	Location and size of reserves	Status of exploitation
Northern Africa	Algeria	Hassi Messaoud/Haoud el Hamra and Zarzaitine-Edjeleh fields; 8.5 billion barrels recoverable (1985).	Low production rate (700,000 bbls/day in 1986) expected to sustain production for 25 to 30 years.
	Egypt	Gulf of Suez fields; 5 billion barrels.	720,000 bbls/day production rate in 1986, 85% for domestic consumption.
	Libyan Arab Jamahiriya	The Sirte basin; 25.9 billion barrels proven.	Sulfur-free light sweet crude; production at about 1 million bbls/day in 1987, 78% for export.
	Morocco	Small reserves in Harisha, Sidi Ghalem, Sidi Fili Toukmit fields. Also significant oil shale reserves located mainly at Timahdit and Tarfaya; 20 billion tons with an oil content of 8 billion tons.	No significant production at present.
	Sudan	Near Bentiu in Upper Nile Province, and in the Red Sea; 850 million barrels of which 28% is recoverable.	Undeveloped.
	Tunisia	El-Borma and Ashtart (offshore) fields; 1.514 billion barrels (1985).	Declining reserves and production would lead to net importation in the 1990s.
Western Africa	Benin	The Sèmè (offshore) field; 100 million barrels.	1987 production at 5,000 to 7,000 bbls/day.
	Cote d'Ivoire	The offshore Espoir and Bélier fields; 119.5 million barrels (1986).	Declining output, minimal exploration and drilling.
	Ghana	The offshore Saltpond field.	Production discontinued 1986 due to falling production and profitability.
	Nigeria	Niger delta and offshore fields; 18 billion barrels.	Production at 1.3 million bbls/day. (1987)
	Senegal	The offshore Dôme Flore field; 2.1 billion barrels.	Undeveloped.
Central Africa	Angola	The Cabinda fields (including Numbi), and the Palanca and Pacassa fields; 2.1 billion barrels recoverable.	Production in 1987 at 328,000 bbls/day.
	Cameroon	Kole field (offshore) in the Rio del Rey basin, the Lokele and Mondi fields; 540 million barrels proven.	Declining production rate to about 90,000 bbls/day by early 1990s.
	Chad	Lake Chad region; 146 million barrels.	Undeveloped.
	Congo	Emeraude, Likouala, Loango Yanga/Sendji offshore fields, and Pointe-Indienne, Bindi, Kundji and Mengo onshore fields; 5.8 billion barrels.	1987 production at 126,000 bbls/day.
	Gabon	The Port Gentil, Kounga, Rabi and Obando fields; 1.02 billion barrels.	1987 production at about 160,000 bbls/day.
	Zaire	Offshore Lukami, Mibale, Motoba and Mwambe fields 140 million barrels.	1986 production at 0.5 million bbls/day.
Eastern and Southern Africa	Madagascar	Heavy oil (4.8 billion bbls) at Tsimororo; Morodava (offshore) and Sakhara areas (1.46 billion bbls); and Bemolanga bituminous sands near Mahajanga (584 million bbls oil content).	Undeveloped.

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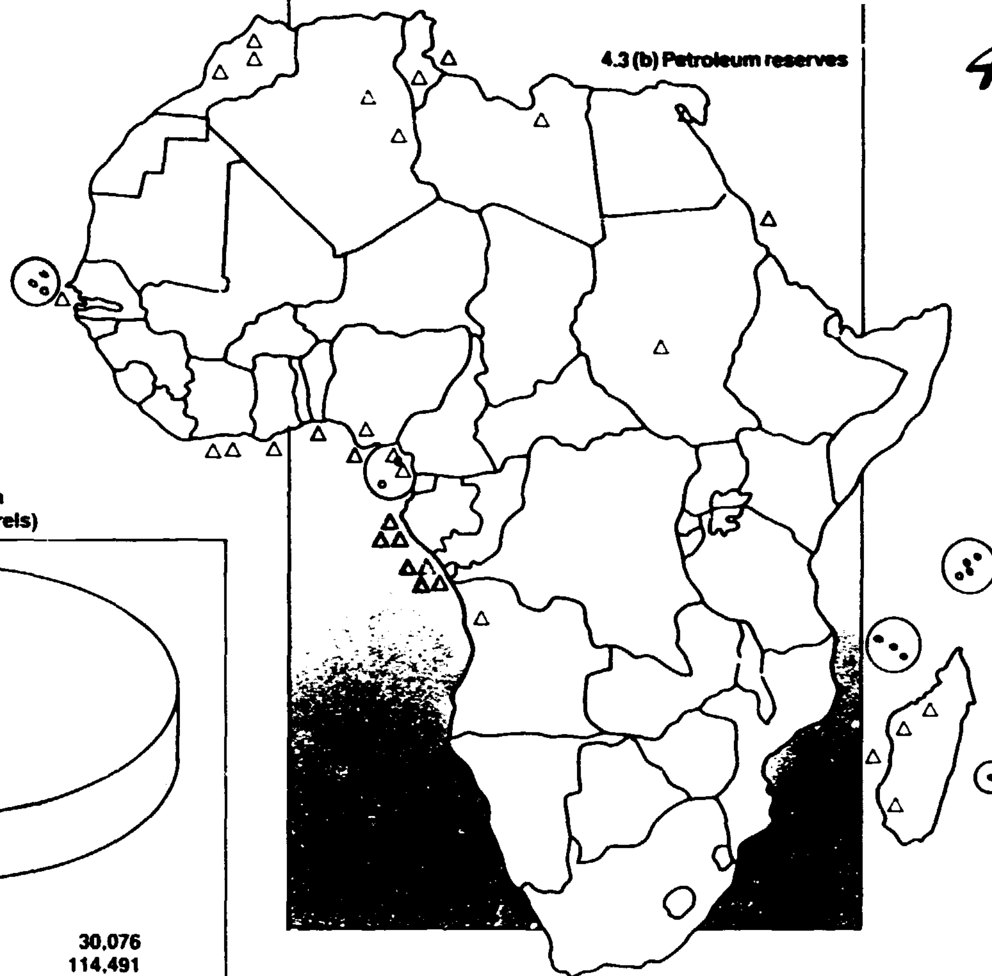
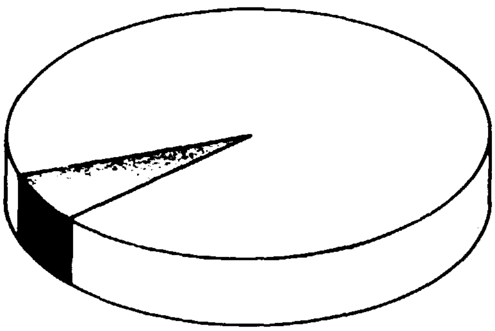


4.3 (b) Petroleum reserves

.3 (d) Africa's share of world's proven petroleum reserves, 1987 (million barrels)

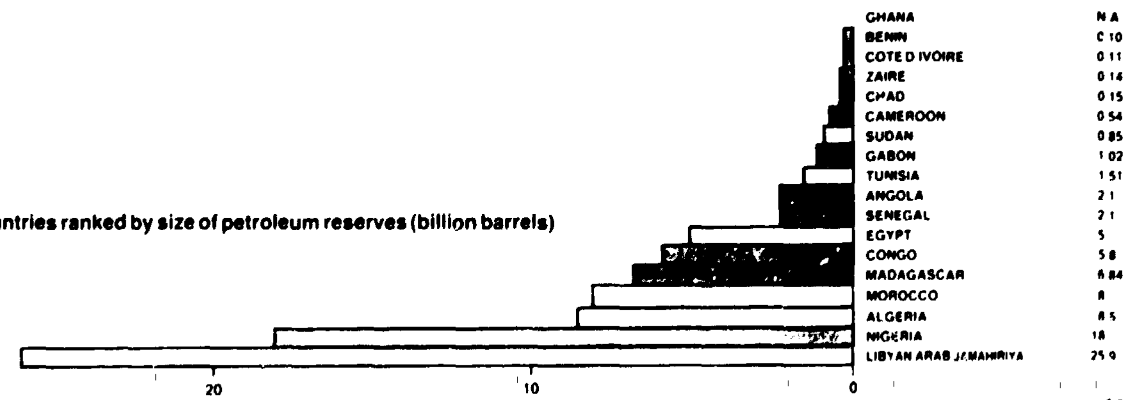


North America	30,076
Latin America	114,491
Western Europe	22,648
Middle East	567,028
Africa	57,958
Asia and the Far East	18,103
Oceania	1,852
Centrally-Planned Economies	78,950

.3 (c) Africa's share of world's proven petroleum reserves, 1981–1987, (million barrels)

Region	1981	1982	1983	1984	1985	1986	1987
North America	36.726.0	34.878.0	34.169.8	34.418.1	33.472 0	31.695.0	30.076.0
Latin America	75.664.2	81.339.8	83.858.9	84.829.8	112.636.5	112.623.3	114.491.0
Western Europe	18.349.4	17.058.8	17.444.5	17.123.8	19.358.1	18.510.8	22.648.3
Middle East	364.860.0	387.005.9	392.175.3	430.399.8	431.640.7	536.837.7	567.028.3
Africa	55.550.8	57.555.5	56.964.3	56.248.7	57.706.6	57.602.1	57.957.7
Asia and the Far East	17.522.2	17.216.1	16.841.9	16.871.7	17.238.3	17.848.7	18.102.6
Oceania	1.879.8	1.791 1	1.756.0	1.585.9	1.625.0	1.879.8	1.852.0
Centrally-Planned Economies	106.195.0	106.633.0	105.301.0	100.960.0	82.805.0	80.700.0	78.950.0
Total world	676.747.4	703.483.2	708.511.7	742.437.8	756.482.2	857.697.4	891.105.9
Africa's share	**8.21%**	**8.18%**	[illegible]	[illegible]	[illegible]	**6.72%**	[illegible]

.3 (e) Countries ranked by size of petroleum reserves (billion barrels)



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NATURAL GAS

In 1987, Africa's share of the world's proven natural gas reserves was 6.45 per cent, equivalent to about 112 trillion m^3. The greatest accumulations are in Algeria (3,000 billion m^3) and Nigeria (2,400 billion m^3).

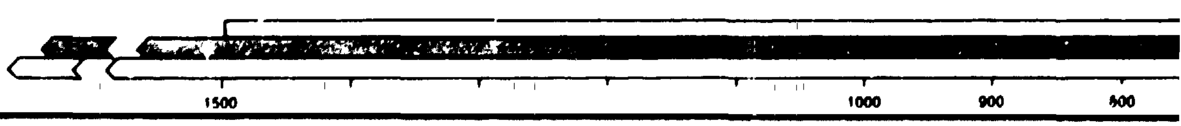
Algeria is a major world producer of natural gas and gas condensates, and is the largest producer in OPEC. Production (in the form of liquefied natural gas (LNG)) is exported mainly to Europe, although domestic consumption (which amounts to less than 15 per cent) has been increasing in recent years.

Most of Nigeria's associated gas output is flared. In fact, less than 10 per cent is marketed to local steelworks, fertilizer plants and power stations. Plans are being made for an LNG project which is expected to come on-stream in the late 1990s. The target market would be Europe and North America.

Other significant African gas producers for domestic consumption are Egypt, Morocco and Senegal. Angola's associated gas output is mostly reinjected to stimulate oil recovery, and virtually all the production in Congo is flared.

4.4 (a) Africa's natural gas reserves

Region	Country	Location and Size of Reserves	Status of Exploitation (1987)
Northern Africa	Algeria	Hassi R'Mel, Rhourde Nouss, Alrar, Rhourde Adra, Gassi Touil and Bassin d'Illizi fields; Proven reserves of 3,000 billion m^3.	Major producer and exporter of gas (as LNG); gross production in 1986 was 97.40 billion m^3 with 40 billion m^3 marketed.
	Egypt	Western desert and the Nile delta; 300–1,500 billion m^3.	Commercially produced as natural gas, condensates and LPG.
	Libyan Arab Jamahiriya	Marsa el Brega, Raguba, Oasis and Amoseer fields; 728 billion m^3.	Gas export in form of LPG (0.5 billion m^3 in 1986).
	Morocco	Kechoula, Jear, Harisha, Doner Jebar, Meskala and Oued Youssef fields; over 3 billion m^3.	Meskala field is source for gas gathering network for phosphate calcination at Youssoufia.
	Tunisia	The Miskar field (in Gulf of Gabes); 84–180 billion m^3.	Undeveloped.
Western Africa	Cote d'Ivoire	The Espoir and Bélier fields (offshore); 23 billion m^3.	Undeveloped.
	Nigeria	East and West of the Niger Delta; total estimated reserves (associated and non-associated) of up to 2,400 billion m^3.	Over 80% of production now flared; plans being made for an LNG project to be commissioned in the mid-1990s.
	Senegal	The Diam-Niadio field; about 50 million m^3.	In production at about 28,000 m^3/day for power generation.
Central Africa	Angola	[illegible] field (in Cabinda) and [illegible] field; [illegible] billion m^3.	Associated gas reinjected to stimulate oil recovery.
	Cameroon	[illegible]	Undeveloped.
	Congo	[illegible]	[illegible] of associated gas production is flared.
	Gabon	[illegible]	Undeveloped.
	Rwanda	[illegible]	Undeveloped.
	Zaire	[illegible] about 1 billion m^3.	Undeveloped.
Eastern and Southern Africa	Ethiopia	The Ogaden region; 25 billion m^3.	Undeveloped.
	Mozambique	The Pande-Buzi field; up to 220 billion m^3.	Undeveloped.
	U.R. of Tanzania	Songo Songo on Kilwa Island, and Kimbiji; up to 173 billion m^3.	Undeveloped.



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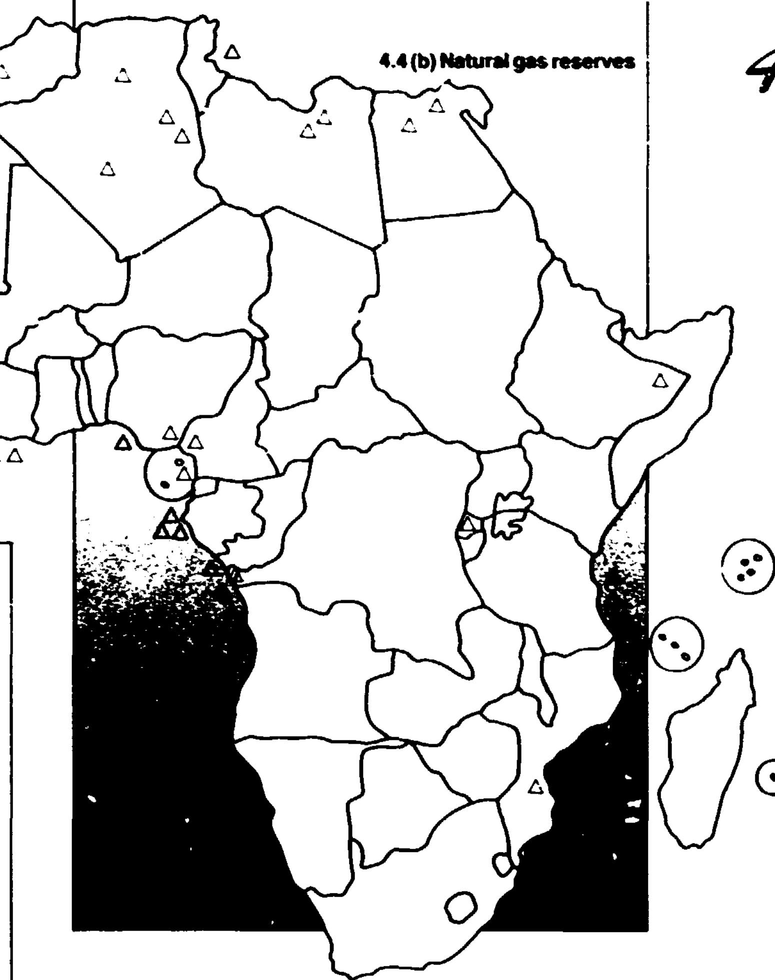
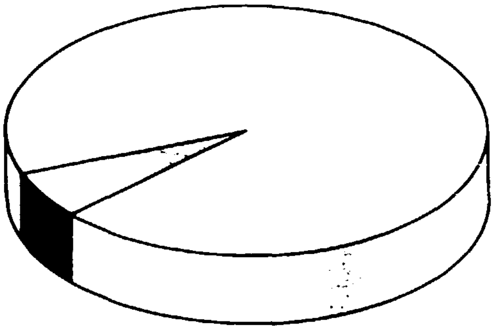


4.4 (b) Natural gas reserves

4.4 (c) Africa's share of world's natural gas reserves, 1987 (billion standard m³)

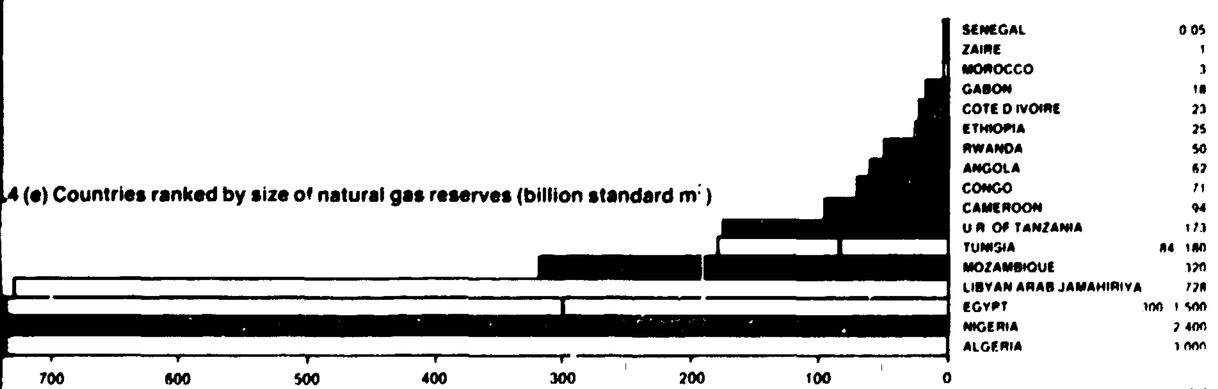


North America	8,040
Latin America	7,039
Western Europe	5,529
Middle East	31,171
Africa	7,195
Asia and the Far East	6,754
Oceania	2,516
Centrally-planned Economies	43,301

4.4 (d) Africa's share of world's proven natural gas reserves, 1982–1987, (billion standard m³)

Region	1982	1983	1984	1985	1986	1987
North America	8,310.9	8,296.3	8,414.4	8,259.6	8,171.1	8,040.0
Latin America	5,260.4	5,330.3	5,441.0	5,662.3	6,564.4	7,038.8
Western Europe	4,252.1	5,463.4	5,637.3	5,551.1	5,586.1	5,529.1
Middle East	25,410.6	25,889.9	27,120.9	27,559.7	30,316.4	31,170.9
Africa	6,427.1	5,923.3	5,920.6	5,948.3	7,163.0	7,195.0
Asia and the Far East	4,366.9	4,675.3	5,226.1	5,742.5	6,592.3	6,754.3
Oceania	1,065.0	1,183.7	1,611.0	1,697.2	2,278.0	2,516.0
Centrally-planned Economies	36,523.5	37,413.0	38,909.0	41,468.0	42,618.0	43,301.0
Total world	91,616.5	94,184.2	98,280.2	101,888.7	109,289.3	111,545.1
Africa's Share	7.02%	6.29%	6.02%	5.84%	6.56%	6.45%

4.4 (e) Countries ranked by size of natural gas reserves (billion standard m³)



4.5

In comparison with many other regions in the world. Africa is relatively well endowed with several alloying minerals

Africa alone accounts for about 95 per cent of the world s known chromite reserves (although the largest reserves occur in South Africa) Zimbabwe s proven reserves are over 500 million tons. of which a substantial proportion consists of the shipping-grade high-chromium variety Most of its production comes from the Great Dyke and is processed into ferro-chromium prior to export Other significant African reserves of chromite occur in Madagascar. where it is mined and beneficiated for export by the state corporation KRAOMA. and in Sudan where it is exploited by Ingessana Hills Mining Corporation Its operations are. however. beset by chronic undercapitalization and antiquated mining equipment and facilities

Africa s share of the world s cobalt reserves is about 33 per cent. mostly from sulfide and oxide deposits in Zaire and Zambia The former accounts for over 75 per cent of the region s reserves. and the latter contributes about 20 per cent Other significant reserves occur in Botswana (along with nickel and copper in the Selebi-Phikwe area). near Kilembe in Uganda. and in association with copper in Zimbabwe

Africa contains 78 per cent of the world's known reserves of manganese. In fact. Gabon is estimated to possess about 26 per cent of the world's reserves (second only to South Africa) and is the second largest producer of manganese ore Ghana is also an important producer. particularly following the modernization of the Nsuta mine and plant and the improved rail connection to Takoradi. Other African countries endowed with significant. but hitherto undeveloped manganese resources are Angola. Tambao in Burkina Faso (although short-term development of this reserve is now doubtful owing to the suspension of the rail project to Ouagadougou). Côte d Ivoire. Togo and Zaire.

Africa's share of the world's known tantalite reserves is about 24 per cent Generally found in association with columbite. large exploited reserves occur in Nigeria and Zaire. Other reserves occur in Ethiopia (undeveloped). Mozambique and Zimbabwe

4.5 (a) Africa's reserves of alloying minerals

	Country	Alloying Minerals	Reserve Location and size	Status of Exploitation (1988)
Northern Africa	Sudan	Chromite	Ingessana Hills near the Ethiopian border: 15 million tons.	Current production at 10,000 to 15,000 tons/year for export.
Western Africa	Burkina Faso	Manganese	Tambao on the northern border: 13 million tons oxide ore (50–55% Mn) and 13 million tons carbonate ore (48% Mn).	Development impeded by suspension (in 1986) of rail connection project to Ouagadougou.
	Cote d'Ivoire	Manganese	Grand Lahou and Ziemongoula deposits: total of 2.7 million tons (44–47% Mn).	Undeveloped.
	Ghana	Manganese	Nsuta deposit: 49 million tons.	Ghana is major manganese exporter, production of 253,000 tons ore (1987).
	Nigeria	Columbite/ Tantalite	In association with tin on the Jos Plateau.	Declining output owing to exhaustion of easier-to-mine deposits.
	Togo	Manganese	The Bayega deposit.	Undeveloped.
Central Africa	Angola	Manganese	Maiombe region (Cabinda) and the Lucala, Quicama and Capula areas. Reserves of at least 5 million tons.	Undeveloped.
	Burundi	Nickel	Buhinda (northeast of Musongati); 29 million tons at 0.8% Ni cut off.	Undergoing tests for possible exploitation.
		Vanadium	Mukanda deposit; 12–15 million tons averaging 0.66% V.	Undeveloped.
	Gabon	Manganese	Moanda area (near Franceville); 200 million tons.	26% of world's reserves; production of 2.4 million tons in 1987.
	Zaire	Cobalt	Shaba region; 1.36 million tons in association with copper.	World's leading producer of cobalt; 1986 output of 14,500 tons.
		Columbite/ Tantalite	Kivu region; 33,600 tons.	In semi-commercial production; output of 120 tons concentrate in 1986.
		Manganese	Near Kisenge; 5 million tons.	Undeveloped.
		Tungsten	Kivu region; 3,000 tons.	Co-product with tin, columbite and tantalite; output of 15 tons tungsten content in 1986.
Eastern and Southern Africa	Botswana	Nickel/ Cobalt	The Selebi-Phikwe deposit (in eastern Botswana); 400,000 tons Ni and 27,000 tons cobalt.	Matte pellets produced at smelter, 18,974 tons contained nickel and 163 tons contained cobalt in 1986.
	Ethiopia	Nickel/ Chromium	West of Kenticha; unquantified.	Undeveloped.
		Columbite/ Tantalite	Kenticha in Sidamo Province; unquantified.	Undeveloped.
	Madagascar	Chromite	The Adriamena, Befandriana and other southern zone deposits; total of 7.61 million tons of ore.	Exploited by SCMAREX; total installed capacity of 340,0.. tons/year.
	Mozambique	Columbite/ Tantalite	Central Zambezia Province; 5,800 tons Ta_2O_5.	Limited mining and declining production (only 4.3 tons Ta_2O_5 concentrate in 1985).
	Uganda	Cobalt	The Kilembe deposit; unquantified.	On a care-and-maintenance basis during 1987.
	U.R. of Tanzania	Titanium/ Vanadium	Liganga (in association with iron); unquantified.	Undeveloped.
	Zambia	Cobalt	The Copperbelt, in the areas around Nchanga, Mufulira, Nkana, Luanshya and Konkola; 544,300 tons.	Co-product with copper; production by Zambia Consolidated Copper Mines Ltd. (ZCCM), part-owned by the Government (60.3%).

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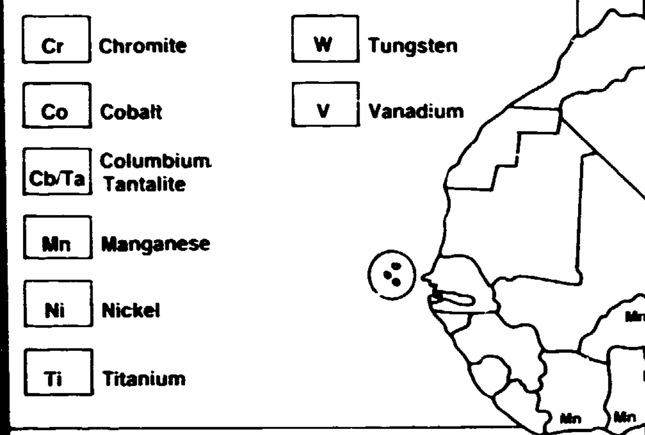
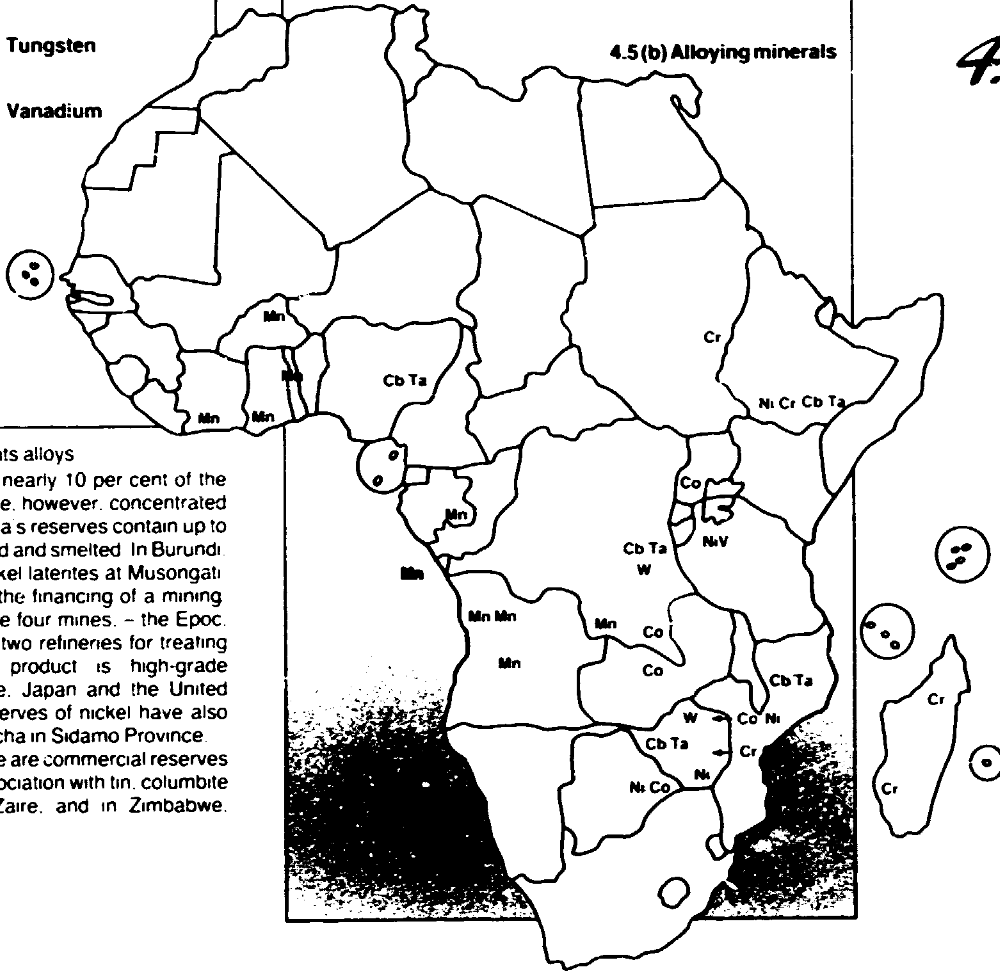




where it is processed into the metal and its alloys

Nickel reserves in Africa account for nearly 10 per cent of the world's total. Virtually all the reserves are, however, concentrated in Central and Southern Africa. Botswana's reserves contain up to 400,000 tons nickel which is locally mined and smelted. In Burundi, studies are being carried out on the nickel laterites at Musongati. Discussions are in progress regarding the financing of a mining smelting project. In Zimbabwe, there are four mines, – the Epoc, Madziwa, Shangani and Trojan, – and two refineries for treating domestically produced matte. The product is high-grade electrolytic nickel for export to Europe, Japan and the United States. Scattered and unquantified reserves of nickel have also been reported in Ethiopia, around Kenticha in Sidamo Province.

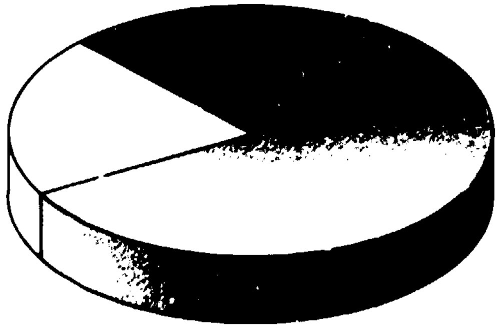
Another alloying mineral of which there are commercial reserves in Africa is tungsten which occurs in association with tin, columbite and tantalite in the Kivu region of Zaire, and in Zimbabwe, northwest of Shamva.

4.5 (c) World distribution of manganese reserves, 1983

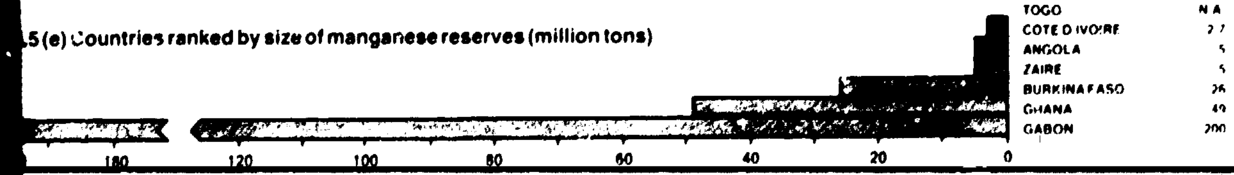
Region	Reserve base* (thousand tons Mn content)	Share of world total (per cent)
Africa**	2,811,700	78.1
Asia	56,234	1.6
Europe	507,920	14.1
North America	7,800	0.2
Oceania	152,376	4.2
South America	62,583	1.7
World	3,598,613	

* Reserve base includes demonstrated resources that are currently economic, marginally economic, and some of those that are currently sub-economic.
** Including South Africa.

4.5 (d) Africa's share of world's manganese reserves



4.5 (e) Countries ranked by size of manganese reserves (million tons)



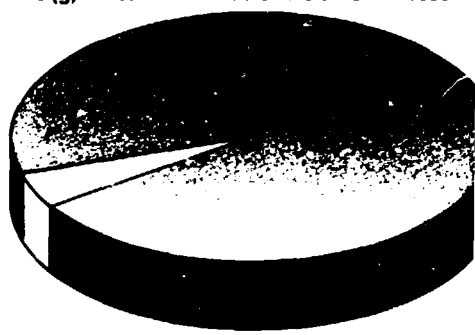
Eastern and Southern Africa Cont.				
	Zimbabwe	Chromite	Kwe-Kwe, Gwelo and Tebekwe areas; reserves are effectively inexhaustible; proven reserves of over 500 million tons.	Mined and smelted to ferrochrome; Zimbabwe is the world's third largest producer.
		Nickel	In the Shamva, Fort Victoria and Gatooma areas; reserves are adequate for 50 years exploitation.	Nickel domestically smelted and refined for export by Anglo-American Corporation.
		Cobalt	In association with copper in the Zawi-Sinola areas and north of Umtali.	In production; 1986 recoverable mine output of 76 tons of metal.
		Columbite/ Tantalite	In association with tin east of Wankie.	Processed to metal and alloys.
		Tungsten	Northwest of Shamva.	Ore and concentrate produced for export.

4.5 (f) World distribution of chromite reserves, 1983

Region	Reserve base* (million tons)	Share of world total (per cent)
Africa**	6,440	94.7
Asia	163	2.4
Europe	181	2.7
North America	4	0.06
Oceania	4	0.06
South America	9	0.1
World	6,801	

* Reserve base includes demonstrated resources that are currently economic, marginally economic, and some of those that are currently sub-economic.
** Including South Africa.

4.5 (g) Africa's share of world's chromite reserve



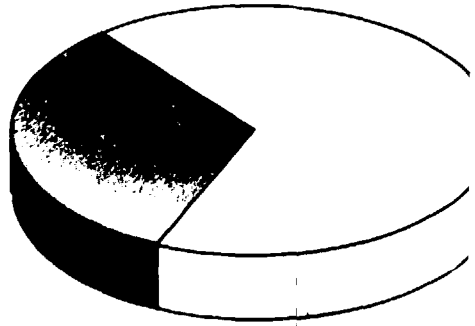
4.5 (h) Countries ranked by size of chromite reserves (million tons)

4.5 (i) World distribution of cobalt reserves, 1983

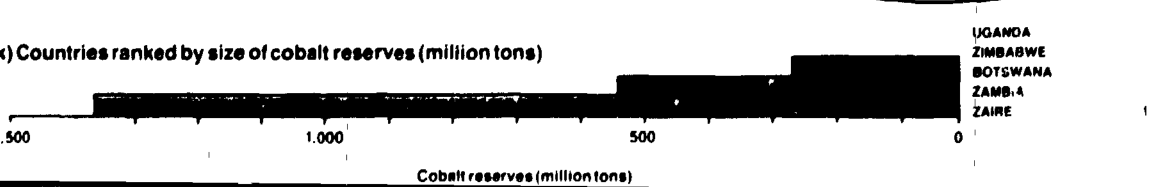
Region	Reserve base* (million kg)	Share of world total (per cent)
Africa**	2,753	33.0
Asia	984	11.8
Europe	431	5.2
North America	2,934	35.1
Oceania	1,088	13.0
South America	163	2.0
World	8,353	

* Reserve base includes demonstrated resources that are currently economic, marginally economic, and some of those that are currently sub-economic.
** Including South Africa.

4.5 (j) Africa's share of world's cobalt reserve



4.5 (k) Countries ranked by size of cobalt reserves (million tons)



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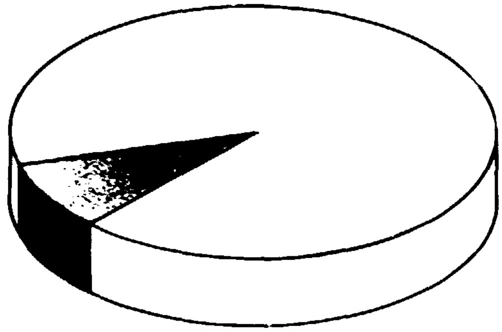
.5 (l) World distribution of nickel reserves, 1983

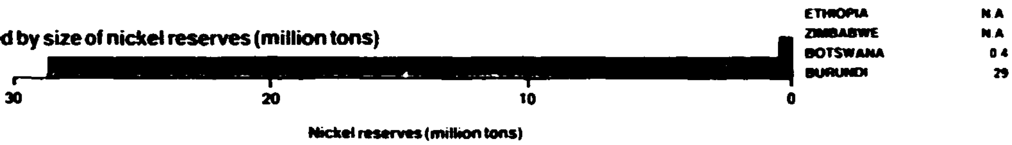
Region	Reserve base* (thousand tons)	Share of world total (per cent)
Africa**	9,614	9.5
Asia	11,338	11.2
Europe	12,652	12.5
North America	15,963	15.8
Oceania	21,496	21.3
South America	29,840	29.6
World	100,903	

* Reserve base includes demonstrated resources that are currently economic, marginally economic, and some of those that are currently sub-economic.
** Including South Africa.

4.5 (m) Africa's share of world's nickel reserves



.5 (n) Countries ranked by size of nickel reserves (million tons)

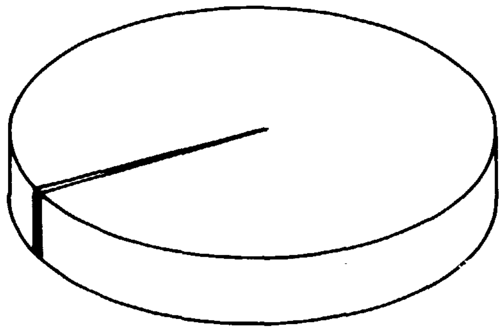


.5 (o) World distribution of tungsten reserves, 1983

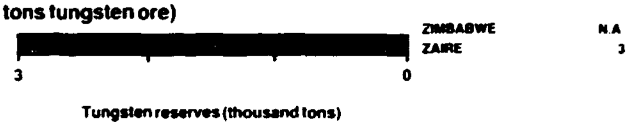
Region	Reserve base* (tons tungsten content)	Share of world total (per cent)
Africa**	20	0.6
Asia	1,535	44.3
Europe	665	19.2
North America	985	28.46
Oceania	150	4.3
South America	110	3.2
World	3,465	

* Reserve base includes demonstrated resources that are currently economic, marginally economic, and some of those that are currently sub-economic.
** Including South Africa.

4.5 (p) Africa's share of world's tungsten reserves



.5 (q) Countries ranked by size of tungsten reserves (thousand tons tungsten ore)



4.5 (s) Africa's share of world's columbium reserves

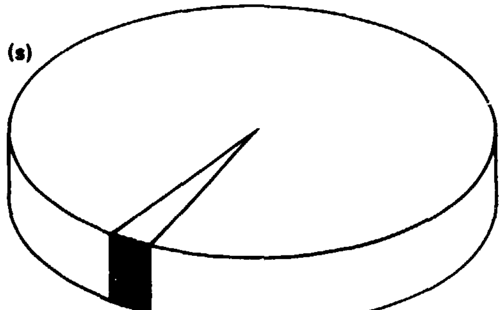
4.5 (u) Africa's share of world's tantalum reserves

.5 (r) World distribution of columbium reserves, 1983

Region	Reserve base* (million kg columbium)	Share of world total (per cent)
Africa**	181	3.6
Asia	9	0.2
Europe	907	18.0
North America	317	6.3
Oceania	-	-
South America	3,628	72.0
World	5,042	

* Reserve base includes demonstrated resources that are currently economic, marginally economic, and some of those that are currently sub-economic.
** Including South Africa.

(s)

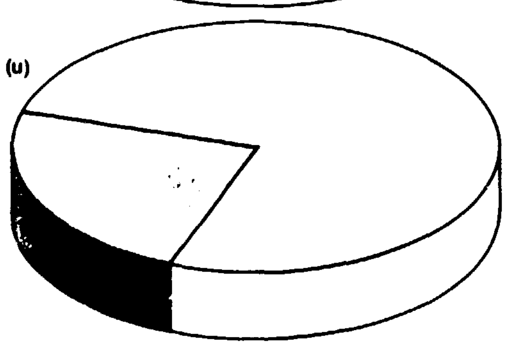


.5 (t) World distribution of tantalum reserves, 1983

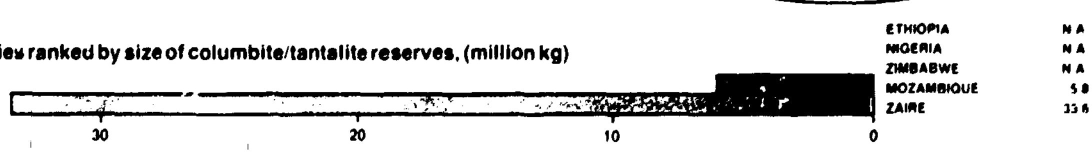
Region	Reserve base* (million kg tantalum)	Share of world total (per cent)
Africa**	10.4	24.2
Asia	10.9	26.3
Europe	7.3	17.6
North America	2.3	5.6
Oceania	9.1	22.0
South America	1.4	3.4
World	41.4	

* Reserve base includes demonstrated resources that are currently economic, marginally economic, and some of those that are currently sub-economic.
** Including South Africa.

(u)



.5 (v) Countries ranked by size of columbite/tantalite reserves, (million kg)



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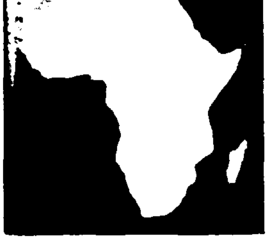

HYDRO-RESOURCES

Africa's technically exploitable hydro-potential is estimated to be over 358.000 MW, equivalent to about 16.2 per cent of the world total. Of this, only about 17.184 MW (4.8 per cent) had been exploited as of 1980. In contrast, Europe and North America had harnessed their respective potentials to the order of 59 per cent and 36 per cent, respectively.

All African countries, except Algeria, Botswana, Cape Verde, Chad, Seychelles and Togo, have exploitable hydro-potentials. The oil price escalations of the 1970s spurred many countries into reassessing their hydro-resources for purposes of exploitation. The recent downward movement in petroleum prices may have slowed down, but not eliminated, the interest in harnessing these renewable energy resources.

The greatest hydro potential in Africa exists on the River Zaire, the second largest waterway in the world. Its hydro-electric potential is estimated at 100.000 MW. Other countries endowed with very extensive hydro-potential are Ethiopia and Mozambique.

4.6 (a) Exploitation of hydro-resources

Region	Country	Hydro-Resources and Status of Exploitation
Northern Africa	Algeria	Very limited hydro-resources.
	Egypt	About 1/4 of electricity demand generally comes from hydro-resources. Installed capacity of Aswan High Dam is 2,000 MW; thermal generating capacity of 1,000 MW.
	Libyan Arab Jamahiriya	Not only is current emphasis on thermal power generation using gas and oil, but hydro-resources are relatively limited.
	Morocco	Less than 20% of power output is hydro-based from 23 plants with a combined capacity of 604 MW. Among newly commissioned plants is the 67-MW Amougguez plant fed from the Ait Chouarit dam; additional capacity would be provided by the 240-MW M'Jara hydro-station and dam when completed.
	Sudan	515 MW of the total installed capacity of 1,035 MW is hydro-based, although supply is regularly disrupted by the seasonality of flow of the Blue Nile.
	Tunisia	Hydro-potential is limited (350 MW) and currently supplies only about 5% of power output.
Western Africa	Benin	The 60-MW Nangbeto dam project on the Mono River (jointly executed with Togo) was completed in 1988.
	Burkina Faso	Three hydro-plants are under construction, the 7.5-MW Bagre dam on Nakanbe River, the 60-MW Noumbiel dam on the Mouhoun River, and the Kompienga dam (15 MW) at Pama (completed in 1988). These will supplement 38.5 MW operating thermal capacity.
	Cape Verde	Very limited hydro-resources.
	Cote d'Ivoire	376-MW hydro-capacity in operation at Kossou and at Taabo and Buyo dams.
	Gambia	Hydro-resources, though limited, are unexploited.
	Ghana	Installed hydro-power capacity is 952 MW, from the Akosombo Dam on the Volta River (792 MW) and the Kpong project (160 MW). Third hydro-dam under study at Bui on the Black Volta.
	Guinea	There is a large but undeveloped hydro-potential, although 70% of installed generating capacity is hydro. Studies are in progress for a 375-MW hydro-project on the Konkouré River.
	Guinea-Bissau	Vast undeveloped hydro-potential, particularly on the Corubal River.
	Liberia	Mount Coffee Dam on St. Paul River feeds a 75-MW station. There are proposals for a station on the Cavalla River.
	Mali	Selingué Dam has a 45-MW hydro-station, supplying over 90% of consumption. The Manantali dam station on the Senegal River valley should be commissioned soon.
	Mauritania	Should benefit from the Manantali dam project when eventually commissioned. Other hydro-electric resources are limited.
	Niger	Supplements its domestic thermal electricity output with imported power from Kainji station in Nigeria while long-term plans are being made for a 125-MW dam and station at Kandadji on the Niger River.
	Nigeria	The installed hydro-capacity consists of the Kainji station (760 MW, with plans for eventual expansion to 960 MW), the Jebba dam and station (540 MW) and the Shiroro dam (600 MW). Output is often hampered by low water levels due to drought.
	Senegal	There are no hydro-stations at present although this situation should be remedied by the Manantali dam when completed.
	Sierra Leone	Virtually all operating capacity is thermal, but work has recommenced on the 67-MW Bumbuna Falls hydro-scheme on the Seli river.
	Togo	Very limited hydro-resources.
Central Africa	Angola	280 MW installed hydro capacity, although there is a large potential on Rivers Kwanza, Cunene, [illegible] and [illegible]. A [illegible]-MW plant is being planned for the early 1990s at Kapanda on the Kwanza River.
	Burundi	16-MW hydro-plant at Rwegura with additional supplies purchased from Zaire's Ruzizi hydro-plant.
	Cameroon	[illegible] MW hydro-potential, of which [illegible]% derives from the Sanaga River. Total installed hydro-capacity of [illegible] MW at Edéa ([illegible] MW) and Song-Loulou. New [illegible]-MW station being planned at the Nachtigal Falls.
	Central African Republic	18-MW hydro-station at the Boali falls; there are plans for a new dam on the M'Bali River.
	Chad	Very limited hydro-resources.
	Congo	Most electricity generation comes from hydro-dams on the Djoué (15 MW) and Bouenza rivers (74 MW). New capacities (over 100 MW) are planned on the Léfini, [illegible] and at [illegible].

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Central Africa Cont.

Country	Hydro-Resources and Status of Exploration
Equatorial Guinea	Hydro-plant near Bata supplies 3.2 MW of net installed capacity of 7 MW.
Gabon	80% of power output is derived from hydro-stations at Kinguélé, Tchimbélé and Poubara; this represents only a small fraction of the large hydro-electric resources on the rivers.
Rwanda	Hydro-potential is about 200 MW, but current exploitation is limited to the Ntaruka station (commissioned in 1983) and the 11-MW Mururu station.
Sao Tome & Principe	The only installed hydro-capacity is the 1.9-MW station at Neves.
Zaire	Total potential hydro-capacity is about 100,000 MW, representing about 13% of the world's total, although installed capacity is only 2,400 MW. Largest plants are the 1,272-MW Inga project on the Lower Zaire and the Ruzizi plant in Kivu.

Eastern and Southern Africa

Country	Hydro-Resources and Status of Exploration
Botswana	Very limited hydro-resources.
Comoros	Construction is in progress on a 4.5-MW hydro-electric dam and station on Tatinga River.
Ethiopia	Hydro-potential of 88,000 gWh per year, of which only 1% has been harnessed. New hydro-plants are proposed at Kaffa (300 MW), Shoa, and Melka Wakana (150 MW).
Kenya	62% of 575 MW installed capacity, all on the River Tana, is hydro. Total hydro-potential is 910 MW. There are plans for a 106-MW station at Turkwell Gorge, and a 40-MW station on the River Sondu.
Lesotho	Substantial but untapped hydro-resources; construction has commenced on the Highland Water Scheme, with a 280-MW hydro-electric energy component due for completion in 2003. A 58-MW hydro-scheme in the Oxbow is also under study, and mini-hydro projects are being implemented at Mantsonyane, Semonkong, Tlokoeng and Qacha's Nek.
Madagascar	45 MW (of the total installed capacity of 100 MW) is hydro-based from seven stations. Andekaleka scheme phase I (58 MW) was commissioned 1982, but phase II (58 MW) is delayed.
Malawi	114 MW (of the 160 MW total installed capacity) is hydro-electric, consisting of the 40-MW Shire river scheme in Tedzani and the Nkula Falls scheme. Total hydro-potential is 1,000 MW, and future projects are under study at Kapachira Falls and at Kholombidzo Falls.
Mauritius	The Champagne station commissioned in 1985, is the only hydro-electric plant supplying about 25% of power demand; current emphasis is on thermal generation fuelled by bagasse from sugar cane.
Mozambique	The Cahora Bassa dam and 2,075-MW station on the River Zambezi is the largest hydro-scheme. Its transmission lines are being rehabilitated and should resume operation in 1988. Other hydro-projects are the Chicamba (40 MW) and Mavuzi (46 MW) on the River Revue. Consideration is being given to the second phase of the Cahora Bassa project, including a 1,640-MW plant.
Seychelles	Very limited hydro-resources.
Somalia	All electricity production is currently thermal, but there is on-going construction on the Bardera dam in the Juba River valley to supply 5 MW of electricity.
Swaziland	Of 50 MW installed generating capacity, 20 MW is derived from the Luphohlo-Ezulwini hydro-electric project.
Uganda	Hydro-potential is estimated to be about 2,000 MW. Owen Falls station is rated at 150 MW and is being expanded to 210 MW, although completion has been delayed.
U. R. of Tanzania	Total installed hydro-capacity is about 250 MW from four plants, one of which is the 200-MW Kidatu station. Several micro-hydro-plants are being proposed.
Zambia	A net exporter of electricity, with 70% of domestic needs met by hydro from the Kafue Gorge scheme (900 MW) and the Kariba North Bank scheme (600 MW) on the Zambezi River.
Zimbabwe	Has substantial hydro-electric potential and is a joint venture partner with Zambia in the Kariba plant. Total installed hydro-capacity is about 633 MW.

SECTION FOUR

.6 (b) World hydro-potential and use, 1980

Region	Technically Exploitable Potential (MW)	Exploited Potential (MW)	Share of Potential Exploited (per cent)
Africa	358,000	17,184	4.8
Asia	610,100	53,079	8.7
Europe	163,000	96,007	58.9
North America	356,400	128,872	36.2
Oceania	45,000	6,795	15.1
South America	431,900	34,049	7.9
USSR	250,000	30,250	12.1
World	2,214,700	366,236	16.5
Africa's Share	16.2%		

DATA SOURCES

USED FOR THE COMPILATION OF THE ATLAS

1) *A Survey of the Iron and Steel Sector in PTA and SADCC Countries*. Vol I. Regional and Country Studies Branch. Studies and Research Division. UNIDO. (1986)

2) *Chromium and the Steel Industry*. Committee on Raw Materials. IISI (1981)

3) *Coal Information. 1988*. International Energy Agency. OECD. (1988)

4) *Development of the African Mineral Sector During the Period 1985–1987 and Projected Possible Prospects for the Period 1988 and Beyond*. Economic Commission for Africa. ECA NRD TRCDUMRA 5. March 1988

5) *Economic Report on Africa. 1989*. Economic Commission for Africa. April 1989

6) *EIU 1986/87 Yearbook Energy Africa*. (1986)

7) *EIU Country Profiles*. 1987 88 and 1988 89

8) *Energy*. SADCC. Luanda. 1–3 February 1989

9) *Energy Review in Africa (Energy Resources. Policies and Outlook for the Future)*. Economic Commission for Africa. ECA NRD ERU 6 87. December 1987

10) *Future Western World Supplies of Iron Ore (State: 1988)*. Committee on Raw Materials. IISI. (1988)

11) *Indirect Trade in Steel. 1985 and 1986*. Committee on Economic Studies. IISI. February 1989

12) *Industrial Co-operation Through the Southern African Development Co-ordination Conference (SADCC)*. UNIDO IS 570. Regional and Country Studies Branch. UNIDO. October 1985

13) *Industry and Development. Global Report 1988/89*. UNIDO. (1988)

14) *Iron and Steel Works of the World*. Metal Bulletin Books. 9th Edition. (1988)

15) *Manganese and the Iron and Steel Industry*. Committee on Raw Materials. IISI. (1980)

16) *Mineral Industries of Africa*. Bureau of Mines. United States Department of the Interior. (1984)

17) *Mineral Exploration Requirements of the Mining Sector of SADCC*. Ministry of Mines. Zambia. and United Nations Revolving Fund for Natural Resources Exploration. January 1988

18) *Mineral Facts and Problems* (1985 Edition). Bureau of Mines. United States Department of the Interior. (1985)

19) *Mineral Commodity Summaries 1989*. Bureau of Mines. United States Department of the Interior. (1989)

20) *Minerals Yearbook. 1986*. United States Bureau of Mines. (1986)

21) *Mining Annual Review 1987*. Mining Journal. (1987)

22) *OPEC Annual Statistical Bulletin*. (1987)

23) *Overview of Mining and Mineral Resource-Based Industries in the Southern African Development Co-ordination Conference (SADCC) Subregion*. UNIDO IS 560. Regional and Country Studies Branch. UNIDO September 1985

24) *Processing of African Raw Materials Into Useable and Tradeable Products*. Economic Commission for Africa. ECA IND GEN 1 89. March 1989

25) *Public Investment Programme. 1988–1990*. Ministry of Finance and Economic Planning. Rep of Ghana. April 1988

26) *Rationalization of Iron and Steel Capacity in Africa Through Industrial Co-operation*. Economic Commission for Africa. ECA IND MET 002 87. December 1987

27) *Raw Materials Report*

- Paul Jourdan. "The Non-Ferrous Metal Industry in Zimbabwe". Vol 4 No 2
- Paul Jourdan. "The Minerals Industry of Mozambique". Vol 4 No 4
- Paul Jourdan. "The Mining Industry of Zambia". Vol 4 No 4
- Jerker Carlsson. "the Mining Industry of Malawi". Vol 5 No 2
- W Sweta. S Wapakwenda. A Chitambo. M Le Brun. and P Jourdan. "The Minerals Sector of the States of the SADCC – Possibilities for a Regional Minerals Policy". Vol 6 No 1

28) *Report to the Council of Ministers of the Niamey MULPOC on Market for Iron and Steel Products in West Africa*. Economic Commission for Africa. ECA JID IOS 1986 54. December 1986

29) *Review of Present Status/Trends and Supply/Demand Market Study of Iron and Steel Products in the West African Subregion*. Economic Commission for Africa. ECA JID IOS 1986 45. June 1986

30) *Report on the Rehabilitation of the Maluku Steel Mill (SOSIDER). Zaire and Recommendations for further Development of the Iron and Steel Industry as Catalyst fo the Industrialization of Zaire*. Industrial Statistics and Sectoral Surveys Branch. Policy and Perspectives Division. UNIDO. (1989)

31) *Statistics of World Trade in Steel 1986*. United Nations. (1987)

32) *Statistics on Iron Ore – 1977–1986*. Trade and Development Board. UNCTAD. (1987)

33) *Steel Statistics of Developing Countries 1988 Edition*. Committee on Statistics. IISI. (1988)

34) *Steel Statistical Yearbook 1988*. Committee on Statistics. IISI. (1988)

35) *Survey of Energy Resources*. World Energy Conference.

36) *Technological Options for Small Integrated Iron and Stee Plants Based on Direct Reduction in ECA Member-Countries*. Economic Commission for Africa. ECA IND MET 008 87. April 1988

37) *The Iron and Steel Industry of West. North and Central Africa*. UNIDO Sectoral Studies No. 41. (1988)

38) *L'Usine Siderurgique De Maluku et Le Developpement Integre de L'Industrie Siderurgique en Afrique Centrale*. Commission Economique pour l'Afrique ECA IND MET 008 88. June 1988

39) *The Steel Market in 1987*. UN Economic Commission for Europe. (1988)

40) *UNCTAD Commodity Yearbook 1988*. United Nations. (1989)

41) *UNIDO Data Base*

42) *Vanadium. Niobium. Molybdenum and the Steel Industry*. Committee on Raw Materials. IISI. (1984)

43) *World Mineral Production 1983–1987 Preliminary Statistics*. British Geological Survey. (1988)

44) *World Development Report. 1988*. The World Bank. (1989)

CROSS REFERENCES

Section of Atlas	Data source
1 1 (a)-(d)	13. 44.
1 2 (a)-(d)	5. 7. 13. 44.
1 3 (a)-(d)	41.
1 4 (a)-(b)	5. 7. 44.
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3 1 (a)-(e)	1. 4. 14. 20. 21. 23. 25. 26. 28. 29. 30. 36. 37.
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