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DEVELOPMENT STRATEGIES FOR FISHERY SYSTEMS IN AFRICA

TYPOLOGY OF THE FIS IN AFRICA

CONTENTS

TABLES

INTRODUCTION

1. VALUE OF A FISHERY SECTOR STUDY

The importance of the fisheries sector's contribution to national economic, social and nutritional goals is now widely recognised and principles for a strategy and plan of action for fisheries management and development have been laid down. Objectives should be based on an assessment of the fishery resources available, and on markets to be served, but also other factors, including foreign operations, must be considered. Most important, the fisheries sector should be viewed as a system in which different industrial, production, consumption and policy components interact.
Correspondingly, developpment strategies should be comprehensive in nature and should address multiple objectives.

2. PROCEDURAL STEPS

The findings in the present study are achieved in three steps.
First, the fisheries sector of each country is described in terms of a fiheries industrial system (FIS). This permits the disaggregation of the sector into its component subsystems and linkages to the rest of the economy taking into consideration economic, technological, sociological and policy factors affecting fisheries production and consumption.
Next, based on the first step, countries are grouped according to similarities of their fisheries sector development.
Finally, comprehensive pattern-specific development strategies covering the areas of investment, technical assistance and regional and international co-operation are proposed together with corresponding suggestions for actions.
The methodological approach developed and used for the study is fully explained in a separate part of the report.

3. MAJOR OUTPUTS

- An assessment of the fisheries systems of 48 African countries within a comprehensive development planning approach and the identification of 3 patterns of development derived from 14 clusters with different characteristics, prevaling in the fisheries systems of the 48 developing countries. These country grouping are not the result of political, geographic or other non fishery specific industrial classifications. They depend solely on those considerations be they economic or otherwise which specifically relate to the development of the fisheries sector.
- List of major and group specific constraints and enhancements.
- Comprehensive development strategies for the 3 identified fisheries patterns of development as well as for the 14 different clusters.
- Pattern-specific actions to be promoted in order to implement the strategies and eliminate major problems hindering their successful application.
- A description of the actions in term of concrete investments, technical assistance, policies, support actions and mechanisms to be applied to the different components of the groups of countries as well as options for co-operation between the countries in this regard.

4. BENEFIT TO USERS

First, government fisheries planning offices and ministeries of fisheries of the 48 countries can directly use the outputs of the study for programming the sector and setting priorities for actions in an integrated manner.
Second, for developing countries the study provides the possibility of sharing and benefitting from other countries' development experiences.
Third , this work will also be of use to international technical assistance and for aid-giving financial organizations promoting the development of the fisheries sector , in designing programmes for country groups rather than for individual countries.

5. STRUCTURE OF THE REPORT

The report is divided into 2 main parts.

FIRST PART gives the main results of the typology work and a detailed analysis of the different patterns of development characterising the groups and clusters of African countries.

SECTION 1 gives an overview of the African fishery sector and intrcduces the concept of industrial fishery system and the different components and countries used for the typology.

SECTION 2 describes in detail THE 14 CLUSTERS and THE 3 GROUPS of countries after summarysing first the methodology used to split the 48 African countries into different groups.

SECTION 3 lists all the constraints and enhancements to be taken in account in elaborating strategies and suggesting actions.

SECTION 4 gives a start to strategies to follow in order to improve the productivity of the fishery sector. Actions are also suggested to give concrete advices on how to make the best investments and the best use of technical assistance.

PART 2 is a complete description of the methodology used for the typology work.

SECTION 1 describes in details the components and variables wich were used here and the one used in the typology of 1987.

SECTION 2 explains the way data was transformed into a specific scale.
It also shows different clustering methods used and component analyses run on the computer to end up with a final dendogram which gives the clusters of countries on which are based the analyses of patterns of development described in part 1.

The APPENDIX gives the outputs of different clustering methods run to do the typology.

PART I: THE FISH INDUSTRY SECTOR ANALYSIS

SECTION 1: FISHERY OVERVIEW AND DEFINITION

1.1 AFRICA AND WORLD FISHERIES

World fish production is now around one hundred million tons per year, and of that total, some 65-70 per cent is used for human consumption. Excluding South Africa, the total fish production of the African continent is around 4.3 million metric tons of which only a small amount is used for non-human consumption. So Africa with 11.0 per cent of the world's population, produces only 4.5 per cent of the world's fish or 6.0 per cent of the world's food fish. Africa's per capita consumption of fish protein at 7.5 kgs is ten per cent less than the average for developing countries and 46 per cent less than the global average.

1.1.1 MARINE FISHERIES

Africa's marine fisheries are mainly located on the west side of the continent. Three huge concentrations of fish stocks are found there; off Namibia and Angola to the south where the cold waters of the Benguela current create an upwelling in the sea; in the Gulf of Guinea where migrating schools of tuna pass and local stocks of small pelagics and shrimps exist; and off Mauritania and Morocco where there are other large pelagic and demersal fisheries. On Africa's east coast the main fish concentrations are found off Mozambique and Somalia though tuna range all over that part of the Indian Ocean.

A major factor in the use of marine fish resources around Africa is the presence of foreign fleets which harvest an estimated 1.5 million tons annually from African waters. Most of these vessels pay license fees or royalties for the right to fish there but it is generally agreed that the return to the state is very small for giving up such a valuable resource. The amount of fish taken by foreign fleets may be worth over a billion dollars annually. Fishing rights have often been bargained for by powerful trading or political groups such as the EEC, USSR or Japan, in return for more nebulous benefits in access to markets, aid or other assistance.

1.1.2 FISH TRADE

African exports of fish products at over US$1,600 million are about 9.0 per cent of FIS exports from the developing world. (Africa's population is 15.0 per cent of the developing world). But Africa imports over US$800 million of fish food a year, so its fish export earnings are only 48 per cent more than fish import costs. The rest of the developing world earns 68 per cent more from fish exports than it pays for fish imports.

The bulk of fish exports from Africa in value, is made up of canned sardines, mackerel and pilchard, canned or frozen tuna and frozen shrimps. There is also a growing trade in frozen reef fish and quality demersal species. Within Africa there is a large informal cross-border trade in dried fish and smoked fish. Fish imports to Africa are nearly all mackerel and sardine in frozen or canned form though some dried codfish or stockfish is still imported from Norway and Portugal.

Note: Fish imports are mostly frozen fish for domestic consumption, usually frozen mackerels, sardines, hakes or other groundfish plus informal imports of dried fish are not always recorded. Imports of special canned fish products are of minor significance. The bulk of Algeria's fish imports are fish meal for animal feed.

1.1.3 INLAND PRODUCTION AND AQUACULTURE

Nearly half of Africa's fish production comes from inland waters - lakes, rivers, swamps and flood plains. This part of the production - close on two million tons, supplies vital protein food to the rural population. However, although Africa's fresh waters are rich in fish and are remarkably productive, aquaculture or the farming of fish has not progressed to any significant extent in Africa. This is in sharp contrast to Asia where fish culture is a substantial industry. China alone produces more fish by farming than all of Africa produces by capture. Export earnings from shrimps culture alone in the Philippines and Indonesia are over a hundred million dollars annually in each country.

Fish culture work in Africa has been continuing since the 1960s but the main impact has been in the stocking of dams and reservoirs with tilapia. Tilapia are a good food fish with wide tolerance of water conditions. As they are algae grazers they do not need to be fed artificially as do carps or shrimps. But commercial fish farming has not yet really begun in Africa on any significant scale. The main reason is probably that the same problems which plague African agriculture also face aquaculture in the continent. Intermittent or infrequent rains affect the water availability. Large-scale fish farming entails water and soil conservation, pond cleaning and fertilization, predator control, artificial inducements to breeding and spawning, disease control and careful feeding. All this involves a long-term approach, a degree of knowledge and skill, and investments of time and money. Most African fish farmers cannot afford the substantial inputs.

Nevertheless, the potential for aquaculture in Africa is good and should be addressed in any development programme.

Note: The table below excludes Botswana, Lesotho and Swaziland which have no fishery resources and also South Africa which caught 878,580 tons, a per capita production of 25.5 kgs. But the totals are all-inclusive.

Table 1: MAJOR FISH EXPORTERS IN AFRICA

Value of Fish Exports in US$		Fish Exports per capita in US$ per cap	
Morocco	415 000,000	Namibia	246.0
Namibia	320,000,000	Seychelles	187.0
Senegal	245,000,000	Mauritania	97.0
Mauritania	194,000,000	Senegal	33.0
Cote d'Ivoire	126,000,000	Morocco	17.0
Tunisia	103,000,000	Mauritius	15.0
Mozambique	65,000,000	Tunisia	10.8
Madagascar	32,000,000	Cote d'Ivoire	10.5
Ghana	29,000,000	Gabon	10.5
Mauritius	16,200,000	Cape Verde	4.3
Nigeria	13,100,000	Mozambique	4.1
Seychelles	12,700,000	Madagascar	2.8
Gabon	12,500,000	Ghana	2.1
Kenya	10,100,000	Sierra Leone	2.1
Sierra Leone	8,200,000	Guinea Bissau	1.5

Note: Fish exports are mostly frozen tuna, canned tuna, frozen shrimps, canned sardines and mackerels and informal cross border trade in smoked fish.

Source: FAO Yearbook of Fishery Statistics 1989

Table 2: MAJOR FISH IMPORTERS IN AFRICA

By weight in tons		By capita in kgs per cap.	
Nigeria	256,000	Seychelles*	94.5
Cote d'Ivoire*	206,000	Congo	18.1
Egypt	103,000	Cote d'Ivoire*	17.1
Zaire	89,000	Gambia	8.3
Angola	74,000	Togo	7.8
Cameroon	69,000	Angola	7.6
Algeria	61,000	Gabon	6.2
Congo	34,000	Eq. Guinea	6.2
Togo	26,000	Cameroon	6.0
Ghana	20,000	Liberia	5.4
Senegal	20,000	Mauritius*	5.4
Mozambique	14,000	Senegal	2.7
Liberia	13,000	Zaire	2.6
Guinea	8,500	Algeria	2.5
Gabon	7,400	Nigeria	2.3
Gambia	6,800	Egypt	2.1
Seychelles*	6,400	Sao Tome	1.6
Mauritius*	5,800	Ghana	1.4
Benin	5,200	Guinea	1.2
Libya	4,200	Benin	1.17

* Those marked with an asterisk import in order to process and export. Gambia also does this to a lesser extent.

Source: FAO Yearbook of Fishery Statistics 1989

Table 3: FISH PRODUCTION: AFRICA 1989

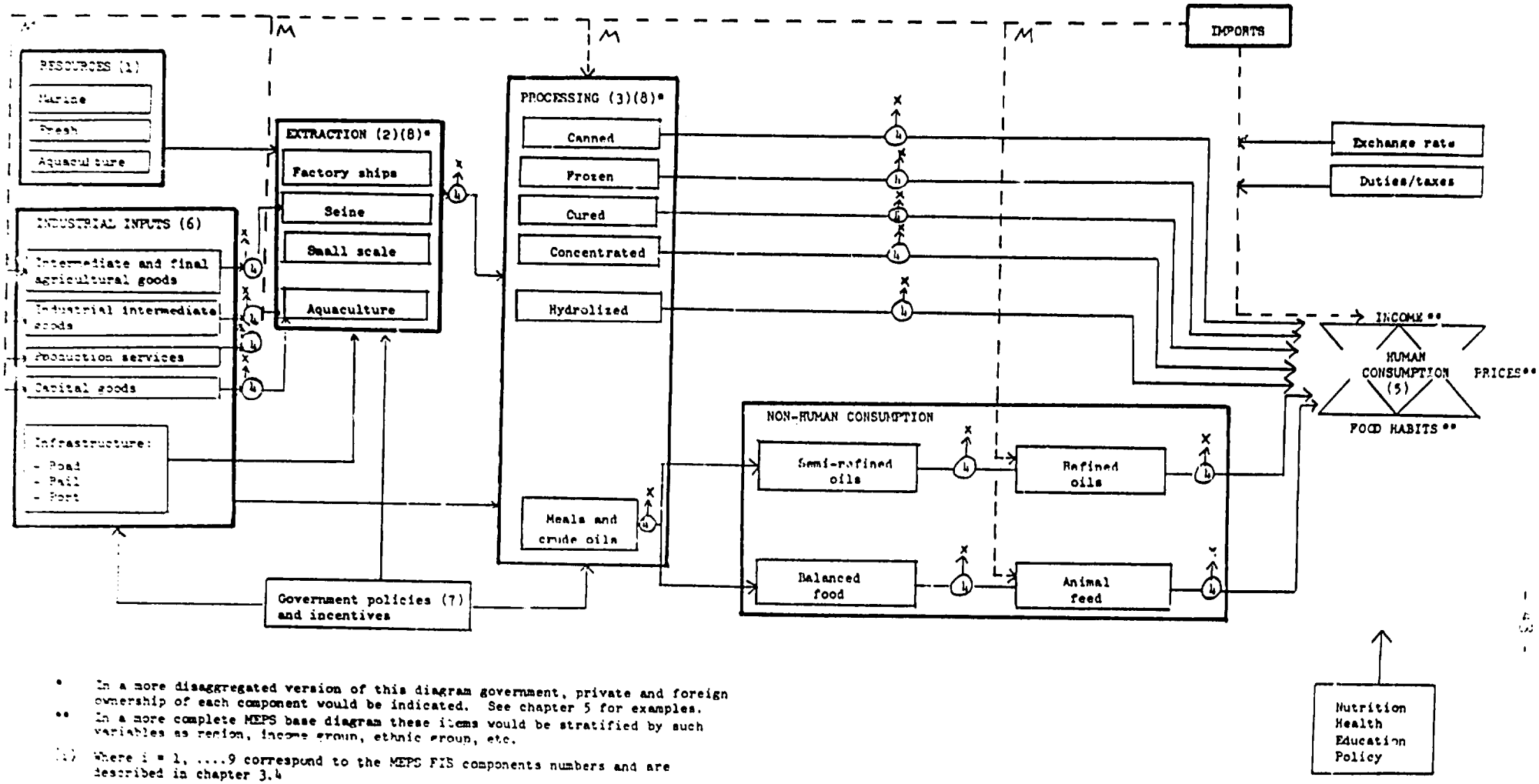
Total Production in tons		Production in kgs per capita	
Morocco	520,354	Namibia	230
Tanzania	386,868	Seychelles	64
Ghana	381,734	Mauritania	48
Namibia	300,000	Senegal	38
Senegal	268,781	Ghana	27
Nigeria	259,507	Sao Tome & P.	25
Egypt	254,000	Morocco	21.7
Uganda	240,000	Gambia	21.6
Zaire	166,000	Gabon	20.8
Kenya	144,000	Chad	20.3
Angola	111,132	Congo	20.2
Chad	110,000	Cape Verde	17.3
Cote d'Ivoire	100,614	Mauritius	15.9
Algeria	99,736	Tanzania	15.6
Madagascar	99,605	Uganda	14.8
Tunisia	95,091	Sierra Leone	13.4
Mauritania	92,612	Comoros	13.2
Malawi	87,900	Tunisia	12.2
Cameroon	77,644	Angola	11.5
Mali	71,836	Malawi	11.0
Zambia	68,000	Eq. Guinea	10.7
Sierra Leone	53,000	Benin	9.6
Benin	42,236	Madagascar	9.2
Congo	38,349	Cote d'Ivoire	9.0
Guinea	34,000	Mali	9.0
Mozambique	33,625	Zambia	8.9
Sudan	24,000	Cameroon	6.9
Gabon	22,900	Liberia	6.8
Zimbabwe	20,000	Kenya	6.4
Somalia	18,200	Guinea	6.3
Gambia	17,619	Egypt	5.1
Mauritius	17,194	Zaire	5.0
Liberia	17,000	Togo	4.8
Togo	16,458	CAF	4.4
CAF	13,000	Algeria	4.2
Burundi	11,700	G. Bissau	3.6
Burkina Faso	8,006	Somalia	3.1
Libya	7,784	Nigeria	2.4
Cape Verde	6,486	Burundi	2.3
Comoros	5,500	Mozambique	2.3
Niger	4,751	Zimbabwe	2.2
Seychelles	4,403	Libya	1.8
Ethiopia	4,263	Djibouti	1.2
Eq. Guinea	4,000	Sudan	1.0
G. Bissau	3,540	Burkina Faso	0.9
Sao Tome	3,000	Niger	0.6
Rwanda	1,472	Rwanda	0.2
Djibouti	470	Ethiopia	0.1

Total: 4,103,754

All Africa (4,982,334 including South Africa)

Source: FAO Yearbook of Fishery Statistics 1989

Figure 1. Base diagram for a FIS indicating the nine components and their linkages with the rest of the economy



* In a more disaggregated version of this diagram government, private and foreign ownership of each component would be indicated. See chapter 5 for examples.

** In a more complete MEPS base diagram these items would be stratified by such variables as region, income group, ethnic group, etc.

(i) Where i = 1, ...9 correspond to the MEPS FIS components numbers and are described in chapter 3.4

M = imports X = exports

1.2 DEFINING FISHERIES INDUSTRIAL SYSTEMS

1.2.1 INTRODUCING A SYSTEMS APPROACH IN DEVELOPMENT

In seeking to promote balanced development of any sector, one must recognise that there are linkages and relationships which will convey the effect of industrial growth or changes upstream and downstream from the main activity. In fisheries for example this would involve both capital and the food processing sector. Among capital goods production there would be boats, engines, fishing gear, ice plants, cold stores, processing plants and refrigerated trucks. The food processing sector would include or involve not only processing plants, but can manufacture, refrigerants, unsaturated oils for canning various packaging items. Then there is the general infrastructure supporting the industry,- harbours, roads, power stations, fuel refineries and so on.

The application of a systems approach is therefore required to promote balanced development of the fisheries sector and its industrial subsectors, and to develop appropriate and far-reaching policies and actions.

1.2.2 DEFINITION OF FIS

A fisheries industrial system can be described as a system that reflects the integrated and interdependent nature of all the industrial resource and consumption elements and the related extraction and processing activities, together with the institutions and policies involved, in any particular fish industry.
Figure 1.2 attemps to display these generically in a simplified form.

The relationship between the complete set of components of any FIS is not a simple one consisting of the exchange of goods and services, but rather a structural one with a high degree of interdependence. This interdependency is interactive in character, so that any change occuring in one of the components tends to modify the whole in a variety of ways and to a varying extent.

The implication of this approach is that a FIS should be developed as a whole rather than by components. The notion of development is replaced by the notion of integrated development. The viability of applying the FIS approach depends however on the feasibility of properly identifying a system's components and their interrelatioships.

1.2.3 RELEVANT COMPONENTS AND COUNTRIES FOR THE TYPOLOGY

Details of the computer programme of the Africa FIS study are given in part 2 of this report. Readers interested in how components are constructed and tested can refer to that section. The nine components used in the study, which the methodology confirmed to be relevant to the patterns of FIS in Africa, were:

1. FISHERY RESOURCES (MSY)
2. RESOURCE UTILISATION
3. EXTRACTION
4. PROCESSING
5. DISTRIBUTION AND MARKETING
6. CONSUMPTION
7. INDUSTRIAL INPUTS
8. FISH IMPORTS
9. FOREIGN INVOLVEMENT

Other components were tested and discarded when computer print-outs made clear that they duplicated information or relationships the computer could detect from other variables.
For example, a fish export component was tested and then discarded, but despite its omission the programme continued to cluster countries together which had similar fish export patterns.

48 African countries were selected for inclusion in the study . All developing countries producing over 3000 tons of fish a year were included. In addition, although their production is currently less , Rwanda and Djibouti were included as they have access to fishery resources well in excess of 3000 tons.
The full list of countries is as follows:

1.ALGERIA	17.GABON	33.NIGER
2.ANGOLA	18.GAMBIA	34.NIGERIA
3.BENIN	19.GHANA	35.RWANDA
4.BURKINA FASO	20.GUINEA	36.SAO TOME PRIN.
5.BURUNDI	21.GUINEA BISSAU	37.SENEGAL
6.CAMEROON	22.KENYA	38.SEYCHELLES
7.CAPE VERDE	23.LIBERIA	39.SIERRA LEONE
8.CENTRAL AFRICAN REPUBLIC	24.LIBYA	40.SOMALIA
9.CHAD	25.MADAGASCAR	41.SUDAN
10.COMOROS	26.MALAWI	42.TANZANIA
11.CONGO	27.MALI	43.TOGO
12.COTE D'IVOIRE	28.MAURITANIA	44.TUNISIA
13.DJIBOUTI	29.MAURITIUS	45.UGANDA
14.EGYPT	30.MOROCCO	46.ZAIRE
15.EQUATORIAL GUINEA	31.MOZAMBIQUE	47.ZAMBIA
16.ETHIOPIA	32.NAMIBIA	48.ZIMBABWE

SECTION 2: PATTERNS OF DEVELOPMENT

2.1 RESUME OF THE METHODOLOGY

Data on all 48 countries was assembled for 15 variables which were used to construct values for the nine components. This was inputed into the computer programme as described in part 2 of the report, and the programme was run accordingly.

The computer analysis is received in several forms, both statistical and graphic. The two main graphic forms are the dendogram and the cluster profiles, examples of which are seen in figures 2.3.2 and in part 2 of the report.

Interpretation of the computer clustering is accomplished in two ways. (i) The clustered countries are studied by a fish industry expert to determine which commonalities link them. This requires some thought and perception as the patterns may not be self-evident. (ii) At the same time the cluster profiles and principal component analysis (table 2.1 in part 2) are examined as they provide graphical and mathematical indications of the areas of similarity.

The number of clusters or groups obtainable from such a study varies from 1 to 48 or however many countries are in the study. However, the search

is for meaningful groups or clusters, and following detailed study of the results, it was agreed that two aggregations were most informative, one of 14 clusters which fall into three groups. The 3 groups reflect the 3 main discernable patterns of FIS development.

The 14 clusters identified by the analysis provide clearly discernible patterns of fish industry development . In some cases the similarities are very strong and in others they are weakened by particular differences. Use of different clustering programmes revealed that some countries have similarities with more than one group. This is also detectible from the standardised variables -
in tables 2.2.1.(part2)

From further analysis of the cluster graphs (figure 2.2.2) the three main patterns of Africa's fish industries emerges. These 3 groups and the 14 clusters are laid out in the section below.

2.2 THE 3 MAIN PATTERN OF FISH INDUSTRY DEVELOPMENT IN AFRICA

Analysis of the 14 clusters and of the cluster graphs reveals three main patterns for the fish industry sector in Africa. For the purposes of differentiation these are termed groups "A", "B" and "C".

Group A is composed of clusters 1 to 5, and has a total of 14 countries.
Group B encompasses clusters 6 to 10, which have 21 countries in all.

Group C involves clusters 11a, 11b and 12. It has 13 countries.

Each major group has very different characteristics which affect the present state and future prospects of the Fish Industries Sector. Their constraints and enhancements differ accordingly and this would call for particular strategy options in each case.

Group A countries have flourishing and growing FIS sectors with the potential to develop further, particularly with regard to the export market. They mostly have already substantial investment in the fishery industries in fish plants, fishing fleets and supporting services.

Group B countries have domestically oriented fish industries and mostly have difficulty meeting the internal demand from local supplies. As a result, many of the countries have to import fish to supplement the national production. Their industries are largely artisanal and only a handful of the countries have an industrial scale deep sea fishing fleet.

In Group C countries the fishery industries are low priority and have not been invested in to any significant degree. This is due mainly to low demand for fish food by the local population, and to the absence of large resources in all except one of the countries.

The contrasts between groups A, B and C are mostly clearly visible in the cluster group graph figure XX which brings into relief the industrialisation of group A (variables V2, V3, V4 seen at graph points 5, 6 and 7); the high consumption and limited resource of group B (variables V1a and V5, graph points 9 and 4); and the almost totally negative situation of group C. Also of note is the high foreign involvement in group A's fishery industries (V13 shown by graph point 1).

Cluster profiles for each of the 14 clusters can be found in part 2 section 2.3 and this help to describe the individual clusters. In addition details of standardised values of components for each country are given in tables 2.2.1 in part 2.

2.2.1 Group Descriptions

A" Group Countries FIS generally flourishing. good marine resources being harvested for both domestic and export market. Basic infrastructure in place; significant foreign involvement; processing and support industries expanding.	Morocco,Tunisia, Namibia, Mauritania, Senegal, Algeria, Ghana, Cote D'Ivoire, Angola, Mozambique, Sierra Leone, Seychelles, Mauritius, Gambia.
B" Group Countries High demand but supply-side problems. FIS resource not adequate for large domestic market. Fisheries chiefly freshwater and artisanal. Marginal increases possible but imports will still be required in most cases. Aquaculture potential good.	Zaire, Congo, Cameroon, Egypt, Nigeria, Gabon, Cape Verde, Guinea, Liberia, Kenya, Madagascar,Tanzania, Uganda, Malawi, Chad, Zambia, Mali, Benin, Togo, Zimbabwe, Libya.
C" Group Countries Fish consumption per capita is mostly very low. To date, there has been little investment in the FIS. Some significant resources exist which could be developed for export both to African and European or Middle East markets.	Comoros, Equatorial Guinea, Sao Tome & Principe, Guinea Bissau, Central African Republic, Niger, Burundi, Somalia, Djibouti, Ethiopia, Rwanda, Sudan. Burkina faso.

2.3 CLUSTER PATTERNS AND DESCRIPTIONS

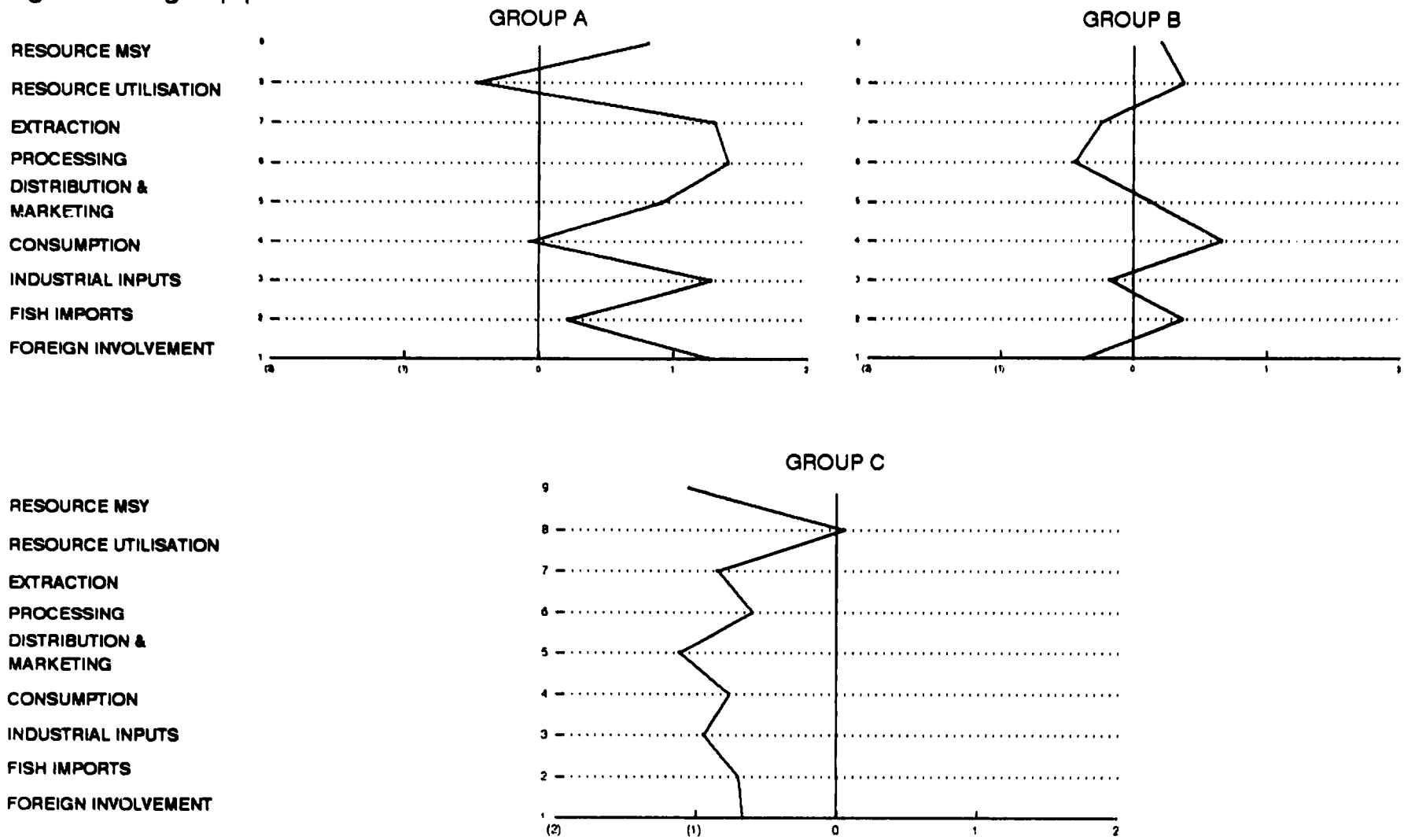
The fourteen clusters are described below in some more detail, as they appear within their respective groups.

2.3.1 GROUP "A"

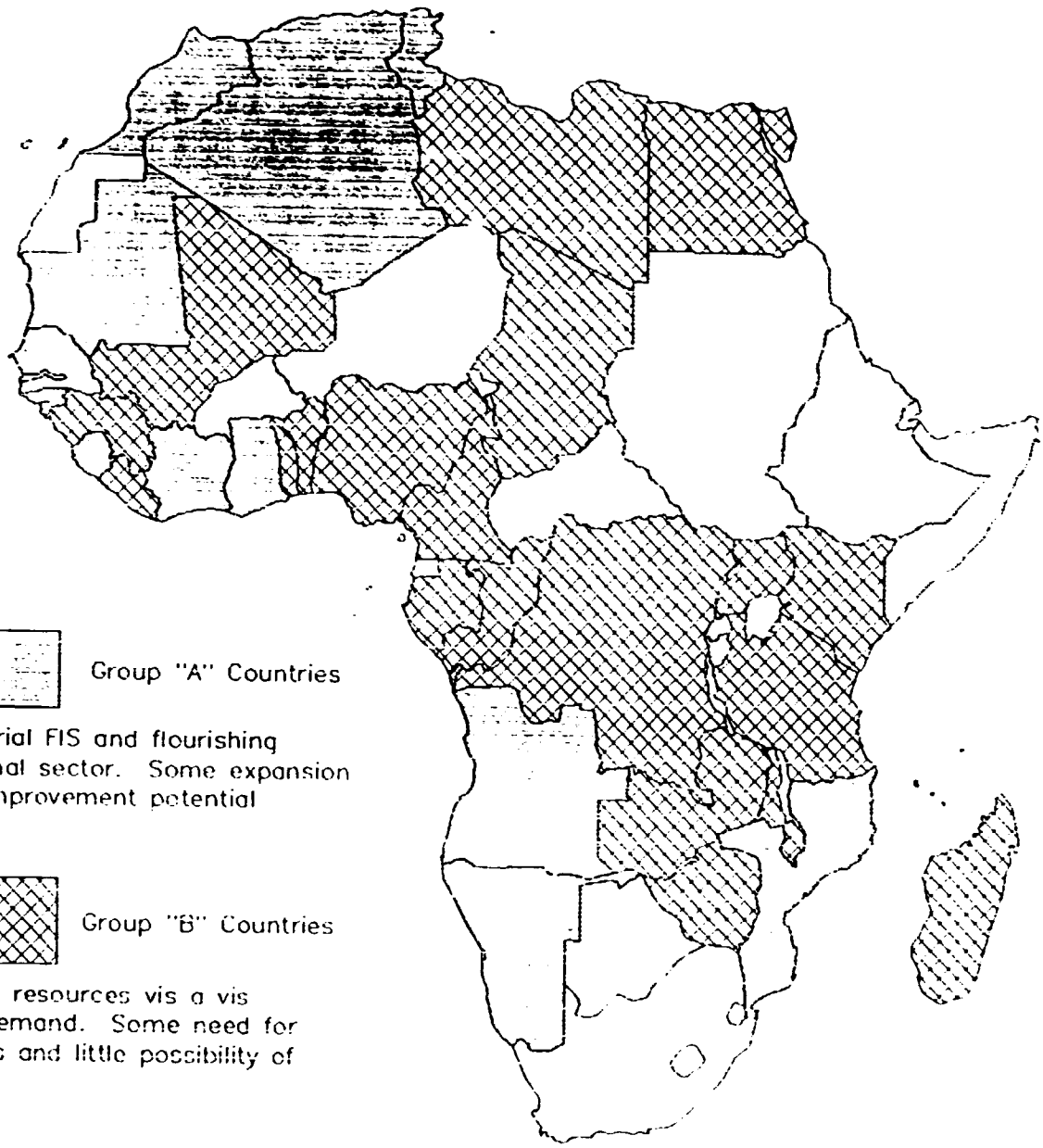
1. Morocco and Tunisia

As the cluster graph displays (fig. 2.1,PART 2), this group along with cluster 3 has the most positive overall set of values. This is to be expected as their fishery industries are well developed and functioning efficiently. Morocco is the major fish exporter in Africa and together the two countries earn more than US$500 million annually from fish exports. Morocco has the larger resources, but both countries are exploiting their fisheries consumption quite fully.

figure 2.2.2 group profiles



AFRICA F.I.S.



Group "A" Countries

Industrial FIS and flourishing artisanal sector. Some expansion and improvement potential

Group "B" Countries

Limited resources vis a vis local demand. Some need for imports and little possibility of export

Group "C" Countries

Low fish consumption. Very little investment to date in FIS. Possibilities of production increases from those states which have marine areas and larger lakes. Some potential for exports

Note: re the small islands which cannot be clearly shaded in this map: Seychelles and Mauritius are in group "A" Comoros, Equatorial Guinea, Sao Tome and Principe are in group "C"

On a per capita measure, their resources and their fish consumption are similar. The group has minimal foreign involvement in their industry. What there is, relates to manufacture and vessel construction rather than to capture or processing which they are well able to handle themselves. Industrial inputs and service industries are high for both countries. Fish imports are insignificant, being confined to special products of low volume. The one major problem facing the group is the difficulty of increasing production since the marine resources are heavily exploited and there is only limited possibility of developing aquaculture or mariculture.

2. Namibia and Mauritania

Cluster 2 has enormous production and export potentials. Neither country consumes much fish internally since the population is small and the Namibians are traditionally meat-eaters. Their industries are, therefore, export-oriented and this has necessitated huge investments in ports and processing facilities, chiefly at Walvis Bay and Nouakchott. Their gross export earnings are close to that of cluster 1. Both countries face the problem that their resources have been harvested chiefly by foreign fleets. Namibia is largely succeeding in its efforts to have most of the vessels registered nationally but Mauritania has much further to go to nationalise capture. The countries though thousand of miles apart have other similarities. Both are largely desert and apart from fish, minerals are the other main national resources.

Development of the FIS in cluster 2 will focus on expansion and upgrading of value-added processing and strengthening of national fishing fleets and fishery management.

3. Senegal, Cote d'Ivoire, Ghana and Algeria

This flourishing group of FIS countries produces over 850,000 tons of fish a year and earns over US$400 million from fish exports. Unlike clusters 1 and 2, their industries have a large artisanal sector which produces practically all of the domestically-consumed fish. Apart from Algeria, all have high per capita fish consumption. The traditional fishermen in Ghana and Senegal dominate fisheries on the West African coast. Migrant bands of Ghanaian or Senegalese fishermen are found operating in practically all countries from Mauritania to Nigeria.

There are strong export processing sectors in Senegal, Cote d'Ivoire and Ghana and expansion is likely in Senegal and Ghana. All four states have fleets of large offshore vessels though most are acquired through some form of foreign participation. The offshore fleets need to be upgraded and expanded and to do so necessitates strengthening of local repair, maintenance and service industries.

Much could be done to reduce losses in the domestic fish supply which varies according to the fishing season. Better smoking and improved storage could save thousands of tons of fish and considerably reduce the need for fish imports at times when local landings are low.

Current efforts to obtain suitable planked boat replacements for large dug-out canoes should continue.

While there has been a long and fairly amicable foreign involvement in the processing sector, the countries are striving for greater national control of the industry and more added-value processing.

4. Angola, Mozambique and Sierra Leone

Like cluster 2, group 4 has immense fishery resources. Together the three countries could produce a million tons of fish a year. But their

resources are largely harvested by foreign fleets, often on terms which are of doubtful value to the country. A major reason for the situation is that the development of all three countries has been greatly retarded by political and economic problems. Angola and Mozambique have suffered from protracted guerilla wars and insurgencies and Sierra Leone from severe economic problems and a very weak currency. (Note: no such data is used in the computer study but the programme analysis can detect similarities related to these problems from secondary or tertiary data relationships).

All three countries have large domestic requirements for fish and have need of foreign currency and remunerative employment for their people. The fishery industry could supply all three in each case, but realisation of its benefits has been hampered by the instability and weakness referred to. Now that a political settlement has been reached in Angola and seems to be not too far off in Mozambique and that Sierra Leone is endeavouring to address its economic problems, progress should be more rapid.

In addition to the marine resource, the group has very productive inland waters but extraction is limited because of poor internal roads and communications. For example the Cahora Bassa dam lake in Mozambique is rich in many species of fish such as abound in Kariba lake upstream, but at present the area is insecure and it is not possible to harvest or distribute fish from the lake.

Much work remains to be done to develop infrastructure and strengthen local institutions and human resource capabilities in group 4.

5. Seychelles, Mauritius and The Gambia

A glance at the cluster graph (2.1,part 2) shows clearly that cluster 5 has good resources, low utilisation, fair degree of industrialisation, small domestic demand and high foreign involvement. This is to be expected in small population countries with export potential in their FIS. None of the countries has the national wealth to develop a fishery export industry on its own and so they must rely on foreign participation to a high degree, both in capture and in processing.

The resource in the Seychelles and Mauritius is chiefly tuna for which there is a buoyant market. Multinational companies which need to secure sources of supply for their canning factories are usually very willing to engage in joint ventures or licensed fishing in countries which have unfished stocks of tuna. However, this usually limits local processing to freezing of whole tuna and sometimes to mere cold storage.

Gambia's resource is more mixed and demersal. The export trade from Gambia, focuses on blacksole, shrimps and some reef fishes or lobsters. The volumes are small but not insignificant to Gambia's economy.

The emphasis in all three countries needs to be on greater national participation, improved handling and quality and more added-value processing.

2.3.2 GROUP "B"

6. Zaire, Congo and Cameroon

This if the first group of major fish importers. Some of those above import fish to process and re-export and some register as imports fish from local waters, caught by foreign fleets and landed as part of the license agreement. But cluster 6 countries import substantially on a regular basis to meet local demand for fish which cannot be produced from national waters. Fortunately, each of the three countries has access to foreign currecny so importing is possible.

The cluster countries fish resources are fairly evenly divided between marine and fresh waters. Zaire has an enormous network of rivers, lakes and swamps. While fish production from such inland waters can be substantial, there are severe difficulties in preservation and distribution. Aquaculture could be usefully introduced in all three states and especially in Cameroon and Congo. If this is designed to target the domestic fish food market, then it would concentrate mainly on tilapia species which are among the cheapest and easiest fish to farm.

Substantial improvements to FIS infrastructure and services may be necessary to raise quality, widen distribution, reduce spoilage and lower fish imports and much will depend on particular government priorities in each country.

7. Egypt and Nigeria

These are the two biggest fish importers in Africa (with the exception of Cote d'Ivoire which imports more than Egypt, but mainly for processing and re-export). They are also the two most populous countries in Africa and have probably the largest industrial base compared to all others except South Africa. Both Nigeria and Egypt have substantial fish resources of their own, marine and fresh, but they are not sufficient to meet the demands of the large population and so they must be supplemented with imports.

Both countries have the resources to develop aquaculture and to engage in fishing ventures in other African waters, should they so decide. However, much of their imports come from Europe and Scandinavia and not from other African states. Some high value fish are exported. Nigeria earns US$13 million a year from export of shrimps chiefly.

8. Gabon, Guinea, Cape Verde and Liberia

Of all the clusters, this and cluster 10 are closest to the mean of the 48 countries in the study. Their resources, consumption, inputs and processing are average for the continent. Only in resource utilisation they are low. The FIS has not been a priority sector for any of their governments and the local private sector industry is fairly small.

Gabon has the largest marine potential, but that of the others is not small and could reward careful investment. The domestic markets are good and there is potential for exports to neighbouring countries and to Europe or the USA.

Cape Verde though small, has the best developed FIS infrastructure with canning plants and cold stores. With a little more effort and investment, it would be grouped with the countries in cluster 5. All four countries could expand production substantially and could benefit economically from the additional industry it would create.

9a Kenya, Madagascar, Tanzania and Uganda

Clusters 9a and 9b are very close as the cluster graph (5.1) shows. The main difference is in the resource which is much larger in 9a countries. All the states are big fish consumers so the FIS though mainly artisanal plays an important national role.

In terms of production, cluster 9a is the largest in the study, producing just more than the other big producer group, cluster 3. Their production interestingly is mostly fresh water though Madagascar has large marine resources and Tanzania and Kenya also have some sea fish stocks. The marine catch could be increased in these three countries.

Improvements to the inland fisheries will depend largely on better roads and improved presentation. Distribution of fish products is remarkably good in Kenya and Tanzania but could still be improved.

While some small export industries may be developed (chiefly utilising shimps and tuna) the main focus of the FIS will be on the domestic market. With a combined population of about 70 million, the group is the largest next to cluster 7 and to cluster 12 whose people are not strong fish consumers.

9b Malawi, Zambia, Chad and Mali

This cluster is close to 9a in every respect except that its resources are fully exploited and offer little possibility of expansion. They are also large fish consumers, so production limitations do create a problem. None of the four are wealthy, so they cannot afford to import.

Aquaculture offers possibilities in Malawi and Zambia, but not in Chad or Mali where the main problem is drought which has reduced the level of lake Chad and the lakes and tributaries of the Niger.

Much work could be done to reduce spoilage in all 4 countries and thus to effectively increase the fish protein delivered to consumers. Improvements to distribution could also help, both in more evenly spread consumption and in more balanced harvesting. There is a tendancy in the lakes and rivers for harvesting to be concentrated around the ends of access roads where merchants may purchase fish.

Fish culture work in Zambia has shown potentials for stocking dams and reservoirs and this has gone on for many years. The successful introduction to lake Kariba of the deep water sardine from lake Tanganyika, has created a small industrial fishery in the lake. But the main beneficiary has been Zimbabwe on the southern side of the lake.

10. Benin, Togo, Zimbabwe and Libya

These four states are mostly exploiting their small fishery resources to the full and are having to import fish to supplement local production. Small increases may be possible through fish culture in some cases but this will not change the situation much.

As a result of the small resource base and the existence of other large industries such as mining and petroleum in Zimbabwe and Libya, the FIS does not have priority in development plans. This creates a more serious problem for Benin and Togo which being poor countries can scarcely afford to import fish food.

Benin has the most flourishing fishery, both marine and brackish water. The brush park system used in lake Nokoue is an example of the best developed traditional system of fish ranching.

2.3.3 GROUP "C"

11a Comoros, Equatorial Guinea, Sao Tome and Principe and Guinea Bissau

These are small countries which have not paid much attention to their fisheries to date, despite modest resources which could be developed. All of them could, given adequate investment in plants and vessels, develop a profitable export trade in fish and fish products. Lack of institutional facilities and infrastructure has hindered development and fish consumption per capita varies greatly among the four. It will probably be necessary to invite foreign participation before any significant fish industry is established.

11b Central African Republic, Niger, Burkina Faso and Burundi

As the cluster graphs show, 11a and 11b are very similar. The difference is due mainly to the inland fisheries nature of 11b countries compared to the marine situation of 11a countries. As with 11a, fish consumption varies a lot. Apart from the Central African Republic where fish consumption is fair, the other states are not good fish consumers.

Production could be increased in Burundi and the Central African Republic with a little effort, and could be used for export to neighbouring countries. Burundi has access to the north end of lake Tanganyika and the Central African Republic has a large network of streams and rivers. However, there appears to be little interest at present by government or people in the fishery sector.

12. Ethiopia, Djibouti, Rwanda, Somalia and Sudan

The final cluster, which groups the main "low priority for FIS" countries is the most wholly negative of all as shown in the cluster graph. The population of the five countries are not fish eaters except in certain coastal or riverine areas. Whether this is due to strong traditional bias or simply to the non-availability of fish, is not clear. Certainly it is reflected in the attitude of the governments which have paid little attention to fisheries. The exception is Somalia which could have also been placed in cluster 8. It has an enormous marine fish resource, but it is one that requires large investment in vessels and processing facilities to exploit. Attempts to date have found extraction to be far from easy due to the remoteness of the area and the lack of harbours and infrastructure.

It is unlikely that much attention will be paid to the FIS by cluster 12 countries, except perhaps Somalia. This is perhaps unfortunate in view of the great need for protein food among the population of the horn of Africa.

SECTION 3 CONSTRAINTS AND ENHANCEMENTS

Before going on to determine what strategies might be appropriate to each group or cluster of countries, it is necessary to pause and to look at the potential for and the obstacles to FIS development as they appear in Africa. These constraints and enhancements are gleaned from fish industry reports and from the experience of FIS officers in the continent.

Six major constraints and six major enhancements are described and related to the countries in the study. While the constraints are formidable they are not insuperable but they need to be recognised before meaningful strategies may be formulated.

3.1 MAJOR CONSTRAINTS AND ENHANCEMENTS

In its efforts towards industrialisation, the African continent faces a formidable range of constraints and obstacles. While it is well endowed with national resources, there are economic, geographical, environmental, human and political factors which make the realisation of these assets a difficult task. Perhaps in the fish industries sector, progress may be easier and more rapid. This is for several reasons. Fish are a resource that is available initially without any investment in seeding, fertilization or land preparation as in the case of agriculture. They do not take many years to reach maturity as do forest plantations.

Their exploitation does not require massive capital inputs as in mining (except perhaps if harbours have to be constructed). Fish are a cash crop for which there are huge and growing markets at home and abroad. Africa has a long tradition of harvesting, preservation, trading and consumption of fish. The technologies used by its two million artisanal fishermen and half million women fish curers, have been developed over many generations and can still produce and compete in the present modern world.

Thus the fish industry sector offers Africa one of its best possibilities for development. Good returns on investment can be obtained in a relatively short term. The industry is mostly labour intensive which is good for the growing population. And it can provide either vital protein food or valuable foreign currency earnings, or, in some fortunate cases, both.

3.1.1 CONSTRAINTS

There are three main constraints which are evident throughout the continent and three others which affect mainly a few countries.

Continent-wide	- Lack of infrastructure and services
	- Lack of capital and/or foreign currency
	- Lack of skilled manpower or technology
Localised	- Resource limitations
	- Environmental problems
	- Limited local demand

All other or minor constraints are a feature of one or more of the above. The first three constraints can be dealt with by judicious provision of finance and training and by development of the sector and its facilities. The second three constraints cannot be changed in themselves, but can be compensated for or overcome through imaginative strategies as discussed below.

C.1 Infrastructure and services

Of the 48 countries in the study, only Morocco and Tunisia do not have this constraint and even they are continuing to improve and strengthen their fishery facilities. In all other countries much work remains to be done, even including those which have already a substantial FIS infrastructure (groups 1,2,3,4 and 7).

Harbours and port facilities are the most expensive and fortunately these are mostly already in place though requiring further development. Coastal landing places for Africa's 50,000 to 100,000 marine canoes are a serious problem in areas of heavy surf. This need relates to the parallel requirements for planked canoes to replace the splendidly functional but timber expensive dug-out vessel. No planked canoe has been developed which can cope with the rigours of beach landing in a heavy surf, something the dug-outs do all the time. Landing places and access roads are a problem in inland fisheries, especially in lakes where the water level and shoreline change substantially because of drought (as in lake Chad) or because of the release of water through a dam (as in Volta and Kariba lakes).

Processing factories and cold stores are needed by all fish exporting countries and cold stores by those which have to import frozen fish. Ice plants are required practically everywhere though maintenance is difficult in remote places. For the artisanal sector there is a need to supplement woodfired smoking with solar drying and to construct stores for dry fish which will be sealed from pest infestation and yet ventilated to prevent condensation.

Fishing fleets are a major requirement, especially for marine fisheries. Mention has already been made of the need to find a replacement to the dug-out canoe as few trees remain large enough to construct them in that way. Harvesting of coastal waters is adequately undertaken by the canoe fleets. Offshore and deep sea waters require much larger craft which in turn need substantial support services. The lack of such vessels means that foreign fleets have to be used to harvest offshore waters. Often this is done on the basis of license and royalty payments but generally the income is considered a very poor return to government in view of the jobs and industry and exports the resource could provide. Mauritania, Angola, Namibia, Mozambique, Sierra Leone and other marine states suffer from this problem.

Repair and maintenance services for offshore vessels are an important constraint for any country wishing to expand its fleet. This sub-sector requires substantial investment. The facilities should, of course, serve all marine shipping needs - merchant, passenger, naval, coastguard and offshore oil as well as fisheries.

Clean fresh water supplies are a critical input to all fish markets and processing plants, as well as ice plants, fish farms and hatcheries. The cost of cleaning, pumping and storing water can be high and thus alternative technologies such as solar pumps and SWS filters are extremely useful.

Supplies of fuel and spare parts need to be available in fishing centres. This is a problem both of distribution of services and of availability of foreign currency (contraint below).

C. 2 Capital and foreign currency

Without substantial investment, little development of industry will take place. Availability of capital is, therefore, a major requirement and its lack a formidable constraint. This problem affects Africa more seriously than any other continent since its businessmen and banks are fledging compared with those in other parts of the world, even excluding the industrialised north.

To compound matters, many African states do not have convertible currencies and this adds to the problem since the biggest part of investment costs is usually in foreign currency.

The normal procedure is to look to the World Bank or the African Development Bank for funds. Private sources however can now offer very attractive terms provided the project is a foreign currency earner and this possibility should be explored more often. For internal credits to industrial enterprises, most countries have some kind of development bank or similar institutions, but these have proved to be poor vehicles for investment finance throughout the developing world.

Where the national currency is not convertible and there is a shortage of foreign currency, fishermen are unable to import the engines, nets and spare parts they require. There is a strong case in some states for allocating part of the industrial fisheries foreign currency earnings towards the import requirements of the artisanal fishery.

Mention should be made of the informal credit systems in Africa, without which much of the small-scale fishery activities would never take place. These include the "esusu" thrift clubs, traditional moneylenders and fish mammies. Real interest charges by moneylenders are extremely high, also those charged by the fish mammies but their effect is cushioned and obscured by intricate arrangements on fish prices and costs of inputs. Also it should be recognized that the better merchants and mammies will pay for or subsidise social activities such as weddings, funerals or religious celebrations. Attempts to "formalise" the informal credit sector have not succeeded.

C.3 Skills and Technology

Africa is rich in fishing skills and technology in its traditional or artisanal sector. But when venturing into offshore operations and export processing, a different array of skills is required. There are two main areas where lack of industrial skills and competence are most severe. The first is the area of middle level technical personnel, namely mechanics, technicians, tradesmen, engineers and operators.

Resolution of this constraint can only come by massive investment in training, both by government and industry but it will take many years of effort to produce skilled manpower in the numbers that are needed in most of the countries with FIS potentials.

The other main area is that of management. Some experts reckon that lack of managerial skills is Africa's single largest constraint. In the FIS sector this includes management of fishery enterprises or industrial services and also resource management and the operation of banking, shipping, maintenance and other commercial services. Fortunately, this need is easier to address in the short term by specialist training programmes than is the need for technical skills.

No discussion of human resources in the FIS sector would be complete without mention of the female workforce. Women form the backbone of the traditional fish processing industry in Africa and they also play a vital role in the supply of informal credit. No programme of training for fish industry personnel should ignore the potential of the women workforce or the particular skills and aptitudes they obviously possess.

C.4 Resource Limitations

A limited resource does not necessarily imply a small resource. It is the size of the resource relative to the demand that is in view. Thus Nigeria with an estimated total MSY of over 300,000 tons of fish is considered to have a limited resource because its huge population of over 112 million requires double that amount of fish protein.

There is little that can be done to increase a natural resource, but much that can be done to conserve, protect and enhance it through wise and effective management. There is also the possibility of south-south co-operation in harvesting joint ventures so that a surplus resource in one state may be harvested to provide increased supplies in another whose own resource is limited.

There are two other important measures that can be taken to compensate for a limited resource. One is to reduce spoilage which destroys around 20 per cent of the domestic fish supply. In countries like Uganda or Tanzania, this could increase the amount of fish effectively supplied to the consumers by 40 to 75 thousand tons. Spoilage itself as a constraint is related to deficiencies in infrastructure, services and skills.

The second approach to resource limitation is to introduce or expand aquaculture, the potential for which is enormous (China itself produces more by fish farming than all of Africa produces by capture). At present Africa's aquaculture activities are few and small in scale. To tap the potential of fish farming will not, however, be easy. It will take enormous efforts in training, design, investment and services to get near to the present levels attained by the Far East countries and S.E. Asia. Management attitudes need to be changed as much as for agriculture in Africa. Fish farming requires long-term planning and much preparatory and maintenance work.

C.5 Environmental Problems

These affect chiefly the drought prone regions of the Sub-Saharan countries where fish production is directly related to the amount of rainfall in any particular year. Lake Chad is a prime example. It is presently much reduced in size and should its level rise again, then fish production would increase accordingly. Other areas of swamp, river or flood plain fisheries are also vulnerable to drought or low rainfall.

There is little that can be done to ameliorate the situation in the short term. In the long term, massive inputs into soil and water conservation, reforestation and irrigation should eventually affect local climates for the better.

Another feature of the environmental problem is the lack of firewood due to over-harvesting of diminishing forests. Most of the preserved fish for local markets in Africa are cured by smoking. To smoke one ton of fish necessitates consuming one cubic metre of fuel wood. As about 1.0 million tons of fish are smoked each year in Africa, this activity consumes up to a million cubic metres of fuel wood. To produce a cubic metre of fire wood from wild forest requires an average area of ten hectares. The fish smoking industry is therefore extracting from wild forest resources over ten million hectares in the continent.

The fuel wood constraint can be overcome. Firstly, by the plantation of woodlots of fast growing trees, specially for this purpose. These can be managed by local communities or families and are commercially viable and allow inter-planting with secondary crops. Secondly, more use could be made of solar drying and salt. Solar dryers can also be used to kill pests and reduce spoilage in cured fish.

There is a second major constraint related to wood. Most African fishing canoes are dug-out of a single large log. Since the canoe may be 30 or 40 feet long, the original tree (usually Wawa variety) must be immense in size. There are very few such trees remaining now due to deforestation. Some reckon that at present rates of utilisation for replacement of old canoes only, there are only 8 or 9 years supply left. A substitute canoe design is needed to overcome this constraint, utilising planked construction. This will not be easy. FAO and others have been working on the problem for over 20 years and still have not an acceptable alternative boat.

C.6 Limited Demand

In a few states in Africa the people traditionally do not eat fish. These countries are located mainly in the horn of Africa (Ethiopia, Somalia, Rwanda) but also there are states like Namibia whose people consume mainly meat protein. There is little internal demand for fish in those countries and in consequence the domestic fish industry has not been developed. But several of these states have massive fish resources which could be harvested and exported. Namibia is an example of one country which has developed its FIS wholly for the export market (except for canned pilchard for South Africa when the two were united). Somalia is an example of a country which could develop such an industry. Even for those states with modest resources, there could be considerable income from cross-border trade in cured fish. This applies well to the inland countries like Rwanda and Burundi. Countries with this constraint are mainly included in Group C.

3.1.2 ENHANCEMENTS

The continent of Africa is well endowed with natural resources and its fisheries are no exception. Both fresh water and marine areas are productive in edible and exportable species which can be harvested profitably.

The workforce, though largely unskilled in formal training, is large and in many regions has good traditional fisheries abilities and aptitudes. There are many deep water ports for merchant vessels to facilitate trade and a growing network of roads and communications. By far the majority of countries in
Africa are fish-eating and there is a strong internal demand for fish protein. All this helps to form the basis of industrial growth in the sector. To summarise, the main enhancements are:

major ones: abundant renewable resources
plentiful traditionally skilled labour
strong domestic demand
good export potential

minor ones: basic infrastructure and communications
openess to foreign co-operation

E.1 Resources

The two largest offshore fisheries are those off South-west Africa and West Africa. Namibia has huge stocks of pilchard and sardines and also hake and demersal fish on the sea bed. The West African States, from Nigeria to Morocco have plentiful schools of mackerels and sardines. Tuna abound in the deep offshore water and shrimps in the inshore grounds. Several areas have good stocks of reef fish like grouper and snapper. Other large marine fisheries exist off Mozambique, Somalia, Angola and Gabon. Even the small island states like Mauritius, Seychelles and Cape Verde have good fish stocks, mostly tuna. Most of the large marine resource countries appear in Group A.

The inland waters of Africa are also very productive. From their lakes and rivers, countries like Tanzania and Uganda produce more fish than do well-developed countries with vast marine fisheries, like England and Australia. South of the Sahara, the bulk of Africa's fish is taken from fresh waters. The main lakes are Tanganyika, Victoria, Malawi, Volta, Kariba, Nasser, Chad and Turkana. The major rivers are the Nile, the Zambesi, the Congo, the Niger and also the Senegal, Gambia, Sanaga, Ogooue, Kwanza, Ruaha and Shebele river systems. Then there are large swamp and flood plan fisheries which rise and fall each year and in addition there are numerous agricultural dams, ponds and reservoirs which produce fish. The production is almost entirely by capture. Aquaculture or the farming fish has not been practiced to any wide extent as yet, though its potential remains great. The big inland fish producers appear mostly in Group B.

E.2 Labour

Africa has about 2.5 million traditional fishermen of whom about half are full time and the rest are seasonal or subsistence level fishermen.

The countries with the strongest traditional fisheries populations are probably Ghana, Senegal, Morocco, but many others have flourishing artisanal sectors. Nigeria, Egypt, Tanzania, Uganda and even Chad and Malawi have long been harvesting and utilising their fish resources. The marine fishermen have good sea skills. Large dug-out canoes operating through surf off exposed beaches in West Africa, exhibit a calibre of seamanship to rival any other small boat fishery in the world. They also operate a variety of ring nets, purse seines, lines and traps that reflect a high degree of fishing technology.

Freshwater fishermen also have their skills. They use more static gear like gill nets and traps, but some have developed a form of "fish ranching" that is close to fish farming. This is the brush park fisheries of lake Nokoue and the shallow lagoons of the West African coastal plains.

Women figure prominently in the fisheries labour force. Most of the traditional processing and retailing of fish is undertaken by womenfolk. There are probably around 750,000 of these, approximately half of whom are full time at the profession and half are seasonally employed or part-time housewives who supplement the family income in this way. Many of the professional fish smokers or "fumeuses" are substantial businesswomen. They have the resources to finance fishery operations which they do to good effect, especially in West Africa. Unfortunately, most U.N. and bilateral aid fishery development programmes to date have ignored the female labour force and its activities and have focused instead on aspects of fish capture and industrial processing where the menfolk are the main beneficiaries.

E.3 Internal Fish Markets

Strong domestic demand for fish exists in the majority of African countries. The only large population state in Africa with low fish consumption is Ethiopia. Low per capita consumption of fish (less than 3.5 kgs per cap. per year) is a feature in perhaps 12 of the 51 African states. In most of the others it is high or significant. In countries where a high per capita consumption is coupled to a large population, there is a very strong internal demand for fish. Countries in this category are Nigeria, Egypt, Congo, Tanzania, Zaire, Ghana, Cameroon and Uganda. All these except Ghana are in Group B.

Some of these countries are large importers of fish since the national production is not sufficient to meet the domestic market needs. However, the strong domestic demand is an incentive to raise production, reduce spoilage losses and widen distribution, all of which should add to fish industry development.

E.4 Export Potential

Fish import requirements can also stimulate trade between African states in fish products. To date most fish export efforts have focused on trade with Europe, the Middle East and the USA where hard currencies can be obtained. Cross border trade in fish has therefore developed informally within the traditional sector and has involved mostly cured fish, either smoked, salted or sun-dried.

Exports to the industrialised countries should be limited to high value species in value-added forms, with cheaper fish kept for local and regional use. The main high-value species are shrimps and tuna and the minor ones, reef fish and lobsters. Value-added processing can make a useful product out of low-value fish. Thus there is a good export trade in canned mackerel and pilchard from countries like Morocco and Namibia. Some tuna importers are resisting efforts by African states to establish canneries. In order to keep their own canneries in business, multi-national companies are pressuring African producers to supply them only whole frozen tuna, or tuna loins in cooked "ready to can" form. The major fish exporters all appear in Group A.

Apart from Namibia and Morocco, African states do not normally produce fish meal or animal feed from fish. The protein is too valuable for human consumption to be used in this way. Morocco's fish meal industry uses mainly fish offal and surplus or low quality fish unsuitable for canning. Namibia utilises good fish for fish meal, but is now seeking to reduce this activity in favour of better added-value processing for human consumption.

A small volume, but useful export production could be developed in fish feed products for the fish farming industry using some high quality fish meals.

E.5 Basic Infrastructure

Harbours, ports and landing places have been constructed in the main fishing countries along with cold stores, fish markets and processing plants. The countries in clusters 1,2,3,4,5 and 7 are all reasonably well equipped to handle fish landings and service fishing fleets although of course there i much room for improvement and in some cases, expansion. Those 16 countries all have substantial marine resources. Some states are favoured with natural deep water harbours, usually but not always, at river mouths.

Internal road networks are not so well developed and for fisheries that creates problems, particularly the inland fisheries where there are many landing places of difficult accesses. But in contrast there are some good river and waterway networks that can be used for the transport of fish.

E.6 Co-operation with Foreign Companies

Following a sometimes difficult period of adjustment in the post-colonial era, most African states are ready to work with foreign partners on terms that are mutually beneficial. In the FIS sector this involves chiefly deep sea capture operations, export marketing and processing for export.

There are two main types of co-operation in the sea fisheries. One is fishing by foreign fleets under a license and royalty payment system. Under this arrangement the fish are taken directly to the foreign state with perhaps only a percentage or a by-catch landed in the host country. These licensed fishing arrangements are regarded as a less desirable form of extracting a rent from the fishery.

The second main type of co-operation is a joint venture involving local processing as well as capture. This provides greater benefits in the form of employment and added value and usually involves an element of training and human resource development for the local partner.

Joint ventures can also be extended to shipbuilding or repair and maintenance and to manufacture or assembly machinery and equipment for the industry sector. Foreign company involvement is the highest in Group A countries.

There is a possibility of joint ventures in fish farming for the export market. Several African countries have the potential to cultivate shrimps as is done extensively in South-east Asia and in Ecuador. The fairly high level of technology involved necessitates the support of a foreign partner and such pilot schemes are already under way.

3.2 GROUP AND CLUSTER ANALYSIS

3.2.1 Group Enhancements

"A" Group Countries Huge stocks of marketable marine fish: tuna, sardine pilchard, mackerel and modest resource of shrimp. Good basic FIS infrastructure and excellent traditional fishery skills. Strong export orientation.	Morocco, Tunisia, Namibia, Mauritania, Senegal, Algeria, Ghana, Cote D'Ivoire, Angola, Mozambique, Sierra Leone, Seychelles, Mauritius, Gambia.

"B" Group Countries Large and expanding domestic markets with strong demand for fish food. Local artisanal sector able to supply fish at modest cost. Except 9b and 10, all have extensive and productive inland or marine waters.	Zaire, Congo, Cameroon, Egypt, Nigeria, Gabon, Cape Verde, Guinea, Liberia, Kenya, Madagascar, Tanzania, Uganda, Malawi, Chad, Zambia, Mali, Benin, Togo, Zimbabwe, Libya.
C" Group Countries Conditions would permit future development or expansion of FIS if desired. Export markets exist close at hand in neighbouring African states and in the middle east.	Comoros, Equatorial Guinea, Sao Tome & Principe, Guinea Bissau, Central African Republic, Niger, BurkinaFaso, Burundi, Somalia, Djibouti, Ethiopia, Rwanda, Sudan.

3.2.2 Group Constraints

"A" Group Countries National fleets not sufficient to harvest offshore resource (except cl.1) Many importers prefer only semi-processed fish thus limiting added value. Artisanal sector lacks access to modern technology and foreign currency inputs (especially cl.4)	Morocco, Tunisia, Namibia, Mauritania, Senegal, Algeria, Ghana, Cote D'Ivoire, Angola, Mozambique, Sierra Leone, Seychelles, Mauritius, Gambia.
"B" Group Countries Fish resources mostly inadequate to meet large domestic demand for fish protein food. Lack of internal transport facilities and poor fish preservation, limit distribution and result in much spoilage.	Zaire, Congo, Cameroon, Egypt, Nigeria, Gabon, Cape Verde, Guinea, Liberia, Kenya, Madagascar, Tanzania, Uganda, Malawi, Chad, Zambia, Mali, Benin, Togo, Zimbabwe, Libya
"C" Group Countries Very low demand for fish food Extremely limited FIS infrastructure. Limited traditional involvement in fishery industry.	Comoros, Equatorial Guinea, Sao Tome & Principe, GuineaBissau, Central African Republic, Niger, Burkina Faso, Burundi, Somalia, Djibouti, Ethiopia, Rwanda, Sudan.

FIS ENHANCEMENTS: AFRICA BY CLUSTER

Continent wide	Cluster Groups	Individual Clusters	
	"A"		
Generally strong domestic demand for fish food	Huge stocks of tuna sardines, pilchards, mackerels and modest resources of shrimps	Well developed capture and processing sectors with good service industries	Morocco Tunisia
		Huge resources of exportable fish and substantial processing industry already established	Namibia Mauritania
Productive waters both marine and fresh	Good basic FIS infrastructure and good export orientation	Good resources and a healthy mix of industrial and artisanal sectors serving export and domestic markets	Senegal, Algeria Cote d'Ivoire Ghana
		Good offshore resources and strong artisanal fisheries. Good export potential	Angola, Mozambique Sierra Leone
		Good marine resources of exportable fish and prospects of strong J.V. co-operation	Seychelles Mauritius Gambia
	"B"		
Large artisanal population working in FIS which can produce fish food at low cost both in terms of capital and operating costs and use of expensive imports such as petroleum (except cluster 2)	Very large domestic markets with strong demand for fish food	Large domestic market for fish could be expanded	Zaire, Congo Cameroon
		Huge domestic market. Good basic infrastructure and service industries	Egypt Nigeria
	Local artisanal sector is able to supply this at modest cost	Marine and inland waters offer potential for development of FIS industry	Gabon, Guinea Cape Verde Liberia
	Most of these countries have substantial inland waters, very productive of fish	Large domestic markets and productive inland waters, plus some export shrimp potentials from coastal areas.	Kenya Madagascar Tanzania Uganda
		Good inland fisheries, skilled artisanal fishermen, strong local demand for fish	Malawi, Zambia Chad, Mali
Potential to increase African fish exports with		Good freshwater fisheries and local demand. Some prospects for aquaculture	Benin, Togo Zimbabwe, Libya

	"C"		
more added value from current annual total of US$1.5 billion to over US$3.0 billion. These exports could involve at least 50% of the countries	Conditions would permit future development of FIS sector if required (though current low demand for fish or low priority of FIS sector inhibits development	Fair amounts of exportable fish in marine waters	Comoros, Eq. Guinea Sao Tome Burkina Faso
		Inland waters have fair potentials to expand fish production	CAF, Burundi Niger Burkina Faso
		Potential exists to greatly expand production if markets can be accessed	Somalia, Djibouti Ethiopia, Rwanda Sudan

FIS CONSTRAINTS: AFRICA BY CLUSTER

CONTINENT WIDE	CLUSTER GROUPS	INDIVIDUAL CLUSTERS	
	"A"		
Lack of trained and experienced management for FIS	National fleets not sufficient to harvest offshore resources (except cluster 1)	No major constraints	Morocco Tunisia
	Many importers prefer only semi-processed products, thus limiting added value	National fleets and processing plants require expansion and upgrading	Namibia Mauritania
Shortage of skilled technical personnel	Artisanal sector lacks access to technology and finance	Additional investment and improvement required	Senegal, Algeria Cote d'Ivoire, Ghana
Inadequate infrastructure and service industries		Both offshore and artisanal fisheries require investment, technology and training	Angola, Mozambique Sierra Leone
		Local industry unable to harvest or process offshore resources. Foreign involvement required	Seychelles, Mauritius Gambia
	"B"		
Many artisanal fisheries lack hard currency to purchase synthetic nets and engines	Fish resources mostly inadequate to meet domestic need for fish protein	Further expansion of production will require greater efforts in preservation, distribution and fish culture	Zaire, Congo Cameroon
		Little possibility of production increases. Distribution infrastructure and network could be made more efficient	Egypt, Nigeria
African FIS businessmen and governments lack investment capital for large scale enterprises	Lack of internal transport facilities and poor fish preservation limit distribution and result in much spoilage	Marine fleets, ports and processing facilities inadequate to fully harvest marine resources	Gabon, Guinea Cape Verde, Liberia
		Further expansion to meet growing demand requires better preservation and increased aquaculture	Kenya, Madagascar Tanzania, Uganda
Foreign fleets harvest much of the fish in offshore marine waters	Where potential exists for marine capture or aquaculture industries, capital and expertise are lacking	Wood fuel for fish smoking becoming scarce. Climate and water supply a major constraint in Chad and Mali	Malawi, Zambia Chad, Mali
		Fishery resources inadequate and limited possibilities of expansion	Benin, Togo Zimbabwe, Libya

"C" Local interest in and demand for fish protein is very low as a result of culture or tradition and therefore the FIS sector has low priority	Potential exists but lack of capital, expertise, manpower, infrastructure are all constraints	Comoros, Eq.Guinea Sao Tome, Guinea Bissau
	Local demand for fish is low. Development would require training and education	CAF, Burundi Niger, Burkina Faso
	No traditional interest in the FIS sector. Very low consumption of fish products	Somalia, Djibouti Ethiopia, Rwanda Sudan

SECTION 4 : FIS SUGGESTED STATEGIES AND ACTIONS

4.1 CONTINENT-WIDE STRATEGIES AND ACTIONS

4.1.1 STRATEGIES

As a continent Africa could produce over 2 million tons more fish than it does if it fully harvested its marine resources and enhanced inland water production with aquaculture. To achieve this enormous potential increase would require four main types of action on a broad front:

i. development of national fleet capability to replace harvesting of offshore waters by foreign fleets which currently take 1.5 million tons out of African waters.

ii. strengthening and upgrading of artisanal fleets and their support facilities. These fleets of traditional canoes produce over 60 per cent of Africa's fish.

iii. development of fish culture systems to enhance inland water production.

iv. establishment and improvement of processing plants and raising of the quality and added value of fishery products.

In order to achieve the aboive, considerable investment and development work will be necessary not only in purely fisheries activities but also in upstream and downstream industry.
Fleet development (strategy i) will require substantial upgrading of support facilities, harbours, shipways, marine workshops, and general services for fuel water, ice, gear, stores and spareports.

To reduce the foreign currency costs of FIS inputs and increase the retention benefits of investments in fish industry enterprises, it would be wise to promote local assembly or fabrication of equipment and components for the industry. There are a number of FIS manufacturers in Europe and Scandinavia who are prepared to assist the establishment of licensed assembly plants in Africa. These could be a valuable addition to the service and support industries for both extraction and processing sectors.

Artisanal fleet strengthening (ii) is an important strategy for African fisheries. A recent World Bank mission to a country close to Africa calculated that over the past 25 years some $390 million was spent on its deep sea fishing industry and very little on its traditional small scale sector. Despite that enormous input, the large scale sector showed only a marginal increase in production over the small scale. Also if one looks at the successful European and Scandinavian fish industries one will find that the present modern fleets are mostly developed from the traditional small scale fleets of the early part of the century. So the African small scale sector should be assisted to grow and improve technoiogically.

The development of fish culture (iii) is a long term task to which there are no easy short cuts.
One reason is that fish farming in Africa faces the same basic problems as other forms of agriculture in the continent, -a traditional short term attitude of survival by rural peasents and some formidable environmental problems.

Strategy iv will involve many actions and investments, both for the modern and traditional fish industry sectors, depending opn the situation

faced in the respective countries.

Lack of adequate storage and distribution facilities and poor quality traditional processing results in high rates of spoilage of fish food, especially in rural areas. Up to 20 per cent of domestic fish supplies may be lost in this way. There are four areas which development strategies could focus on to redress the situation. These are fish drying or curing systems, storage facilities, transport networks and fuel or energy inputs.

African fish export earnings could benefit from additional added value processing and this possibility should be pursued vigorously. Two examples are pertinent. Export of whole frozen tuna could be superceded by export of cooked frozen tuna loins, or of canned tuna. Some of the fish currently reduced to fish meal in Namibia could be processed for human consumption.

Reduction in the volume and cost of fish imports will be difficult to achieve owing to rising internal demand in Africa and to the rising cost of fish generally. It would however be helpful to explore the possibilities of fish trade within the African continent to reduce the hard currency cost of fish imports. There is scope for joint-ventures with other African companies to achieve this.

4.1.2 ACTIONS SUGGESTED

Practical actions which could be initiated to support the above strategies are:

i. To develop national fleets and encourage joint-ventures which could necessitate local registration of vessels and insist on local landing or transhipment of catches, even if destined for abroad. Upgrade local shipyards for repair and maintenance work and improve supply services and facilities for fuel, stoves, ice, lubricants and spare parts. Encourage local assembly of vessels from "kits" supplied by overseas yards.

ii. To strengthen and improve artisanal fleets, assist development of replacement craft to the dug-out canoe. Encourage mechanisation where this is profitable and establish workshops for repair and maintenance. Help larger-boat fishermen to use ice, go further afield and to participate where possible in offshore fisheries, e.g. for tuna. Provide sheltered landing places for canoes in areas of surf, and access roads and jetties for those in isolated parts of lakes and rivers.

iii. Provide training and demonstration centres for fish farming, and hatcheries to produce seedlings. Encourage establishment of network of input supplies including fertiliser, feeds, filters, tools and hardware.

iv. Invest in efficient added-value processing plants targetting lucrative export markets but also providing canned fish at reasonable cost for the local or regional market.

v. Promote the use of fuel-efficient smoking ovens and solar driers. Provide hygienic bases for fish smokers close to landing places.

vi. Develop suitable designs and encourage construction of dry fish storage sheds, fly screened to eliminate pests and well-ventilated to prevent condensation.

vii. Improve road access to and from fish landing and processing places. Encourage this if necessary by "food for work" programmes to enable local communities to construct and maintain roads, fords and bridges.

viii. Encourage and facilitate planting and management of wood-lots of fast-growing trees for fuel-wood for fish smoking. Provide technical training and demonstrations of solar drying units for fish.

ix. Use incentives for local businesses and foreign partners to encourage more added-value processing in-country. Discourage export of un-processed or semi-processed fish. Ensure supplies of energy, water, materials and spare parts for processing plants.

x. Encourage and facilitate south-south co-operation within Africa in the area of fish trade. Develop un-tapped fish resources for regional use in areas where local demand is low.

xi. Form partnerships with foreign manufacturers to assemble or produce components for the extraction and processing sectors of the fish industry.

4.2 GROUP AND CLUSTER ANALYSIS

Group Strategies

"A" Group countries Maintain FIS growth. Improve added value. Develop upstream and downstream industries, manufacturing, construction and servicing. Replace foreign fleets with local vessels within national marine EEZ.	Morocco, Tunisia, Namibia, Mauritania, Senegal, Algeria, Ghana, Cote D'Ivoire, Angola, Mozambique, Sierra Leone, Seychelles, Mauritius, Gambia.
"B" Group Countries Miximise production within safe M.S.Y. limits and introduce aquaculture. Reduce fuel-costs of preservation and e.g. plant wood-lots for fuel for fish smoking in areas of deforestation.	Zaire, Congo, Cameroon, Egypt, Nigeria, Gabon, Cape Verde, Guinea, Liberia, Kenya, Madagascar, Tanzania, Uganda, Malawi, Chad, Zambia, Mali, Benin, Togo, Zimbabwe, Libya.
"C" Group Countries Consider developing FIS for export and tourist industries since fish food is not a priority need locally.	Comoros, Equatorial Guinea, Sao Tome and Principe, Guinea Bissau, Central African Republic, Niger, BurkinaFaso, Burundi, Somalia, Djubouti, Ethiopia, Rwanda, Sudan.

4.2.1 Analysis of Group "A"

The 14 countries in group A all have flourishing fish industry sectors and have already invested in a considerable FIS infrastructure. Their resources are substantial and in most cases sufficient to meet the needs of the domestic market and have a surplus for export. All of the states have a significant inland fisheries. All but two of them have had long traditional involvement in fisheries and have a large cadre of skilled artisanal fishermen and fish curers.

There are perhaps 5 main policies that might be important for the future health of their fish industries.

i. Maintain growth. Some expansion and improvement of the industry is possible in all of the countries. The main areas for this growth are increased production and improved processing for export. The strategy to follow would focus on management of the fishery and support for the industrial activities.

ii. Improve added-value. Group A countries currently export over $1.5 billion worth of fish products. Processing included canning in Morocco, Namibia, Tunisia and Cote D'Ivoire, fish meal production in Namibia, and some tuna loin processing in Ghana. Export processing in most of the other states is limited to freezing of whole tuna, shrimp, lobster and reef fish. There is scope for improvements in the quality and volume of canned fish, of frozen cooked tuna loins, and of shrimp and lobster products.

iii. Offshore harvesting. Under international law, all of the states lay claim to an exclusive economic zone or EEZ extending up to 200 miles offshore. The deeper offshore waters contain stocks of tuna fish and on the sea bed at the edge of the shelf, stocks of hake and other demersal fish. Sardines and mackerels are found both inshore and offshore above the continental shelf. At present foreign fleets harvest much of the offshore resource around Africa. The long term intention of all African states affected is to replace the foreign fleets with national vessels.

iv. Support industry. There is an enormous amount of work to be done to develop the FIS support industries. These include shipyards, workshops, cold stores, net factories, transport and packaging industries. A major efforts needs to be made also in local assembly, manufacture or fabrication of fish industry components or equipment.

v. Artisanal FIS. The artisanal sectors in most African fisheries are a large and important part of the production system. They are big employers of labour and supply most of the domestic market needs. Their contribution to the industry should be strengthened by appropriate improvements in technology, both in extraction and processing. This in turn will support small scale industries such as boatyards, marine motor workshops, ice plants and transport services.

<u>GROUP "A" CLUSTER SPECIFIC ACTIONS</u>

Cluster 1: Morocco, Tunisia -

Maintain profitability and growth of industry by focusing on resource management, quality control and support industry. For Morocco, develop and strengthen shipyards and marine workshops. For Tunisia, improve fresh and frozen fish handling systems to provide quality high value products for tourism and export.

Cluster 2: Namibia, Mauritania -

Strengthen and expand national fleet for harvesting offshore waters. Move steadily from low value whole frozen products to higher value-added processing. Continue to build up infrastructure in ports for vessel servicing and for fish handling.

Cluster 3: Senegal, Algeria, Ghana, Cote D'Ivoire -

Institute management measures to protect coastal fish stocks and reduce industrial/artisanal friction. Encourage industrial fleet to focus mainly on tuna. Strengthen and upgrade the processing sector and develop both upstream and downstream industry. Encourage artisanal sector to engage in offshore fishery in cooperation with industrial fleets. Improve artisanal preservation and storage methods.

Cluster 4: Angola, Mozambique, Sierra Leone -

Seek and encourage investment in both on-shore and off-shore industry. Move away from license agreements with foreign fleets towards more joint-venture operations with significant degree of in-country processing. Provide inputs and market outlets for artisanal fisheries.

Cluster 5: Seychelles, Mauritius, Gambia -

Continue to cultivate FIS joint ventures with foreign companies but increase retention benefits of these activities and build up shore infrastructure to facilitate this. Protect inshore fishermen from deep sea fleets and monitor extraction activities carefully. Provide training for nationals at all levels for the fishery sector.

4.2.2 Analysis of Group "B"

The 21 countries in group B have a strong internal demand for fish food but have difficulty meeting this need from the resource available. Their fisheries are chiefly freshwater and most of the harvesting and preservation is undertaken by the artisanal sector.

While the resource limitation is a serious impediment, there are policies which if adopted could alleviate the situation and maximise benefits from the fishery sector.

i. Maximise production. This has to be done within the limits of established sustainable yields. Harvesting of lakes, rivers and swamps tends to be undertaken close to fish landing places. To obtain more balanced harvesting it may be necessary to increase the number of access roads or to develop some form of water borne fish transport.
Some of the countries in group B which have access to marine waters are not harvesting them very well. This would include Cape Verde, Gabon, Guinea, Kenya, Liberia, Libya and Zaire. There is considerable scope for increasing production in those states.

ii. Promote aquaculture. The farming of fish has great possibilities in the fresh water areas of most of the countries of group B. Since food fish is the main requirement, low technology or non-intensive systems would be appropriate. These would use chiefly algae grazing species like Tilapia which are easy to farm and have a wide tolerance of water conditions. The basic research and development work for this has been undertaken in most of the regions o Africa.

iii. Reduce spoilage. Of the total fish production of B group countries, over 300,000 tons are lost annually due to spoilage. This is about 20 per cent of the total. The loss represents a retail value of about $200 million equivalent, and a protein food volume sufficient to supply over ten million consumers.

iv. Improve distribution. Part of the production and spoilage problems can be traced to difficulties in distribution. This applies to remote parts of countries where access to and from fishing centres due to poor roads and lack of bridges. Some areas can be inaccessible during the rainy season which is unfortunate when it coincides with the best fishing season. Improvements to roads in such areas will help distribution of fish products and reduce spoilage caused by transport delays.

v. Reduce spoilage. Better quality preservation of fish and improved storage systems will also reduce spoilage. Preservation is chiefly by smoking, but sun-drying and wet-salting are also practiced.
Introduction of more efficient ovens, solar dryers and more hygienic practices would all help. Storage of cured fish requires attention. Properly designed and constructed storage sheds could reduce much of the spoilage caused by infestation and fungi.

vi. Export high-value species. At least half of the group B countries have the possibility to develop a modest but lucrative export trade in high value fish species. These are mainly marine crustaceans, shrimp, and some lobster, but reef fish and certain large pelagics could also be marketed in this way. Madagascar, Nigeria, Gabon and Kenya already do this successfully, earning over $70 million between them in this way. Such exports can help to defray the foreign currency costs of food fish imports.

vii. Seek low-cost imports. Fish imports to group B countries total over 600,000 tons. This substantial amount of protein food import costs the group about $300 million in foreign currency. Efforts should be made to locate sources of lower-cost acceptable fish for import. Some African countries such as Namibia, Mauritania, Somalia have huge stocks of suitable fish and some of the import requirement might be obtained from them through some kind of joint-venture or trade cooperation.

GROUP "B" CLUSTER SPECIFIC ACTIONS

Cluster 6: Zaire, Congo, Cameroon -

Expand marine fish extraction in Zaire and Congo and invest in on-

shore facilities for handling, marketing and processing. Improve presentation and distribution inland in all countries and promote greater use of aquaculture. Put greater emphasis on fishery management, both inland and marine to achieve balanced sustainable harvesting.

Cluster 7: Egypt, Nigeria -

Maximise efficiency of both industrial and artisanal sectors. Put considerable effort into improving distribution, preservation and retailing facilities and systems. Seek additional fish supplies from other African states with surplus resources. Possibly engage in joint ventures, sending vessels to operate in the EEZ's of other African states, and helping to establish processing facilities.

Cluster 8: Gabon, Guinea, Cape Verde, Liberia -

Develop marine potential after careful assessment of resources, extractability, foreign/local markets and processing needs. Engage in joint ventures where appropriate but insist on incorporation of training programmes for local operators. Invest in local support infrastructure.

Cluster 9a: Kenya, Madagascar, Tanzania, Uganda -

Support and strengthen management and conservation of fishery waters, both fresh and marine. Improve fish handling and distribution systems. Introduce solar dryers, improved storage units. Increase number of ice plants and improve clean water supplies. Develop selected export products, mainly shrimp and tuna from marine waters. Promote aquaculture and encourage fish farmers.

Cluster 9b: Malawi, Zambia, Chad, Mali -

Strengthen fisheries management to promote balanced harvesting of inland fishery waters. Encourage the growth of fish farming and fish ranching (brush parks). Improve the preservation of fish through appropriate technologies. Reduce the use of scarce wood fuel for fish smoking. Establish woodlots for fuel for the FIS.

Cluste 10: Benin, Togo, Zimbabwe, Libya -

Encourage the growth of environmentally beneficial fish ranching and fish farming systems, particularly brush parks.
Promote stocking of dams and reservoirs. Develop both low cost (tilapia) and high value (prawns) fish culture and integrated aquaculture/agriculture forestry. Assist small processors and merchants to improve facilities.

4.2.3 Analysis of Group "C"

The 13 countries in group C are not traditionally large consumers of fish or fish products. Internal demand for fish is low and this probably accounts for the low level of investment in the fishery sector. Somalia has made some efforts in this direction but has faced formidable problems in extraction, handling and processing.
About half of the group have access to marine waters and half have access to inland lakes and rivers. Resource is not a problem in group C, but demand is. This is the reverse of the group B situation. Possible strategies must therefore look to external markets to support any significant development.

4.2.4 SUMMARY TABLE

STRATEGY POSSIBILITIES FOR AFRICA FIS CLUSTER GROUPS

Continent wide	Cluster Groups	Individual Clusters	
	"A"		
	Main Growth	Focus on resource management and increased quality or added value	Morocco Tunisia
	Improve added value	Strengthen national fleet to replace foreign vessels in off-shore waters. Progress towards more high quality, added value products	Namibia Mauritania
Strengthen and improve artisanal FIS in both production and preservation	Develop upstream and dowstream industries	Strengthen processing sector and both upstream and downstream industry Encourage artisanal/commercial co-operation. Improve traditional preservation methods	Senegal, Algeria Cote d'Ivoire Ghana
Aim for eventual "Africanisation" of offshore fisheries by developing national fleets	Replace foreign fleets with local vessels	Seek investment in both on-shore and offshore FIS activities. Provide inputs and market outlets for rural artisanal sector	Angola, Mozambique Sierra Leone
		Continue to develop export industry with J.V. partners but strengthen local share in added value processing	Seychelles Mauritius Gambia
	"B"		
	Maximise production within safe MSY limits and introduce aquaculture	Strengthen fisheries management. Improve inland production and distribution. Expand aquaculture	Zaire, Congo Cameroon
Endeavour to raise quality and to reduce spoilage	Seek additional low cost supplies from neighbouring African states	Improve distribution and preservation retailing facilities. Seek additional supplies from other African states on South-South co-operation basis	Egypt Nigeria
		Invest in selected production/ marketing systems after careful analysis potential and prospects. Train local operators	Gabon, Guinea Cape Verde Liberia
	Reduce spoilage and improve distribution	Support management and conservation of fishery waters. Improve handling and distribution. Develop selected export products. Use aquaculture	Kenya Madagascar Tanzania Uganda
In export trade seek to expand added value processing	Plant wood-lots for fuel for fish smoking in areas of diminishing forests	Encourage spread of fish farming and improved preservation fish products. Reduce use of scarce timber for fuel for fish smoking. Plant woodlots	Malawi Zambia Chad, Mali

		Protect and support brush park fisheries as intermediate form of fish farming. Develop both low cost and high value added culture and integrated fish farming	Benin, Togo Zimbabwe Libya
	"C"		
Develop local manufacture or assembly of inputs for FIS fleets and factories	Consider developing FIS sector for export trade and/or possibly tourism industry	Investigate export fish markets and determine feasibility of harvesting marine waters for this, with or without J.Vs.	Comoros, Eq. Guinea Sao Tome Guinea Bissau
		Promote fish food as low cost protein and raise quality/availability of fish products	CAF, Burundi Niger, Burkina Faso
		Consider alternative uses of fish resources (export, reduction, tourism) and determine most profitable and sustainable methods of utilisation	Somalia, Djibouti Ethiopia, Rwanda Sudan

i. Investigate markets. There are three major markets around which a viable fish industry might be developed. These should be investigated to determine their potential and requirements. The first which requires less heavy investment in infrastructure is the tourist or leisure industry. The Red Sea, Gulf of Aden and lakes Tanganyika and Kivu, all within reach of one or more of group C states, could be utilised in this way for sports fisheries, or diving. The second market is that for artisanally cured fish for neighbouring African countries. The third is the European and Middle East market for high quality table fish, shrimp and lobster. A decision to develop the fishery resource could be made following assessment of the foreign currency and employment benefits to be gained from accessing either of the three markets.

ii. Develop local markets. Fish protein, if available in an acceptable form, might be an important element in nutrition in the horn of Africa which has been beset by famine. Investigations to determine the types and forms of fish products which would meet positive consumer response, would be most valuable. A domestically oriented FIC might well then be developed to meet that potential demand.

GROUP "C" CLUSTER SPECIFIC ACTIONS

Cluster 11a: Comoros, Equatorial Guinea, Sao Tome and Principe, Guinea Bissau -

Investigate and cultivate export markets for high value species. Engage in joint-ventures where appropriate to obtain investment in vessels and processing plants. Consider also cooperation with other African states who are interested in fishing within the national waters.

Cluster 11b: Central African Republic, Burundi, Niger, Burkina Faso -

Encourage domestic consumption of fish and promote local production. Improve handling and distribution systems. Where surpluses are possible, consider expanding cross-border trade in dried fish products. Help local fishermen obtain inputs necessary for harvesting.

Cluster 12: Somalia, Djibouti, Ethiopia, Rwanda, Sudan -

Consider alternative uses of fish resources (export, reduction, tourism) and determine most profitable methods of utilisation. For Somalia, develop offshore fishery for export purposes, in cooperation with foreign partners. Encourage fish consumption locally among traditional fish eating parts of population, and facilitate supplies of fish in acceptable forms.

4.3 SUMMARY OF REQUIRED TECHNICAL ASSISTANCE ACTIVITIES AND INVESTMENT

The continent and group-specific sections are summarised here to clarify the role that UNIDO and other agencies might play in support of integrated development of the fish industry sector.

While the suggested actions are listed individually it is important to remember that they should in each case be part of a well though out integrated plan for the sector. UNIDO has assisted in the formation of such programmes and one example of this (for Ghana) is summarised in Appendix .

Investments. Africa's FIS investment needs are substantial and include basic infrastructure, extraction fleets, processing facilities, support industry and aquaculture. Fishing port developments are continuing in many states in Africa: particularly on the western coast. Offshore fisheries require these and it is important for fishing fleets to have separate berthing and discharging facilities from merchant ships otherwise considerable unnecessary restrictions and costs are encountered. For the small scale sector some investment in breakwaters, floating or fixed, is needed in places of open surf. Provision of hygienic covered marketed with good access roads and clean water supplies are also vital. Some intermediate and low cost technologies can be applied to reduce the cost of these facilities.

Offshore fishing fleets are needed to harvest the 1.5 million tons currently extracted by foreign (non-African) vessels. It will take many years to develop these and it is important that they are acquired with care to avoid unnecessary expense or inappropriate types. Governments should seek for maximum retention benefits in vessel purchases and should strengthen local ability to repair and maintain ships and to assemble or fabricate components.

Despite enormous progress, Africa still has to invest substantially in the processing sector, particularly where this provides the export market with added-value products. The emphasis needs to be on greater efficiency and good quality control. Namibia wishes to reduce its low-value processing (fish meal) and increase its higher value processing like canning. Countries exporting tuna are moving from a whole frozen product, to a cooked de-boned frozen product, and ultimately to a canned product. All this requires further investment.

Of the support industries, ship building, marine engineering and manufacturing are the most important. These in turn require the support of steel mills, welding gas plants, hydraulic, electrical and refrigeration engineer services.

Most of the support industry will also serve merchant fleets, naval and passenger vessels and it is therefore important to develop thwm in cooperation with other sectors which have similar needs.

Aquaculture investments will need to include the establishment of hatcheries and small feed mills, and the construction of ponds and irrigation channels. A range of small service industries is needed to support fish farming with the supply of inputs like fertilizers, feeds, seed and antibiotics, and in farming the chain of distribution and/or processing facilities.

Technical Assistance. The area of training is probably the main field for technical assistance and this should cover both technical and managerial skills. The main training needs probably lie in the processing and engineering sectors. But more and more now it is being recognised that managerial skills are of prime importance in development and these need to be strengthened at all levels in both government and industry. Greater imagination and flexibility is needed now in devising training programmes in view of limited resources and the difficulty in releasing valuable staff for prolonged periods. Many training programmes, particularly in the management field can (and should) be conducted in the trainees own plant or factory.

Technology transfer in processing and engineering will be needed to accompany the investments in new plant and equipment. This can best be achieved in cooperation with foreign private sector companies. In the area of manufacture, while major companies may protect their products and market vigourously, many small and medium sized manufacturers are very willing to help establish other licensed units in different parts of the world. UNIDO can act as a catalyst in this.

Policy development and application is an area where assistance would be appropriate. The complex nature of modern integrated industrial development programmes is such that policy measures need to be determined with great care and in recognition of the effects of government actions in all sectors and sub-sectors, sometimes not directly related to the industry in question. UNIDO can help governments address these questions by providing the background industry analysis and issues papers on which the policies may be built.

For the small scale or artisanal sector, a broader form of assistance is required, covering the management of their integrated village economies and helping to establish the elementary or primary industry base for the growth of production, processing, transport and service industries at village level. These rural enterprises though small units individually can in total have a significant impact on the sector as they handle in Africa about 2 million tons of fish worth over a billion dollars and provide remunerative employment for some 2 million persons.

PART II : METHODOLOGICAL APPROACH TO THE FIS.

SECTION 1: DESCRIPTION OF THE FISHERIES INDUSTRIAL SYSTEMS OF AFRICA.

The suggested FIS approach requires a concrete description of the FIS.The aim was to start from the previous job published in 87 under the title 'industrial development strategies for fishery systems in developing countries'.

This study was an analysis of the fishery systems for 64 world countries. Within the 1990/1991 IDDA programme , the present typology has been commissioned to focus on the African continent .

In considering the description of the fishery industrial system it was necessary to ensure that the components used previously were meaningful and appropriate for only Africa .

The previous typology took 26 African countries into account but half of them were concentrated in one or two clusters with similar characteristics . The final choice , after trying many options , was to keep the following 9 components for describing the system : Resource MSY , Resource utilisation. Extraction , Processing , Distribution and Marketing , Consumption ,Industrial inputs , Fish imports and Foreign involvement.

The analysis of the FIS is , thus , reduced to the analysis and evaluation of each of these components and their linkages . They cover the most important aspects of the FIS.

1.1 THE NINE FIS COMPONENTS:

1.1.1 PREVIOUS COMPONENTS

The following is a description of the nine main FIS components used in the previous typology:

1.RESOURCE.
This component describes the fish and crustacean resources available to an industrial system indicating how rich they are, how well they are managed and how they are split among marine , freshwater and aquaculture sources.

2.EXTRACTION.
This component describes the type , condition , management and utilisation of labour and capital (vessels) used in the harvesting of the resource . Foreign participation is also an important consideration.

3.PROCESSING.
This component describes the type , condition , management , utilisation and physical distribution of the labour , plant and equipment used in the domestic processing of extracted fish and crustaceans as well as their variable inputs and type of outputs.

4.DISTRIBUTION AND MARKETING.
This component describes the channels and methods used in the distribution of outputs from each FIS component to the next downstream component . Marketing intelligence and the type of retail mechanisms present are also considered.

5.CONSUMPTION.
The type , quantity , substitutability , price and income sensitivity , and desired nutritional requirements of domestic final goods demand of the system is described herein . Where appropriate , other stratifications of thedistribution of consumption (income,regional) are also considered.

6.INDUSTRIAL INPUTS.
This component describes the extent to which intermediate and capital goods are domestically available to the FIS on the one hand . and the quality and state of domestic services and infrastructure on the other.

7.GOVERNMENT POLICY.
The government 's view toward the sector is included in this component . Hence. the existence of incentive schemes subsidies access to foreign exchange and favourable macroeconomic policies are noted.

8.OWNERSHIP.
The industrial structure is described with respect to vertical and horizontal integration and concentration on the one hand . and with respect to public . private and foreign ownership distribution on the other.

9.EXPORT ORIENTATION.
The balance between production for export and for local consumption is described.

These components were tested on the list of the African countries after completing the consumption variable by the potential of the market. The results did not give a clear idea of the similarities or dissimilarities between groups of countries (see section 2 for the proceeding). **So it led to the selection of these new 9 variables.**

1.1.2 NEW COMPONENTS

1. RESOURCE MSY: This component describes the fish and crustacean resources. It gives a value for the estimated sustainable yield of the whole fishery. It is in fact an estimation of the real potential of the total fishery resource. including a modest assessment of aquaculture potential.

2. RESOURCE UTILISATION: This component gives the percentage of the resource which is presently harvested by the country . It does not include foreign exploitation of the fishery unless the fish is landed in the country . It shows in fact the gain that goes to the country.

3.EXTRACTION: This component is an assessment of the fish harvesting or production sub_sector . In particular it relates to the size of the extraction industry relative to the country and the degree of industrialisation involved in the fishing fleets and their support facilities . It focuses on the fleets of larger commercial vessels and ignores the large but artisanal fleets of traditional canoes.

4.PROCESSING: Domestic processing of an industrial nature is described by this variable . relevant to the production . All freezing , canning , and reduction of fish is included but not artisanal curing activities such as smoking . Fish sold fresh whether filleted or on ice are not considered . The component therefore is a measure of the size and degree of industrial fish processing.

5.DISTRIBUTION AND MARKETING: This component describes the channels and methods used in the distribution of the outputs . It takes the number of intermediaries into account , and the general efficiency and complexity of the system.

TABLE 3.1 :LIST OF THE VARIABLES BY COMPONENT

COMPONENT		*VARIABLES*	*WEIGHTING*
V1a	**RESOURCE MSY**	1 Value for the estimated sustainable yield of the whole fishery.	1
V1b	**RESOURCE UTILISATION**	2 Percentage of the estimated resource which is harvested by the country. Foreign exploitation included if catch landed.	1
V2	**EXTRACTION**	3 Extraction per capita.	0.5
		4 Industrial share of extraction.	0.5
V3	**PROCESSING**	5 Share of the catch which is processed (frozen, canned or minced). (Surimi)	1
V4	**DISTRIBUTION & MARKETING**	6 Level of distribution channels.	0.5
		7 Marketing methods.	0.5
V5	**CONSUMPTION**	8 Per capita consumption.	0.5
		9 Size of the domestic potential. (population)	0.5
V6	**INDUSTRIAL INPUTS**	10 Quality and efficiency.	0.3
		11 Processing and extraction inputs.	0.2
		12 Extraction services and infrastructure.	0.25
		13 Processing services and infrastructure.	0.25
V12	**FISH IMPORTS**	14 Amount of fish imported.	1
V13	**FOREIGN INVOLVEMENT**	15 Value for the amount of foreign participation in the fish sector (especially harvesting of resources by foreign fleets).	1
VARIABLES DISCARDED			
V7	**GOVERNMENT POLICY**	Pricrity given to FIS by the national government.	0.5
		Measure of the assistance provided to the sector.	0.5
V8	**OWNERSHIP**	Proportion of private sector ownership of the FIS components. (The previous typology used the reverse,-the degree of government involvement).	1
V9	**EXPORT ORIENTATION**	Share of catch destined for foreign markets.	1
V10	**ARTISANAL SECTOR**	The size of the FIS small scale sector.	1
V11	**KW/CAPITA**	Electricity generation relative to population	1

6.CONSUMPTION: This describes the consumption habits and the potential of the internal demand for fish and fish products . The component gives an indication of the potential for developing the sector.
The variable is view in a dynamic way evaluating the level of possible development of internal consumption.

7.INDUSTRIAL INPUTS: This component describes the level of the communications networks (railways, roads, ports) and the quality of services necessary around the fisheries (cold stores, shipyards,fuel and supplies,etc).
It also reflects the efficiency and quality of the handling and support system.

8.FISH IMPORTS: The balance between production and consumption is described here . It gives an indication of the role (or weight) of the fish sector in the economy , and whether demand exceeds national production.

9.FOREIGN INVOLVEMENT: This component describes the role of foreign fleets in harvesting . It shows the orientation of the sector and indicates the degree of national benefit and control.

These components describe well the FIS .The first 6 components are more descriptive of the basic internal aspects of the FIS and the other 3 give an assessment of how the rest of the economy and foreign economies help the sector to work.

1.2 THE FIS BASIC CHARACTERISTICS VARIABLES

After the selection and definition of the main components of the FIS , it is necessary that they be quantified .
To this effect, a set of variables has been selected to describe the important aspects of each FIS component as well as to identify the bottlenecks and the positive aspects of the sector.

Though the FIS components are conceptual constructs , the variables chosen are expressed in quantitative or qualitative terms . Their values correspond to existing data or information for the 48 countries .
Quantitative data was obtained on the following items : Extraction , production , exports ,imports processing ,industrial and artisanal sizes , fish consumption , population.

They were found mainly in the FAO COUNTRY FISHERY PROFILES and YEAR BOOKS OF FISHERY STATISTICS, mostly 1989 . Some other sources were also helpful , like the data prepared for UNIDO by Agro-economic services Ltd the Economist country reports or world economic data.

Table.1.1 lists by component the 15 variables used to describe and quantify the 9 FIS components . It also shows the weights given to calculate a value per component.

Note here that the component industrial inputs was simplified . It was formerly aggregated from 7 variables but in this case reduced to 4 according to the data and information available.
For reference , Annexe 1 lists the variables used in the previous typology.

TABLE 3.2 :LIST OF VALUES GIVEN TO THE VARIABLES FOR EACH COUNTRY

VARIABLES / COUNTRY	RESOURCE MSY	RESOURCE UTILISATION	EXTRACTION	PROCESSING	DISTRIBUTION MARKETING
	V1a	V1b	V2	V3	V4
MOROCCO	5.00	4.60	3.75	3.50	2.80
TUNISIA	2.35	4.55	2.40	1.30	2.70
NAMIBIA	3.25	1.25	5.00	4.70	2.20
MAURITANIA	4.80	1.20	4.70	4.00	2.10
SENEGAL	4.10	4.50	3.00	1.50	2.00
ALGERIA	3.20	2.50	2.60	1.20	2.50
COTE D'IVOIRE	2.55	3.75	2.60	2.00	3.20
GHANA	4.70	3.70	2.65	1.00	3.20
ANGOLA	4.60	1.20	3.00	2.20	2.00
MOZAMBIQUE	2.80	1.10	2.10	1.30	1.80
SIERRA LEONE	4.10	1.10	2.40	2.00	1.70
SEYCHELLES	2.15	0.25	3.60	3.00	2.00
MAURITIUS	1.64	1.36	3.50	1.80	2.60
GAMBIA	1.10	2.85	3.10	1.50	2.30
ZAIRE	3.40	4.00	1.00	0.10	1.70
CONGO	1.70	3.00	2.25	0.20	2.00
CAMEROON	2.30	4.00	3.00	0.80	2.30
EGYPT	4.00	4.10	1 45	0.30	2.10
NIGERIA	3.85	4.55	1.10	0.40	2.50
GABON	2.80	0.80	2.60	0.30	2.00
GUINEA	2.30	1.70	1.80	0.20	1.80
CAPE VERDE	1.10	1.00	2.45	1.80	1.80
LIBERIA	1.10	1.70	1.60	0.50	1.60
KENYA	3.00	4.25	1.10	0.30	2.00
MADAGASCAR	2.80	3.30	1.50	0.45	1.30
TANZANIA	4.55	4.45	1.70	0.30	2.00
UGANDA	3.80	4.20	1.40	0.10	1.50
MALAWI	2.30	4.40	1.50	0.20	1.70
ZAMBIA	2.06	4.04	1.35	0.20	2.10
CHAD	2.45	4.75	1.63	0.10	1.70
MALI	2.00	4.50	1.15	0.10	1.30
BENIN	1.44	4.16	1.20	0.20	1.90
TOGO	1.06	3.74	1.10	0.50	2.10
ZIMBABWE	1.06	4.14	1.70	1.40	2.40
LIBYA	0.60	3.40	0.80	0.40	1.80
COMOROS ISLANDS	0.40	4.00	1.30	0.10	1.30
EQUATORIAL GUINEA	0.23	4.17	1.35	0.20	1.20
SAO TOME & PRINCIPE	0.20	3.75	1.90	0.30	1.40
GUINEA-BISSAU	0.20	4.35	2.00	1.20	1.60
CENTRAL AFR. REP.	0.80	4.30	0.90	0.10	1.00
NIGER	0.38	4.02	0.30	0.10	1.30
BURKINA FASO	0.60	4.00	0.40	0.10	1.00
BURUNDI	0.80	4.00	1.15	0.10	1.00
SOMALIA	3.10	0.50	0.80	0.50	1.40
DJIBOUTI	0.24	0.56	0.45	0.10	0.90
ETHIOPIA	0.80	1.50	0.10	0.20	1.60
RWANDA	0.35	1.25	0.10	0.02	1.10
SUDAN	1.25	2.55	0.60	0.10	1.40
MEAN	2.1950	3.0633	1.8569	0.8952	1.8521
VARIANCE	2.0670	2.0270	1.2323	1.1805	0.2958
STANDARD DEVIATION	1.4377	1.4237	1.1101	1.0865	0.5439

TABLE 4.2 :LIST OF VALUES GIVEN TO THE VARIABLES FOR EACH COUNTRY

VARIABLES / COUNTRY	CONSUMPTION	INDUSTRIAL IMPUTS	FISH IMPORTS	FOREIGN INVOLVEMENT
	V5	V6	V12	V13
MOROCCO	2.40	3.90	1.25	2.50
TUNISIA	2.10	3.80	0.86	1.10
NAMIBIA	1.05	3.60	0.10	4.80
MAURITANIA	1.90	2.90	0.10	5.00
SENEGAL	2.25	3.00	3.74	2.70
ALGERIA	2.30	3.90	4.50	1.10
COTE D'IVOIRE	2.65	3.50	5.00	4.20
GHANA	2.80	3.40	3.25	3.00
ANGOLA	2.30	2.90	4.90	4.90
MOZAMBIQUE	1.90	2.30	2.70	4.00
SIERRA LEONE	2.10	2.30	1.82	3.80
SEYCHELLES	0.57	2.90	1.90	4.50
MAURITIUS	1.76	2.50	1.80	4.50
GAMBIA	1.75	2.80	1.90	2.80
ZAIRE	2.85	1.40	5.00	1.20
CONGO	3.20	1.60	3.80	1.00
CAMEROON	2.60	2.30	4.90	1.00
EGYPT	3.20	2.60	5.00	1.70
NIGERIA	4.20	2.70	5.00	2.00
GABON	2.20	1.75	2.00	1.50
GUINEA	1.75	1.40	2.10	2.00
CAPE VERDE	1.90	2.30	0.15	2.00
LIBERIA	1.90	1.80	2.60	1.40
KENYA	2.25	2.45	1.20	0.80
MADAGASCAR	2.00	1.80	0.10	1.20
TANZANIA	2.85	1.70	0.10	0.80
UGANDA	2.50	1.30	0.10	0.10
MALAWI	2.15	1.70	0.12	0.20
ZAMBIA	2.05	1.60	0.35	0.30
CHAD	2.30	1.10	0.10	0.10
MALI	1.90	1.00	0.45	0.10
BENIN	1.60	2.10	1.80	1.30
TOGO	1.80	2.00	3.50	1.30
ZIMBABWE	1.50	1.90	1.00	0.70
LIBYA	1.40	2.50	1.70	0.10
COMOROS ISLANDS	1.30	1.20	0.30	1.20
EQUATORIAL GUINEA	1.35	1.50	1.80	1.30
SAO TOME & PRINCIPE	2.38	1.30	0.18	1.30
GUINEA-BISSAU	0.90	1.40	0.15	1.50
CENTRAL AFR. REP.	1.30	0.90	0.45	0.10
NIGER	1.20	1.10	0.40	0.10
BURKINA FASO	1.50	1.00	1.80	0.10
BURUNDI	1.35	1.00	0.10	0.10
SOMALIA	1.60	1.80	0.10	1.80
DJIBOUTI	0.55	1.30	0.45	0.10
ETHIOPIA	2.50	1.80	0.20	0.10
RWANDA	1.15	1.10	0.15	0.10
SUDAN	1.85	1.40	0.20	0.10
MEAN	1.9763	2.0729	1.6910	1.6167
VARIANCE	0.4743	0.7112	2.8560	2.2431
STANDARD DEVIATION	0.6887	0.8434	1.6900	1.4977

1.3 SELECTION OF THE COUNTRIES

The previous typology covered 64 world developing countries whose annual catch was above 22500 tonnes per year . Here the decision was to cover the African continent only.
The exercise was applied to 48 countries excluding only 3 , which are Lesotho, Swaziland and Botswana. The production or potential of their fishery sector was not of sufficient importance.
Only one major fishing state in Africa was excluded from the study and was the Republic of South Africa which was not considered as a developing country.
The tables 1.2 list the countries and the values given to the variables according to the scale described in section.

SECTION 2 : METHODS APPLIED TO IDENTIFY THE GROUPS OF COUNTRIES

The aim was to find out , with all the data available , the commonalities and contrasts among all the FIS of countries included in the study.
Computer and statistical methods were used to identify clusters with well defined characteristics.

2.1 TREATMENT OF DATA .

The first step was to translate the variables into a specific scale .In the previous typology a scale from 1 to 5 was chosen. Here it was expanded by using decimals to two places and was started from 0. In this scale . 0 has to be read as a low value and 5 the high one .

Note that high does not necessarily mean good as high imports of fish are not necessarily bad if they are a way to feed a big population.
If it was decided to translate 5 as good , one could have found the decision very subjective in the case of variables like foreign involvement. Taking such a decision would have involved already interpreting the variable and this would have been at the expense of clarity and consistency of the figures.

By utilising this scale , it is possible to cope with the excessive weights of certain values . For example , countries with a very high potential would have been grouped together had the variable been expressed in metric tonnes per year . Such a variable would have had to much importance compare to the others.

There is the possibility to standardise the values , that is to change the scale by retrieving the mean of the values for each variable and dividing the result by the standard deviation .
You have then a normal distribution with a mean equal to 0 and a standard deviation of 1 . This operation does recast the variables in dimensionless units but it only partially removes the size displacements which affect the similarity between objects.

Table 1.2 gives the values of mean and standard deviation per component used to calculate the figures in tables 2.2.1.

2.2 RUNNING THE SAS COMPUTER PROGRAM.

SAS is the statistical computer program which gives the possibility to run the clusters analysis used in this typology.
For this typology job , many clustering methods were tried to help in the search for the meaningful variables to split the group of African countries into appropriate clusters.

The problem is that use of too many variables tends to hide specific characteristics of groups.

2.2.1 : MULTIVARIATE CLUSTER ANALYSES .

A multivariate analysis was used which shows the commonalities and constrasts among countries . There are different methods , more or less complex , and each technique has a different method of clustering .
Six different methods were tried , two of which are more frequently used . They are the Ward's minimum variance clustering analysis method and the Average linkage analysis.

Like the other methods , Ward's method follows a series of clustering steps that begin with n clusters , each containing one object and it ends with one cluster containing all objects (here all the countries) . At each step , it makes whichever merger of two clusters that will result in the smallest increase in the value of the variance .

The Average linkage method applies the same principe but defines the similarities between any two clusters as the average of the similarities between objects in one cluster and objects in the other .It works with the average euclidean distance coefficient.

More extreme , there are the single clustering analysis and the complete clustering analysis . The first one evaluates the similarities between clusters by taking the minimum euclidean distance coefficient . The second one mesures the similarities of the two most dissimilar objects and thus takes the maximum value of the euclidean distance coefficient to cluster countries.

Also used were the flexible analysis which gives similar results as the complete linkage analysis or Ward's method , and finally the median method . (All details about statistical formulas or the different methods can be found in ' Cluster Analysis for Researchers ' H. C. Romesburg and in the SAS User's guide).[1]

2.2.2 : testing the variables .

Use of clustering methods and component analysis

Initially the program was run with the 9 variables chosen in the previous typology .
It became clear , in the early stages of the analysis that the variable V8 (the degree of government ownership and control) was not helpful to the clustering proceedure . The V8 data were largely subjective and in any case, few African countries had high public ownership in the fishery sector .
However , removal of the variable did not remove the close linkage between the only two African States with high government ownership and control of FIS , namely Mozambique and Angola. So it was decided to exclude V8.

Some additional variables were then introduced to see what changes they would bring . V10 ,which is the variable of the size of the artisanal sector, was reckoned to be an important one.

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[1]cluster analysis for researchers, Romesburg. H.C.
Belmont.Calif.Lifetime Learning analysis 1984.
SAS user's Guide:Statistics,Version 5 Edition.
Cary,NC:SAS Institute Inc.,1985.

PRINCIPAL COMPONENT ANALYSIS

48 OBSERVATIONS
13 VARIABLES

SIMPLE STATISTICS

	V1A	V1B	V2	V3	V4	V5	V6
MEAN	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
ST DEV	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

	V7	V9	V10	V11	V12	V13
MEAN	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
ST DEV	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

CORRELATIONS

	V1A	V1B	V2	V3	V4	V5	V6
V1A	1.0000	-0.0099	0.5094	0.4385	0.5383	0.5802	0.5695
V1B	-0.0099	1.0000	-0.2514	-0.3594	0.0910	0.3265	-0.1231
V2	0.5094	-0.2514	1.0000	0.8713	0.6116	0.0598	0.6992
V3	0.4385	-0.3594	0.8713	1.0000	0.5039	-0.1294	0.7177
V4	0.5383	0.0910	0.6116	0.5039	1.0000	0.4833	0.8265
V5	0.5802	0.3265	0.0598	-0.1294	0.4833	1.0000	0.2612
V6	0.5695	-0.1231	0.6992	0.7177	0.8265	0.2612	1.0000
V7	0.6389	-0.2110	0.8322	0.7998	0.6324	0.1537	0.7167
V9	0.3689	-0.3196	0.7977	0.8758	0.3726	-0.1088	0.5738
V10	-0.2953	0.3535	-0.6304	-0.7809	-0.4050	0.2084	-0.6428
V11	0.2189	-0.1529	0.4267	0.3733	0.5094	0.0824	0.5344
V12	0.3531	0.0606	0.1916	0.0543	0.5045	0.5431	0.4327
V13	0.4946	-0.4721	0.8008	0.8147	0.5237	0.0357	0.6483

	V7	V9	V10	V11	V12	V13
V1A	0.6389	0.3689	-0.2953	0.2189	0.3531	0.4946
V1B	-0.2110	-0.3196	0.3535	-0.1529	0.0606	-0.4721
V2	0.8322	0.7977	-0.6304	0.4267	0.1916	0.8008
V3	0.7998	0.8758	-0.7809	0.3733	0.0543	0.8147
V4	0.6324	0.3726	-0.4050	0.5094	0.5045	0.5237
V5	0.1537	-0.1088	0.2084	0.0824	0.5431	0.0357
V6	0.7167	0.5738	-0.6428	0.5344	0.4327	0.6483
V7	1.0000	0.7241	-0.5708	0.3906	0.1706	0.8006
V9	0.7241	1.0000	-0.7244	0.2446	-0.0741	0.7008
V10	-0.5708	-0.7244	1.0000	-0.5309	0.0188	-0.5708
V11	0.3906	0.2446	-0.5309	1.0000	0.3630	0.3386
V12	0.1706	-0.0741	0.0188	0.3630	1.0000	0.3333
V13	0.8006	0.7008	-0.5708	0.3386	0.3333	1.0000

PRINCIPAL COMPONENT ANALYSIS

	EIGENVALUE	DIFFERENCE	PROPORTION	CUMULATIVE
PRIN1	6.64580	4.20113	0.511216	0.511216
PRIN2	2.44468	1.38204	0.188052	0.699268
PRIN3	1.06264	0.17531	0.081741	0.781009
PRIN4	0.88732	0.36761	0.068256	0.849265
PRIN5	0.51971	0.16099	0.039978	0.889242
PRIN6	0.35872	0.04119	0.027594	0.916836
PRIN7	0.31752	0.05140	0.024425	0.941261
PRIN8	0.26613	0.12041	0.020471	0.961732
PRIN9	0.14571	0.01832	0.011209	0.972941
PRIN10	0.12740	.	0.009800	0.982741

EIGENVECTORS

	PRIN1	PRIN2	PRIN3	PRIN4	PRIN5	PRIN6	PRIN7	PRIN8	PRIN9	PRIN10
V1A	0.247778	0.280676	0.364334	-.157109	-.544231	0.061816	0.188029	-.434711	0.271532	-.070016
V1B	-.118730	0.346393	0.238670	0.712039	0.297249	0.171594	0.319848	-.176935	-.133363	-.060589
V2	0.351221	-.071996	0.118579	0.040029	0.207610	0.317911	0.006917	0.227297	0.569151	-.335979
V3	0.349875	-.207838	0.098587	0.064214	0.123419	-.059880	0.118534	-.022757	0.164723	-.024480
V4	0.288172	0.309914	-.098527	0.203187	0.167848	-.206153	-.559196	0.092430	-.027932	-.316892
V5	0.064653	0.556690	0.210458	-.123782	-.279432	-.087131	0.009389	0.587311	-.204832	-.041013
V6	0.338212	0.139635	-.124562	0.141989	0.060541	-.454779	-.215689	-.239892	0.207752	0.464890
V7	0.346509	-.007640	0.220760	0.006576	0.004491	0.387518	-.252085	-.210556	-.440167	0.327217
V9	0.310338	-.248352	0.237704	0.106508	0.057376	-.090349	0.298228	0.482245	-.038409	0.427622
V10	-.293350	0.237286	0.204102	-.254513	0.305886	0.407237	-.330801	0.057062	0.315975	0.396067
V11	0.214712	0.084121	-.669900	0.214042	-.331491	0.502703	0.040227	0.112367	0.016520	0.128654
V12	0.126433	0.442189	-.345095	-.364291	0.402668	-.083311	0.473791	-.094917	0.034419	0.107556
V13	0.335576	-.082191	0.047424	-.362129	0.279813	0.146085	0.030361	-.121356	-.418330	-.291141

Also included was V11 which was the KW generated per capita . It gave an idea of the industrial infrastructure . Then, finaly , introduced were V12 and V13. V12 represented imports of fish to have a clearer idea of the role of the fish sector on the economic stability and the potential demand .
V13 indicated the degree of foreign involvement . This is important as it gives a measure of the foreign participation , which is in some countries very high .particularly in extraction.

These new variables raised the number to 12 . Clustering methods were applied at each step to see the change brought by each of the new variables .
This way to check the validity of variables could seem irrational . But the output was discussed by an expert who had to compare results to his knowledge of the countries 'fishery sector .

In addition , Principal component analysis and component cluster analysis were also run to see the usefulness of the new variables . These methods give clusters of variables and the proportion of variation explained by them as well as correlation coefficients.

Table 2.1 lists the coefficients of correlation between all the variables tried . A coefficient of correlation is a relative measure expressing the degree of linear association between two variables . If the coefficient r is above 0.7 or below -0.7 , than r squared is more than 0.5 . Then , more than 50% of the variance of one variable Y is explained by the linear association of both variables Y and X .

Note that a low coefficient does not mean that there is no association between the two variables. There could exist a non linear association.
Variables V2 , V3 , V7 and V13 are correlated to the other variables.
To choose one , V2 , which is extraction , this is correlated to variables like processing , government policy , exports , and foreign involvement .
Also, government policy is correlated to extraction , processing , industrial inputs , exports and foreign involvement . It may be reflected in all these variables in some way.

Other variable-reduction method

The problem of reducing a big amont of variables did not exist as there were already 9 variables chosen in the previous typologie and most of them were kept for the new one.
Some jobs will begin with so many variables that it is necessary to reduce their amount . The component analyses are then , at that stage , very helpful by indicating the most important variables for defining the FIS and reducing the number of variables.

Annexes 2 and 3 also show relations between variables . These methods are the oblique principal component analysis and the oblique centroid component cluster analysis . They give similar output to factor procedure output and can be used as a variable-reduction method . The first one gives a tree and shows how variables could be joined .
The second one clusters the variables and gives the proportion of the variance which is explained by these clusters. As many components will be derived as are necessary to account for the linear structure in the original variables. The first component will account for the greatest proportion of variance , the second component for the second largest proportion , etc.

Examples

On page 21 there are first 6 clusters .The steps with less clusters were not included here as they don't bring more information than the last results . In the clusters can be already seen the variables that give similar information .

Also page 22 gives the correlation between the clusters . For example, cluster 1 and 5 are correlated . As cluster 5 is including V10 . the artisanal sector, it seems that it could easily have been deleted .
On page 23 are given 7 clusters . Cluster 1 is full of variables giving the same information . Some have to be discarded and that was decided after running clustering methods without each of them.

The principal component analysis (table 2.1) also gives eigenvalues which indicate that 3 or 4 components provide a good summary of the data . accounting for 85% of the standardized variance . Subsequent components contribute less than 4% each. The first eigenvector shows a negative loading on the variable V10 (Artisanal sector) and the variable V1b (resource utilisation) . But no variable was given a high positive loading . The second has a high loading on consumption and the third one a high negative one on KW/capita. This is a way to give an interpretation to the components .
But this exercise was here not necessary as the components were chosen from the previous typology .

After running almost 50 options . the decision was to split V1 into its 2 variables . The average of both biases the meaning of the variable and the idea to split countries with high or low potential was interesting . The component analysis showed also that V1a and V1 were giving the same information . V1b was in fact hidden.

Table 1.1 lists all of the variables which were tried . both those which retained and those which were discarded for the final analysis.

2.3 THE FINAL OUTPUT.

2.3.1 CHOICE OF A DENDOGRAM

At this stage it was discovered that the average linkage analysis was the more interesting . The dendogram was clear and it also fitted well with current studies by fish industry experts . The Ward's was not as helpful as in the previous typology but it supported the clusters given by the Average method.

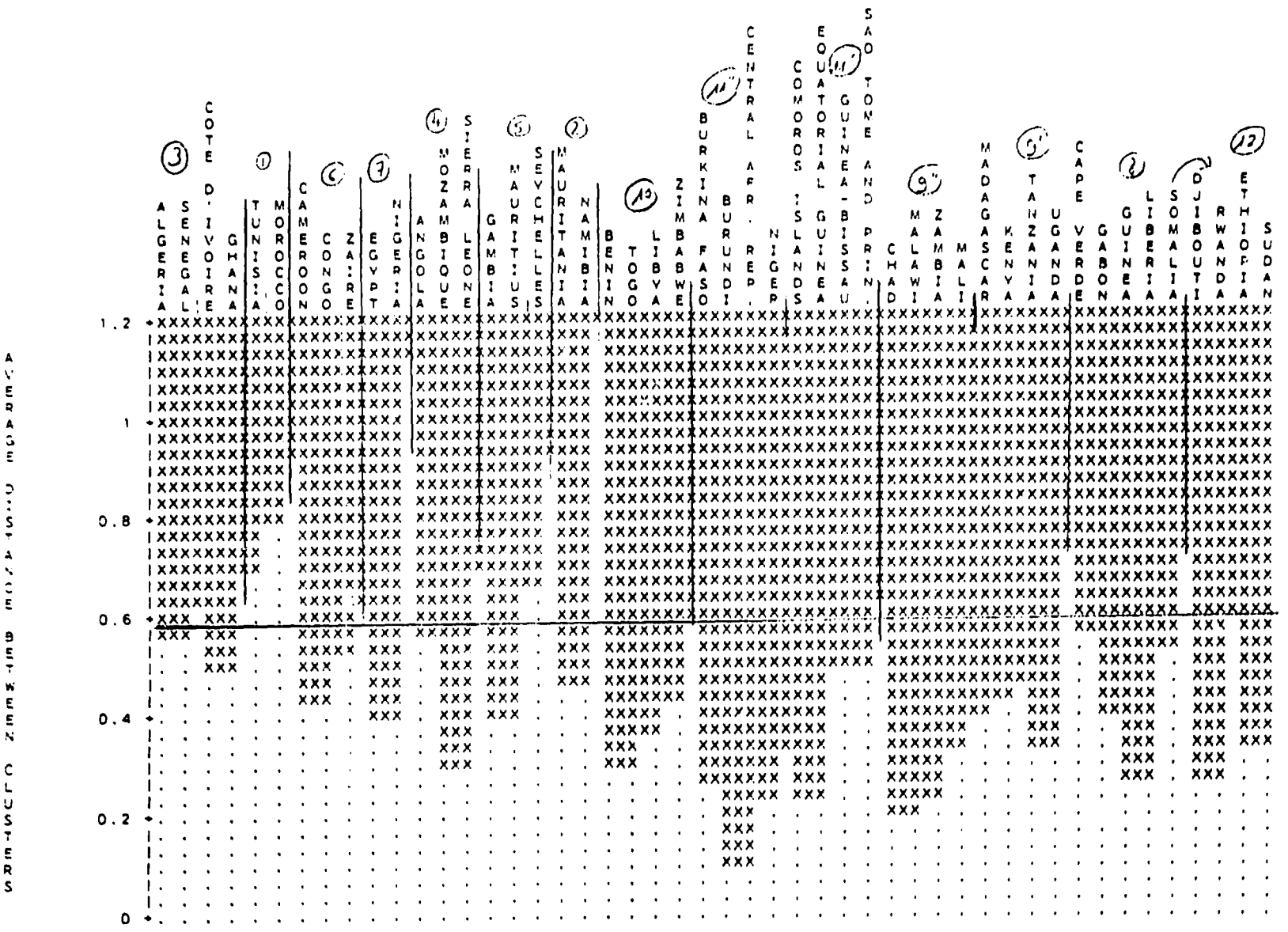
After running all 13 variables on this method . all options were tried . dropping one variable at each step .

Results less V9 , V7 and V9 , V9 and V11 ,V7 and V11 were good.
That means that the output , i.e the dendogram , was clear and gave well splitted clusters.
Also good were the results less V10, V7 and V11 or less V7 , V9 and V11 . It was finally concluded that the best result would be obtained by using all variables except V7 , V9 , V10 and V11 .
To return to the component analyses it was seen that V7 and V9 were in the same cluster with lots of other variables like extraction and processing , V10 was correlated to the cluster 1 and V11 was a cluster on its own . But it has finally too much weight and results were better without it .

Figure 1.3

AVERAGE LINKAGE CLUSTER ANALYSIS

NAME OF OBSERVATION OR CLUSTER



The dendogram . figure 2.2 . gives the best results of distinct clusters of countries .
The line determining the number of clusters is a subjective decision . The expert draws it at the level at which the number of clusters are chosen .If the line is drawn higher there would be less clusters but bigger ones . On the bottom . each country would appear in a separate cluster .

The choice of 14 clusters was decided after checking with other computer clustering methods .

Annexe 4 gives the output of the Ward's method which closely agrees with final clusters.
Annexe 5 and 6 give the output of complete and median methods . They are also interesting to compare with the final output of the linkage analysis .
Annexe 7 gives the list of the countries clustered by the computer which also supports the different clusters chosen on the base of statistical results and expert' knowledge of the sector .

2.3.2.CLUSTER PROFILES AND RESULTING DEVELOPMENT PATTERNS

Following the above approach 14 clusters were identified as possessing different characteristics. The next step was then to draw the cluster profiles to have a quick view of the major characteristics of each.These profiles (figures 2.1) were drawn from the standardised values in table 2.2.1.
The tables 2.2.1 and 2.2.2 were built from table 1.2. Any figure near zero indicates that for the countries in the group , the FIS component is close to the average of all 48 countries .
Table 2.2.3 shows in detail and per country those figures that give a more precise idea of each country's situation.

Finally these 14 clusters fall into 3 major developing groups which could be use for development strategies and possible actions for improvement of the sector.

Table 5-2-1 STANDARDISED VARIABLES

VARIABLES COUNTRY	RESOURCE MSY	RESOURCE UTILISATION	EXTRACTION	PROCESSING	DISTRIBUTION MARKETING
	V1a	V1b	V2	V3	V4
MOROCCO	1.9510	1.0793	1.7054	2.3974	1.7428
TUNISIA	0.1078	1.0442	0.4893	0.3726	1.5590
NAMIBIA	0.7338	-1.2736	2.8315	3.5018	0.6397
MAURITANIA	1.8119	-1.3088	2.5612	2.8575	0.4558
SENEGAL	1.3250	1.0091	1.0298	0.5566	0.2720
ALGERIA	0.6990	-0.3957	0.6694	0.2805	1.1912
COTE D'IVOIRE	0.2469	0.4823	0.6694	1.0168	2.4782
GHANA	1.7424	0.4472	0.7145	0.0964	2.4782
ANGOLA	1.6728	-1.3088	1.0298	1.2009	0.2720
MOZAMBIQUE	0.4208	-1.3790	0.2190	0.3726	-0.0358
SIERRA LEONE	1.3250	-1.3790	0.4893	1.0168	-0.2796
SEYCHELLES	-0.0313	-1.9760	1.5703	1.9372	0.2720
MAURITIUS	-0.3860	-1.1964	1.4802	0.8327	1.3751
GAMBIA	-0.7616	-0.1498	1.1199	0.5566	0.8235
ZAIRE	0.8381	0.6579	-0.7719	-0.7319	-0.2796
CONGO	-0.3443	-0.0445	0.3541	-0.6398	0.2720
CAMEROON	0.0730	0.6579	1.0298	-0.0876	0.8235
EGYPT	1.2555	0.7281	-0.3665	-0.5478	0.4558
NIGERIA	1.1511	1.0442	-0.6818	-0.4558	1.1912
GABON	0.4208	-1.5897	0.6694	-0.5478	0.2720
GUINEA	0.0730	-0.9576	-0.0512	-0.6398	-0.0958
CAPE VERDE	-0.7616	-1.4492	0.5343	0.8327	-0.0958
LIBERIA	-0.7616	-0.9576	-0.2314	-0.3637	-0.4635
KENYA	0.5599	0.8335	-0.6818	-0.5478	0.2720
MADAGASCAR	0.4208	0.1662	-0.3215	-0.4098	-1.0150
TANZANIA	1.6380	0.9740	-0.1413	-0.5478	0.2720
UGANDA	1.1164	0.7984	-0.4116	-0.7319	-0.6473
MALAWI	0.0730	0.9388	-0.3215	-0.6398	-0.2796
ZAMBIA	-0.0939	0.6860	-0.4566	-0.6398	0.4558
CHAD	0.1774	1.1847	-0.2044	-0.7319	-0.2796
MALI	-0.1356	1.0091	-0.6368	-0.7319	-1.0150
BENIN	-0.5251	0.7703	-0.5917	-0.6398	0.0881
TOGO	-0.7895	0.4753	-0.6818	-0.3637	0.4558
ZIMBABWE	-0.7895	0.7562	-0.1413	0.4646	1.0074
LIBYA	-1.1094	0.2365	-0.9521	-0.4558	-0.0958
COMOROS ISLANDS	-1.2485	0.6579	-0.5017	-0.7319	-1.0150
EQUATORIAL GUINEA	-1.3668	0.7773	-0.4566	-0.6398	-1.1989
SAO TOME & PRINCIPI	-1.3876	0.4823	0.0388	-0.5478	-0.8312
GUINEA-BISSAU	-1.3876	0.9037	0.1289	0.2805	-0.4635
CENTRAL AFR. REP.	-0.9703	0.8686	-0.8620	-0.7319	-1.5666
NIGER	-1.2624	0.6719	-1.4025	-0.7319	-1.0150
BURKINA FASO	-1.1094	0.6579	-1.3124	-0.7319	-1.5666
BURUNDI	-0.9703	0.6579	-0.6368	-0.7319	-1.5666
SOMALIA	0.6295	-1.8004	-0.9521	-0.3637	-0.8312
DJIBOUTI	-1.3598	-1.7583	-1.2674	-0.7319	-1.7505
ETHIOPIA	-0.9703	-1.0981	-1.5827	-0.6398	-0.4635
RWANDA	-1.2833	-1.2736	-1.5827	-0.8055	-1.3828
SUDAN	-0.6573	-0.3606	-1.1322	-0.7319	-0.8312

Table 5.2.1 STANDARDISED VARIABLES (2)

VARIABLES COUNTRY	CONSUMPTION V5	INDUSTRIAL IMPUTS V6	FISH IMPORTS V12	FOREIGN INVOLVEMENT V13
MOROCCO	0.6153	2.1664	-0.2610	0.5898
TUNISIA	0.1797	2.0479	-0.4918	-0.3450
NAMIBIA	-1.3449	1.8107	-0.9415	2.1255
MAURITANIA	-0.1107	0.9807	-0.9415	2.2590
SENEGAL	0.3975	1.0993	1.2124	0.7233
ALGERIA	0.4701	2.1664	1.6621	-0.3450
COTE D'IVOIRE	0.9783	1.6922	1.9580	1.7249
GHANA	1.1961	1.5736	0.9225	0.9236
ANGOLA	0.4701	0.9807	1.8988	2.1923
MOZAMBIQUE	-0.1107	0.2693	0.5970	1.5913
SIERRA LEONE	0.1797	0.2693	0.0763	1.4578
SEYCHELLES	-2.0419	0.9807	0.1236	1.9252
MAURITIUS	-0.3140	0.5064	0.0645	1.9252
GAMBIA	-0.3285	0.8621	0.1236	0.7901
ZAIRE	1.2687	-0.7979	1.9580	-0.2782
CONGO	1.7769	-0.5608	1.2479	-0.4117
CAMEROON	0.9057	0.2693	1.8988	-0.4117
EGYPT	1.7769	0.6250	1.9580	0.0556
NIGERIA	3.2289	0.7436	1.9580	0.2560
GABON	0.3249	-0.3829	0.1828	-0.0779
GUINEA	-0.3285	-0.7979	0.2420	0.2560
CAPE VERDE	-0.1107	0.2693	-0.9119	0.2560
LIBERIA	-0.1107	-0.3236	0.5379	-0.1447
KENYA	0.3975	0.4471	-0.2906	-0.5453
MADAGASCAR	0.0345	-0.3236	-0.9415	-0.2782
TANZANIA	1.2687	-0.4422	-0.9415	-0.5453
UGANDA	0.7605	-0.9165	-0.9415	-1.0127
MALAWI	0.2523	-0.4422	-0.9296	-0.9459
ZAMBIA	0.1071	-0.5608	-0.7935	-0.8791
CHAD	0.4701	-1.1536	-0.9415	-1.0127
MALI	-0.1107	-1.2722	-0.7344	-1.0127
BENIN	-0.5463	0.0321	0.0645	-0.2114
TOGO	-0.2559	-0.0865	1.0704	-0.2114
ZIMBABWE	-0.6915	-0.2050	-0.4089	-0.6121
LIBYA	-0.8367	0.5064	0.0053	-1.0127
COMOROS ISLANDS	-0.9819	-1.0351	-0.8231	-0.2782
EQUATORIAL GUINEA	-0.9093	-0.6793	0.0645	-0.2114
SAO TOME & PRINCIPE	0.5862	-0.9165	-0.8941	-0.2114
GUINEA-BISSAU	-1.5627	-0.7979	-0.9119	-0.0779
CENTRAL AFR. REP.	-0.9819	-1.3908	-0.7344	-1.0127
NIGER	-1.1271	-1.1536	-0.7639	-1.0127
BURKINA FASO	-0.6915	-1.2722	0.0645	-1.0127
BURUNDI	-0.9093	-1.2722	-0.9415	-1.0127
SOMALIA	-0.5463	-0.3236	-0.9415	0.1224
DJIBOUTI	-2.0709	-0.9165	-0.7344	-1.0127
ETHIOPIA	0.7605	-0.3236	-0.8823	-1.0127
RWANDA	-1.1997	-1.1536	-0.9119	-1.0127
SUDAN	-0.1833	-0.7979	-0.8823	-1.0127

Table 5.2-2 STANDARDISED VARIABLES BY CLUSTERS

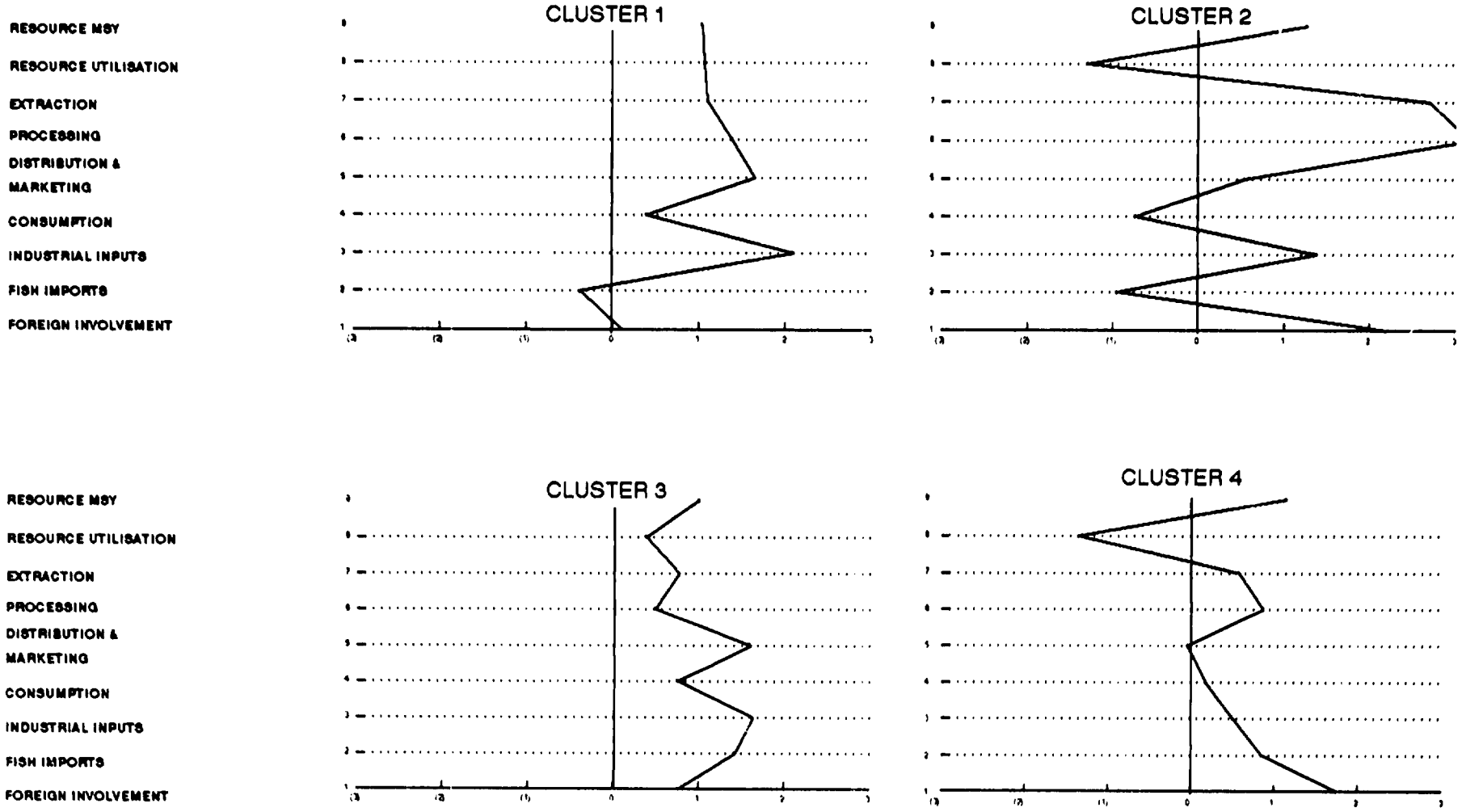
14 CLUSTERS	V1a	V1b	V2	V3	V4
CLUSTER 1	1.0294	1.0618	1.0973	1.3850	1.6509
CLUSTER 2	1.2729	–1.2912	2.6963	3.1797	0.5477
CLUSTER 3	1.0033	0.3857	0.7708	0.4876	1.6049
CLUSTER 4	1.1395	–1.3556	0.5794	0.8634	–0.0345
CLUSTER 5	–0.3930	–1.1074	1.3901	1.1088	0.8235
CLUSTER 6	0.1890	0.4238	0.2040	–0.4865	0.2720
CLUSTER 7	1.2033	0.8862	–0.5242	–0.5018	0.8235
CLUSTER 8	–0.2574	–1.2385	0.2303	–0.1797	–0.0958
CLUSTER 9'	0.9338	0.6930	–0.3891	–0.5593	–0.2796
CLUSTER 9''	0.0052	0.9546	–0.4048	–0.6859	–0.2796
CLUSTER 10	–0.8034	0.5596	–0.5917	–0.2487	0.3639
CLUSTER 11'	–1.3476	0.7053	–0.1976	–0.4098	–0.8772
CLUSTER 11''	–1.0781	0.7141	–1.0534	–0.7319	–1.4287
CLUSTER 12	–0.7282	–1.2582	–1.3034	–0.6546	–1.0518

	V5	V6	V12	V13
CLUSTER 1	0.3975	2.1072	–0.3764	0.1224
CLUSTER 2	–0.7278	1.3957	–0.9415	2.1923
CLUSTER 3	0.7605	1.6329	1.4388	0.7567
CLUSTER 4	0.1797	0.5064	0.8574	1.7471
CLUSTER 5	–0.8948	0.7831	0.1039	1.5468
CLUSTER 6	1.3171	–0.3631	1.7016	–0.3672
CLUSTER 7	2.5029	0.6843	1.9580	0.1558
CLUSTER 8	–0.0563	–0.3088	0.0127	0.0723
CLUSTER 9'	0.6153	–0.3088	–0.7787	–0.5954
CLUSTER 9''	0.1797	–0.8572	–0.8497	–0.9626
CLUSTER 10	–0.5826	0.0618	0.1828	–0.5119
CLUSTER 11'	–0.7169	–0.8572	–0.6412	–0.1947
CLUSTER 11''	–0.9275	–1.2722	–0.5938	–1.0127
CLUSTER 12	–0.6480	–0.7030	–0.8705	–0.7857

3 GROUPS	V1a	V1b	V2	V3	V4
GROUP A	0.8104	-0.4613	1.3068	1.4049	0.9185
GROUP B	0.2118	0.3798	-0.2459	-0.4436	0.1341
GROUP C	-1.0513	0.0537	-0.8515	-0.5987	-1.1192

	V5	V6	V12	V13
GROUP A	-0.0570	1.2850	0.2164	1.2731
GROUP B	0.6627	-0.1820	0.3711	-0.3682
GROUP C	-0.7641	-0.9441	-0.7018	-0.6644

figure 2.1 cluster profiles



RESOURCE MSY

RESOURCE UTILISATION

EXTRACTION

PROCESSING

DISTRIBUTION & MARKETING

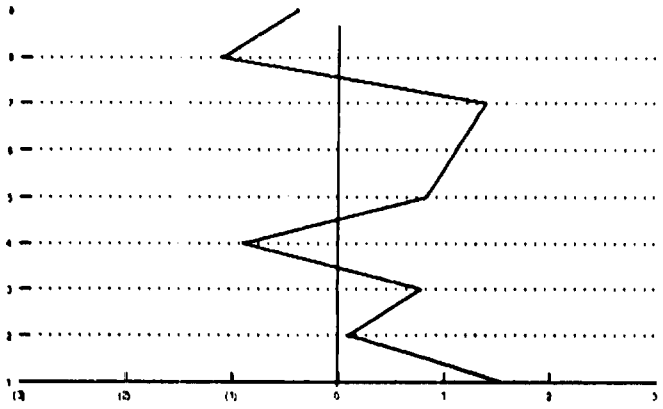
CONSUMPTION

INDUSTRIAL INPUTS

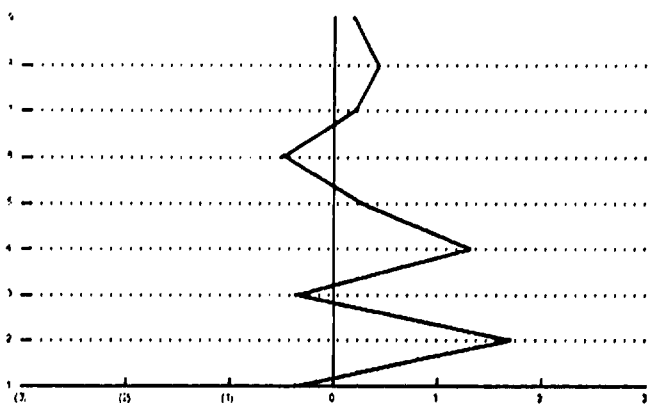
FISH IMPORTS

FOREIGN INVOLVEMENT

CLUSTER 5



CLUSTER 6



RESOURCE MSY

RESOURCE UTILISATION

EXTRACTION

PROCESSING

DISTRIBUTION & MARKETING

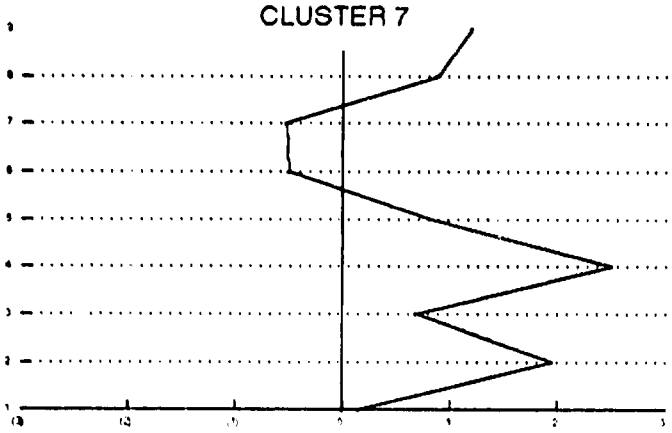
CONSUMPTION

INDUSTRIAL INPUTS

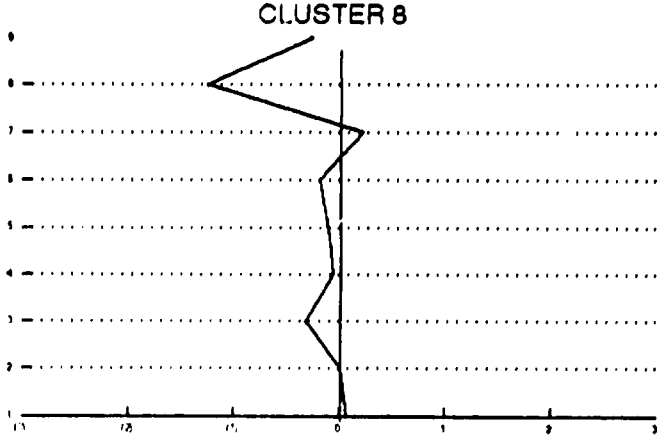
FISH IMPORTS

FOREIGN INVOLVEMENT

CLUSTER 7



CLUSTER 8



RESOURCE MSY

RESOURCE UTILISATION

EXTRACTION

PROCESSING

DISTRIBUTION & MARKETING

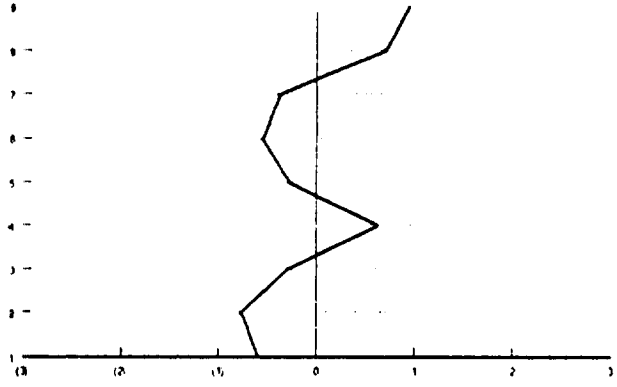
CONSUMPTION

INDUSTRIAL INPUTS

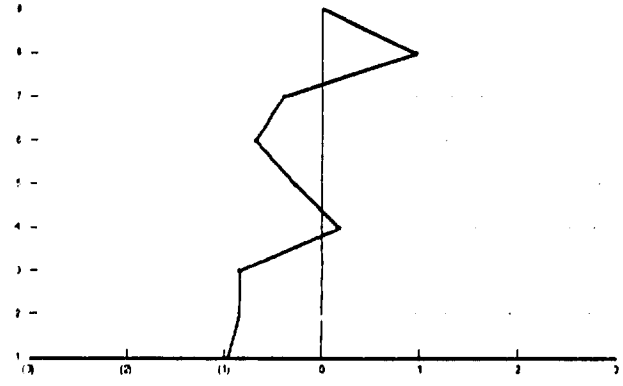
FISH IMPORTS

FOREIGN INVOLVEMENT

CLUSTER 9'



CLUSTER 9''



RESOURCE MSY

RESOURCE UTILISATION

EXTRACTION

PROCESSING

DISTRIBUTION & MARKETING

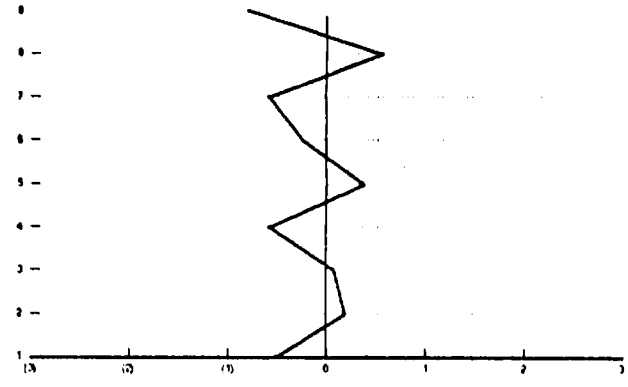
CONSUMPTION

INDUSTRIAL INPUTS

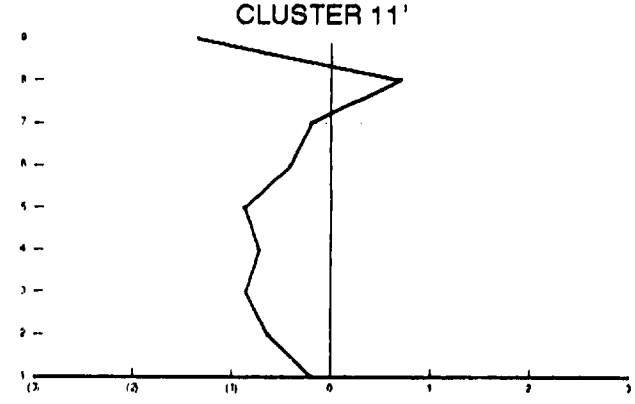
FISH IMPORTS

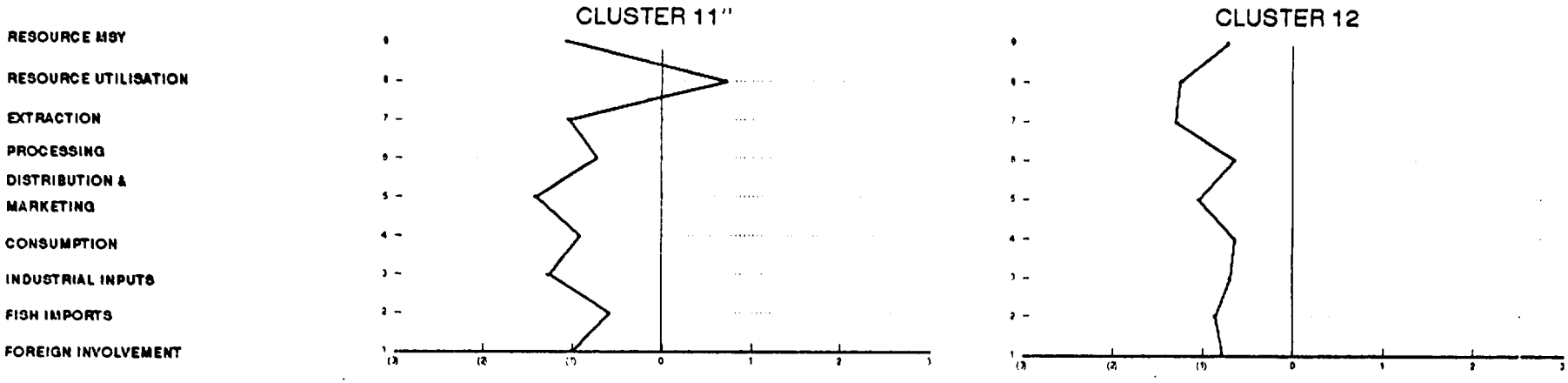
FOREIGN INVOLVEMENT

CLUSTER 10



CLUSTER 11'





note about the scale of X :

each component was scaled so that across the 48 countries
each has a variance of 1 and a mean of 0 .
so, a deviation from the mean greater than 1, is more than one standard deviation away from the average of the 48 countries .
thus all points above 1 or below -1 are exceptional in comparison with the whole sample .

Table 9.2.3

OBS	OBS	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11	VAR12
1	V2	0.66243	1.0190	-0.5855	-1.2987	-0.6301	1.01899	0.5287	-0.8530	-0.2022	-0.4964	0.35043	0.66243
2	V3	0.27758	1.1883	-0.6331	-0.7242	-0.7242	-0.08671	0.8240	-0.7242	-0.7242	-0.7242	-0.63315	1.00616
3	V4	1.17876	0.2691	0.0872	-1.5502	-1.5502	0.81490	-0.0948	-1.5502	-0.2767	-1.0044	0.26911	2.45229
4	V5	0.46516	0.4652	-0.5406	-0.6843	-0.8998	0.89620	-0.1096	-0.9716	0.4652	-0.9716	1.75827	0.96804
5	V13	-0.34136	2.1693	-0.2092	-1.0021	-1.0021	-0.40744	0.2533	-1.0021	-1.0021	-0.2753	-0.40744	1.70682
6	V6	2.14376	0.9704	0.0318	-1.2589	-1.2589	0.26644	0.2664	-1.3762	-1.1415	-1.0242	-0.55489	1.67443
7	V12	1.64474	1.8789	0.0638	0.0638	-0.9316	1.87895	-0.9023	-0.7267	-0.9316	-0.8145	1.23486	1.93750
8	V10	-0.31917	-0.7834	0.6093	0.7022	0.7022	0.14508	0.3308	0.8879	0.8879	0.6093	0.60932	-0.04062
9	V7	-0.11392	1.1360	-0.4264	-1.2076	-1.2076	0.35478	0.8235	-1.2076	-0.1139	-1.0513	-0.58263	0.97973
10	V11	1.09731	0.3312	-1.4006	-1.1213	-1.4006	0.27533	-0.8020	-0.8419	-1.4006	-0.4748	0.11572	0.35513
11	V9	-0.43555	-0.4355	-0.5125	-0.5125	-0.5125	-0.05089	1.0069	-0.5221	-0.5221	-0.4932	-0.38747	0.91076
12	V1A	0.69171	1.6553	-0.5196	-1.0978	-0.9601	0.07227	-0.7537	-0.9601	0.1755	-1.2354	-0.34069	0.24434

OBS	VAR13	VAR14	VAR15	VAR16	VAR17	VAR18	VAR19	VAR20	VAR21	VAR22	VAR23	VAR24
1	-1.2541	-0.36269	-0.4518	-1.5661	0.6624	1.10813	0.70700	-0.05070	0.1276	-0.67468	-0.22898	-0.9421
2	-0.7242	-0.54207	-0.6331	-0.6331	-0.5421	0.55080	0.09544	-0.63315	0.2776	-0.54207	-0.35993	-0.4510
3	-1.7321	0.45104	-1.1863	-0.4586	0.2691	0.81490	2.45229	-0.09476	-0.4586	0.26911	-0.45862	-0.0948
4	-2.0492	1.75827	-0.8998	0.7525	0.3215	-0.32507	1.18355	-0.32507	-1.5463	0.39332	-0.10956	-0.8279
5	-1.0021	0.05506	-0.2092	-1.0021	-0.0771	0.78184	0.91396	0.25327	-0.0771	-0.53958	-0.14313	-1.0021
6	-0.9069	0.61844	-0.6722	-0.3202	-0.3789	0.85311	1.55710	-0.78955	-0.7896	0.44244	-0.32022	0.5011
7	-0.7267	1.93750	0.0638	-0.8731	0.1809	0.12235	0.91282	0.23946	-0.9023	-0.28752	0.53222	0.0052
8	0.6093	0.42362	0.6093	0.6093	0.1451	-0.04062	0.14508	0.60932	0.6093	0.51647	0.42362	-2.6404
9	-1.2076	0.04231	-0.5826	-1.2076	-0.2702	0.35478	1.44843	-0.73886	-0.7389	0.04231	-0.73886	-0.7389
10	-0.5227	1.47239	-0.4030	-1.0814	1.4724	-0.12370	0.11572	-0.73021	-0.6823	-0.12370	1.07337	2.5099
11	-0.5221	-0.48363	-0.5125	-0.5221	-0.2913	1.05501	-0.00280	-0.49325	-0.4836	-0.43555	-0.49325	-0.5125
12	-1.3456	1.24232	-1.3524	-0.9601	0.4164	-0.75365	1.72411	0.07227	-1.3731	0.55406	-0.75365	-1.0978

OBS	VAR25	VAR26	VAR27	VAR28	VAR29	VAR30	VAR31	VAR32	VAR33	VAR34	VAR35	VAR36
1	-0.3181	-0.31812	-0.6301	2.5344	1.4647	1.6875	0.2167	2.8018	-1.3878	-0.67468	-1.5661	0.0384
2	-0.4055	-0.63315	-0.7242	2.8276	0.9240	2.3723	0.3687	3.4651	-0.7242	-0.45100	-0.7971	-0.5421
3	-1.0044	-0.27669	-1.0044	0.4510	1.3607	1.7246	-0.0948	0.6330	-1.0044	1.17876	-1.3683	-0.8225
4	0.0341	0.24964	-0.1096	-0.1096	-0.3107	0.6088	-0.1096	-1.3308	-1.1153	3.19506	-1.1871	0.5801
5	-0.2753	-0.93600	-1.0021	2.2354	1.9050	0.5836	1.5747	2.1032	-1.0021	0.25327	-1.0021	-0.2092
6	-0.3202	-0.43755	-1.2589	0.9704	0.5011	2.1438	0.2664	1.7918	-1.1415	0.73577	-1.1415	-0.9069
7	-0.9316	-0.91990	-0.7267	-0.9316	0.0638	-0.2582	0.5908	-0.9316	-0.7559	1.93750	-0.9023	-0.8848
8	0.6093	0.60932	0.6093	-3.1046	-0.7834	-1.5262	-0.7834	-3.1046	0.6093	0.60932	0.1451	0.6093
9	0.1985	0.82349	0.0423	1.7609	1.9171	2.0734	1.7609	2.3858	-0.8951	-0.42639	-1.5200	-0.7389
10	-0.2833	-0.36311	-1.1213	-0.3232	0.7542	0.4748	1.3128	1.7916	-1.2410	-0.12370	-1.0973	-0.3631
11	-0.2432	-0.48363	-0.4836	3.7957	0.9108	1.1993	0.3338	4.1804	-0.5125	-0.43555	-0.5221	-0.4932
12	0.4164	0.07227	-0.1342	1.7929	-0.3820	1.9306	0.4164	0.7261	-1.2492	1.13908	-1.2699	-1.3731

OBS	VAR37	VAR38	VAR39	VAR40	VAR41	VAR42	VAR43	VAR44	VAR45	VAR46	VAR47	VAR48
1	1.01899	1.5538	0.4841	-0.9421	-1.1204	-0.13984	-0.67468	0.4841	-0.4073	-0.76383	-0.45183	-0.13984
2	0.55080	1.9169	1.0062	-0.3599	-0.7242	-0.54207	-0.35993	0.3687	-0.7242	-0.72422	-0.63315	0.45973
3	0.26911	0.2691	-0.2767	-0.8225	-0.8225	0.26911	0.45104	1.5426	-0.6406	-0.27669	0.45104	0.99683
4	0.39332	-2.0205	0.1778	-0.5406	-0.1814	1.25539	-0.25323	0.1778	0.7525	1.25539	0.10596	-0.68427
5	0.71576	1.9050	1.4425	0.1211	-1.0021	-0.53958	-0.20922	-0.3414	-1.0021	-0.27529	-0.86993	-0.60565
6	1.08777	0.9704	0.2664	-0.3202	-0.7896	-0.43755	-0.08555	2.0264	-0.9069	-0.78955	-0.55489	-0.20289
7	1.19973	0.1224	0.0755	-0.9316	-0.8731	-0.93161	1.05920	-0.4866	-0.9316	1.93750	-0.78522	-0.40463
8	0.14508	-1.2477	0.1451	-0.7834	0.6093	0.79502	0.14508	-1.7119	0.6093	0.60932	0.60932	-0.78342
9	0.97973	0.9797	0.9797	-0.4264	-0.8951	0.35478	-0.27016	0.0423	-0.7389	-0.89510	0.04231	-0.58263
10	0.24340	1.5043	-0.4429	-1.4006	-0.1237	-0.47484	-0.05985	0.7542	-0.7621	0.21148	2.12679	1.29682
11	1.29543	0.5261	0.3338	-0.1471	-0.4355	-0.49325	-0.50286	0.3338	-0.5125	-0.51248	-0.48363	-0.48363
12	1.31115	-0.0310	1.3112	0.6229	-0.6504	1.62087	-0.78118	0.1067	1.1047	0.82936	-0.09292	-0.78118

OBS	OBS	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11	VAR12
13	V18	-0.39153	-1.2951	0.762209	0.651005	0.651005	0.651005	-1.4341	0.859512	1.17227	0.651005	-0.044018	0.477249

OBS	VAR13	VAR14	VAR15	VAR16	VAR17	VAR18	VAR19	VAR20	VAR21	VAR22	VAR23	VAR24
	-1.7399	0.720508	0.769159	-1.0866	-1.5731	-0.14827	0.442498	-0.94755	0.894264	0.824761	-0.94755	0.233991

OBS	VAR25	VAR26	VAR27	VAR28	VAR29	VAR30	VAR31	VAR32	VAR33	VAR34	VAR35	VAR36	VAR37
13	0.164489	0.929015	0.998517	-1.2951	-1.1839	1.06802	-1.3646	-1.2603	0.664906	1.03327	-1.2603	0.477249	0.998517

OBS	VAR38	VAR39	VAR40	VAR41	VAR42	VAR43	VAR44	VAR45	VAR46	VAR47	VAR48
13	-1.9553	-1.3646	-1.7816	-0.35678	0.963766	0.470299	1.03327	0.79001	0.651005	0.678806	0.748309

APPENDIX

Annexe 1

Table 3.1. The FIS characteristic variables (Previous typology)

Component	Variables	Description
Resource	1. Raw material	The maximum sustainable yield resource of extended economic zone (EEZ) and inland waters in thousands of metric tons per annum.
	2. Resource utilization	Per cent of resource extracted. Since this is across all species, over-exploitation of certain species cannot be ruled out.
Extraction	3. Extraction throughput	Quantity extracted, harvested or produced from EEZ and inland waters in thousands of metric tons per annum. This includes foreign catch only if landed.
	4. Artisanal share of extraction	Per cent of characteristic 3 that is caught or harvested by the artisanal sector.
Processing	5. Processed share of extraction	The percentage of the landed catch which is processed (either artisanally or commercially).
Distribution and marketing	6. Sophistication of distribution channels	An assessment of the sophistication of the methods of distribution used, e.g. road, rail, and the general level of distribution infrastructure. Also important is the flexibility and reliability of the distribution chain.
	7. Sophistication of marketing methods	An assessment of the complexity and flexibility of marketing methods. Also important is the efficiency of marketing procedures.
	8. Degree of intermediation	Meant to measure the organizational "distance" between the producer and consumer. In particular the number of middlemen typically involved.
Consumption	9. Per capita consumption	The per capita apparent domestic consumption per annum.

Table 3.1. The FIS characteristic variables (continued)

Component	Variables	Description
Industrial inputs	10. Storage and handling efficiency	An assessment of the level of on-board and quayside fish loss and reduction in fish quality.
	11. Processing sophistication	Describes the processing system. This attempts to capture the proportion of the processing capacity that is high level, i.e. freezing, canning, etc. The scale of operation and level of capital intensity is also considered.
	12. Extraction inputs	A measure of the local availability of intermediate and capital goods and spare parts for extraction. Pertains to spare parts for vessels, engines and fishing gear. Where applicable, quality and size is also considered.
	13. Processing inputs	A measure of the local availability of intermediate and capital goods and spare parts for processing. Pertains to the quality of packaging materials, availability of ice, etc.
	14. Extraction services	Quality of the workforce in extraction activities.
	15. Processing services	Quality of the workforce in processing activities. (Services are also affected by availability of intermediate/ capital goods and adequate infrastructure.)
	16. Extraction infrastructure	An assessment of the quality, size and number of ports as well as the availability of repair and maintenance facilities.
	17. Processing infrastructure	An assessment of the adequacy of infrastructure in major processing areas including the reliability of public utilities, etc.
Government policy	18. Priority given to FIS	A subjective assessment of the relative importance accorded to the FIS by the national government.
	19. Assistance provided	An assessment of the importance of incentives and assistance provided directly to those working within the FIS.

Table 3.1. The FIS characteristic variables (continued)

Component	Variables	Description
Ownership	20. Role of government	Primarily, the proportion of government ownership of the FIS components but the extent of government regulations and control is also considered.
Export orientation	21. Share of catch destined for foreign markets	That percentage of the catch (measured in fresh fish weight equivalent) which is exported regardless of product form.

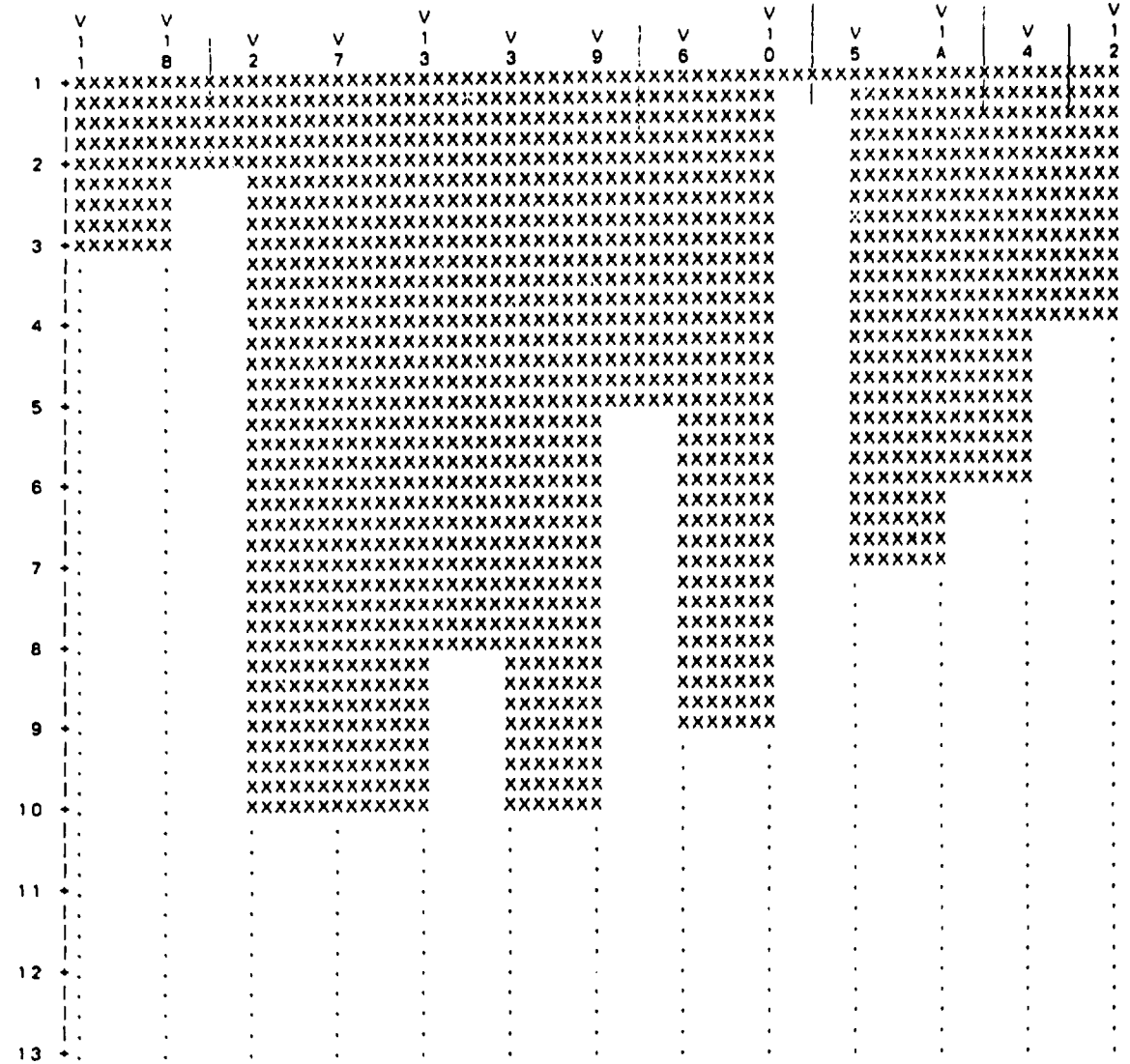
Note: Sources used in addition to FAO databanks, yearbooks and reports, include both a large number of country and sector-specific serials and pertinent reports reviewed and compiled by Agro-Economic Services Limited, England under contract to UNIDO, as well as UNIDO and FAO experts' assessments.

11/ Based on the common factor model employed in multivariate statistics, the first principal component obtained from a weighted principal components factor analysis was employed to extract from the set of 21 variables in table 3.1 a single common factor for each of the nine FIS components. Further details are given in Volume 2. See also Mulaik, S.A. (1972), The Foundations of Factor Analysis, New York, McGraw-Hill.

Annexe 2

OBLIQUE PRINCIPAL COMPONENT CLUSTERING

NAME OF VARIABLE OR CLUSTER



OBLIQUE PRINCIPAL COMPONENT CLUSTER ANALYSIS

48 OBSERVATIONS PROPORTION = 1.000000
13 VARIABLES MAXEIGEN = 0

NUMBER OF CLUSTERS	TOTAL VARIATION EXPLAINED BY CLUSTERS	PROPORTION OF VARIATION EXPLAINED BY CLUSTERS	MINIMUM PROPORTION EXPLAINED BY A CLUSTER	MAXIMUM SECOND EIGENVALUE IN A CLUSTER	MINIMUM R-SQUARED FOR A VARIABLE	MAXIMUM 1-R**2 RATIO FOR A VARIABLE
1	6.619233	0.5092	0.5092	2.389103	0.0315	.
2	8.217864	0.6321	0.6260	1.036214	0.1606	0.8593
3	8.985836	0.6912	0.5764	0.847132	0.5646	0.6416
4	9.832968	0.7564	0.6260	0.648406	0.5646	0.6100
5	10.397869	0.7998	0.6896	0.632417	0.5779	0.5997
6	10.981667	0.8447	0.6896	0.521810	0.6493	0.6569
7	11.493019	0.8841	0.7901	0.419787	0.7901	0.4687
8	11.912806	0.9164	0.8420	0.339915	0.7977	0.4687
9	12.201230	0.9386	0.8515	0.297042	0.8515	0.4687
10	12.498272	0.9614	0.8742	0.209738	0.8590	0.4589

Annexe 3

OBLIQUE CENTROID COMPONENT CLUSTER ANALYSIS

CLUSTER SUMMARY FOR 6 CLUSTERS

CLUSTER	MEMBERS	CLUSTER VARIATION	VARIATION EXPLAINED	PROPORTION EXPLAINED	SECOND EIGENVALUE
1	5	5.0000	4.2071	0.8414	
2	2	2.0000	1.7089	0.8544	
3	1	1.0000	1.0000	1.0000	
4	2	2.0000	1.5431	0.7715	
5	1	1.0000	1.0000	1.0000	
6	3	3.0000	2.2469	0.7490	

TOTAL VARIATION EXPLAINED = 11.7059 PROPORTION = 0.836139

		R-SQUARED WITH		
	VARIABLE	OWN CLUSTER	NEXT CLOSEST	1-R**2 RATIO
CLUSTER 1				
	V2	0.8798	0.4478	0.2177
	V3	0.9043	0.6097	0.2451
	V13	0.8057	0.3385	0.2937
	V7	0.8214	0.4490	0.3241
	V9	0.7985	0.5248	0.4240
CLUSTER 2				
	V1	0.8544	0.3564	0.2262
	V1A	0.8544	0.2854	0.2037
CLUSTER 3				
	V1B	1.0000	0.1250	0.0000
CLUSTER 4				
	V5	0.7715	0.3652	0.3599
	V12	0.7715	0.2508	0.3049
CLUSTER 5				
	V10	1.0000	0.5106	0.0000
CLUSTER 6				
	V4	0.8095	0.3324	0.2854
	V6	0.8269	0.5353	0.3725
	V11	0.6197	0.2819	0.5296

STANDARDIZED SCORING COEFFICIENTS

CLUSTER	1	2	3	4	5	6
V1	0.00000	0.54092	0.00000	0.00000	0.00000	0.00000
V2	0.21803	0.00000	0.00000	0.00000	0.00000	0.00000
V3	0.21803	0.00000	0.00000	0.00000	0.00000	0.00000
V4	0.00000	0.00000	0.00000	0.00000	0.00000	0.38517
V5	0.00000	0.00000	0.00000	0.56923	0.00000	0.00000
V13	0.21803	0.00000	0.00000	0.00000	0.00000	0.00000
V6	0.00000	0.00000	0.00000	0.00000	0.00000	0.38517
V7	0.21803	0.00000	0.00000	0.00000	0.00000	0.00000
V9	0.21803	0.00000	0.00000	0.00000	0.00000	0.00000
V10	0.00000	0.00000	0.00000	0.00000	1.00000	0.00000
V11	0.00000	0.00000	0.00000	0.00000	0.00000	0.38517
V12	0.00000	0.00000	0.00000	0.56923	0.00000	0.00000
V1A	0.00000	0.54092	0.00000	0.00000	0.00000	0.00000
V1B	0.00000	0.00000	1.00000	0.00000	0.00000	0.00000

OBLIQUE CENTROID COMPONENT CLUSTER ANALYSIS

CLUSTER STRUCTURE

CLUSTER	1	2	3	4	5	6
V1	0.30053	0.92435	0.59701	0.43809	-0.14220	0.39519
V2	0.93798	0.45198	-0.25140	0.14309	-0.63042	0.66922
V3	0.95097	0.36901	-0.35939	-0.04275	-0.78085	0.61431
V4	0.57653	0.54107	0.09101	0.56227	-0.40503	0.69971
V5	0.00239	0.60431	0.32651	0.87838	0.20839	0.31849
V13	0.89761	0.33710	-0.47211	0.21002	-0.57084	0.58184
V6	0.73167	0.52859	-0.12307	0.39497	-0.64283	0.90935
V7	0.90631	0.57184	-0.21095	0.18460	-0.57078	0.67007
V9	0.89359	0.34109	-0.31958	-0.10410	-0.72444	0.45875
V10	-0.71457	-0.23664	0.35349	0.12931	1.00000	-0.60810
V11	0.38673	0.20303	-0.15287	0.25355	-0.53091	0.78720
V12	0.14732	0.31684	0.06064	0.87838	0.01877	0.50079
V1A	0.53425	0.92435	-0.00985	0.53128	-0.29529	0.51104
V18	-0.35178	0.31760	1.00000	0.22038	0.35349	-0.07123

INTER-CLUSTER CORRELATIONS

CLUSTER	1	2	3	4	5	6
1	1.00000	0.45155	-0.35178	0.08522	-0.71457	0.65283
2	0.45155	1.00000	0.31760	0.52435	-0.23664	0.49020
3	-0.35178	0.31760	1.00000	0.22038	0.35349	-0.07123
4	0.08522	0.52435	0.22038	1.00000	0.12931	0.46636
5	-0.71457	-0.23664	0.35349	0.12931	1.00000	-0.60810
6	0.65283	0.49020	-0.07123	0.46636	-0.60810	1.00000

CLUSTER 6 WILL BE SPLIT

OBLIQUE CENTROID COMPONENT CLUSTER ANALYSIS

CLUSTER SUMMARY FOR 7 CLUSTERS

CLUSTER	MEMBERS	CLUSTER VARIATION	VARIATION EXPLAINED	PROPORTION EXPLAINED	SECOND EIGENVALUE
1	5	5.0000	4.2071	0.8414	
2	2	2.0000	1.7089	0.8544	
3	1	1.0000	1.0000	1.0000	
4	2	2.0000	1.5431	0.7715	
5	1	1.0000	1.0000	1.0000	
6	2	2.0000	1.8265	0.9133	
7	1	1.0000	1.0000	1.0000	

TOTAL VARIATION EXPLAINED = 12.2856 PROPORTION = 0.877542

		R-SQUARED WITH		
	VARIABLE	OWN CLUSTER	NEXT CLOSEST	1-R**2 RATIO
CLUSTER 1				
	V2	0.8798	0.4703	0.2269
	V3	0.9043	0.6097	0.2451
	V13	0.8057	0.3761	0.3114
	V7	0.8214	0.4983	0.3560
	V9	0.7985	0.5248	0.4240
CLUSTER 2				
	V1	0.8544	0.3564	0.2262
	V1A	0.8544	0.3360	0.2192
CLUSTER 3				
	V18	1.0000	0.1250	0.0000
CLUSTER 4				
	V5	0.7715	0.3652	0.3599
	V12	0.7715	0.2404	0.3008
CLUSTER 5				
	V10	1.0000	0.5106	0.0000
CLUSTER 6				
	V4	0.9133	0.3324	0.1299
	V6	0.9133	0.5353	0.1867
CLUSTER 7				
	V11	1.0000	0.2982	0.0000

OBLIQUE CENTROID COMPONENT CLUSTER ANALYSIS

STANDARDIZED SCORING COEFFICIENTS

CLUSTER	1	2	3	4	5	6	7
V1	0.00000	0.54092	0.00000	0.00000	0.00000	0.00000	0.00000
V2	0.21803	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
V3	0.21803	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
V4	0.00000	0.00000	0.00000	0.00000	0.00000	0.52321	0.00000
V5	0.00000	0.00000	0.00000	0.56923	0.00000	0.00000	0.00000
V13	0.21803	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
V6	0.00000	0.00000	0.00000	0.00000	0.00000	0.52321	0.00000
V7	0.21803	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
V9	0.21803	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
V10	0.00000	0.00000	0.00000	0.00000	1.00000	0.00000	0.00000
V11	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
V12	0.00000	0.00000	0.00000	0.56923	0.00000	0.00000	0.00000
V1A	0.00000	0.54092	0.00000	0.00000	0.00000	0.00000	0.00000
V1B	0.00000	0.00000	1.00000	0.00000	0.00000	0.00000	0.00000

CLUSTER STRUCTURE

CLUSTER	1	2	3	4	5	6	7
V1	0.30053	0.92435	0.59701	0.43809	-0.14220	0.45499	0.15642
V2	0.93798	0.45108	-0.25140	0.14309	-0.63042	0.68581	0.42668
V3	0.95097	0.36901	-0.35939	-0.04275	-0.78085	0.63916	0.37330
V4	0.57653	0.54107	0.09101	0.56227	-0.40503	0.95564	0.50938
V5	0.00239	0.60431	0.32651	0.87838	0.20839	0.38952	0.08239
V13	0.89761	0.33710	-0.47211	0.21002	-0.57084	0.61323	0.33855
V6	0.73167	0.52859	-0.12307	0.39497	-0.64283	0.95564	0.53440
V7	0.90631	0.57184	-0.21095	0.18460	-0.57078	0.70587	0.39056
V9	0.89359	0.34109	-0.31958	-0.10410	-0.72444	0.49517	0.24463
V10	-0.71457	-0.23664	0.35349	0.12931	1.00000	-0.54825	-0.53091
V11	0.38673	0.20303	-0.15287	0.25355	-0.53091	0.54611	1.00000
V12	0.14732	0.31684	0.06064	0.87838	0.01877	0.49032	0.36304
V1A	0.53425	0.92435	-0.00985	0.53128	-0.29529	0.57965	0.21892
V1B	-0.35178	0.31760	1.00000	0.22038	0.35349	-0.01678	-0.15287

INTER-CLUSTER CORRELATIONS

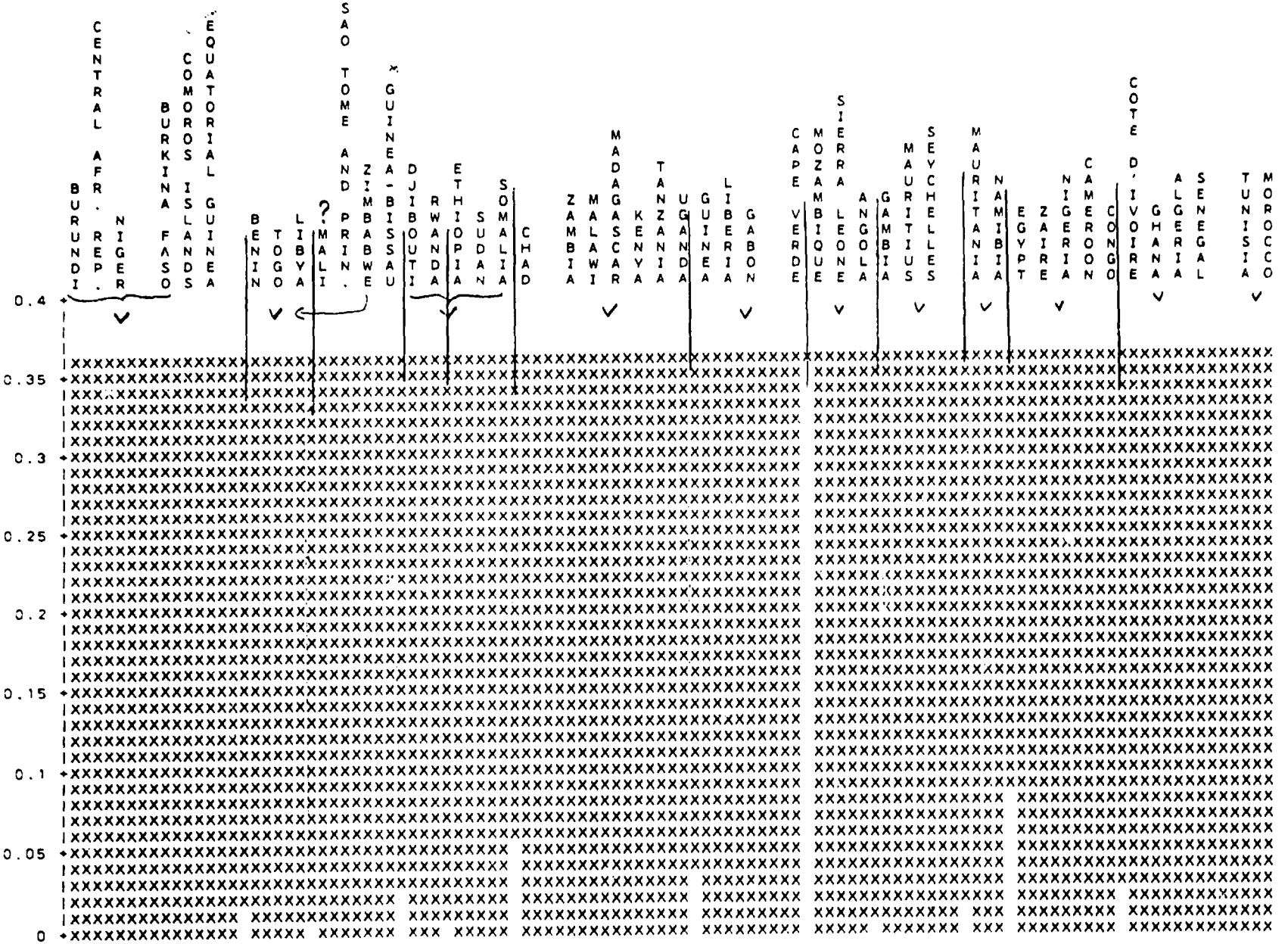
CLUSTER	1	2	3	4	5	6	7
1	1.00000	0.45155	-0.35178	0.08522	-0.71457	0.68446	0.38673
2	0.45155	1.00000	0.31760	0.52435	-0.23664	0.55965	0.20303
3	-0.35178	0.31760	1.00000	0.22038	0.35349	-0.01678	-0.15287
4	0.08522	0.52435	0.22038	1.00000	0.12931	0.50084	0.25355
5	-0.71457	-0.23664	0.35349	0.12931	1.00000	-0.54825	-0.53091
6	0.68446	0.55965	-0.01678	0.50084	-0.54825	1.00000	0.54611
7	0.38673	0.20303	-0.15287	0.25355	-0.53091	0.54611	1.00000

NO CLUSTER MEETS THE CRITERION FOR SPLITTING

Annexe 4

WARD'S MINIMUM VARIANCE CLUSTER ANALYSIS

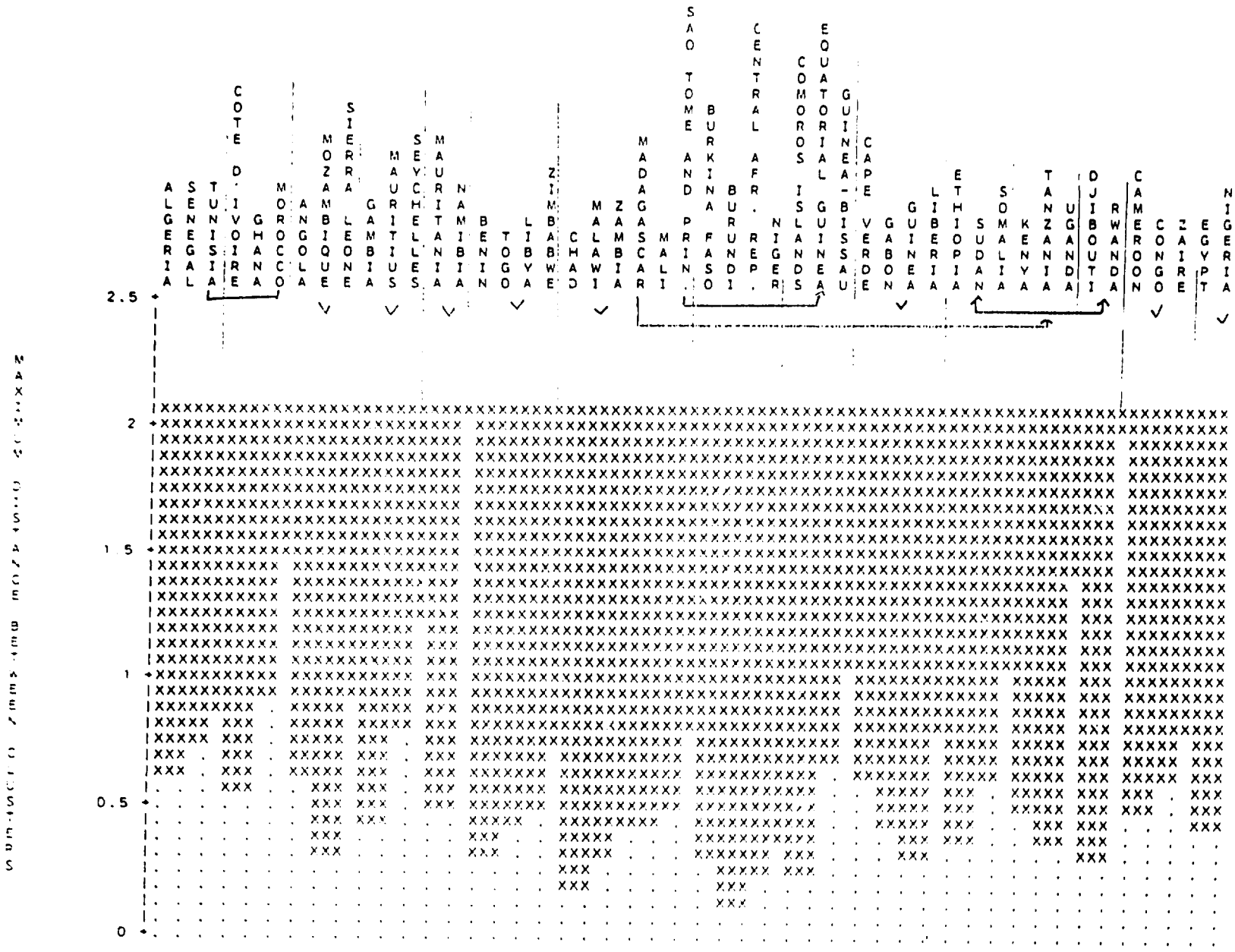
COUNTRY



Annexe 5.

COMPLETE LINKAGE CLUSTER ANALYSIS

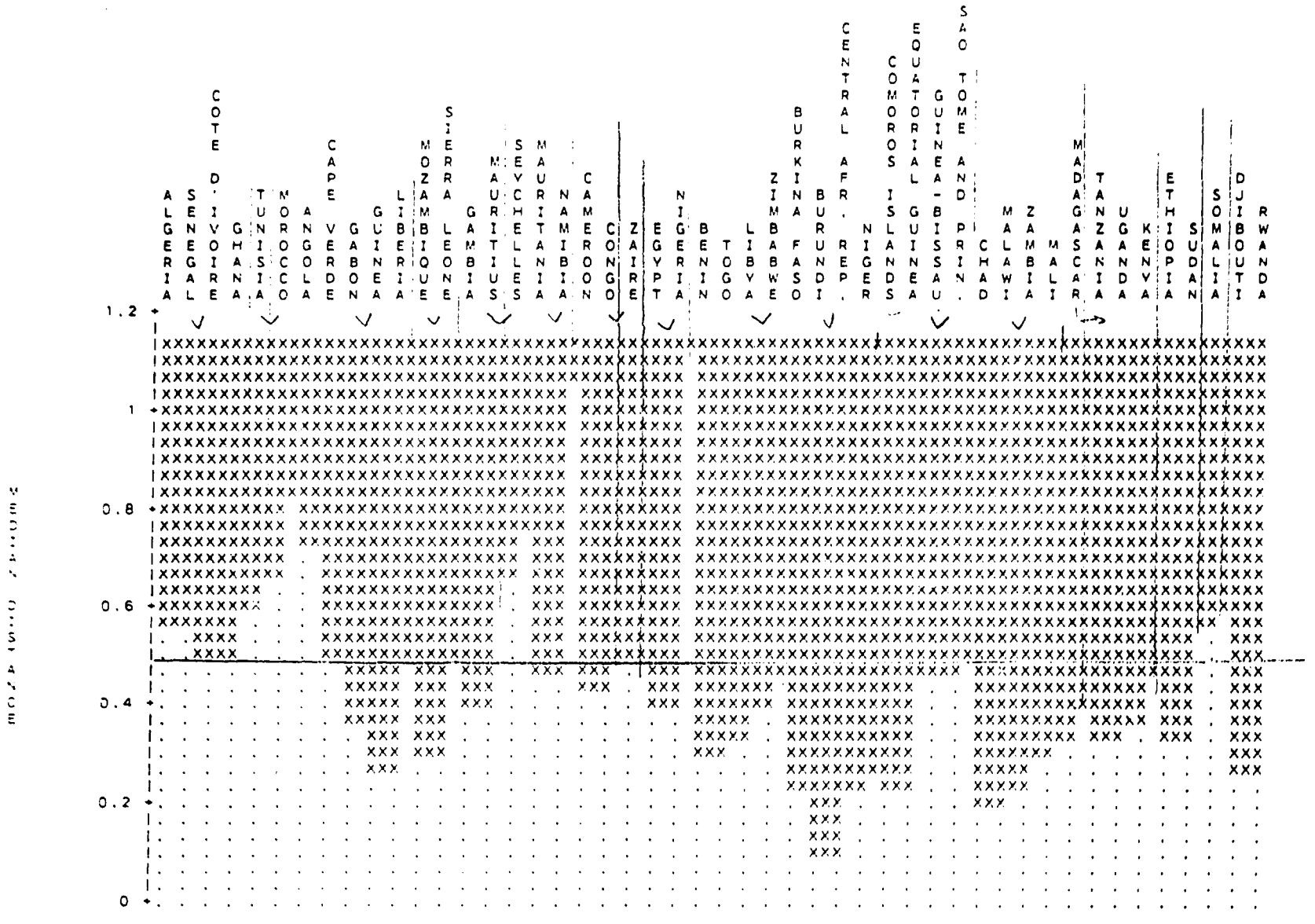
NAME OF OBSERVATION OR CLUSTER



Annexe 6

MEDIAN HIERARCHICAL CLUSTER ANALYSIS

NAME OF OBSERVATION OR CLUSTER



Annexe -7-

CLUSTER=1

COUNTRY	V2	V3	V4	V5	V6
BURUNDI	-0.6301	-0.72422	-1.5502	-0.8998	-1.2589
CENTRAL AFR. REP.	-0.8530	-0.72422	-1.5502	-0.9716	-1.3762
NIGER	-1.3878	-0.72422	-1.0044	-1.1153	-1.1415
COMOROS ISLANDS	-0.4964	-0.72422	-1.0044	-0.9716	-1.0242
EQUATORIAL GUINEA	-0.4518	-0.63315	-1.1863	-0.8998	-0.6722
BURKINA FASO	-1.2987	-0.72422	-1.5502	-0.6843	-1.2589
BENIN	-0.5855	-0.63315	0.0872	-0.5406	0.0318
TOGO	-0.6747	-0.35993	0.4510	-0.2532	-0.0856
LIBYA	-0.9421	-0.45100	-0.0948	-0.8279	0.5011
ZIMBABWE	-0.1398	0.45973	0.9968	-0.6843	-0.2029
GUINEA-BISSAU	0.1276	0.27758	-0.4586	-1.5463	-0.7896
SAO TOME AND PRIN.	0.0384	-0.54207	-0.8225	0.5801	-0.9069

COUNTRY	V12	V13	V1A	V1B
BURUNDI	-0.93161	-1.0021	-0.9601	0.651005
CENTRAL AFR. REP.	-0.72667	-1.0021	-0.9601	0.859512
NIGER	-0.75595	-1.0021	-1.2492	0.664906
COMOROS ISLANDS	-0.81450	-0.2753	-1.2354	0.651005
EQUATORIAL GUINEA	0.06380	-0.2092	-1.3524	0.769159
BURKINA FASO	0.06380	-1.0021	-1.0978	0.651005
BENIN	0.06380	-0.2092	-0.5196	0.762209
TOGO	1.05920	-0.2092	-0.7812	0.470299
LIBYA	0.00525	-1.0021	-1.0978	0.233991
ZIMBABWE	-0.40463	-0.6056	-0.7812	0.748309
GUINEA-BISSAU	-0.90233	-0.0771	-1.3731	0.894264
SAO TOME AND PRIN.	-0.88476	-0.2092	-1.3731	0.477249

CLUSTER=2

COUNTRY	V2	V3	V4	V5	V6
CHAD	-0.20224	-0.72422	-0.2767	0.46516	-1.1415
MALAWI	-0.31812	-0.63315	-0.2767	0.24964	-0.4376
ZAMBIA	-0.45183	-0.63315	0.4510	0.10596	-0.5549
MALI	-0.63011	-0.72422	-1.0044	-0.10956	-1.2589
TANZANIA	-0.13984	-0.54207	0.2691	1.25539	-0.4376
UGANDA	-0.40726	-0.72422	-0.6406	0.75252	-0.9069
MADAGASCAR	-0.31812	-0.40546	-1.0044	0.03412	-0.3202
KENYA	-0.67468	-0.54207	0.2691	0.39332	0.4424

COUNTRY	V12	V13	V1A	V1B
CHAD	-0.93161	-1.0021	0.17551	1.17227
MALAWI	-0.91990	-0.9360	0.07227	0.92901
ZAMBIA	-0.78522	-0.8699	-0.09292	0.67781
MALI	-0.72667	-1.0021	-0.13421	0.99852
TANZANIA	-0.93161	-0.5396	1.62087	0.96377
UGANDA	-0.93161	-1.0021	1.10467	0.79001
MADAGASCAR	-0.93161	-0.2753	0.41640	0.16449
KENYA	-0.28752	-0.5396	0.55406	0.82476

CLUSTER=3

COUNTRY	V2	V3	V4	V5	V6
Somalie					
DJIBOUTI	-1.2541	-0.72422	-1.7321	-2.0492	-0.9069
RWANDA	-1.5661	-0.79708	-1.3683	-1.1871	-1.1415
ETHIOPIA	-1.5661	-0.63315	-0.4586	0.7525	-0.3202
SUDAN	-1.1204	-0.72422	-0.8225	-0.1814	-0.7896

COUNTRY	V12	V13	V1A	V1B
DJIBOUTI	-0.72667	-1.0021	-1.3456	-1.7399
RWANDA	-0.90233	-1.0021	-1.2699	-1.2603
ETHIOPIA	-0.87305	-1.0021	-0.9601	-1.0866
SUDAN	-0.87305	-1.0021	-0.6504	-0.3568

CLUSTER=4

COUNTRY	V2	V3	V4	V5	V6
GUINEA	-0.05070	-0.63315	-0.09476	-0.32507	-0.78955
LIBERIA	-0.22898	-0.35993	-0.45862	-0.10956	-0.32022
GABON	0.66243	-0.54207	0.26911	0.32148	-0.37889
~~Somalie~~	-0.94211	-0.35993	-0.82248	-0.54059	-0.32022
CAPE VERDE	0.52872	0.82402	-0.09476	-0.10956	0.26644

COUNTRY	V12	V13	V1A	V1B
GUINEA	0.23946	0.25327	0.07227	-0.9475
LIBERIA	0.53222	-0.14315	-0.75365	-0.9475
GABON	0.18091	-0.07708	0.41640	-1.5731
SOMALIA	-0.93161	0.12113	0.62288	-1.7816
CAPE VERDE	-0.90233	0.25327	-0.75365	-1.4341

CLUSTER=5

COUNTRY	V2	V3	V4	V5	V6
MOZAMBIQUE	0.21672	0.36865	-0.09476	-0.10956	0.266443
SIERRA LEONE	0.48415	1.00616	-0.27669	0.17780	0.266443
ANGOLA	1.01899	1.18831	0.26911	0.46516	0.970438

COUNTRY	V12	V13	V1A	V1B
MOZAMBIQUE	0.59078	1.57468	0.41640	-1.3646
SIERRA LEONE	0.07551	1.44254	1.31115	-1.3646
ANGOLA	1.87895	2.16932	1.65528	-1.2951

CLUSTER=6

COUNTRY	V2	V3	V4	V5	V6
EGYPT	-0.36269	-0.54207	0.45104	1.75827	0.618440
NIGERIA	-0.67468	-0.45100	1.17876	3.19506	0.735773

COUNTRY	V12	V13	V1A	V1B
EGYPT	1.93750	0.055059	1.24232	0.72051
NIGERIA	1.93750	0.253271	1.13908	1.03327

CLUSTER=7

	COUNTRY	V2	V3	V4	V5	V6
	Seychelles					
5	GAMBIA	1.10813	0.550800	0.81490	-0.32507	0.853105
	MAURITIUS	1.46469	0.824019	1.36070	-0.31071	0.501108

COUNTRY	V12	V13	V1A	V1B
GAMBIA	0.122352	0.78184	-0.75365	-0.1483
MAURITIUS	0.063799	1.90504	-0.38199	-1.1839

CLUSTER=8

	COUNTRY	V2	V3	V4	V5	V6
6	CAMEROON	1.01899	-0.08671	0.81490	0.89620	0.26644
	CONGO	0.35043	-0.63315	0.26911	1.75827	-0.55489
	ZAIRE	-0.76383	-0.72422	-0.27669	1.25539	-0.78955

COUNTRY	V12	V13	V1A	V1B
CAMEROON	1.87895	-0.40744	0.07227	0.651005
CONGO	1.23486	-0.40744	-0.34069	-0.044018
ZAIRE	1.93750	-0.27529	0.82936	0.651005

CLUSTER=9

	COUNTRY	V2	V3	V4	V5	V6
2	MAURITANIA	2.53438	2.82762	0.451039	-0.1096	0.97044
	NAMIBIA	2.80181	3.46513	0.632970	-1.3308	1.79177

COUNTRY	V12	V13	V1A	V1B
MAURITANIA	-0.93161	2.23539	1.79294	-1.2951
NAMIBIA	-0.93161	2.10325	0.72612	-1.2603

CLUSTER=10

	COUNTRY	V2	V3	V4	V5	V6
3	COTE D'IVOIRE	0.662428	1.00616	2.45229	0.96804	1.67443
	GHANA	0.706998	0.09544	2.45229	1.18355	1.55710

COUNTRY	V12	V13	V1A	V1B
COTE D'IVOIRE	1.93750	1.70682	0.24434	0.477249
GHANA	0.91282	0.91398	1.72411	0.442498

CLUSTER=11

COUNTRY	V2	V3	V4	V5	V6
ALGERIA	0.66243	0.277582	1.17876	0.465160	2.14376
SENEGAL	1.01899	0.550800	0.26911	0.393321	1.08777

COUNTRY	V12	V13	V1A	V1B
ALGERIA	1.64474	-0.34136	0.69171	-0.39153
SENEGAL	1.19973	0.71576	1.31115	0.99852

CLUSTER=12

COUNTRY	V2	V3	V4	V5	V6
SEYCHELLES	1.55384	1.91689	0.269107	-2.0205	0.970438

COUNTRY	V12	V13	V1A	V1B
SEYCHELLES	0.122352	1.90504	-0.030972	-1.9553

CLUSTER=13

COUNTRY	V2	V3	V4	V5	V6
TUNISIA	0.484146	0.368655	1.54263	0.177803	2.02643

COUNTRY	V12	V13	V1A	V1B
TUNISIA	-0.48660	-0.34136	0.106682	1.03327

CLUSTER=14

COUNTRY	V2	V3	V4	V5	V6
MOROCCO	1.68755	2.37226	1.72456	0.608839	2.14376

COUNTRY	V12	V13	V1A	V1B
MOROCCO	-0.25824	0.583624	1.93059	1.06802