OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

18057

Distr.
LIMITED

PPD.197
30 April 1991

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

ORIGINAL: ENGLISH

ALLOCATING TECHNICAL ASSISTANCE RESOURCES AMONG AFRICAN COUNTRIES FOR REHABILITATION OF AGRO-FOOD INDUSTRIES*

Special Measures and Activities Division

* This document has not been edited.

V.91 23949

PREFACE

This report was prepared by UNIDO's Programme Development Support Unit (PDSU). Dr.John Sender was the main consultant to the study and provided advice on the format of the document.

PDSU gratefully acknowledges the active collaboration of Mr.B.M.Vlavonu of the U.N. Economic Commission for Africa and consultants Mr.J.Winters and Mr.O.Omosaiye.

Valuable assistance was likewise received from specialists of the agro-industries branch of UNIDO's Division of Industrial Operations and from Mr.Eric Blackwell, a UNIDO intern. FAO provided important items of data used in the study.

CONTENTS

Figures

Tables

Allocating Technical Assistance Resources Among African Countries For Rehabilitation of Agro-Food Industries

I. Introduction

UNIDO's Programme Development Support Unit (PDSU) has been established to promote the programme approach methodology in identifying and formulating integrated development programmes. The focus of PDSU's work to date has been on contributing to the preparation of the 1990/1991 programme of the Industrial Development Decade for Africa (IDDA). In line with the programming priorities of IDDA, PDSU's work has concentrated on programming the development of agro-related industries, including the input subsystems of fertilizers, pesticides and agricultural machinery as well as agro-processing industries.

The aim of the work presented in this document was to establish a basis for allocating technical assistance resources among African countries according to rehabilitation priorities in agro-food industries. The classification is based on a broad series of attributes reflecting the actual and potential performance of agro-processing industries. While it may safely be argued that all African countries require rehabilitation in one or more areas of industrial production, the task of PDSU was to identify countries in which rehabilitation efforts may be short gestating and likely to meet with success.

The reason for undertaking this work stemmed from a number of considerations. The principal motivation followed from an inquiry made by UNDP on ways in which limited funds for the rehabilitation of agro-processing industries might be targeted in a systematic manner. Secondly, in applying the programme approach methodology, PDSU faced the problem of having to select a small number of priority agro-processing lines for further study from amongst the complex and varied array of agro-processing lines operating in Africa. The work undertaken to this end, identifying patterns of development in African agro-processing industries, simultaneously provided a large volume of information useful for the present document.

The document describes a procedure used to classify characteristics of African agro-processing industries with a view to providing a framework for the allocation of rehabilitatory technical assistance resources among African countries. In this way, some operationally relevant order is imposed on existing information. This approach is somewhat unusual in as much as the greater part of classificatory work on developing countries centres on broad macro-economic or quality-of-life related criteria. Classifications on a sectoral basis and for technical assistance purposes are far less common.

The classifications are not immutable, as relative country positions will change both over time and with exercises using more disaggregated data. The classifications offer a frame of reference which may be used for different purposes according to operational requirements (see section VII). The results are not specific to individual processing lines, a constraint imposed by the paucity of data. Relatedly, an ideal typology would include information as to the kind of rehabilitation required, which will in turn affect costs and shape priorities. However, for comparative purposes such information is presently unavailable for most African countries.

The results of this work do not imply an order of merit among countries, nor is it suggested that actions be taken with any exclusivity on the basis of the research findings. However, it is hoped that such work may ultimately lead to a more comprehensive and accurate identification of the technical assistance requirements of recipient countries and thus enhance the impact of limited techical assistance resources.

Other outputs derived from this classificatory work might be useful for specific sub-exercises in which sectoral or other classifications of African countries may assist the targeting of technical assistance (1). For example, grouping countries according to multiple indicators of human resource development, industrial infrastructure or the agricultural resource base, all of which are considered here, might provide classifications of direct use to other technical assistance related work Future work should attempt to

---

1/ See for example, Industrial Development Strategies for Fertilizer Industrial Systems in Africa, UNIDO, 1990, PPD.170.

detail key factors which cause country grouping and identify the requirements for countries to move from one group to another. As is evident in the above comments, preparation of the study pointed to the need for more disaggregated, industry-specific databases and data collection mechanisms.

Section II of the document provides an outline of the method employed. Section III details the components of the AFIS and explains the reasons for selecting the variables used to assess the development of each component in each country. Section IV describes the statistical tools used to group countries and the process of assigning a scale to the resulting groups. Section V describes both the industrial pre-conditions which may be important in facilitating the rehabilitation of agro-processing industries and the process of grouping countries according to the development of these pre-conditions. This section also describes the variable chosen to indicate the need for rehabilitatory assistance in agro-processing industries. Section VI provides the main results, illustrating how some countries were identified as having both a marked need for rehabilitatory assistance and favourable industrial pre-conditions to absorb such assistance. Section VII provides a brief discussion of the research findings and points to possible areas for future work.

The present application of the programme approach was undertaken with the continuous assistance of experts familiar with Africa's agro-food industrial systems (AFIS). The final structure of the document is the responsibility of Mr.Alistair Nolan.

II. Methodology

UNIDO's programme approach is applied at three different levels (2). Elements from the first stage, that of drawing up a typology of sectoral development patterns, were employed here. Much classificatory work related to developing countries is of a univariate and frequently macro-economic nature, often employing indicators of little immediate relevance to a technical assistance agency. However, the first stage of the programme approach aims at identifying groups of countries possessing similar patterns of development across a range of variables affecting a given industrial system. The use of multivariate statistical tools in comparing constituent elements of an industrial system across a number of countries provides classifications which are directly relevant to the identification and formulation of technical assistance and investment needs. An industrial system is conceptualised as an arrangement of interlinked flows of goods and services resulting in the production of a specific industrial output(s) (3).

Although a detailed account of the methodology used is provided in each section of the document, an overview of the main steps may be useful here. Briefly, the study began by identifying the main components making up the AFIS in Africa, be these related to the raw material base for the AFIS, industrial infrastructure supporting the AFIS, demand for processed agricultural goods etc. Countries are subsequently grouped according to readings on a number of variables reflecting the operation of each component. The process of grouping countries was undertaken using cluster analysis. The

---

(2) See "The Application of A Programme Approach to Technical Assistance Project Identification and Formulation". Unpublished document prepared by the UNIDO Project Appraisal Section, October 1988.

(3) The importance of the concept of an integrated system will be seen when assessing industrial pre-conditions required to facilitate industrial rehabilitation and development (section V).

A base diagram is used to represent graphically an industrial system. An illustration of the process of drawing up a base diagram is found in: "Industrial Development Strategies for Fishery Systems in Developing Countries", Volume 1 (PPD 30) Sectoral Studies Series No.32, Sectoral Studies Branch, April 1987. PPD 30. UNIDO. page 41.

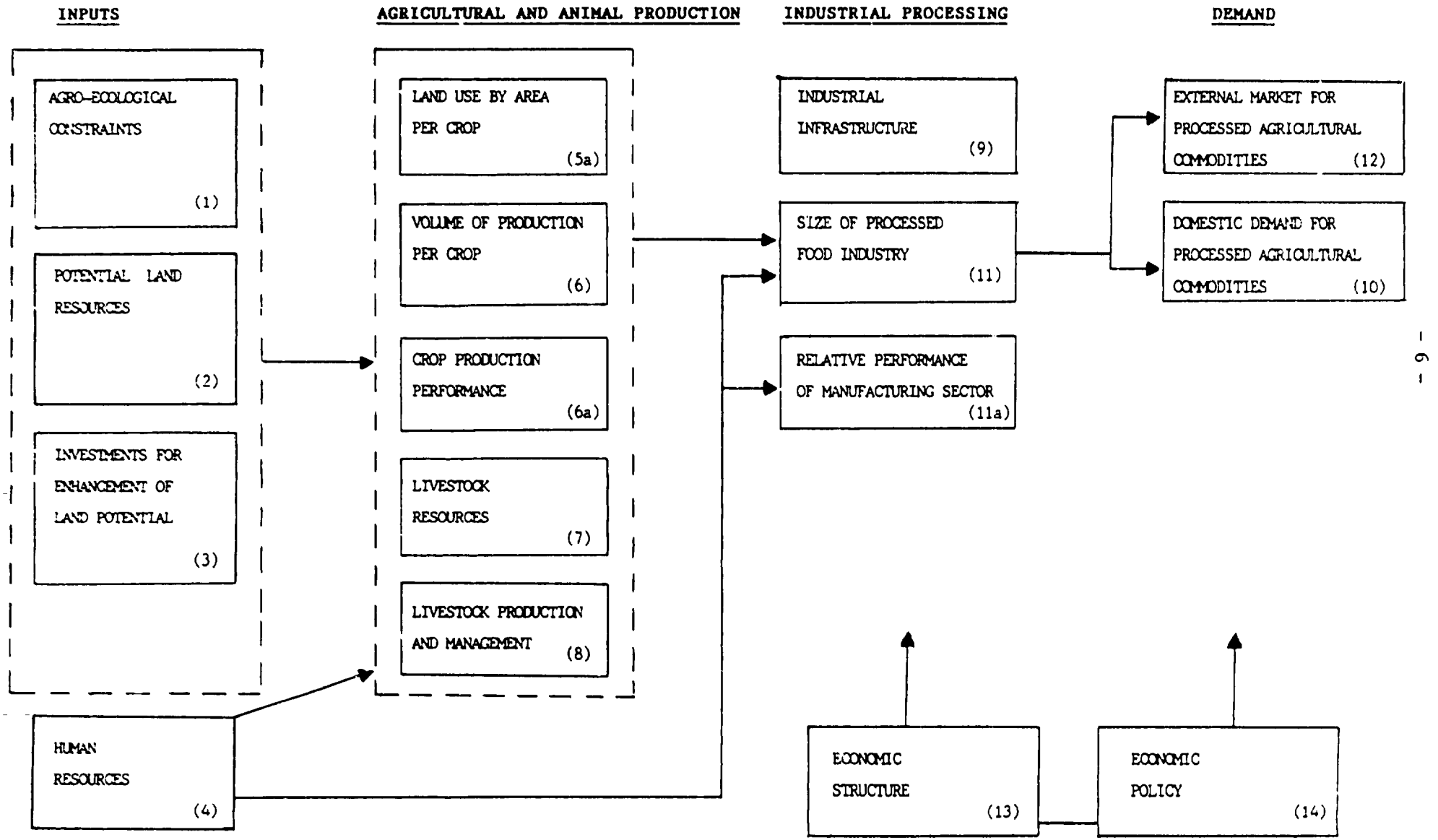
results of this procedure are used as a measure of industrial pre-conditions required for the potential success of rehabilitatory technical assistance and/or investments in African agro-food industries. The classification of countries obtained on the industrial pre-conditions variables are then compared against an indicator of the need for rehabilitatory assistance. A country is considered particularly appropriate for rehabilitatory assistance in agro-food industries when a marked need for such assistance coincides with positive industrial pre-conditions. This procedure is described in greater detail below.

III. System Components and Variables

The first requirement of the study was to identify the distinct production, processing, consumption, commercial and other activities common to the agro-processing systems of all African countries regardless of their processing specialization. Such shared activities were termed "components" of the agro-processing system. The components were chosen with a view to quantitatively describing, for each country, the economic and technical conditions which significantly influence the development of the AFIS. Fourteen components were initially identified. For the purpose of analysis some components were later discarded or amalgamated where they provided similar or highly correlated information. Of the fourteen components initially identified eight were used throughout the analysis. The fourteen components are seen in figure 1, which is a generic base diagram of the agro-food industrial system.

Each of the components was then described by a number of relevant variables. It will be seen that many of the variables have been collected for different years. While maintaining a common base year(s) in the data was preferable for comparative purposes, this was often not possible on account of divergences in statistical sources and variations in cross country coverage between more recent and more distant years. An unusually long time series was sometimes used where the additional information thus provided was felt to be necessary. The rationale behind the identification of components and the selection of variables to describe the components is briefly commented on below. Components 13 and 14 are not described as these played no major part in the subsequent analysis.

Figure 1: **SUMMARY BASE DIAGRAM OF AGRO-FOOD INDUSTRIAL SYSTEMS IN AFRICA**



Component 1: Agro-ecological Constraints

Variables used:

(i) National fuelwood supply and demand balance (millions of cubic metres) 1980.

(ii) Average annual variation in food production (%) 1976-87.

(iii) Total cereal production: annual average coefficient of variation (positive or negative) 1970-85.

(iv) Countries subject to declining soil fertility (a numerical scale was used according to whether declining fertility was present, slight or moderate).

(v) Countries having both a negative annual average rate of growth of per capita dietary energy supply (1969/71 to 1979/81) and estimated by FAO to require more than 100 thousand tons of food aid during 1983/84 to 1985/86 (dichotomous variable).

It is often noted that a continuous supply of (undamaged) raw material inputs to agro-processing industries is a necessary precondition for their potential development. This component thus attempts to capture the vulnerability of a country to fluctuations in environmental conditions, be these of natural or man-made origin. Since the existence of excessive demand for fuelwood is often argued to be the most important factor causing the depletion of vegetative cover and contributing to soil erosion and degradation, a quantitative measure of the scale of this problem (variable i) is particularly useful. Variables (ii) and (iii) attempt to capture information relating to climatic variability and agricultural constraints posed by pests and disease. Variable (iv) is an FAO-estimated dummy variable. Concerning variable (v), the existence of large numbers of people affected by transitory food shortages may be regarded as a reasonable indicator of severe agro-ecological constraints.

Component 2: Potential Land Resources

Variables used:

(i) Potential cultivable land (hectares per capita 1980).

(ii) Annual and permanent cropland (hectares per capita 1980).

(iii) Reserves of potential cultivable land (hectares per capita 1980).

(iv) Area of the country in square kilometres.

Component 2 again reflects both the actual and potential agricultural resource base for the provision of inputs to agro-processing industries. The size of a country is well known to exert an important influence on patterns of industrialization, agricultural sector and trade performance. This component should, a priori, provide a particularly useful basis for the classification of countries according to their requirements for support to develop agro-food industries.

Component 3: The Record of Investment to Enhance Land Potential

Variables used:

(i) Total number of hectares brought under irrigation (1970 to 1986)
(ii) Number of crops per country for which annual average growth in production exceeded 10% (1976-86).
(iii) Number of new crops introduced during 1961-86.
(iv) Imports of tractors and agricultural machinery 1982-1986, millions of current $ US.
(v) Average imports of pesticides 1982-87 (000's $ U.S.)
(vi) Average imports of fertilizers 1982-87 (000's $ U.S.)
(vii) Mechanized area as a percentage of arable area 1982.

As with components 1 and 2, this component focuses on the capacity to supply raw material inputs by indicating both the extent of investments made to improve the potential productivity of land resources and the availability of certain productivity raising inputs. Dynamism in the agricultural sector is partly reflected in variables (i) and (iii).

Component 4: Availability of Human Resources

Variables used:

(i) Life expectancy at birth (latest available data for all countries).
(ii) Percentage of females in age group enrolled in primary education (1985) (the "age group" refers to children of usual primary school

attendance age).

(iii) Annual average growth in the agricultural workforce (%) (1980-87).

(iv) Number of technicians working in agriculture (1984)

(v) Percentage of age group enrolled in secondary education (1985).

(vi) Percentage of age group enrolled in tertiary education (1985).

A scarcity of skilled and semi-skilled labour may lead to bottlenecks in the AFIS of some African countries. There likewise exists evidence suggesting seasonally determined labour shortages in the agricultural sector of some African countries. There is likely to exist a long-run relationship between the rate of growth of agricultural output and population growth, which is reflected in the first variable. Variable (i) also captures quality-of-life information which bears a direct relation to labour productivity (4). Another quality-of-life indicator is variable (ii). This variable relates to the status of women and is known to correlate strongly with other indicators of female and rural household welfare.

Component 5: Land Use by Disaggregated Crop Acreages

Variables used:

(i) Mean area cultivated with pulses 1983-87 000s hectares.
(ii) " " coffee " .
(iii) " " tobacco " .
(iv) " " groundnuts in shell " .
(v) " " sisal " .
(vi) " " sesame seed " .
(vii) " " sunflower " .
(viii) " " sugar cane & beet " .
(ix) " " soybeans " .
(x) " " cocoa " .
(xi) " " tea " .
(xii) " " roots & tubers " .

---

(4) A summary of research on this issue is found in: Labour Productivity: Un Tour d'Horizon, World Bank Staff Working Papers No.497, October 1981.

Analysis was also undertaken on a further component describing crop production for each country in volume terms. The use of area data was chosen in preference to volume data as the resulting cluster analyses were more tractable and because there are some reasons to suppose that production data are even more variable than area data.

Component 6: Crop Production (performance)

Variables used

(i) Average annual rate of growth of agricultural exports (%) 1978-87 (value terms)

(ii) Average annual rate of growth of gross agricultural production (%) 1970-84

(iii) Average annual rate of growth of food production (%) 1980-87.

This component was used as an indicator of achievement in agricultural production. The inclusion of an export variable is justified in this respect by the fact that agricultural trade data may often be more reliable than production data.

Component 7: Livestock Resources

Variables used:

(i)	Cattle population	(000's)	(1987)
(ii)	Pig population	(000's)	(1987)
(iii)	Sheep population	(000's)	(1987)
(iv)	Goat population	(000's)	(1987)
(v)	Equine population	(000's)	(1987)
(vi)	Numbers of poultry	(000,000's)	(1987)

This component is an additional measure of the raw material base from which the agro-processing industry may draw its principal inputs. An important weakness in livestock ownership data arises from the fact that

livestock owners may frequently benefit from concealing the truth about livestock numbers. This may permit them to avoid destocking campaigns, customs and other forms of taxation. The fact that rustling is a significant phenomenon in some areas may compound this problem.

Component 8: Livestock management

Variables used:

(i) Average annual rate of growth in numbers of cattle (%) (1980-87).
(ii) Average annual rate of growth in numbers of pigs (%) (1980-87).
(iii) Average annual rate of growth in numbers of sheep (%) (1980-87).
(iv) Average annual rate of growth in numbers of goats (%) (1980-87).
(v) Average annual rate of growth in numbers of equines (%) (1980-87).
(vi) Average annual rate of growth in numbers of poultry (%) (1980-87).

This component provides an indication of the efficiency with which a country has managed its livestock resources. As such, a deficiency of the variables is that they accord equal weight to changes in small or large livestock populations.

Component 9: Infrastructure (supportive of AFIS)

Variables used:

(i) Energy Consumption per capita in kgs coal equivalent (1986)
(ii) Installed electricity capacity (kilowatts per thousand inhabitants)
(iii) Number of commercial vehicles in use (000's) (1985)
(iv) Country share in total manufacturing value added of Africa, 1985.
(v) Capacity of assembly and wholesale markets for fruit and vegetables, 1983 (000s metric tons).

The variables of component 9 measure (directly and indirectly) the availability of supportive infrastructure for the domestic AFIS, both in production and distribution.

Component 10: Size of the Domestic Market for Agro-Processed Products

Variables used:

(i) Urban population as a percentage of total population (1985).
(ii) Percentage of the population with access to safe water.
(iii) Manufacturing output as a percentage of GDP (1981-86 mean at 1980 constant prices).
(iv) Number employed in industry as a percentage of the labour force.

Component 10 reflects structural demographic and macroeconomic factors tending to correlate strongly with a rising level of per capita income. Variable (ii) is a proxy indicator of such factors, reflecting the extent of urbanization. The variables thus provide information relating to domestic demand for processed agricultural commodities, both through the effects of increased levels and sources of income as well as changing consumer preferences - shifting dietary patterns associated with a rapid process of urbanization are a case in point. The usefulness of variable (iv) would have been increased had data for the numbers employed in manufacturing as a percentage of the labour force been available for all countries.

Component 11: Size of Processed Food Industry

Variables used:

(i) Processed fruit and vegetables 1983 (000s mt)
(ii) Processed oilseeds, 1983 (000s mt)
(iii) Processed Sugar crops,1983 (000s mt)
(iv) Processed cereals for non-food use 1983 (000s mt)
(v) Ginning of seed cotton 1983 (000s mt).
(vi) Persons employed in ISIC 311, mean 1983-86 (000s)
(vii) Persons employed in manufacturing of beverages mean 1983-86 (000s)
(viii) " " textiles " .
(ix) " " tobacco " .

The above variables provide a measure of the extent of agro-food processing. To a degree these indicators may also be considered as dummy

variables for the availability of some intangibles such as administrative skills and industrial experience. The relevance of these variables would be greatly increased by a longer time series. Data on a wider range of processing operations would be desirable.

Component 12: Export Market for Processed Agricultural Commodities

Variable used:

(i) The 1984/85 country share of Africa's exports of manufactures as a percentage of the 1974/75 country share of Africa's exports of manufactures (manufactured exports expressed in constant US $ 1980).

The purpose of employing this variable was to view the degree to which individual countries had been able to maintain their share of Africa's exports of manufactures. Export data for processed agricultural commodities was frequently outdated and of limited coverage. Manufactured exports data was thus used as a proxy on the argument that the greater part of Africa's manufactured exports are of agricultural origin. Other things being equal, countries experiencing a fall in their export share were assumed to have failed to capture an existing foreign demand, even though the value of manufactured exports may have registered a positive annual average rate of growth. However, given a diversity of exported processed agricultural produce this assumption might be questioned. It may be argued that changes in a country's share of aggregate exports could reflect shifts in foreign demand in individual product markets, rather than the country's ability to hold a market share in a particular manufactured export. Nevertheless, despite such a high level of aggregation, the variable chosen may still be informative. This is because African manufactured exports contribute only a small fraction of world exports of manufactures (5), while world trade in manufactures was expanding

(5) Developing Africa accounted for 0.67 % of the value of world exports of manufactured goods (excluding iron and steel and non-ferrous metals) in 1986. Source, UNCTAD, Handbook of International Trade and Development Statistics, 1988.

very rapidly during the period of this data (6). Thus there may be reason to believe that inadequate foreign demand may not have been the major constraint on trade in a number of agro-processed products, and hence that a decline in a country's share of Africa's total manufactured exports may not necessarily be attributable to depressed foreign demand for the particular manufactures of that country. At its weakest the chosen variable contains implicit information on how country a performed in market b as compared to the performance of country c in market d. Ideally, and with appropriate data, a variable assessing relative export performance among countries would disaggregate between products and calculate changing export shares in each. On account of these difficulties, the statistical work that followed experimented with lower weights being assigned to this and other variables.

IV. Cluster Analysis

Having assembled dat. for all the variables described above, cluster analysis was performed on each component separately. This allowed the identification of groups of countries with similar readings on the variables of each component.

Cluster analysis is a multivariate statistical technique for data review and analysis which permits the identification of similarities and dissimi ities between objects (in this case countries) in a data set (7).

---

(6) The value of world exports of manufactured goods (excluding iron and steel and non-ferrous metals) grew at 13.3 % per annum during the period 1970 - 1986. Source, UNCTAD, Handbook of International Trade and Development Statistics, 1988. More significantly for the case of Africa, the value of OECD imports of manufactured goods from low- and middle-income countries grew at 21 % per annum over the period 1967 - 1987. Source, The World Bank, World Development Development Report 1989, p.197.

(7) A useful overview of the different clustering methods, their limitations and the philosophy behind numerical taxonomy is given in Everitt, B.S. Cluster Analysis, Second Edition, London: Heineman Educational Books Ltd., 1980.

A host of clustering techniques exist, some using more complex algorithms than others. Each technique has specific clustering characteristics. Two of the methods occurring most frequently in the cluster analysis literature were employed here, namely the Wards Minimum Variance method and the Average Linkage Method. After trial runs, the Wards Minimum Variance method was found to yield consistently satisfactory results. The Average Linkage Method was occasionally employed in conjunction with the Wards method and their outputs compared. This cross-check was performed to avoid results that might be artifacts particular to a given clustering technique.

An example of the graphic output from a clustering exercise, termed a dendrogram, is seen in figure 2. Figure 2 is the output from a cluster analysis of the variables in component 1 (agro-ecological constraints). The dendrogram may be read in the following manner. At the start of the clustering process all countries are treated as distinct and separate objects, similar only to themselves. As the process begins, at the base of the dendrogram (semi partial R squared distance between objects = 0+), countries with similar readings on the variables join together, forming groups or "clusters" of countries. At successive steps unclustered countries are joined with previously formed clusters until, at the top of the dendrogram, all objects form a single undifferentiated cluster. The number of clusters derived from the dendrogram depends on the level at which it is read. Clusters are separated one from the other by an empty column extending from the base of the dendrogram. Thus in figure 2 it is seen that 5 clusters are obtained by reading the dendrogram at line a, and 9 clusters are found at line b. The notion of similarity between objects (the level at which the dendrogram is read) exists on a variable scale and changes according to the needs and circumstances of a particular research goal.

Assigning a Scale to Country Groups for Each Component

For each component, the resulting clusters of countries were scaled according to their main characteristics. The score assigned to each cluster was given to every country within that cluster. The scores seen on the dendrogram in Figure 3 help to illustrate this procedure. In this way a ranking of countries was obtained on each component. This ranking reflected

positive or negative attributes of each country on the variables describing each component. The scaling procedure itself was undertaken on the basis of expert inspection of the cluster analyses and the supporting databases.

Creating a Composite Component

To assess the performance of countries in terms of the supply of raw materials to agro-f[illegible] industries, a composite component was created by means of a cluster analysis that combined a number of components. This composite component was built up by simultaneously clustering components 1, 2 and 3: agro-ecological constraints (1), potential land resources (2) and the record of investment to enhance land potential (3). Table 1. and figure 3. illustrate this operation. The fourth column in Table 1 gives the values assigned to each country according to the cluster in which they fall for this composite component. The scales attributed to countries following cluster analysis of components 1, 2 and 3 are also seen. Figure 3 is the dendrogram from this process. The results of this exercise afforded a single scale for all countries, where each score indicated the present and potential performance in terms of raw material supply of each country relative to all other countries.

Figure 2:

Cluster of AFIS data for component 1.

WARD'S MINIMUM VARIANCE CLUSTER ANALYSIS

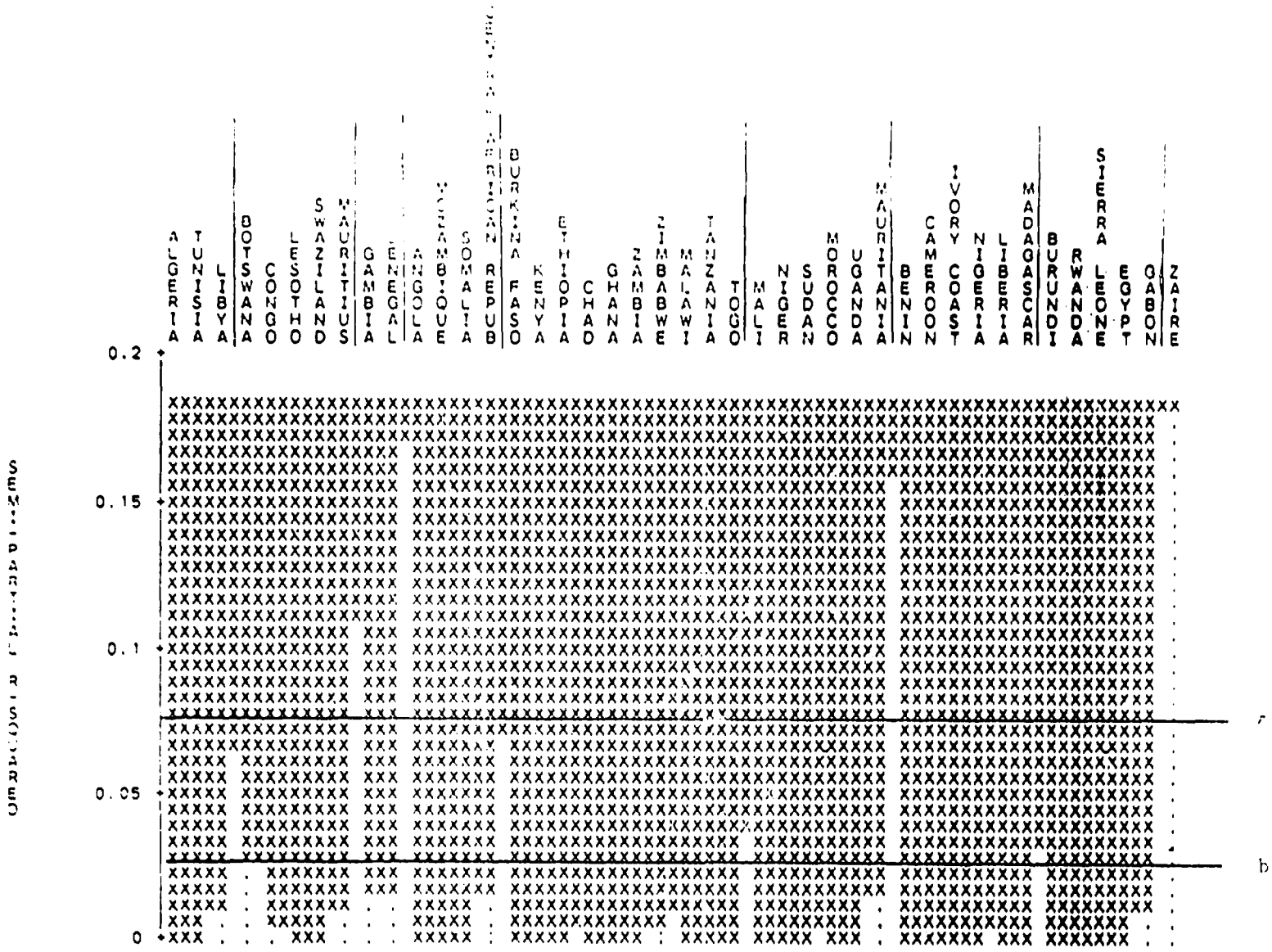


Table 1: COMPOSITE COMPONENT AGRICULTURAL RAW MATERIAL SUPPLY

OBS	COUNTRY	INDIVIDUAL COMPONENTS			COMPOSITE COMPONENT
OBS	COUNTRY	Agro-ecological Constraints (C1)	Potential Land Resources (C2)	Investments in Land Potential (C3)	
1	Algeria	4	2	4	5
2	Egypt	5	2	5	5
3	Libya	4	2	4	5
4	Swaziland	3	1	4	5
5	Tunisia	4	3	4	5
6	Botswana	3	3	1	4
7	Cameroon	3	3	1	4
8	Congo	3	3	1	4
9	Gabon	3	3	2	4
10	Côte d'Ivoire	3	3	2	4
11	Kenya	2	3	3	4
12	Madagascar	3	3	2	4
13	Morocco	2	3	3	4
14	Nigeria	3	4	3	4
15	Sudan	2	4	3	4
16	Zimbabwe	2	3	3	4
17	Angola	1	4	1	3
18	Burkina Faso	2	3	1	3
19	Central African Republic	1	3	1	3
20	Ghana	2	3	1	3
21	Mozambique	1	4	1	3
22	Senegal	1	3	1	3
23	Tanzania	2	4	1	3
24	Uganda	2	3	1	3
25	Zaire	2	5	1	3
26	Zambia	2	4	2	3
27	Benin	3	1	2	2
28	Burundi	3	1	1	2
29	Lesotho	3	1	1	2
30	Liberia	3	1	1	2
31	Mauritius	3	1	1	2
32	Rwanda	3	1	1	2
33	Sierra Leone	3	1	1	2
34	Chad	2	2	1	1
35	Ethiopia	2	2	1	1
36	Gambia	1	1	2	1
37	Malawi	2	1	1	1
38	Mali	2	2	1	1
39	Mauritania	2	2	1	1
40	Niger	2	2	2	1
41	Somalia	1	1	1	1
42	Togo	2	1	1	1
43	Cape Verde	.	1	.	.
44	Comoros Island	.	1	.	.
45	Djibouti	.	.	.	.
46	Equatorial Guinea	.	.	.	.
47	Guinea	.	3	1	.
48	Guinea-Bissau	.	1	.	.
49	Sao Tome and Principe	.	1	.	.
50	Seychelles	.	1	.	.

V. Industrial Pre-conditions Facilitating Rehabilitation

While it may safely be argued that all African countries require rehabilitation in one or more areas of industrial production, the task of PDSU was to identify countries in which efforts at rehabilitation in agro-food processing industries may be short gestating and likely to meet with success. It was therefore decided that countries identified for rehabilitation assistance should be considered priority candidates when possessing high scores on a set of industry-related pre-conditions. An additional criterion for the selection of countries was their record over the past 15 years in maintaining their manufacturing output growth relative to other African countries. This criterion will be discussed in more detail below.

The six industry-related pre-conditions that where chosen could be measured using components from the AFIS system, as is outlined below (see also Figure 1):

a. Supply of agricultural raw material (composite component).
b. Domestic demand for processed agricultural commodities (component 10).
c Availability of infrastructure to support the processing industry (component 9).
d. Size of the processed food industry (component 11).
e. Availability of human resources (component 4).
f. External market for processed agricultural commodities (component 12).

It is reasonable to assume that countries with relatively low readings on one or more of the above criteria might experience serious difficulties in their rehabilitation efforts due to the appearance of bottlenecks at one or another of the components making up the AFIS.

A second round of cluster analysis was then performed on the scaled

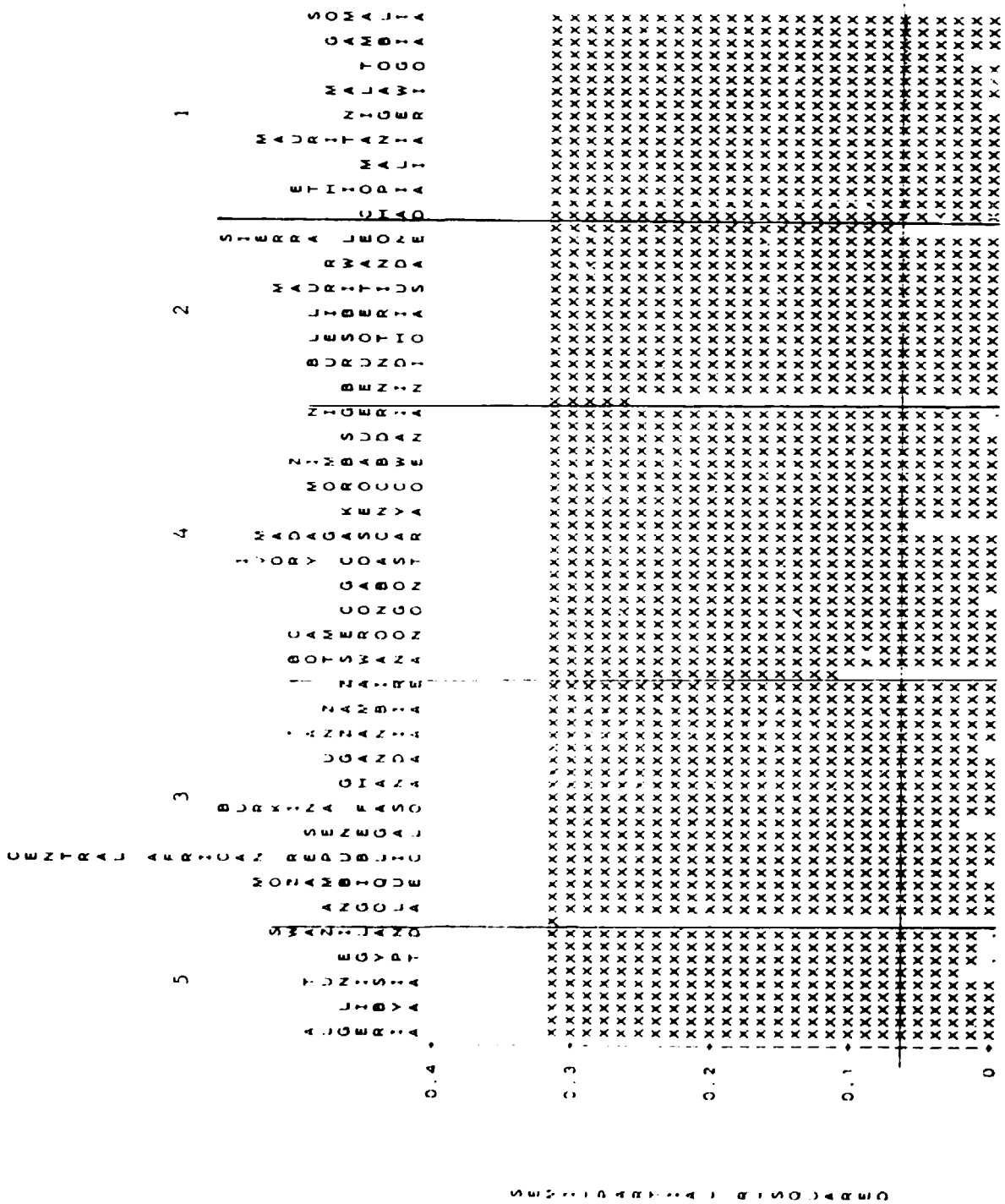

COMPOSITE COMPONENT – RAW MATERIAL SUPPLY
WARD'S MINIMUM VARIANCE CLUSTER ANALYSIS
1
2
3
4
5
0.4
0.3
0.2
0.1
0

Figure 3:

readings of these components related to the preconditions criteria (a to f) (8). This second stage of clustering served to identify groups of countries with similarly patterned readings on the pre-conditions criteria. These country groups were themselves scaled, in the manner outlined above. A ranking of countries was thus obtained according to the relative strength of industrial pre-conditions likely to affect efforts at rehabilitation of agro-food industries (9).

It was recognized that the pre-conditions criteria may vary in importance. The size of the agro-processing industry, for example, may bear an important relationship to the presence of managerial and labour skills as well as industrial infrastructure. However, as it is not the size of the industry, but the ability to use existing capacity that is the central concern, and in light of very low rates of industrial capacity utilization in many African countries, an additional analysis was performed with a smaller weight placed on the "size of industry" component (component 11 received 9.1

---

(8) Some detail is lost through scaling outputs. Nevertheless, the large number of variables in use would have greatly complicated interpretation of results had the original variables been used when clustering all the components. Despite the loss of information, scaling might also be thought of as highlighting information most relevant to the research goal. Scaling outputs also avoids the need, during the second stage of cluster analysis, to appropriately weight components having different numbers of variables.

(9) The false impression might be given that this scale represents a simple addition of pre-conditions scores. The cluster analyses group countries according to the pattern as well as value of readings on variables. Hence, countries with highly ranked preconditions criteria may not be ranked highly on all the pre-conditions. While the purpose of attempting to arrive at a ranking of countries according to industrial preconditions was to identify different levels of achievement, interpretation and scaling of outputs had to consider the fact that development patterns may occasionally overlap. The differences in patterns of development may be interesting to explore for technical assistance purposes. This possibility is briefly commented on in the last section.

per cent of the total weight in this cluster analysis as opposed to the previous weight of 16.6 per cent). The scaled results of this exercise are seen in column 2 of table 2 in the Annex.

In a similar vein, the criteria relating to foreign and domestic demand for processed agricultural commodities will vary in importance between countries. This variation will reflect the relative shares of domestic and foreign consumption of the processed commodity and even the differing potentials for trade in some agro-processed products. For these reasons a clustering of the pre-conditions variables was carried out both with and without scaling component 12 (foreign demand). Scaling this component was felt to be useful, in place of using the percentage figures in which the variable is expressed, as the information sought was whether a country had failed to capture an existing foreign demand and not the precise degree to which each country's share of African manufactured exports had changed over time. By scaling the variable this distinction could be emphasized.

The results from the cluster analyses of industrial pre-conditions using different weights on selected components are presented in table 2 of the Annex. A consistent and discrete pattern is evident in the rankings. The country scores are sufficiently similar on the three modified runs for a simple mean figure to be representative of the emerging pattern. This fact indicates some robustness of the identified groups. However, where an analysis with modified components produced a divergence from the results of other analyses, as is seen in the case of Kenya, the final ranking of a country on the preconditions was made after an assessment of previous cluster analyses and data readings for that country. The final score of each country on the pre-conditions variables is seen in table 4.

Indicating the Need for Rehabilitation

After completing the ranking of countries according to the existence of preconditions favourable to rehabilitation, an indicator variable was constructed which would point to countries most in need of assistance to rehabilitate the manufacturing sector. This variable recorded each country's 1985 share in Africa's total manufacturing value added (MVA) as a percentage of the 1970 share. Countries losing a major part of their share were assumed to have used the capacity they had available in 1970 for increasing value

added in manufacturing less effectively than other countries. A low score on this variable was taken to suggest a rehabilitation requirement. MVA was used as an indicator of AFIS performance on the argument that a large share of African MVA derives from agro-processing industry. For example, the contribution of the food branch to manufacturing value added was over 20 percent in 1985, while the shares of textiles, beverages and tobacco accounted for over 25 percent.

Table 3 lists all countries by rank order of their 1985 share of African MVA as a percentage of their 1970 share of African MVA.

Table 3. African Countries by Rank Order of their 1985 Share of African MVA as a Percentage of their 1970 Share of African MVA

Country	Increase in MVA Snare (%)	Score on Indicator Variable.
Libya	450	5
Lesotho	400	5
Gabon	240	5
Cameroon	209	5
Gambia	200	5
Swaziland	182	4
Botswana	171	4
Mauritius	171	4
Algeria	165	4
Tunisia	161	4
Kenya	160	4
Nigeria	139	3
Egypt	136	3
Rwanda	133	3
Malawi	120	3
Congo	105	2
Mali	100	2
Burundi	96	2
Cote d'Ivoire	91	2
Morocco	88	2
Zimbabwe	88	2
Burkina Faso	86	2

table 3 continued.

Ethiopia	81	2
Madagascar	69	2
Zambia	69	2
Cape Verde	67	2
Niger	66	2
Liberia	63	2
Senegal	63	2
Mauritania	59	2
Tanzania	54	1
Sierra Leone	51	1
Benin	49	1
Central African Rep.	41	1
Sudan	40	1
Zaire	40	1
Chad	38	1
Ghana	33	1
Angola	31	1
Mozambique	31	1
Somalia	27	1
Togo	27	1
Comoros Islands	-	n.a.
Djibouti	-	n.a.
Equatorial Guinea	-	n.a.
Guinea	-	n.a.
Guinea Bissau	-	n.a.
Reunion	-	n.a.
Sao Tome and Principe	-	n.a.
Seychelles	-	n.a.

Source: based on World Bank, UNCTAD and UNIDO data.

VI. Selecting Countries in Africa for Rehabilitation of Agro-food Industries

The rankings of countries on both the indicator variable and the combined pre-conditions variable were then juxtaposed. Countries with low scores on the indicator variable and high scores on the pre-conditions variable were considered priority candidates for rehabilitation subject to expert corroboration of results (10). Table 4. presents scores on the indicator of the need for rehabilitation, the indicator of industrial preconditions and the selection of countries.

(10) Scores of 1 or 2 on the indicator variable were considerd low, since these meant that the 1985 share of African MVA as a percentage of the 1970 share was generally below 100%. Scores on pre-conditions to be considered as high began at 4. These cut off points were decided from a review of the collected data and informed assessment.

Table 4. Selection of African Countries for Rehabilitation of Agro-food Processing Industries

	Score on Indicator Variable	Final Score on Preconditions	Selected Countries
Algeria	4	7	
Angola	1	n.a.	
Benin	1	3	
Botswana	4	4	
Burkina Faso	2	3	
Burundi	2	1	
Cameroon	5	5	
Cape Verde	2	n.a.	
Central Afr.Repub.	1	3	
Chad	1	n.a.	
Comoros	n.a.	n.a.	
Congo	2	4	CONGO
Cote d'Ivoire	2	6	COTE D'IVOIRE
Djibouti	n.a.	n.a.	
Egypt	3	7	
Eq.Guinea	n.a.	n.a.	
Ethiopia	2	2	
Gabon	5	4	
Gambia	5	3	
Ghana	1	5	GHANA
Guinea	n.a.	n.a.	
Guinea-Bissau	n.a.	n.a.	
Kenya	4	4	
Lesotho	5	4	
Liberia	2	4	LIBERIA
Libya	5	7	
Madagascar	2	5	MADAGASCAR
Malawi	3	3	
Mali	2	1	
Mauritania	2	1	
Mauritius	4	4	
Morocco	2	7	MOROCCO

table 4 continued.

Mozambique	1	n.a.	
Niger	2	3	
Nigeria	3	6	NIGERIA
Rwanda	3	3	
Sao Tome	n.a.	n.a.	
Senegal	2	5	SENEGAL
Seychelles	n.a.	n.a.	
Sierra Leone	1	3	
Somalia	1	n.a.	
Sudan	1	2	
Swaziland	4	n.a.	
Tanzania	1	n.a.	
Togo	1	4	TOGO
Tunisia	4	7	
Uganda	1	3	
Zaire	1	5	ZAIRE
Zambia	2	5	ZAMBIA
Zimbabwe	2	6	ZIMBABWE

VII. Conclusions and Future Work

This work attempts to systematically identify countries which may be considered for receipt of rehabilitatory assistance in agro-food industries in a way which permits a degree of priority to be attached to limited technical assistance resources. This typology exercise also provides a set of rankings from which smaller or larger numbers of countries may be selected according to operational needs. In this regard, parameters for selection on the indicator and preconditions scores could be modified in a justified manner. Hence, the list of countries selected here should not be considered as fixed.

Clearly, on account of data limitations, there are a number of approximations involved in such an exercise. The use of dummy variables in the measurement of individual components and the indicator variable points to

the need for more disaggregated and industry-specific databases. Some assumptions noted in the text, again deriving largely from data deficencies, may cause results to diverge from the real-world situation. The results are thus best considered as a characterization of the existing situation (11).

Again, on account of insufficient disaggregated data, this work does not lead to conclusions regarding specific processing lines. It is also the case that some qualitative factors, such as the types of rehabilitation required, would be important in the selection of priorities among countries or processing lines. Relevant qualitative information might be collected through questionnaires or other means and can be used in clustering procedures.

Future work might contemplate the use of alternative statistical techniques (and possibly new data sources) to attempt to explain why countries group as they do. The use of techniques which permit tests of statistical significance would be important in this regard. Factor analysis could be employed to assist in the scaling of country groups once clusters have been identified. Factor analysis might also be used to identify a limited number of variables particularly useful in preliminary classifications at the sectoral level.

More disaggregated data would permit a similar but more detailed exercise to be undertaken both on a country and a branch specific basis. Were such disaggregated data to be collected, a typology could refine the results obtained above and provide supplementary outputs relating to specific processing lines. In addition to selecting manufacturing branches for rehabilitation, such an exercise might indicate where the extension of existing processing capacity, or the establishment of new processing lines, could be considered most realistically. Future work might also assess relative country performance on each component with a view to an operationally useful typology of assistance needs throughout the AFIS. A better

---

(11) Even trade data, which is sometimes considered more reliable than other forms of data, is frequently flawed. This problem is thoroughly treated in "On the Accuracy of Economic Observations: Do Sub-Saharan Trade Statistics Mean Anything ?", A.J.Yeats, The World Bank Economic Review, Vol.4 No.2.

understanding of the use of available development indicators is a positive secondary output of such work.

Classificatory work may also assist to indicate countries suitable for the repetition of strategies successfully implemented in other countries having a similar development pattern. This objective may have time and cost saving implications for a technical assistance agency such as UNIDO. Relatedly, typology exercises may afford a framework by which countries can assess their particular development experience against that of countries having different patterns of development.

ANNEX . Table 2. Scaled Industrial Preconditions After Three Cluster Analyses of Modified Data.

	Column 1	Column 2	Column 3
	Unweighted component 11 clustered with unscaled component 12	Weighted component 11 clustered with unscaled component 12	Unweighted cluster with scaled component 12
Algeria	7	7	7
Angola	n.a.	n.a.	n.a.
Benin	3	3	3
Botswana	4	5	4
Burkina Faso	3	3	2
Burundi	1	1	2
Cameroon	5	6	5
Cape Verde	n.a.	n.a.	n.a.
Central Afr.Repub.	3	3	2
Chad	n.a.	n.a.	n.a.
Comoros	n.a.	n.a.	n.a.
Congo	4	5	4
Cote d'Ivoire	6	6	6
Djibouti	n.a.	n.a.	n.a.
Egypt	7	7	7
Eq.Guinea	n.a.	n.a.	n.a.
Ethiopia	2	2	1
Gabon	4	5	4
Gambia	3	3	2
Ghana	4	5	5
Guinea	n.a.	n.a.	n.a.
Guinea-Bissau	n.a.	n.a.	n.a.
Kenya	7	6	5
Lesotho	5	4	3
Liberia	5	4	3
Libya	7	7	7
Madagascar	5	6	5

table 2 continued.

Malawi	3	3	2
Mali	1	1	2
Mauritania	1	1	1
Mauritius	4	5	4
Morocco	7	7	7
Mozambique	n.a.	n.a.	n.a.
Niger	3	3	3
Nigeria	6	6	6
Rwanda	3	3	3
Sao Tome	n.a.	n.a.	n.a.
Senegal	5	6	5
Seychelles	n.a.	n.a.	n.a.
Sierra Leone	3	3	3
Somalia	n.a.	n.a.	n.a.
Sudan	2	2	1
Swaziland	n.a.	n.a.	n.a.
Tanzania	n.a.	n.a.	n.a.
Togo	5	4	2
Tunisia	7	7	7
Uganda	3	3	3
Zaire	5	6	5
Zambia	5	6	5
Zimbabwe	6	6	6

Note: A number of countries are excluded from the analysis due to inadequate coverage of the data.