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INDUSTRIAL DEVELOPMENT STRATEGIES FOR AFRICAN AGRICULTURAL MACHINERY INDUSTRIAL SYSTEMS

DRAFT REPORT

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CHAPTER I

INTRODUCTION

1.1 Background and Context

Agriculture is the largest single sector of economic activity in Africa. In contrast with other developing areas, where agricultural and particularly food production have kept pace with rising population, Africa as a whole has experienced declining agricultural production and self-sufficiency in major food commodities. Part of the problem has been the lack of incentives and support mechanisms to sustain agricultural development in the predominantly small-farm sector. Another constraint has been inadequate attention to adapting known-technologies to suit the needs of the African farmer. Meanwhile, industrialization has been slow, hesitant, and disappointing in terms of income and employment creation. Furthermore, the symbiosis between the agricultural and industrial sectors evident in the early industrialization of developed economies has been slow to evolve. In many parts of Africa, much of farming remains traditional and untouched by new technology, whilst modern farming methods are often confined to enclaves supported by imported technology and expertise.

In this context, both agriculture and sectors supplying improved inputs to agriculture are priorities for sustained development. The local manufacture and servicing of agricultural tools, equipment and machinery is one such sector. Mechanization inputs, such as animal-power equipment, are needed to improve the work rate, quality, and remove the drudgery, of farm operations. At the same time, the local production of these inputs provides an opportunity for developing a capability in simple manufacturing.

For many mainly agricultural economies, the local manufacture and servicing of agricultural machinery is a primary and fundamental step in the early industrialization process. Proposals

to develop this sector, however, need to be integrated with proposals to develop both the farming sector (the demand for AMI products) and the industrial sector (the supply of inputs to AMI). Of particular importance is the need to strengthen or create institutions, such as industrial extension or credit organizations, and to create a policy environment which encourages both private and public sector initiative. AMI is thus identified as a sector worthy of particular development assistance and one which requires an integrated approach to development planning. The following report applies the UNIDO programme approach to the African AMI Sector.

1.2 Objective and Method

1.2.1 Objective

The objective of the enquiry reported in this document is to identify agricultural manufacturing industry development strategies appropriate to the needs of developing countries in Africa. These strategies then provide a framework for identifying technical assistance and investment needs and priorities. A subsidiary objective is to demonstrate the UNIDO programme approach to AMI sector planning.

1.2.2 Method

The disappointing performance of many industrial technical assistance and investment projects in developing countries has often been attributed to the lack of integration of projects within the industrial sector, and the lack of coordination with other development activities. Effective projects must respond to real needs, and to be self-sustaining. This means that projects need to be integrated with other sectors and to be adequately supported by the necessary infrastructure and institutions.

The systems approach provides a framework for understanding the components and structure of a sector before proceeding to project identification and design.

The approach involves three steps

(i) developing broad groupings or typologies of countries which have common characteristics, circumstances, practices, needs, and priorities with respect to the AMI sector.

(ii) designing generalized or indicative programmes for country typologies within which suitable project activities can be identified and formulated.

(iii) preparing detailed country-specific sectoral or integrated programmes and projects which address the particular circumstances and needs for technical assistance and investment of the country concerned.

This document reports on (i) above, and goes some way towards compiling generalized development strategies referred to (ii). Compilation of indicative programmes for country typologies must await the completion of the country case studies to be undertaken in December 1989.

1.3 Structure of Report

Following this introduction, Chapter 2 provides an overview of the AMI Sector in Africa making reference to the policy context, the characteristics of agricultural mechanization , AMI constraints, and proposals for development. Chapter 3 presents the main groupings or typologies of African countries, classified according to AMI status and needs. Chapter 4 formulates a set of AMI and related development strategies tailored to meet the needs of each typology. The report ends with a brief statement of conclusions and recommendations in Chapter 5.

CHAPTER 2

THE AGRICULTURAL MACHINERY MANUFACTURING INDUSTRY IN AFRICA

This Chapter describes the context and main characteristics of the Agricultural Machinery Manufacturing Industry in Africa. The chapter briefly describes the setting of AMI in a global and African development context. Types of agricultural machinery and mechanisation systems are described, with particular reference to farming systems. AMI in Africa is then reviewed, with reference to the demand for and local manufacture of various categories of agricultural machinery. Factors which influence AMI development, are identified and recommendations made for AMI development. The chapter provides the basis for the grouping of African countries into AMI typologies.

2.1 INTERNATIONAL CONTEXT OF AMI

The output value of the agricultural machinery industry worldwide is about US$50 billion. Of this developing countries are thought to contribute no more than 7.%. Africa's contribution is negligible. As a consumer, Africa's role is also small. Its market for modern, internationally traded equipment is limited in size and dispersed over a large area. Table 2.1 gives selected statistics for the main African importers. Although not significant in a global context, AMI imports represent a substantial commitment of limited foreign exchange.

Given limited or difficult markets, transnational corporations have shown modest interest in Africa. The tendency has been to supply standard equipment with minor modifications for local conditions (stronger filtering devices, less sophisticated features). Limited sales have not so far justified re-design or modification in mass-production manufacturing. Attempts to scale-down tractor technology to suit African conditions have met with limited technical and commercial success.

Table 2.1

Imports of Tractors and Agricultural Machinery

US$M. 1986	Agricultural Machinery	Agricultural and Horticultural Machinery	Tractors
Main African Importers			
Algeria	29	16	4
East Africa	18	11	47
Egypt	37	13	62
Ethiopia	20	11	19
Libya	58	43	30
Morocco	24	20	32
Nigeria	15	9	22
South Africa	41	30	50
Sudan	18	16	8
Zimbabwe	4	3	5
All Africa	319	212	348
North America	1,206	970	1,468
Europe	5,653	4,087	2,762

Source: Bulletin of Statistics on World Trade in Engineering Products, Economic Commission for Europe, Geneva, 1987.

To date, transnational companies have made few collaborative or joint venture arrangements with local manufacturers. Small markets, political uncertainties, and limited industrial infrastructure have been a barrier to such initiatives. Actions to relieve these constraints could encourage international collaboration and technology transfer across a broad range of AMI products.

2.2 CONTEXT OF AGRICULTURAL MECHANIZATION AND MACHINERY INDUSTRY DEVELOPMENT

Agricultural mechanization and AMI development need to be set in the context of agricultural and industrial development objectives.

2.2.1 Agricultural Development Objectives

Agriculture is the principal sector of the economy for most African countries. It typically contributes 33% of GDP, generates 45% by value of exports, and employs about 65% of the economically active population. Africa contains, however, the greatest concentration of countries which experience regular food deficits.

Most African countries include agricultural development objectives within their national development plans. These objectives usually allude to:

- the achievement of a satisfactory level of self-sufficiency in staple food crops

- the expansion of agricultural exports

- the substitution of imported agricultural and food commodities

-the improvement of rural incomes, employment, and essential services in the farming and rural sector

-the protection or enhancement of environmental quality

More recently there has been a re-focussing of attention on smallholder agriculture; both to improve the production of food in the subsistence sector, and to increase market sales generated by the emergent and small-scale commercial sector. This has generally followed a multi-sectoral approach involving rural infrastructure and support services.

Common factors which inhibit the development of smallholder agriculture are: limitations of the natural environment; inadequacies in the institutions and infrastructure supporting agriculture, particularly as they affect input supply and marketing; and, particularly important, inadequate price incentives to producers.

2.2.2. Industrial Development Objectives

Programmes in the industrial sector are needed to complement agricultural sector initiatives by improving the capacity to manufacture and fabricate tools, equipment and machines. The main objectives of industrial development in this respect are often the following:

-to achieve greater self-sufficiency in manufactured goods;

-to save or generate foreign exchange by import substitution of finished or partly-finished goods;

-to develop a basic capability in engineering supplies and services to support other sectors;

-to improve employment and income opportunities in the industrial sector of urban and rural areas;

-to participate in inter-regional trade.

The local manufacture and servicing of agricultural machinery is a primary and fundamental industrial activity, commonly found in newly industrialising economies. The pace and direction of growth in the agricultural machinery manufacturing sector is closely linked to the form and prosperity of the farming sector.

2.2.3. Types of Agricultural Mechanization

Taken in its broadest definition, agricultural mechanization involves the design, manufacture, distribution, use, and servicing of all types of agricultural tools, equipment, and machines.

Agricultural mechanization technologies are often classified in terms of power source and degree of sophistication:

hand tools:	hoes, mattocks, machettes , axes, hammers
hand operated machines:	pumps, threshers, knap-sack sprayers
animal-drawn equipment:	ploughs, cultivators
engine-powered machines:	pumps, threshers, mills
tractor-drawn equipment:	discs, harrows, tractors
self-powered harvesters:	areal harvesters, forage harvesters

Mechanization can further be classified according to operation type:

land clearing and preparation
crop establishment
crop care
harvesting
post-harvesting processing (and storage)
materials handling and transport (including water delivery).

For the purpose of the present report the distinction is drawn only between the categories of hand tools and hand-operated

machines, animal-drawn equipment, stationary engine-powered machines, tractor-drawn equipment, and tractors.

Because of the often disappointing performance of improved mechanization technology in Africa, FAO, in particular, have been advocating for some time the formulation of national agricultural mechanization strategies. This involves an attempt to describe in detail how mechanization will be introduced, used and sustained in order to meet a country's long-term development objectives.

2.2.4. Farming Systems and Mechanization

The direction and rate of development in the agricultural machinery manufacturing sector is closely related to the form and prosperity of the farming sector. Farming systems reflect a complex of past and present economic, political, social, technical and bio-environmental factors.

In most cases, the sophistication of farming systems, farm mechanization and the agricultural machinery manufacturing sector are highly positively correlated, and tied to the general level of economic development. Higher per capita GDP associated with industrialisation usually implies that a smaller proportion of the total workforce is engaged in agriculture, which in turn implies high capital inputs in the form of mechanization to substitute for labour, if self-sufficiency in food is not to suffer. Higher-output systems are required to generate a market surplus, and these usually involve greater mechanization inputs in terms of farm power for field work, irrigation water delivery, post harvest operation, transport and storage. Studies (FAO, 1975) show that higher crop yields are associated with (but not necessarily due to) higher farm power inputs. There may be exceptions to the link between average per capita GDP and the dominant agricultural technologies in countries where dualistic economies isolate high-income industrial or petroleum enclaves, leaving the rural sector largely untouched. This is perhaps the case in Nigeria and to a lesser extent in Egypt.

Existing farming systems and related mechanization also reflect historical factors; especially exposure to outside influences. Colonial settlements have resulted in large commercial

farms operating alongside smallholdings. Such systems have then been adopted by some indigenous commercial farmers. Transnational companies and Governments operate mechanised plantation production. In some areas, such as northern Africa, the use of animals is traditional, but in others, including most of Africa south of the Sahel, work animals were first introduced during the colonial era (East Africa) or only in the last 30 years (West and Central Africa).

Farming systems and related agricultural mechanization strongly reflect the natural environment: soils, climate, topography. These determine crop and livestock suitability, the type of operations required for crop production, and the time available for field work. For instance, soil moisture conditions determine power requirements for land preparation, the degree of weed infestation, and the risk of damage to soil structure if compacted by heavy machinery. Many African soils are fragile, and thus very sensitive to cultivation practices.

Farming systems and the role of mechanization are strongly influenced by the relative availability of land and labour. The mechanization of field operations mainly increases output per man rather than output per hectare of land. Mechanization can make a significant contribution where available land allows the extension of the cropped area. However, where land is the limiting factor, and labour relatively plentiful, mechanization is often less advantageous, unless it can increase yields through irrigation, crop protection or better timeliness.

The dominant farming systems in all African countries are still based on traditional farming, which involve approximately 95 per cent of the rural population. Typically, small family farms, scattered over a number of plots, have areas proportional to the number of agricultural workers (0.5-0.7 ha/worker), and are usually less than 2 to 3 ha in total.

Production is based on food crops and non-intensive cultivation methods, without the use of modern inputs such as fertilizers, pesticides, selected seeds. Agricultural equipment is predominantly limited to hand tools, with some use of animal-drawn tools. Even recourse to simple hand-operated machines is very rare. Cropping techniques are strongly dependent on agro-climatic

conditions, as well as on very well-established traditions and habits. As a consequence, yields are extremely poor and only a small part of the production is marketed. This results in very a low level of farmers' incomes, which hampers the introduction of improved production techniques.

Raising the level of traditional farming has often been attempted in the past, both by introducing cash crops (cotton, rice, groundnuts, etc.) for additional income, and through farmers' co-operatives or development organisations for the diffusion of improved techniques. The latter method has proved the more effective, but has involved very great organisational efforts, and the benefits have often been disappointing . There is a strong tendency for farmers to prefer the better-known traditional techniques, abandoning new farming systems or cash crops as soon as problems arise. This often occurs due to climatic constraints, inadequate repair and maintenance, and delays in the supply of inputs.

Animal-power farming is often associated with development initiatives as a means of increasing cultivated area per worker. The use of the animal-drawn equipment can permit an increase in the area cultivated per worker to 2 to 3 ha. Theoretically, this is a very promising option because it is relatively easy to master, requires low maintenance, and the costs are moderate: animal mechanization was very widespread in industrial countries up to the 1940's. Nevertheless, in spite of its positive features, the growth of animal mechanization in Africa is very low, and in some countries a reduction of interest has been recorded (Senegal). This is a result of some specific African problems:

- traditionally, cropping and animal breeding are very often two separate activities, farmers are not used to raising animals;

-animal husbandry, particularly feeding and health care are poor so that the efficiency of the draught animals is reduced, and veterinary services are needed in support;

-the cost of animals and equipment is relatively high (in the order of US$700-900); credit is needed for purchase;

-some traditional food crops, such as roots and tubers , are not well suited for animal mechanization;

-improved cultivation equipment is just one of the several inputs required for the improvement of farming systems, and in the absence of the others (selected seeds, fertilizers, agro-chemicals, storage facilities), the impact of animal power can be disappointing.

Modern mechanization based on the use of tractors, which has been promoted in the past as the fastest way of developing African agriculture, is still very little diffused. Excluding the Mediterranean African countries, modern mechanization touches no more than 1 to 3 per cent of the rural population, mainly confined to large-scale farms (state farms, co-operatives, agro-industrial units, etc.) and organisations for hiring equipment.

The introduction of tractors in African countries has in recent years become the subject of particular criticism, as an example of the blind application of a technology from industrialized countries into a completely different technical, economical, social, environmental and political context.

The main conceptual error is that tractorization is a typical energy-intensive technology, while in most cases agricultural development in Africa calls for labour-intensive strategies employing large numbers of people. But several additional negative impact results occur:

-the purchase of tractors drains scarce foreign exchange

resources;

-investment and operating costs (spare parts, fuel) are too high in comparison with farmers' purchasing power and generally increase faster than agricultural product prices;

-there is a serious lack of trained personnel for tractor operation and maintenance;

-the inadequate infrastructure for tractor service and repairs and provision of spare parts (which is accentuated by the very wide variety of makes) leads to a very poor level of productive utilization, generally not exceeding 10 to 20 per cent.

-even during productive use, a predominant share of time is devoted to transporting agricultural products and miscellaneous materials or to running fixed equipment (pumps, threshers, electric generators, etc.); this generally represents an uneconomic use of available power;

-the use of tractors for heavy cultivation may result in the degradation of fragile soils;

Therefore, whilst tractorization may be appropriate in cash-crop, profit-oriented farming, it is unlikely, in the short- or medium-term, to provide a solution that is adequate for the real development needs of the majority of the rural population.

2.3 Agricultural Machinery Manufacturing in Africa

2.3.1 Classification of Production System

Three main levels of agricultural machinery manufacturing can be identified, according to the characteristics of the production units and the methods used:

-artisanal craft and blacksmith workshops usually at village level;
-small- or medium-scale production units with up to 50 workers;
-large-scale production units with more than 50-100 workers.

The definition of scale here is related to African production patterns and does not refer to the concept of small-, medium- or large-scale in industrialized countries.

Table 2.2 shows the general relationship between categories of equipment and characteristics of production in Africa.

2.3.2 Demand for and Supply of AMI Products in Africa

(i) General Considerations

The development of the agricultural machinery industry in Africa is at a very low level. The strategic importance of this sector has often been ignored, as countries have looked for more sophisticated industrial technologies.

The vast majority of farmers in Africa rely on the use of simple hand tools, most of which are produced by local blacksmiths, often using scrap steel. The presence of workshops in African countries producing hand tools, animal equipment, or tractor-related machines is shown in Table 2.3. Currently, out of 50 African countries examined, 39 produced improved hand tools, 31 produced animal-drawn equipment, 14 produced engine powered and tractor equipment, and 17 assembled tractors from knock-down kits. Only one country, Algeria, manufactures tractors.

This reported incidence of manufacturing probably overstates the extent of AMI activity. Many establishments are ill-equipped and their production is sporadic. Furthermore, the average size of industrial units is very small: one single enterprise, in Algeria, with approximately 6,000 workers, represents about 25 per cent of

Table 2.2

Typology of agricultural equipment production in Africa

ARTISANAL LEVELS	SMALL- GR MEDIUM-SCALE UNITS	LARGE-SCALE UNITS
	HAND TOOL PRODUCTION	
Products:		
Hand tools following traditional pattern; poor quality	Hand tools plus some other equipment such as animal-drawn equipment or simple hand-operated machines	Hand tools plus some other equipment such as animal-drawn equipment or processing machines
Equipment:		
Coal fired' hand-blown; hand forging	Forging and welding facilities	Forging and welding facilities; heat treatment; machine shop; paint shop;
Output:		
50-5000 units/year	10,000-70,000 units/year	100,000-1,500,000 units/year
Manpower:		
2-10 workers	10-50 workers	50-700 workers
	ANIMAL-DRAWN EQUIPMENT AND HAND-OPERATED MACHINES	
Products:		
Simple tillage equipment	Ploughs, cultivators, seeders, shellers, threshers	Ploughs, cultivators, seeders, tool bar, sprayers, ox/donkey cart, shellers, threshers, mills and pumps
Equipment:		
Similar to hand tool production	Similar to hand tools plus foundry facilities (external)	Similar to hand tools plus foundry (internal or external) and quality control facilities
Output:		
20-300 units/year	500-8000 units/year	10,000-100,000 units/year
Manpower:		
5-15 workers	15-50 workers	50-500 workers
	MOTORIZED EQUIPMENT	
Products:		
-	Tractor-drawn equipment, processing machines assembly with a very low local added value	Tractor-drawn equipment, trailers, processing machines, storage equipment assembly. Some tillage equipment can be entirely produced locally.
Equipments:		
-	Machine shop, paint shop	Machine shop; sheet metal sheer, break; press shop; tool room; paint shop; foundry
Output:		
Manpower:	700-2,000	1,500-7,000

Table 2.3

Summary of Existing Facilities for Manufacture of Agro-machinery in Africa

Country	Level of Technology	Mainly Importing	Hand tools	Animal drawn equipm.	Simple powered machinery	Tractor Assembly
1.	Algeria		x	x	x	x
2.	Angola		x	x		x
3.	Benin		x	x		
4.	Burundi	x	x			
5.	Botswana	x	x			
6.	Burkina Faso	x		x		
7.	Cameroon	x	x	x		
8.	Cape Verde	x				
9.	Central African Republic	x	x			
10.	Chad	x		x		
11.	Comoros Islands	x	x			
12.	Congo		x	x		x
13.	Djibouti	x	x			
14.	Ethiopia		x	x	x	x
15.	Egypt		x	x	x	x
16.	Equatorial Guinea	x	x			
17.	Ghana		x	x	x	x
18.	Gabon	x				
19.	Gambia	x	x			
20.	Guinea		x	x		
21.	Guinea-Bissau	x	x			
22.	Ivory Coast		x	x		
23.	Kenya		x	x	x	x
24.	Liberia		x	x		
25.	Lesotho		x	x		
26.	Libya		x	x		
27.	Madagascar		x	x		
28.	Mozambique		x	x		
29.	Malawi		x			
30.	Mali		x	x		
31.	Mauritius	x			x	x
32.	Mauritania	x				
33.	Morocco		x	x		x
34.	Niger	x				
35.	Nigeria		x	x	x	x
36.	Rwanda		x			
37.	Sao Tome and Principe	x				
38.	Senegal	x	x	x	x	x
39.	Sierra Leone	x	x			
40.	Seychelles	x				
41.	Somalia	x				
42.	Sudan	x		x		
43.	Swaziland	x			x	x
44.	Togo		x	x		
45.	Tanzania		x	x	x	x
46.	Tunisia		x	x		x
47.	Uganda		x	x	x	
48.	Zambia		x	x	x	x
49.	Zaire		x	x	x	x
50.	Zimbabwe		x	x	x	x
TOTAL NUMBER OF COUNTRIES IN EACH GROUP		23	39	31	14	17

the estimated total industrial work force in the agricultural machinery sector in Africa. It is estimated that no more than 20 industrial firms manufacturing agricultural machinery in Africa have more than 200 workers. Africa's agricultural machinery industry employs less than 1 per cent of the total industrial labour force and its output accounts for a negligible percentage of the total market for modern agricultural machinery. Production is almost entirely devoted to supplying local or national markets and the export of finished products or components between African countries is practically unknown.

Due to market limitations, the range of equipment produced is often very broad; a large part of the manufacturing enterprises have multi-product output, and for some of them agricultural machinery is a sideline.

In spite of the distinction made between industrial and artisan production, a rigorous classification is not possible because of the very vague border line between the two categories. Several co-operatives of artisans have been set up, mainly in Western Africa, which are between the two categories.

(ii) Hand Tools

It is estimated that hand tools are the only form of mechanization technology used by 80 per cent of African farmers. It is estimated that the demand for hand tools in Africa is about 70-90 million units per year.

According to the United Nations Statistical Office, imports of hand tool for agriculture and forestry (item SITC 695.1) show a wide variation over the past ten years from US40 to 20 million (US$18 million in 1984). Converting the monetary values to physical units, imports account for between 10 and 20 million units per year. Therefore, local production (artisans and industry) can be estimated to supply approximately 80 per cent of the total demand (55-75 million units/year). No official statistical information

exists as far as industrial production is concerned, so that the supply from this source is not well-known. An estimate of the theoretical full production capacity of industry indicates a value of some 25 million units/year, but with a very low capacity utilization, in the range of 30-60 per cent. The contribution of the industrial sector can therefore be estimated to be on the order of 10 million units per year. No accurate or detailed data exist on the number, characteristics, output, and potential of commercial producers of hand tools in Africa. Annex 2.4 of Annex 1 contains a general description of the better known factories.

The remaining balance of the total demand is covered by the artisanal sector, which supplies approximately 54-65 million units - the actual production is not officially recorded. Thus, the artisanal sector is today, and will be for some years to come, the more relevant supplier of hand tools.

(iii) Animal-drawn and Hand-operated Machines

Statistics on the consumption of hand and animal-powered machines are not available; import statistics are incomplete or show a high level of aggregation, and no reliable figures are available for local production. Animal use varies considerably amongst and within countries; in West and Coastal and Central Africa it can be negligible, in the Sahel and parts of East Africa, animals may provide up to 30% of power input. Overall, perhaps 10 to 15% of farmers have work animals; most of these would have a plough and one other implement.

Animal-drawn equipment is produced by a wide category of production units, ranging from artisan co-operatives with 15-20 workers and an output of 700-1000 units per year, to large-scale (in African terms) enterprises, employing 300-500 workers and with an output of 100-150,000 units per year.

Some of these are real' "manufacturers", starting from imported steel, but others are mainly assembling semi-finished

products and components imported from Europe, India, and China. The share between the two categories is not well-defined nor reported. Even in the case of actual manufacturing and not just assembly, the designs used are generally imported from abroad, and thus are sometimes not well-suited to local conditions. Factory equipment for the different stages of production is generally old and of poor quality (due to inadequate maintenance), which reduces the quality of the output. Table 2.5 of Annex 1 contains some examples of animal-drawn and simple powered equipment.

(iv) Engine Powered, Tractor Mounted, Equipment and Tractors

The average number of tractors per thousand hectares of arable and permanent crop land in Africa is 2.5. Excluding the four most mechanized countries (Algeria, Egypt, Swaziland and Zimbabwe) which have values between 7 (Zimbabwe) and 21 (Algeria), the average for the remaining 46 countries is 1.1. The same value in developed agricultural systems ranges from 24 for extensive cultivation patterns (USA), to 80 for intensive agriculture (France, Italy). The population of tractors in many countries is below 2000 . Tractors for field work probably assist less than 5% of the African population.

Thus, annual demand for tractors in Africa is very low, and even including tractors for non-agricultural uses (mining, earth moving, etc.), which account for an important share of the total, it is of the order of 35,000 units per year. By comparison, this is less than 50 per cent of the annual demand for tractors in many individual European countries . Import figures for both tractors and tractor mounted equipment have shown wide fluctuation about a declining trend. This reflects foreign exchange scarcity and problems of sustaining motorized mechanization. A complication in the interpretation of import statistics is that much (about 90% according to FAO) of the continent's Agricultural Machinery imports is obtained under concessionary-aid-in kind arrangements. Imports may not match needs, and may discourage local manufacture.

Manufacturing activity pertaining to tractors, implements and power-operated machines is practically non-existent in the African region. The very few enterprises in this sector are mainly concentrated in North African countries. Algeria has the only tractor and engine manufacturing plant,with approximately 3,500 workers and an output of about 8,000 engines and 4,500 tractors.

A few African enterprises are merely assembling a small number of tractors (e.g. in Nigeria and Zaire) with a very low local value added. Facilities for the production of a wide range of tractor-mounted equipment, trailers, pumps, etc. are available in Algeria, Morocco, Egypt and Tunisia.

Of the remaining African countries, only Zimbabwe has significant production of agricultural equipment, with an important export activity to nearby countries. Although the production machinery is old, the quality of the equipment produced is comparable with equipment imported from industrialized countries.

Some plant exists in Kenya that manufactures tractor implements with imported components, but the quality is moderate and not usually comparable with imported equipment.

2.3.3 Factors Influencing Agricultural Mechanization

Drawing on the preceding discussion, table 2.6 contains the factors which influence AMI status and development. These factors were used to identify and explain variations in AMI, and, where information was available to group countries according to common patterns of AMI development.

Table 2.6

Farming Systems

- Farm size and type: subsistence, emergent, commercial, plantation
- Farm tenure
- Major land uses (crop and livestock systems)
- Ratio of food/cash cropping
- Rainfed: irrigated area
- Use of improved inputs (fertilizer)
- Yields
- Farm incomes

Agricultural Resources Base

- Crop areas
- Land: population ratio
- Land: agricultural population ratio
- Agro-ecological zones (climate, soils, topography)

Economic Development Indicators

- Population (and growth)
- GNP, GDP per capita (and growth)
- Industrial sector contribution to GDP
- Agricultural sector contribution to GDP
- Percentage of population engaged in agriculture
- Balance of trade and international indebtedness
- Food self-sufficiency

Mechanization Inputs

- The use of hand tools and machines
- The use of work animals and equipment
- The use of stationary engine powered machines
- The use of tractors and related equipment
- The percentage of total farm power from different sources

Mechanisation Imports/Exports

- Imports and exports by main type of agricultural equipment
- Percentage self-sufficiency in machinery inputs
- Percentage import taxes on materials, components, and finished goods

Local Manufacturing

- Size and type of manufacture classified by
  - product range (type and quality)
  - product quantities
  - production facilities
  - size of labour force and skills
  - organisation: public, private, cooperative
- Ancillary manufacturing supplies and sevices
  - by materials
  - by services/processes
- Repair and maintenance workshops

Institutions Supporting AMI (in both agric and industrial sectors)

- Ministries responsible
- Trade and manufacturers associations
- Manpower development; education, training,
- Markets and prices for agricultural inputs and outputs
- Extension
- Research and development
- Credit
- Procurement and distribution systems
- Machinery user groups, syndicates, hire services.

2.3.4 Constraints and Enhancements for AMI Development

Most of the constraints experienced by agricultural machinery manufacturers in Africa reflect the low level of economic development, as shown by low farming prosperity and a slow growth of basic industrial, urban, and rural infrastructure.

The main constraints facing manufacturers can be summarized as follows:

From the manufacturing point of view:

-difficulties in supply of quality raw materials and semi-finished goods (profiles, components) lead to a limited choice of appropriate construction elements;

-imports of raw materials and components from foreign manufacturers experience long delays in supply, generating difficulties in production planning;

-production equipment and machinery need to be imported, initial supply and subsequent repairs and maintenance are often a problem;

-industrial ancillary facilities (heat treatment, special machinery, quality control, etc.) are not available;

-inadequate and expensive energy and water supplies;

-inadequate designs and specifications.

From the human resources viewpoint:

-lack of skilled local manpower leads to low productivity and poor maintenance of production equipment;

-national engineering capability is inadequate to design or

to adapt agricultural equipment to fit the local conditions;

-the low level of management emphasizes other local difficulties;

-inadequate training facilities and programmes;

From the market viewpoint:

-low crop prices and yields give low and fluctuating farm incomes thereby restricting market demand;

-conservative attitude of farmers to new technology;

-widely dispersed market, and poor distribution and repair and servicing infrastructure;

-limited interregional trade;

-restrictive licencing practices;

-competition from dumped' imports.

From the institutional viewpoint:

-absence of agricultural mechanization strategy;

-incoherent or contradictory governmental policies regarding import licencing, taxation, and foreign exhange allocations;

-difficulties of foreign exchange procurement for imports;

-Communications (national and international) problems;

-Concessionary-aid-in-kind imports do not match needs (or undercut market);

-Inadequate industrial and agricultural extension, including credit for manufacturers and farmers.

The extent to which the above factors constrain AMI varies amongst countries. The absence of a constraint often indicates an opportunity for enhancement. These constraints and enhancement factors were used to propose AMI development strategies for countries facing similar circumstances (see 3. below).

2.4 Recommendations for AMI Development

Agricultural development and the provision of relevant technology is critical for the welfare of the African continent. The local manufacturing and servicing of agricultural machinery is an important activity for an emerging industrial sector. Africa, as a continent, imports the majority of its improved AMI products. This commits scarce foreign exchange, and fails to develop a local capability in manufacturing and industrial processes.

Proposals for the development of AMI require activities across a broad front. They can be grouped with respect to institutional, agricultural, and industrial development.

The first group of activities relate to the development of an institutional environment which encourages both agricultural and AMI development in accordance with national needs. Specific actions include:

- -the formulation of an agricultural mechanization strategy which identifies mechanization needs, and best ways of meeting these;

- -the formulation of an AMI strategy which identifies priorities and development activities;

- -the review of Governmental policies as they influence incentives to local manufacturers; namely import-licencing, taxes, and foreign exchange allocation.

- -the establishment of a regional network for the sharing and

transfer of appropriate mechanization and manufacturing technology.

The second group of activities relate to the performance of the farming sector. They include:

-the promotion of improved farming technologies, e.g. animal-drawn equipment, post-harvesting simple machines, pumps, chemicals, fertilizers, selected seeds, training farmers in animal breeding, training, and veterinary care, must be adequately emphasized;

-the strengthening of institutions, delivering and supporting the use of mechanization and related technologies at farm level, with particular reference to research and development, input supply, credit and extension;

-improvements in agricultural and rural facilities and infrastructure, e.g. irrigation, drainage, soil conservation, crop processing and storage, fisheries, forestry;

-the development of farmer groups and associations who might benefit from the collective use of improved mechanization e.g. farmer cooperatives.

The third group of activities involves the development of the AMI itself.

In this case the most effective, short- or medium-term intervention is the rehabilitation or up-grading of existing facilities for agricultural machinery production. Table 2.7 summarizes possible actions for upgrading production facilities.

SECTION 1

(requirements at (a) blacksmith/rural units le
(b) from blacksmith/rural unit to small/mediu
(c) from small/medium scale to medium/large s

Table 2.7

Note: ↓ upgrading within present level; → upgrading from present level to next level

Elements	Blacksmith/ Rural Family Worker/Ownership Units →	Small/medium scale industry →	Medium/large industry
1. Product design	- requires improved prototypes and relevant assistance	- requires applied R+D institutional support	- requires institutional support on licencing
2. Material required	- requires provision of carbon steel, wood, hardware, sheet metal and sections (material EN1 series, scrap material, etc.)	- requires provision of mild steel, cast iron, carbon steel wood, sheet metal, sections, paints and some subcontracted components (material EN1, 8, 16, 32, 42 and castings grade 16, 17)	- requires provision of steel-medium and high carbon, free cutting and forge steel; casting - grey malleable. nodular and non-ferrous castings; sheet metal and sections, paint, boughout semi-finished and finished components: imported components both semifinished and finished, hardware and components
3. Management	- requires introduction of basic techniques, but retaining rural environment and traditions	- normally on line management ownership based on individual or partnership has to be strengthened through institutional training	- requires well- defined management system with horizontal and vertical inter-action, administration, finance, production and marketing are major departments
4. Production techniques	- application of simple powered machinery, simple jigs and fixture and basic heat-treatment etc. necessary	- application of jig and welding fixtures are common. Production techniques are more job basis with minimum batch size. Heat-treatment, process planning, method study standards and quality control etc. at elementary levels. Need upgrading.	- based on batch or continuous production system, application of process planning, settling up of standards, quality control, production control, cost control and common and essential wide application of jigs, tool fixtures, welding fixtures are essential.
5. Machine tools	- small hand tools such as hammer, anvil chisel, hacksaw, small coal fired furnace with hand-operated blower, pedal-operated grinding wheel and occasional use of bending, drilling equipment when power available when necessary. - need upgraded simple production equipment.	- some manual operated equipment plus power-operated conventional machine tools, welding units, limited inspection equipment, electrical/ coal/oil fired furnaces, some heat-treatment, are necessary. - need supporting industries such as foundry, forgeshop, and common engineering facilities.	- conventional powered machine tools and equipment plus semi-automatic and special purpose machinery. Also tool room machinery, gear cutting, heat-treatment, painting, fabrication equipment are necessary. - Need upgrading local technical capabilities in selection of machine tools and negotiations with supplies.

Elements	Blacksmith/ Rural Family Worker/Ownership Units
6. Supporting production facilities (within the plant)	- introd improv facili heat-t and so contro
7. Outside supporting industries	- Needs indust workin and su proper scrap requir
8. Marketing	- needs of co- instit keting tion t direct farme
9. Financial assistance	- as ve assis the f stitu lable suffe quate pital nanci tions
Elements	Blacks Rural Worker Units
10. Financial assistance cont.	- main on l lend high rate - ther to g atte este of r anci tuti sist unit lop ent

ELEMENTS OF UPGRADING PRODUCTION FACILITIES

(requirements at (a) blacksmith/rural units level,
(b) from blacksmith/rural unit to small/medium scale level and
(c) from small/medium scale to medium/large scale level)

→ upgrading from present level to next level

SECTION 2

Elements	Blacksmith/ Rural Family Worker /Ownership Units →	Small/medium scale industry →	Medium/large industry
6. Supporting production facilities (within the plant)	- introduction of improved simple facilities for heat-treatment and some quality control necessary	- some heat-treatment and quality control/inspection facilities necessary. - Need establishment of common engineering and technical service facilities for small/medium scale industries	- heat-treatment quality control inspection are an integral part of large scale industry
7. Outside supporting industries	- Needs hardware industry, wood-working industry and supply of proper steel and scrap iron required	- needs foundry, hardware industry, special component industry, such as disc, high carbon steel tines etc., and also jigs and tool manufacturing	- needs foundry (ferrous, grey malleable, spheroidal iron and non-ferrous) forging and die casting, gear cutting and transmission shaft manufacture, special sheet metal components, rubber parts, electrical items, paint, etc.
8. Marketing	- needs development of co-operative institutional marketing, in addition to present direct sales to farmers	- through wholesale distributor or directly to farmers. - needs assistance in marketing and strengthening of distribution/ service systems.	- needs strengthening of agents, national distributors with some/adequate facilities for spare parts supply and after sales service. - needs strengthening of spare parts supply, repair and maintenance and training programme.
9. Financial assistance	- as very little assistance from the financial institutions available now, they suffer from inadequate working capital. needs financial institutional support.	- as at present limited finances available from private sources or governmental institutional loans, there is a need for expansion of this programme.	- need significant domestic private capital, national financial institutional and governmental loans.

Elements	Blacksmith/ Rural Family Worker/Ownership Units →	Small/medium scale industry →	Medium/large industry
10. Financial assistance cont.	- mainly depends on local money lenders with high interest rates. - there is a need to give more attention to establishment of rural financial institutions to assist these small units to develop rural entrepreneurship.	- working capital from banks against inventory security - there is a need to strengthen small scale ind. development corporations/ institutions and link the financial institutional activities to promote this sector.	- international institutional finances and equity and equity participation by foreign collaborator are the main sources of finances. Working capital through banks against raw material stock, inventory and work in progress. - there is a need for international financial assistance in this sector.

Small/medium scale industry →	Medium/large industry →
- requires applied R+D institutional support	- requires institutional support on licencing
- requires provision of mild steel, cast iron, carbon steel wood, sheet metal, sections, paints and some subcontracted components (material ENI, 8, 16, 32, 42 and castings grade 16, 17)	- requires provision of steel-medium and high carbon, free cutting and forge steel; casting - grey malleable. nodilur and non-ferrous castings; sheet metal and sections, paint, boughout semi-finished and finished components: imported components both semifinished and finished, hardware and components

Small/medium scale industry →	Medium/large industry →
- normally on line management ownership based on individual or partnership has to be strengthened through institutional training	- requires well- defined management system with horizontal and vertical interaction, administration, finance, production and marketing are major departments
- application of jig and welding fixtures are common. Production techniques are more job basis with minimum batch size. Heat-treatment, process planning, method study standards and quality control etc. at elementary levels. Need upgrading.	- based on batch or continuous production system, application of process planning, settling up of standards, quality control, production control, cost control and common and essential wide application of jigs, tool fixtures, welding fixtures are essential.
- some manual operated equipment plus power-operated conventional machine tools, welding units, limited inspection equipment, electrical/ coal/oil fired furnaces, some heat-treatment, are necessary. - need supporting industries such as foundry, forgeshop, and common engineering facilities.	- conventional powered machine tools and equipment plus semi-automatic and special purpose machinery. Also tool room machinery, gear cutting, heat-treatment, painting, fabrication equipment are necessary. - Need upgrading local technical capabilities in selection of machine tools and negotiations with supplies.

The main objectives are to increase productivity, to reduce unit costs and to improve quality. Broad categories of action include:

-the strengthening of institutions supporting AMI with particular reference to industrial extension (research, development, design, training, marketing and credit.);

-the promotion of regional institutions for research and development in agricultural machinery that are able to design, adapt and test equipment that is suitable for local conditions;

-reviewing and upgrading facilities with respect to design, process engineering,material procurement and control, quality control, and product specifications;

-assessing and meeting training needs with respect to production management and marketing skills; rehabilitation and equipping of facilities especially for in-service training;

-promoting the development of artisanal workshops for repairs and servicing, and simple manufacture;

-upgrading selected factories in order to extend and improve the range and quality of local production;

-improving facilities and infrastructure for the procurement, distribution and maintenance of agricultural machinery;

-possible rehabilitation of existing unserviceable tractors and equipment.

2.5 SUMMARY

This Chapter has reviewed the context and features of African AMI. The factors which explain variations in AMI circumstances and practices have been identified, together with constraints which impede development. This review provides a frame of reference for the grouping of countries according to patterns of development in the AMI, as seen in Chapter 3, and the formulation of generalised strategies in Chapter 4. By identifying patterns of development in this industry, based upon the levels of development of components within the AMI system, technical assistance appropriate to given development patterns can be formulated in a cost effective fashion. Relatedly, by identifying and addressing those components of an industrial system which act as constraints on the system's development a greater impact may be obtained from the prescribed technical assistance and investment activities.

CHAPTER 3. MAJOR AMI TYPOLOGIES

This Chapter describes the main grouping or typologies of countries, classifed according to common characteristics with respect to AMI status and needs.

The main components of the AMI system are described, together with the variables which were used to cluster countries into groups. The chapter concludes with a brief description of the six major AMI typologies in preparation for the cluster specific strategies which are derived in Chapter 4.

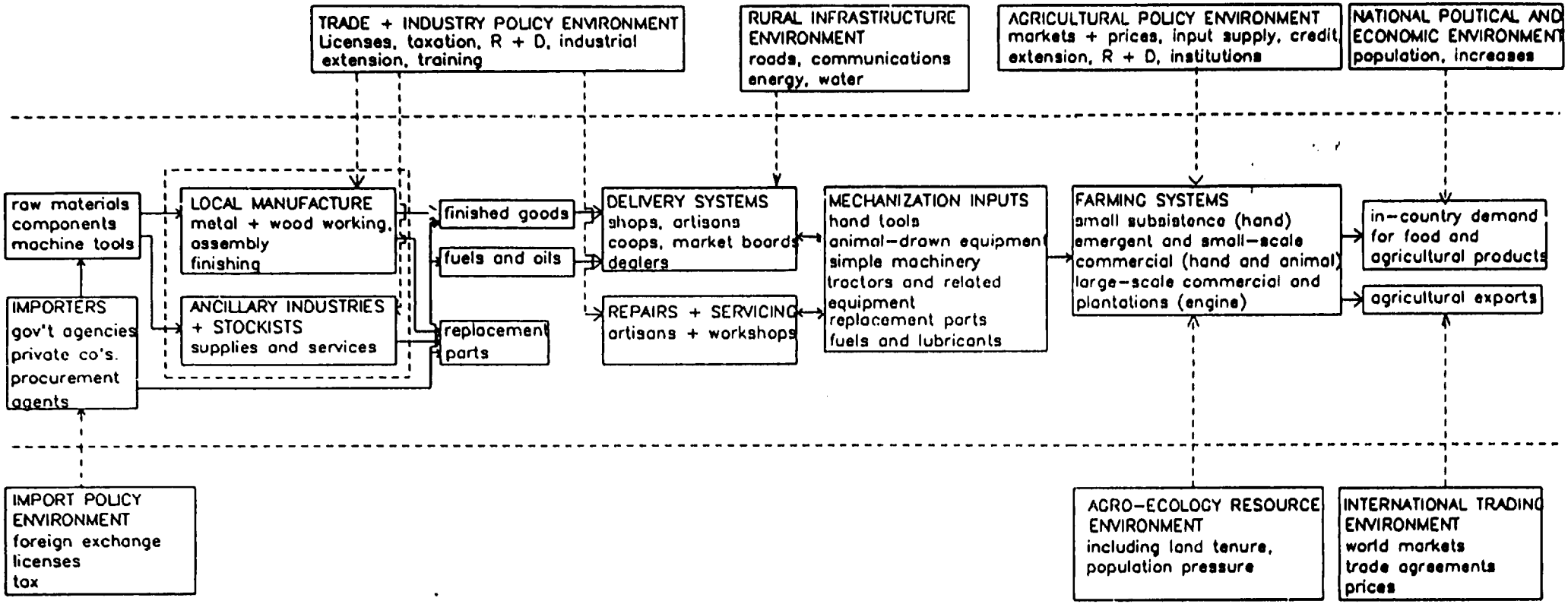
3.1 DEFINITION OF THE AGRICULTURAL MACHINERY INDUSTRY (AMI) SYSTEM

Figures 3.1 and 3.2 show the context and main features of AMI. Figure 3.1 shows AMI in a broad functional setting. The demand for farm tools and machinery by farmers. Supply can be met by imports or local manufacture. In between, there is a network of delivery and servicing agents. The five major sub-systems of imports, local manufacture, delivery, servicing, and on-farm use are influenced by a large number of external variables; many of which are politically defined.

Figure 3.2 considers in more detail the engineering processes involved in the manufacturing of AMI products themselves. This is a sub-system of Figure 3.1.

3.2. COMPONENTS OF THE AGRICULTURAL MACHINERY INDUSTRY

Outlined below are the components important to the development and potential of the AMI with the simple descriptions of each. Within the limits of available data, the variables used to describe these components are summarised in Table 3.1.


TRADE + INDUSTRY POLICY ENVIRONMENT
Licenses, taxation, R + D, industrial extension, training
RURAL INFRASTRUCTURE ENVIRONMENT
roads, communications
energy, water
AGRICULTURAL POLICY ENVIRONMENT
markets + prices, input supply, credit, extension, R + D, institutions
NATIONAL POLITICAL AND ECONOMIC ENVIRONMENT
population, increases
raw materials
components
machine tools
LOCAL MANUFACTURE
metal + wood working, assembly
finishing
ANCILLARY INDUSTRIES + STOCKISTS
supplies and services
finished goods
fuels and oils
replacement parts
DELIVERY SYSTEMS
shops, artisans
coops, market boards
dealers
REPAIRS + SERVICING
artisans + workshops
MECHANIZATION INPUTS
hand tools
animal-drawn equipment
simple machinery
tractors and related equipment
replacement parts
fuels and lubricants
FARMING SYSTEMS
small subsistence (hand)
emergent and small-scale commercial (hand and animal)
large-scale commercial and plantations (engine)
in-country demand for food and agricultural products
agricultural exports
IMPORTERS
gov't agencies
private co's.
procurement agents
IMPORT POLICY ENVIRONMENT
foreign exchange
licenses
tax
AGRO-ECOLOGY RESOURCE ENVIRONMENT
including land tenure, population pressure
INTERNATIONAL TRADING ENVIRONMENT
world markets
trade agreements
prices

ASE DIAGRAM:
GRICULTURAL MACHINERY Figure 3.2

PRODUCT GROUPS 1 - 6

INPUTS, SERVICES AND ANCILLARY INDUSTRIES | RAW MATERIALS | METAL AND WOOD WORKING | ASSEMBLY FINISHING | FINISHING, ASSEMBLY | FINAL PRODUCTS | DISTRIBUTION

TRADE
A1, A2, A3, A4
A5

MANPOWER
Relativ.unskilled draftsman, tech. sch. A34, A33, A15, A16

DESIGNS
A0, A26, Q

INVESTMENT IN MACHINERY AND EQUIPMENT
A21, A32

SMALL PARTS
(nuts, bolts)

REPLACEMENT PARTS

ENERGY
Q

MAINTENANCE AND REPAIR (PLANT)

STEEL BARS, SECTIONS, SHEETS
I Castings
A20

FORGING
A17, Q

PRESS SHOPS
CUTTING
A18, A19

WELDING

DRILLING
MILLING
TURNING
MACHINING
A22, A23

HEAT TREATMENT

WOOD WORKING

CASTING
A24, A25, Q

ASSEMBLY
A12, A13, A14
Q

PAINTING

GRINDING, POLISHING, SHARPENING

PLASTIC COATING

GALVANIZING

PLATING

HAND TOOLS

ANIMAL DRAWN IMPLEMENTS
A10

TRACTOR DRAWN IMPLEMENTS
A11

SIMPLE, LOW-COST POWER EQUIPMENT

MANUALLY OPERATED EQUIPMENT

POWER OPERATED EQUIPMENT

ARTISANS

COOPERATIVES/ PRODUCERS ASSOCIATIONS

COMMERCIAL DEALERS

STATE INSTITUTIONS
A7

(FARMER)

A6
Q

RURAL INDUSTRIAL INFRASTRUCTURE

AGRICULTURAL DEVELOPMENT POLICY AND INSTITUTIONS

FOOD AID
A35

GOVERNMENT POLICY
A8, A9

TRADE RELATED
A27, A28, A29
A36

INVESTMENT RELATED
A30, Q

AGRICULTURAL MECHANISATION POLICY
A31

FARMING SYSTEMS

3.2.1. Existing AMI facilities

This component describes the present situation in the country as far as the production of agricultural machinery is concerned. Due to poor available statistics on number, size and characteristics of existing units, a qualitative evaluation based on a synthesis of all available documents and information has been used to obtain a relative perspective.

3.2.2 Inputs and Services

This component assesses the local availability of essential raw materials for agricultural machinery manufacture and the engineering and manufacturing knowledge level of availability to the AMI.

3.2.3 Industrial infrastructure

Some basic metal-working industry facilities have been considered in order to describe the availability of ancillary support units for production. As above, a qualitative evaluation has been used.

3.2.4 Agricultural development and potential

This component evaluates the use of other technical inputs for improved agriculture (e.g. tractors in use and fertilizer usage per ha.) as a general indicator of efforts to raise the level of agricultural production and the relative importance of the agricultural sector.

This component also quantifies the possibilities for future expansion and improvement of agricultural production, and therefore helps to identify potential increased agricultural machinery demand.

3.2 5 Economic resources

In order to take account of the strong correlation between the present and potential development of the agricultural sector, and the overall national economic situation of each country, the availability of economic resources is evaluated.

3.2.6 Size of the market

This component assesses the market development potential of the AMI sector.

3.2.7 Government policy

This component gives a qualitative evaluation of the Government's perceived attitude towards foreign investment, and tax impositions on raw materials.

Table 3.1

Main variables used to characterize AMI components

Component	Variable	Description
	A57	Countries that are mainly importers of agri cultural machinery and equipment
Existing AMI facilities	A58	Existence of manufacturing facilities for hand tools
	A59	Existence of manufacturing facilities for animal-drawn equipment
	A60	Existence of manufacturing facilities for simple processing machines
	A61	Existence of tractor assembly facilities
	A13	Number of large scale producers of agricultural equipment.
Inputs and Services	A20	Number of raw materials types produced locally
	A21	Knowledge for manufacturing
Industrial infrastructure	A17	Existence of forge facilities
	A18	Existence of stamping facilities
	A19	Percentage of capacity utilization of stamping facilities
	A20	Assessment of the availability of raw materials
	A21	Assessment of the lack of knowledge as a constraint for manufacturing processes
	A22	State of available machine shop facilities
	A23	Percentage capacity utilization of machine shops
	A24	Numberof foundries
	A25	% of foundaries not operating
	A26	Number of manufacturing design facilities

Table 3.1 continued

Component	Variable	Description
Agricultural development and potential	A73	Number of tractors in use per 1000 hectare of arable and permanent crop land
	A63	Consumption of fertilizer per hectare of arable and permanent crop land
	A55	Percentage contribution of agriculture to GDP
	A69	Reserve of potential cultivable land per capita
Economic resources	A83	Gross domestic product (GDP) per capita
	A45	Number of Commercial vehicles in use.
	A76	% Secondary education enrollment
Size of the market	A46	Total population
	A84	Imports of hand tools
	A88	Imports of agricultural machinery
Government policy	A32	Assessment of foreign investment climate
	A27	% import taxes levied on raw materials for agricultural machinery
	A28	% import taxes levied on unfinished component parts for agricultural machinery

It should be noted that due to the poor coverage of some data not all of the variables listed above could be used in the final classification of countries.

3.3 CONSTRAINT AND ENHANCEMENT VARIABLES

Tables 3.2 and 3.3 contain listings of constraint and enhancement variables respectively which were used to assist in the formation of country groups. These variables are used in Chapter 4 to guide strategy selection; suggested activities are identified which overcome constraints and also exploit enhancement opportunities.

Table 3.2

AMI component	Constraint Number	Description
Agricultural Machine industry	1a 1b 1c	- Limited buildings, plant and equipment - Limited human resources; production and management skills - Limited product range/designs
Inputs and Services	2a 2b	- Limited production materials and components supplies, and services. - Limited or underdeveloped, Industrial support institutions e.g. credit, training, extension distribution
Industrial Infrastructure	3a 3b	- Poorly developed ancillary industries and related facilities (e.g. foundries, forges) - Poorly developed transport, communication, and utilities infrastructure.

Table 3.2 continued.

AMI component	Constraint number	Description
Agricultural Development	4a	- Subsistence oriented farming systems
	4b	- Major resource constraints; land/water/ labour
	4c	- Lack of appropriate mechanisation technology available locally
	4d	- Pests/diseases restrict crop and livestock production
	4e	- Low farm incomes
	4f	- Inadequate farmer support systems; extension, training, input, supply, marketing, credit, research and development.
	4g	- Restrictive institutions, customs and practice; e.g. land tenure, water rights.
Markets and Distribution	5a	- Small or fragmented markets
	5b	- Underdeveloped market agents and supporting institutions
	5c	- Underdeveloped market infrastructure

Table 3.2 continued

AMI component	Constraint number	Description
Government Policy	6a	- Unclear or contradictory policy objectives with respect to (i) agricultural development (ii) industrial development
	6b	- Inappropriate policy instruments with respect to (i) agricultural development e.g. pricing (ii) industrial development e.g. tax, F.E. allocation, licencing
	6c	- Lack of Agricultural Mechanisation Strategy
Economic (National Level)	7a	Low incomes/capita
	7b	Natural Resources very limited
	7c	Foreign exchange very limited
	7d	Unfavourable investment climate

Table 3.3

Enhancement Variables

AMI component	Enhancement number	Description
Agricultural Machinery Industry	1a	- Existing capabilities under-exploited at artisanal small-scale, large-scale levels,
	1b	- Appropriate designs for equipment available
Inputs and Services	2a	- Existing Institutions to support AMI
Industrial infrastructure	3a	- Developed industrial sectors capable of servicing AMI needs
Agriculture Development	4a	- Availability of resources; especially land and water,
	4b	- Presence of or potential for improved rainfed or irrigated farming systems,
	4c	- Presence of improved mechanisation technology,
	4d	- Existing institutions active in farmer organisation and support.
Markets and Distribution	5a	- Potentially large market,
	5b	- Existing market agents and institutions,
	5c	- Existing market infrastructure,
	5d	- Existing or potential regional trade.

Table 3.3. continued.

AMI component	Enhancement number	Description
Government Policy	6a	- Presence of National Development Plan with Sectoral Plans used by Government.
	6b	- Agricultural Mechanisation Strategy Formulation
Economic (National Level)	7a	- High incomes/capita
	7b	- Reserves of natural resources
	7c	- Foreign exchange available
	7d	- Favourable investment climate
	7e	- Donor funds available

3.4 IDENTIFICATION OF DEVELOPMENT PATTERNS

From the analysis of different AMI components the following groups of countries with similar patterns of development have been identified. Figure 3.3 shows the profiles for the six groups. The profiles show the group position of each AMI component against the overall mean. Differences between groups are apparent. Making reference to Figure 3.3 the following brief descriptions are made.

3.4.1 Group 1: Relatively well developed AMI facilities

(Algeria, Egypt, Morocco, Zimbabwe)

Relatively well-developed countries with a consolidated industrial sector including good quality facilities for all kinds of agricultural machinery production. A generally well developed agricultural sector exists and the economies are broadly based.

3.4.2 Group 2: Countries with Good Potential for AMI Development

(Cameroon, Ivory Coast, Kenya, Malawi, Mozambique, Senegal, Tanzania, Zambia)

These countries have good potential for agricultural machinery manufacturing, even though the industrial sector is in the early development stage. Basic production facilities do exist, populations are high, and agricultural production potential is good.

3.4.3 Group 3: Mainly artisanal level producers

(Benin, Burkina Faso, Ethiopia, Ghana, Madagascar, Mali, Niger, Nigeria, Togo, Zaire))

These countries are linked by having quite well-established agricultural machinery production mid-way between artisanal and semi-industrial levels. They have high populations and agriculturally biased economies, but poor raw material availability and low GDP per capita.

3.4.4 Group 4: Mainly importing countries
(Angola, Burundi, Central African Republic, Chad, Guinea, Liberia, Mauritania, Rwanda, Sierra Leone, Somalia, Sudan, Uganda)

These are less developed and low GDP/capita countries in which both industrial infrastructure and agricultural machinery production are practically absent, or not functioning.

3.4 5 Group 5: Countries with small markets for agricultural machinery
(Cape Verde, Comoros Islands, Djibouti, Equatorial Guinea, Gambia, Guinea-Bissau, Lesotho, Sao Tome and Principe)

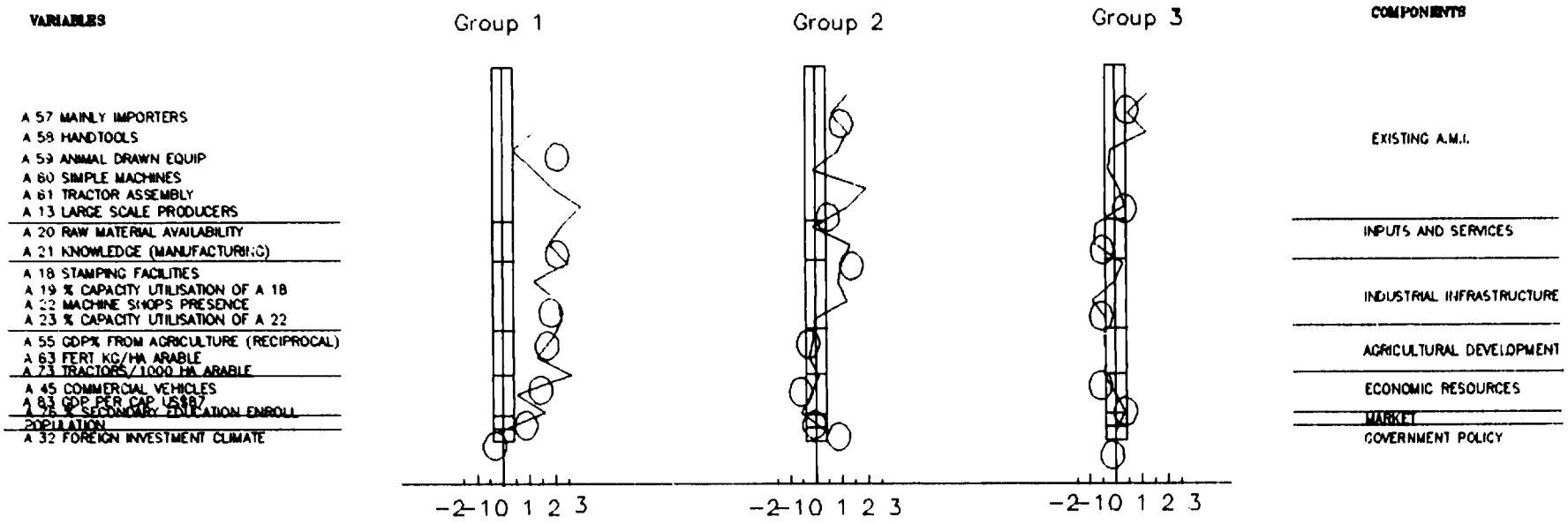
These are very small countries generally with fewer than one million inhabitants, and with poorly developed industrial infrastructure and raw material availability.

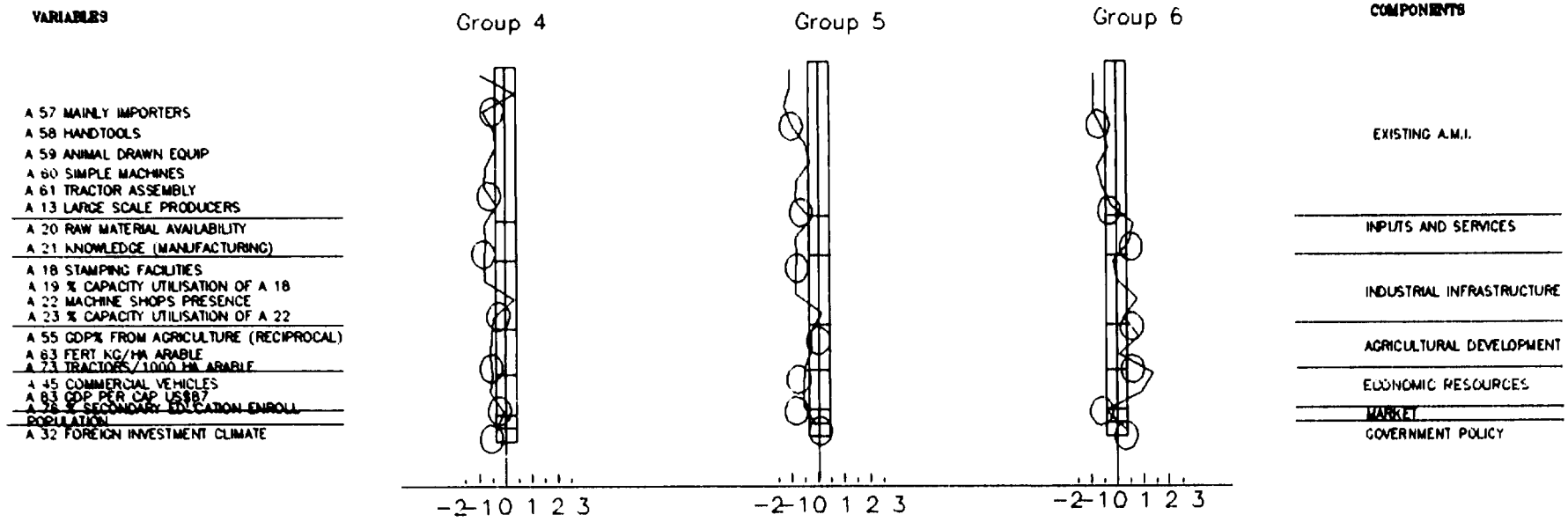
3.4.6 Group 6: Countries with low domestic priority on AMI
(Botswana, Congo, Gabon, Libya, Mauritius, Seychelles, Swaziland, Tunisia)

Agricultural machinery production does not appear to be a high priority for these countries due to the low contribution of the agricultural sector to their GDP, and because of low populations. GDP per capita is among the highest in Africa. They import their limited agricultural equipment needs.

3.5 SUMMARY

The preceding analysis has identified six clusters with different AMI patterns and needs. Groups 1, 2, and 3 demonstrate an existing capability in AMI, with Group 1 being the most advanced and Group 3 the least advanced of this subset. Groups 3, 4, 5, each for their own different reasons, have relatively low existing AMI capability. In the next Chapter, AMI development strategies and related actions are identified for each of these groups.


VARIABLES
A 57 MAINLY IMPORTERS
A 58 HANDTOOLS
A 59 ANIMAL DRAWN EQUIP
A 60 SIMPLE MACHINES
A 61 TRACTOR ASSEMBLY
A 13 LARGE SCALE PRODUCERS
A 20 RAW MATERIAL AVAILABILITY
A 21 KNOWLEDGE (MANUFACTURING)
A 18 STAMPING FACILITIES
A 19 % CAPACITY UTILISATION OF A 18
A 22 MACHINE SHOPS PRESENCE
A 23 % CAPACITY UTILISATION OF A 22
A 55 GDP% FROM AGRICULTURE (RECIPROCAL)
A 63 FERT KG/HA ARABLE
A 73 TRACTORS/1000 HA ARABLE
A 45 COMMERCIAL VEHICLES
A 83 GDP PER CAP US$87
A 75 % SECONDARY EDUCATION ENROLL
POPULATION
A 32 FOREIGN INVESTMENT CLIMATE
Group 1
Group 2
Group 3
-2-10 1 2 3
-2-10 1 2 3
-2-10 1 2 3
COMPONENTS
EXISTING A.M.I.
INPUTS AND SERVICES
INDUSTRIAL INFRASTRUCTURE
AGRICULTURAL DEVELOPMENT
ECONOMIC RESOURCES
MARKET
GOVERNMENT POLICY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A 55 GDP% FROM AGRICULTURE (RECIPROCAL)
A 63 FERT KG/HA ARABLE
A 73 TRACTORS/1000 HA ARABLE
A 45 COMMERCIAL VEHICLES
A 83 GDP PER CAP US$87
A 75 % SECONDARY EDUCATION ENROLL
POPULATION
A 32 FOREIGN INVESTMENT CLIMATE
Group 4
Group 5
Group 6
-2-10 1 2 3
-2-10 1 2 3
-2-10 1 2 3
COMPONENTS
EXISTING A.M.I.
INPUTS AND SERVICES
INDUSTRIAL INFRASTRUCTURE
AGRICULTURAL DEVELOPMENT
ECONOMIC RESOURCES
MARKET
GOVERNMENT POLICY

CHAPTER 4

4. AMI DEVELOPMENT STRATEGIES

This Chapter describes each of the AMI country-groups and identifies, in view of the constraints and enhancement opportunities facing each typology, a set of possible strategy components.

Appropriate actions which may require technical assistance for investment funding are also identified. The chapter ends with a summary of strategies and actions by country group.

4.1 INTERPRETATION OF GROUPS AND STRATEGIES

The reader is reminded that the grouping of countries has been performed primarily on the basis of existing AMI development, and, future AMI development needs and priorities. The purpose is to define similar patterns of AMI development and common strategies for development; that is indicative action programmes for country-groups. It is recognised that there may be significant differences within country-groups (for instance, as determined by variation in farming system). But these detailed differences in AMI development requirements would be identified during country specific project identification studies. The purpose of the groupings and strategies is thus to direct and prioritise further enquiry, and to ensure project needs and resources.

The groupings should not be interpreted as orders of merit; rather as associations of common need. Furthermore, due to the inevitable variations in country circumstances and practice within groups, not all of the strategy components and related suggested activities may be relevant to any one member of a group.

These groupings are currently based on available information, some of which is incomplete. The next stage of enquiry will involve

selected case studies of group members in order to verify and refine the AMI strategies. Thus the strategies are provisional at this stage.

These caveats are important for the interpretation of the group descriptions and strategies. The classification and analysis are intended to be helpful and positive, and to result in appropriate project design and sustainable development in accordance with needs and resources.

4.2 GROUP I: AMI DESCRIPTION AND STRATEGY

4.2.1 Group Description

Group I is described as 'relatively well developed AMI facilities countries' (Algeria, Egypt, Morocco, Zimbabwe).

A group profile is contained in Figure 4.1. These countries are grouped together because they have relatively well developed agricultural machinery. Relative to other African countries they have a high degree of self sufficiency in farm mechanisation inputs. They have reasonable access to facilities, skills, material supplies and services. This enables the production of a broad range of agricultural machinery, including engine-powered and tractor operated machinery.

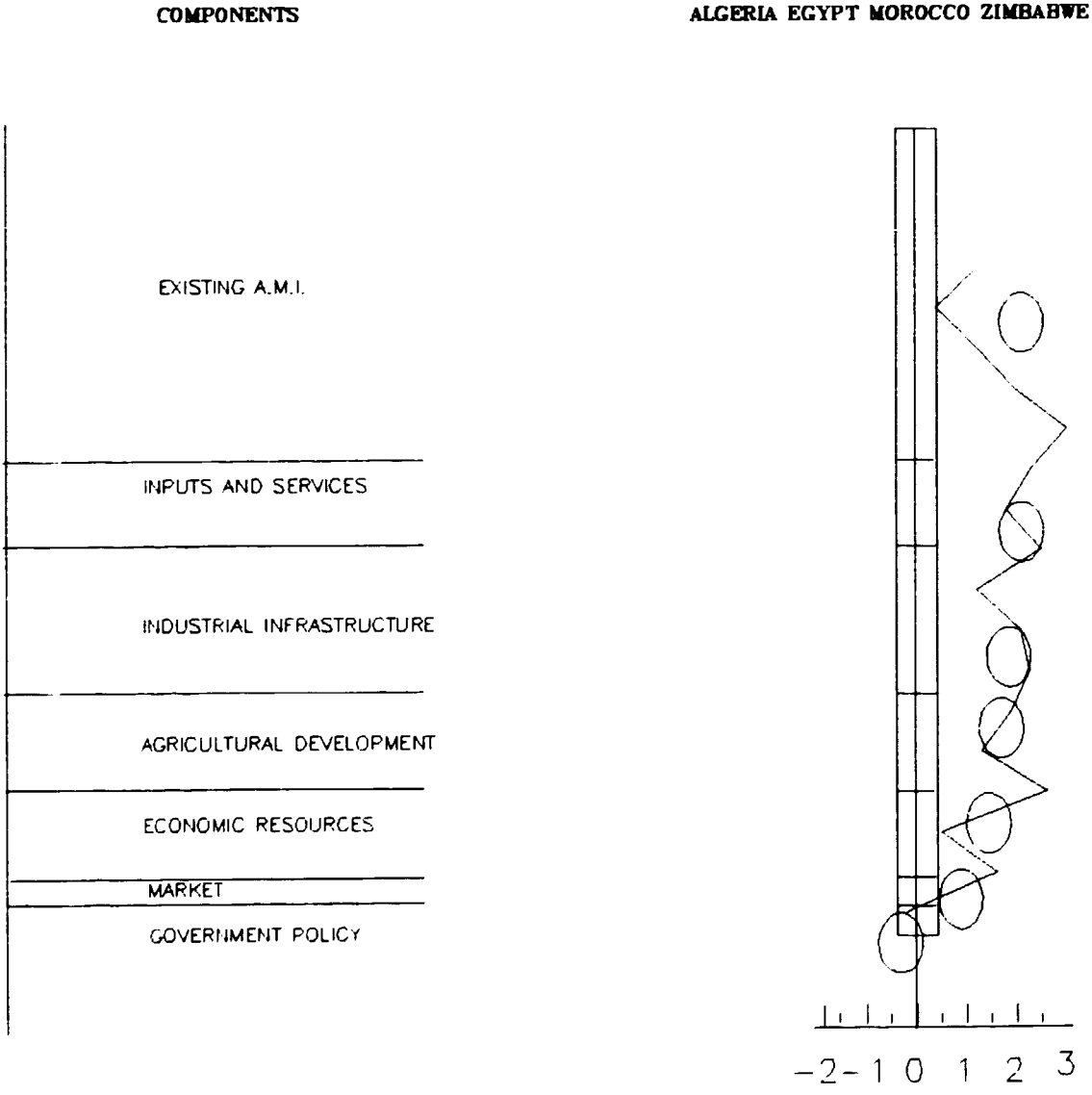
The agricultural sector is relatively advanced in terms of the use of improved technology. Fertiliser and tractor use are relatively high, and in the north of Africa irrigation is widely practiced.

All of these countries contain relatively large scale machinery production units. Algeria is the only African country which manufactures tractors. Other countries in the group assemble tractors, using a significant number of locally manufactured parts. Algeria and Zimbabwe also export farm machinery within their respective regions. Whilst these countries are relatively sophisticated in production methods and product range, they experience limitations imposed by ageing machine tools, unreliable or poor quality material supplies, out-of-date designs, and shortage of specialist manufacturing skills.

With respect to agriculture, the sector contributes less than 20% on average to GDP. This is low because of the relatively high degree of development in other sectors. Three of the countries are in the arid African zone, where irrigated agriculture,

Figure 4.1

Group 1 Country Profile
Relatively well developed
AMI facilities countries



livestock and orchard production crops are important farming systems. Zimbabwe has a variety of systems ranging from European commercial farms to traditional, subsistence smallholders. Compared to other African countries, farming systems show a relatively high use of improved technology such as improved seeds, agro-chemicals, irrigation, and mechanisation. The countries are amongst the continent's top users of both tractors and animal power. For instance, tractors account for about 40% and 20% of power inputs in Algeria and Zimbabwe respectively. Work animals account for about 20% of power inputs in all countries of the group. In the North African countries, it is common to find combinations of mechanisation technology in one farming system; tractors for tillage, animals for water lifting and transport, and hand systems for crop protection and harvesting.

Of all African countries, Egypt, given its special problems of severe population pressure, is the only one to systematically assess agricultural mechanisation needs and formulate a mechanisation strategy. This has identified priorities for research and development, and for mechanisation selection on regional agricultural development projects.

Tractor use is likely to increase in all members of the group. There is a particular need for a greater range of improved quality tractor-mounted equipment; particularly for crop establishment,and crop protection. There is also scope for a greater range of stationary engine powered machines, especially for water delivery and post harvest processing. Animals will continue as a main power source. For the most part designs of animal drawn equipment are adequate, although there is scope for encouraging the wider adoption and manufacture of non-tillage equipment (e.g. seed drills).

Population sizes are relatively high for this group. Population pressure is greatest in Egypt. There is scope for extending the area cultivated in the other countries. This partly determines the priority for mechanisation products; whether for yield increases (e.g. irrigation, crop protection) or area increases (e.g. tillage).

Generally, market prospects for the group are favourable; average levels of economic development and incomes (US$1180 per

capita) are high by continent standards. Infrastructure and market accessibility are good. The climate for foreign investment is, however, not always favourable, mainly due to uncertainties or complexities attributable to Government policies or practices. To be attractive to donor agencies, technical assistance and investment projects would need to be carefully targeted at selected manufacturers in order to consolidate and improve their existing capabilities.

4.2.2 Summary of Constraints

The main constraints facing this group of countries relate to problems experienced by existing manufacturers in terms of aged machine tools, fluctuating volume production, shortages of raw materials and component supplies, unimproved designs of equipment and lack of specialist production skills, such as tool-making or metallurgical expertise. Product quality and finish is below international standard, and supporting technical documentation is lacking. This limits potential for exports, and reduces ability to compete with imported finished goods. A major problem is that of unclear or contradictory government policies regarding foreign exchange allocations, import licencing, and taxation.

4.2.3 Summary of Enhancements

The main enhancements are the existing capability in agricultural machinery manufacturing across a broad front, and the ability to draw on a well established industrial infrastructure. Existing manufacturers are experienced, understand the market for their products, and are able to articulate their needs in terms of technical assistance and investment funding. There is scope for collaboration with developed-country manufacturers. Relatively high incomes in these countries favour an expansion of the market for a wider range of better quality equipment; especially tractor mounted and engine-powered machines. There are opportunities for exporting to other countries in the region.

4.2.4 Strategy for AMI Development

The strategy for Group I is to consolidate and further exploit the existing AMI capability. This involves overcoming present manufacturing deficiencies with respect to production facilities and skills, and to improve product range and quality.

Table.4.1 summarises the main components of the strategy. Priority should be given to formulating a national agricultural mechanisation strategy, with particular emphasis on assessing the relative needs for hand, animal, and engine-powered technology. Technical assistance for government policy review and training in mechanisation needs evaluation is recommended. Egypt has some experience in this area. Government policy, especially in terms of incentives for local companies and would-be foreign investors, needs to be reviewed.

A second major suggested action is that of a programme of support to existing factories producing relatively sophisticated equipment; notably tractor mounted tillage, crop establishment, crop protection and trailed harvester equipment, as well as stationary machines such as pumps and mills. Technical assistance and funding could help overcome inadequacy of production plant and available skills. The formation of collaborative ventures, producing improved designs under licence, is recommended.

The group is also a major manufacturer of animal powered equipment. Suggested actions include support to improve product designs and quality control, extend product range, exploit the potential for exporting to, or undertaking collaborative ventures with, other African countries.

The strategy should support programmes to train and equip village level artisans who have an important role in supporting the use of improved mechanisation inputs. The strategy requires that AMI should be integrated within other agricultural development programmes. For the countries concerned this is likely to involve more attention to crop protection inputs, mechanised harvesting and post harvest operations, and irrigation. The implications for AMI

need to be assessed accordingly.

In many respects this group of countries represents a model for those countries developing an AMI sector. In this respect, there are opportunities for collaboration between Group I and particularly Groups 2 and 3.

Table 4.1 Summary of strategies and Actions for Group 1

Strategy	Special Problems	C	E	Appropriate Actions
Formulate Agric.Mech. strategy in order to identify mech. needs and best ways of meeting these.	Inadequate definition of agric. mech needs. Inadequate information base on agric. mech. and AMI Inadequate or contradictory government policies. regarding agric. mech. and AMI development.	5a,b,c		Technical assistance to help formulate national agric. mech strategy and identification of appropriate govt. policies. and identify suitable programmes and projects for agric. mech. and AMI development. Ta Training needs assessment and training delivery for agric. mech. and AMI strategyformulation.
Upgrading of existing manufacturing establishments especially for tractor mounted, and engine powered stationary equipment.	Aged machine tools fluctuating volume production Poor quality and finish. material supply problems unimproved designs lack of managerial and production skills lack of product	1a 1b 1c 2a 2b	1a 1b	Technical assistance and investment funding for factory upgrading with respect to selection and acquisition of machine tools and production facilities, production engineering techniques, material specification, new designs under licence agreements, quality control, product specification, business and marketing management.

Strategy	Special Problems	C	E	Appropriate Actions
Support to existing manufacturers of animal powered equipment.	Potential for improved designs of quality standards, and extending range of animal equipment Potential for export or collaboration with other African manufacturers.	1a 1b 1c 2a 2b	1a 1b	Technical assistance and investment funding for product development, improved production facilities, and marketing management.
Support to artisan and village workshops	Limited access to facilities, skills, materials, and working capital for repairs and servicing, and manufacture of simple tools and equipment.	1a 1b 1c 2a 2b	1a 1b	Village workshop extension support programme; practical skills and elementary management training, product design and credit provision.
Establishment of joint venture agreements	Lack of adequate designs, poor quality assurance, lack of product specification.	1b 1c	1b 2a	Technical assistance and investment funding for joint ventures, or production under licence.
Agricultural mechanisation and industrial extension support.	Inadequate link between farmers, extension services, research stations, and manufacturers.	2b 4f	2a	Technical assistance and training support to existing farmer and AMI support institutions.

Strategy	Special Problems	C	E	Appropriate Actions
Manpower development in order to support AMI	Lack of adequately trained production, managerial, and marketing personnel	2b	2a	Training needs assessment with respect to production managerial and marketing staff: Training delivery to support above actions.
Integrate AMI with other development project activities.	Insufficient attention given to agricultural mech. needs and AMI opportunities in other development projects.			Technical assistance to assess mechanisation needs and AMI of locally relevant activities, especially irrigation, crop processing, fisheries, livestock, forestry.
Tractor rehabilitation in order to improve the supply and sustainability of tractor parts.	Large number of tractors in derelict or unrepairable condition. Inadequate skills in tractor operation and maintenance.	2a,b 4f		Feasibility study to assess need for and type of rehabilitation project. Identify local agents for rehabilitation project. Foreign exchange and credit provision.

Group 2

4.3 AMI DESCRIPTION AND STRATEGY

4.3.1 Group Description

This group is described as 'countries with good potential for AMI development' (Cameroon, Ivory Coast, Kenya, Malawi, Mozambique, Senegal, Tanzania, Zambia).
They have good potential for agricultural machinery manufacturing, even if the general state of the industrial sector is in the early development stage. Figure 4.2 contains a Group profile.

The main feature of this group is the existence of a national AMI sector including small- or medium-scale enterprises, which is negatively affected by the poor development of the industrial sector.

Except for tractors, almost every kind of agricultural equipment is sporadically produced. Hand tools are produced by TROPIC in Cameroon, which is one of the main enterprises in this sector, and by UFI in Tanzania. Both have an output of more than 1,000,000 units per year. Animal-drawn equipment is produced in large quantities by SISMAR in Senegal, and by almost all other countries in the group. Simple hand-operated machines and tractor mounted cultivation equipment are also produced (mainly using imported components) in some countries of the group ()Kenya, Tanzania). These countries suffer from the lack of low quality ancillary metal-working facilities, as well as from manufacturing-related constraints such as poor management, shortage of skilled manpower, obsolete machinery, and difficulty in the supply of raw materials.

The countries cover a range of agro-ecological zones ranging from mainly cereals and pulses of the Sahel (Senegal), through the root, tuber, and tree crops of the wet western coastal belt (Ivory Coast, Cameroon), to central and eastern Africa, where farming systems vary according to altitude. Although agriculture remains predominantly traditional and hand-power based, work animals make a significant contribution, especially for cereal and pulse cropping systems, and especially in Senegal, Kenya and Tanzania, and to a

lesser extent Malawi, Zambia, and Mozambique. The group also contains a number of large-scale commercial farms and plantations, which use modern inputs (tractors, fertilisers, and irrigation). Kenya, Zambia, and Mozambique have tractor population densities higher than the continential average. Outside of the commercial sector, many of these are known to be unserviceable. Lack of adequate repair and maintenance facilities and skills limit the performance of tractor and engine-powered technology. A number of countries in the group have recognised the importance of mechanisation and have established specialist research and development projects for small implement improvement (Kenya, Malawi).

Most of the countries have populations over 10 million. Whilst many of them have below average GDP/capita, their longer term potential is favourable, and the foreign investment climate is generally good.

4.3.2. Constraints

The main constraints facing AMI relate to poor production facilities, inadequate production and management skills, and poor designs and quality of finished product. Producers also suffer from intermittent raw material supply, and high import taxes on raw materials and component parts. Unreliability of government policy relating to import licencing, tax levels, and foreign exchange allowances also create difficulties. These countries have often received concessionary trade-in-aid in mechanisation inputs which undermines local manufacture. Manufacturers also face uncertain market prospects due to low and fluctuating farm incomes, and problems of distribution. Repair and service infrastructure has also been slow to develop such that improved mechanisation has proved difficult to sustain.

4.3.3. Enhancements

The main strengths of the group are the existing facilities, skills, and experience in the production of a wide range of agricultural machinery, from hand tools, through animal-drawn equipment, to tractor mounted and engine-powered machines. In most places energy supplies and basic utilities are available, including a basic infrastructure.

Agricultural development potentials are high, with favourable soils and climates. Farmers also have experience of, and are aware of the potential benefits of improved inputs, though unreliable supplies and support currently discourage their use. The countries are able to demonstrate the effective use of hand, animal and engine powered systems, though the latter have proved difficult to sustain in the small-farm sector. The scope for animal power systems development in the southern and eastern African countries of this group is considerable, and, together with improved hand tools and simple manual and power operated machines, provide a large potential market for AMI products. In addition, commercial farming and plantation enclaves, some of which are re-emerging after a period of decline, have a requirement for tractor operated equipment and crop processing machinery.

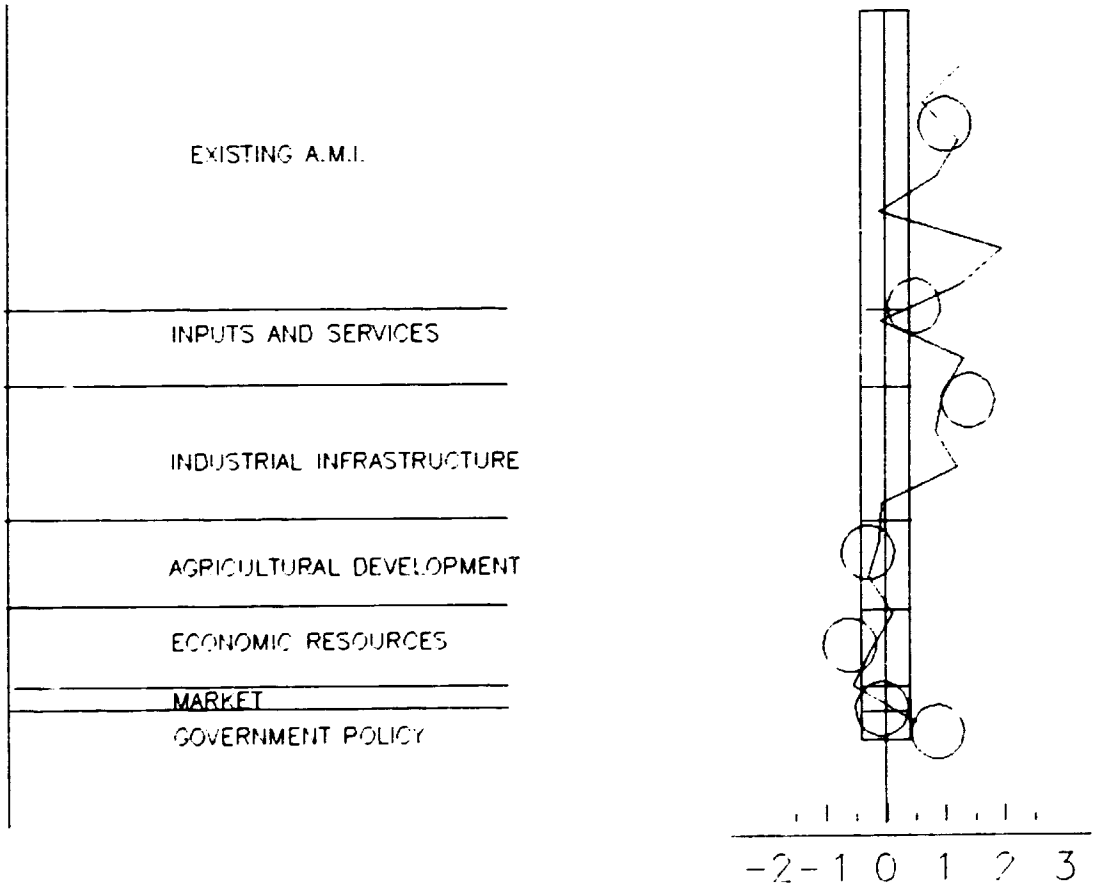
Figure 4.2

Group 2 Country Profile

Countries with good potential for AMI Development

COMPONENTS

CAMEROON IVORY COAST KENYA MALAWI MOZAMBIQUE SENEGAL TANZANIA ZAMBIA



4.3.4 Strategy

The overall strategy for Group 2 is to strengthen and extend the existing considerable capability in AMI and to overcome the constraints which presently inhibit its development.

Table 4.2 summarises the components of a broad strategy, together with a listing of possible actions.

Great emphasis is placed within this group on the formulation at national level of appropriate strategies for agricultural mechanisation and AMI. AMI strategy will also need to refer to country industrialisation policy. Technical assistance should be provided for this purpose. A favoured approach would be to set up a forum with representatives from responsible ministries, government, commercial, and farmer organisations in order to define AMI issues, needs, and priorities. This is likely to call for a review of Government policies as they influence AMI development, with recommendations accordingly. Simultaneously, the prospects of a regional network for agricultural mechanisation technology and manufacturing should be considered. Technical assistance could be provided for both of these activities.

A key component of the strategy for this Group is the establishment of a capability in agricultural mechanisation and AMI strategy management at an existing research centre. This task force, steered by relevant organisations, would be responsible for coordinating agricultural mechanisation and AMI activities. This unit would assess mechanisation needs, and coordinate research, development, design and evaluation, and industrial extension to local manufacturers.

Another important component is that of manpower training for manufacturing, repairs and servicing, procurement, management and marketing. Technical assistance should be provided for training needs assessment and subsequent delivery.

The constraints due to inadequacies in industrial and general infrastructure require that AMI needs be recognized in the design and justification of such projects.

Central to the strategy are proposals to improve both manufacturing and repair/servicing capabilities. The strategy would include activities to upgrade selected manufacturing units. Emphasis would be placed on designs, facilities, skills, materials supply, and credit. These would cover a range of product/production situations according to need. The feasibility of collaborative ventures with African or developed-country manufacturers could be examined. Parallel to this, the strategy would attempt to improve artisanal and small-scale workshops as a means of improving village based repair and servicing. A project to establish a training centre for artisans, together with a package of suitably designed industrial extension and credit could be undertaken.

There is a sizeable tractor population within the group. In some countries, a large proportion is unserviceable. The strategy could examine the feasibility of a tractor rehabilitation project carried out with a major manufacturer/distributor. Activities to ensure the improved operation and maintenance of these tractors would be a pre-condition for implementation.

Animals are an important power source in this group and the strategy should pay particular attention to the development of animal powered mechanisation. For this reason, a separate animal-power development project could be identified in order to adapt known technology, and encourage its adoption by farmers This project would closely liase with other farmer support organisations (credit, extension, veterinary services) as well as AMI.

The strategy must also integrate AMI with other development activities especially as these reflect local needs. This integration has often been neglected. Particular examples are water lifting and delivery, food processing, and simple domestic utensils and appliances. Attention should also be paid to opportunities for machinery joint-ownership (e.g. pumps for water-user associations). Experience suggests that mechanisation technology has rarely been designed to meet the needs of women whether as workers or household managers. This omission should be redressed.

In summary, Group 2 is a priority group for AMI development and assistance. The general strategy involves the review and appraisal of Government policy in order to create an environment for private initiative to design, adapt, develop, manufacture and deliver appropriate mechanisation products. Simultaneously, supporting institutions, whether public or private, need to direct development in pursuit of rural needs.

4.4 GROUP 3: AMI DESCRIPTION AND STRATEGY

4.4.1 Group Description

This group is described as mainly artisanal producers' (Benin, Burkina Faso, Ethiopia, Ghana, Mali, Niger, Togo, Zaire). A group profile is given in Figure 4.3.

These countries are grouped by having reasonably well-established agricultural machinery production based on a mix of artisanal workshops and small-scale commercial factories. These countries, along with Group 2, are a priority for AMI development. In many respects, the general level of AMI development in Group 2 (semi-industrial) countries is indicative of the type of development possible in Group 3 in the long-term.

As a group, these countries import the majority of their agricultural machinery needs, although imports are relatively modest. Production is confined to a range of hand tools and animal drawn equipment. A number of these countries have attempted since the early 1970's, to improve the structure and integration of the agricultural machinery manufacturing. For instance, Benin, Burkina Faso and Niger have grouped artisan's into cooperatives in order to promote semi-industrial production, and improve repair and maintenance services. Similarly, Mali, Togo and Ethopia have organised and assisted artisans/blacksmiths within the framework of agricultural development schemes. Nigeria has a federal organisation for coordinating agro-industrial development, including mechanisation inputs. Similarly, Ethiopia has recently established a small-farm technology information centre in order to support mechanisation in the region.

As a group these countries have reasonable access to basic materials and skills. They are, however, generally lacking in industrial infrastructure with respect to foundries, forging and stamping facilities. This is indicative of a generally low level of

Figure 4.3

Group 3 Country Profile
Mainly Artisanal Producers

COMPONENTS

EXISTING A.M.I.

INPUTS AND SERVICES

INDUSTRIAL INFRASTRUCTURE

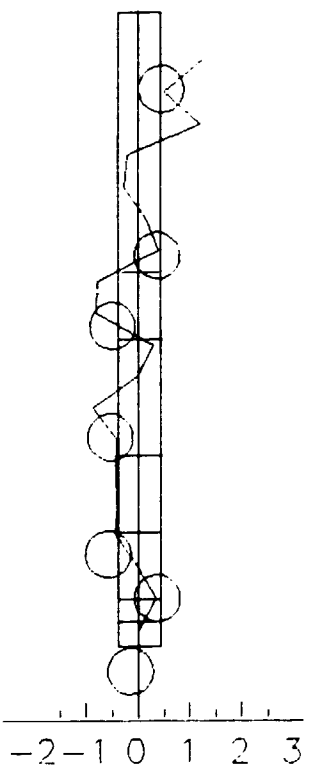
AGRICULTURAL DEVELOPMENT

ECONOMIC RESOURCES

MARKET

GOVERNMENT POLICY

BENIN BURKINA FASO ETHIOPIA GHANA
MADAGASCAR MALI NIGER NIGERIA TOGO ZAIRE



industrial activity. Thus the main pattern of machinery production involves the rudimentary fabrication of farm machinery using imported materials and components. One important exception is Nigeria which has a well-developed and wide-ranging industrial sector. The country assembles tractors as part of commercial vehicle assembly factories, but otherwise imports most machinery needs. There is however a network of small workshops producing simple powered equipment, some under licence agreements to foreign manufacturers. In this respect, Nigeria has many of the preconditions for AMI development.

For most countries in the group, agriculture is the most important sector, accounting for a relatively high share of GDP, and employment. Whilst production systems vary from mainly cereals and pulses in the Sahel and drier parts of Ethiopia, to roots and tubers in the wetter coastal and central regions, they are predominantly hand labour based, subsistence oriented systems, with relatively low use of improved inputs, and resultant low incomes. In some areas, notably Ethiopia, Madagascar, Mali and Niger, work animals provide in excess of 10% of total power inputs to farming. Generally tractors provide less than 50% of power inputs often confined to the state farming sector. Nigeria is again an exception; the country has 40% of West Africa's tractor population. Many of these are engaged in government tractor hire services.

Farming systems and resource availability significantly influence mechanisation need. In the wetter areas; the greatest needs are for improved hand tools and simple hand operated or engine powered stationary equipment for post-harvest operations. In the drier areas, there is potential for increased animal use for cereal production; together with potential for small-scale pumped irrigation. There is scope in Nigeria, and to a lesser extent Ghana, for the rehabilitation of the existing tractor stock held mainly by government organizations. Whilst institutions for farmer support exist, they are often underdeveloped or ill-equipped; with limited involvement in mechanisation technology.

Population sizes and land areas vary considerably in the group, but with the exception of Ghana and Benin, show relatively high population densities. In some cases, particularly in the Sahel, the

use of animals could extend the area cultivated but within the limits imposed by soils and climate.

Generally, the market for agricultural equipment is limited and fragmented at the present time, confined to hand tools and animal equipment. This reflects the relatively low level of development of the predominant small-farm sector, and the low incomes and purchasing power of farmers. Economic development in the group is relatively low: an average of US$280/capita compared to $680/capita overall. The group has a reasonable investment climate for foreign capital, and is considered a worthy target for funding by international development agencies.

4.4.2 Summary of Constraints

The main constraints facing this group of countries relate to the problems presently experienced by existing artisanal and small scale producers of agricultural machinery in terms of production facilities, material supplies and services, and limited product range and quality The lack of industrial infrastructure generally restricts production to simple fabrication. Low incomes and traditional farming systems due to low yields and low prices also restrict market demand. Problems of dispersed populations and limited infrastructure further restrict market development. Unclear or contradictory government policies regarding foreign exchange allocation, import licencing and taxation, also constrain the development of AMI.

4.4.3 Summary of Enhancements

The main enhancements relate to the potential for strengthening and extending the existing facilities and experience in agricultural machinery manufacturing. Market potential exists, particularly for an improved or extended range of hand tools, animal drawn equipment, simple post-harvest processing equipment and irrigation pumps. In some cases existing state or development project agencies already distribute these.

Furthermore, the relatively low GDP/capita of this group, and the predominance of agriculture in the national economy also

encourage a favourable disposition to AMI development on the part of potential donor agents and recipient governments.

4.4.4 Strategy

The emphasis of an AMI strategy for this group would be to strengthen and extend the existing artisanal and small-scale manufacturing capability, in order to increase the number, range and quality of hand tools, hand operated machines, animal-powered equipment, and simple engine-powered equipment.

Table 4.3 summarises the components of a proposed strategy, together with suggested actions required to meet strategy objectives.

The first step should be to formulate a national agricultural mechanisation strategy which assesses mechanisation needs and best ways of meeting these over a given time horizon. AMI development should be firmly placed in this context. Government policies influencing both agricultural mechanisation and AMI should be carefully reviewed; especially regarding such issues as concessionary imports, import licencing, customs duties, and foreign exchange allocations for raw materials, semi-finished and finished agricultural tools and equipment, and machine tools. For this purpose technical assistance could be provided to design and deliver consultation meetings/workshops and training material for agricultural mechanisation and AMI strategy formulation and implementation.

As for Group 2 countries, the overall strategy for mechanisation and AMI in Group 3 should be supported and coordinated by the establishment or strengthening of an Agricultural Mechanisation Centre at an existing research station. This centre would undertake farming systems and AMI research, making the link between farmers, extension services, and mechanisation research and development. The centre would also coordinate an industrial extension service for local manufacturers. The activities of this centre will depend on group and country specific needs.

Group 3 countries would benefit particularly from the establishment of a regional network on agricultural mechanisation

and manufacturing technology. Of particular interest would be collaboration between researchers, policy-makers, and commercial manufacturers, especially between Group I, 2, and 3 members.

Collaboration between commercial organisations for manufacturing under licencing and agreements for factory management services could be featured by such a network. Technical assistance could be provided for this purpose.

An important strategy component is that of training in order to alleviate the shortages of skilled manpower in production, repairs and servicing, procurement, research and development, and management and marketing.

The strategy would aim, by means of an industrial extension programme, and specifically a village workshops project, to help artisanal and small commercial workshops to improve their facilities, skills, and access to materials. The main role of these village workshops is the repair and maintenance, rather than the manufacture, of tools and simple machinery, including engine-powered units. Technical assistance and funding could be provided for skills, training, workshop design, and credit package for small workshops. Similarly the strategy could upgrade the quality or capacity of selected small and medium scale commercial workshops; especially with respect to production facilities, skills, material supplies, and designs for animal drawn equipment, the assembly of hand operated machines e.g. knapsack sprayers using mainly imported components, and the fabrication of simple machines suited to imported small engines. In some countries, there may be a need and justification for tractor rehabilitation through tractor franchise agents, although the requirements for sustained tractor operations also need to be satisfied for such schemes to be of value.

Animal power systems development is an important strategy component for a number of countries in the group; especially where increased labour productivity can extend the cultivated area, or where existing traditional animal-based systems offer scope for improvement. Two types of activities are identified for which technical assistance and funding are needed; one which adapts and modified known animal power technology to suit local conditions and

advises local manufacturers on design and production, and another which demonstrates to and trains farmers in the use of work animals.

In all countries of the group there is scope for the selective use of low-cost animal or stationary engine powered technology, especially for water lifting and post-harvest processing. Specific actions could include the evaluation of mechanisation options and recommend appropriate designs, mainly transferring proven technology from elsewhere. Industrial extension would assist local workshops, in manufacture and assembly. A critical factor will be the repair and servicing of these machines through village workshops, operator training, and possibly the organisation of farmers into machine sharing groups (e.g. pump-user associations). The needs of women as a target beneficiary group should not be neglected, in terms of both farming and household related activities.

The AMI development strategy must be integrated with other agricultural and rural development activities as they affect the changes in farming practices (e.g. new crops, new inputs, irrigation), institutions supporting farming and rural communities (e.g. extension, education), and rural infrastructure (e.g. roads, electricity). These changes will influence the demand for improved agricultural mechanisation, and the ability of AMI to respond.

Table 4.2 Strategies and appropriate actions for Group 2

STRATEGY	SPECIAL PROBLEMS	RELEVANT CONSTRAINTS	ENHANCE MENTS	APPROPRIATE ACTIONS
Formulate Agricultural Mechanisation Strategy in order to identify agricultural mechanisation needs and best ways of meeting these.	Inadequate definition of agricultural mechanisation needs. Inadequate information base. Inadequate or contradictory Government policies regarding agricultural mechanisation.	5a 5b 5c		Technical assistance to help formulate national agricultural mechanisation Strategy, and identification of related policies, programmes and projects. Training needs assessment and training delivery for Agricultural Mechanisation Strategy Formulation.
Formulate AMI Strategy in order to determine appropriate type and rate of AMI development	Unclear or contradictory government priorities and policy Incomplete and unreliable data base Inadequate ministerial coordination. Insufficient incentives to manufacturers.	5a 5b		Technical assistance to formulate a national AMI task force to develop an AMI data base and to set up a national AMI forum, in order to assess AMI's role in agricultural strategy, together with responsibilities for action and coordination.
Review Government Policy as it affects AMI	Low priority to AMI development. Penalising import taxes and duties Unreliable or irrational licencing, quota and foreign exchange allocations.	5a		Technical assistance (following from AMI review) for reappraisal of Govt AMI and related policies, and recommendations consistent with AMI and national priorities.

Develop Regional network for agricultural mechanisation and machinery manufacturing	Missed opportunities for: transfer of experience and technology between countries of similar or different stages of AMI development, economies in research and development, training and industrial extensions. Collaboration between manufacturers, especially licencing agreements. Inter-regional trade and barter. Pressure on national governments to support AMI.	1c 2b 4c	2a 4c	Technical assistance and funding for regional forum, symposia, training programmes and collaborative ventures.
Establish a capability in Agricultural mechanisation and AMI Strategy management	Inadequately defined mechanisation needs. Need to adapt available designs to suit local needs, machinery evaluation, Inadequate links between farmers, extension, research and development, credit, and manufacturers.	2b 4c		Establishment of a National Agricultural Mechanisation Centre at existing research station, responsible for co-ordinating agricultural mechanisation strategy and AMI activities, especially farming systems research, mechanisataion extension, machine design and evaluation, industrial extension to local manufacturers.

Manpower Development in order to provide skills for AMI	Lack of adequately trained graduate, technician, and craft skills with respect to management, production, spares and servicing, and procurement.	2b	2a	Training needs assessment with respect to graduate, technicians and craft grades. Reorientation of existing full-time course syllabi to meet needs. Skills development project for in-service training in particular; - local manufacture, - repairs and servicing - procurement and distribution - management and marketing
Develop ancillary industrial sector	Inadequate metal working and industrial supplies and services	3a 3b		Tecnnical assistance and investment funding for foundries, scrap recovery, forging press and machine tooling facilities and skills development.
Rehabilitate/improve urban/rural infrastructure	Inadequate roads and railways, transport, telecommunications, electricity, water supplies.	3b		Investment projects in rural/urban infrastructure

Upgrading of existing small and medium size factories in order to increase the output of hand tools, simple hand operated machinery, animal-drawn equipment, and simple stationary engine powered machines and selected tractor-mounted equipment.	Limited buildings, plant, equipment, production and management skills. Limited access to improved product designs, and materials Limited access to advice, training, credit.	1a,b,c, 2a,b	1a 1b	Technical assistance to formulate a programme of industrial extension (coordinated by national centre, see above) Upgrading of selected manufacturing units to produce machines suited to local market needs. Emphasis on designs, machine tools, production methods, materials supply, and credit and training. The need for technical assistance and investment funding will depend on product types and required production facilities. Technical assistance for collaborative ventures with foreign manufacturers with licences or management agreements.
Strengthen artisanal and small-scale workshops: in order to improve village-based repairs and servicing and provide some simple hand tools and equipment.	Limited buildings, plant and equipment. Limited production and management skills. Limited product designs. Limited supplies and services. Limited institutional support.	1a 1b 1c 2a 2b	 1a 1b 	Technical assistance and funding for individual or grouped workshops for buildings, equipment, designs, training, credit. Establishment of Village workshop project; Establishment of training centre for artisan training and industrial extension.

Tractor rehabilitation in order to improve the supply and sustainability of tractor power.	Large numbers of standard tractor types in derelict or unservicable condition. In adequate skills in tractor operation/maintenance. Inadequate spare parts supplies, and local service facilities.	2a,b 4f		Feasibility Study to assess need for, and type of, rehabilitation project. Selection of tractor manufacturer and local agents responsible for rehabilitation. Credit lines for investment and working capital in rehabilitation workshops and training facilities.
Improve Mechanisation inputs procurement and distribution.	Inefficient or wasteful system for the procurement, handling storage and distribution of AMI materials and services.	5a,b 6b,c		Technical assistance and investment funding for improved procurement (sourcing, licencing, foreign exchange allocations, etc.), handling, and distribution of supplies and services.
Animal Power Development in order to encourage the adaption, development, and diffusion of animal power technology for small-scale 'emergent' farmers.	Poor implement designs or quality. Limited range of equipment. Lack of animal husbandry skills. Lack of credit for purchase. Lack of information on available technology.	4f	4a,b,c	Project for animal-power development; establishment of animal-power training unit, farm-based animal breeding, instructor and farmer training, information base on animal power technology, technology appraisal and evaluation, adaption, design and technical assistance for local manufacture, integration with livestock and agricultural extension.

Integrate AMI with other rural development activities	Insufficient attention given to non-field 'mechanisation' needs. Lack of knowledge or availability of appropriate technology. Inadequate institutional support to non-agricultural activities Inadequate 'targetting' of mechanisation needs assessment Lack of attention to social organisation and participation.	4c 7a	4d	Technical assistance to assess mechanisation needs of locally relevant activities. e.g. irrigation pumps rural transport water supply food processing and storage fisheries and fish farming forestry and fuel lots livestock rearing and fattening, dairy household utensils. Particular attention should be paid to mechanisation' suited to farmer groups e.g. pump-user associations, and to activities commonly undertaken by women (whether domestic, commercial or subsistence).

Table 4.3 Strategies and appropriate Actions for Group 3

STRATEGY	SPECIAL PROBLEMS	RELEVANT CONSTRAINTS	ENHANCE-MENTS	APPROPRIATE ACTIONS
Formulate Agricultural Mechanisation Strategy in order to identify agricultural mechanisation needs and best ways of meeting these.	Inadequate definition of agricultural mechanisation needs. Inadequate information base. Inadequate or contradictory Government policies regarding agricultural mechanisation.	5a, b, c		Technical assistance to help formulate national agricultural mechanisation Strategy, and identification of related policies, programmes and projects. Training needs assessment and training delivery for Agricultural Mechanisation Strategy Formulation.
Formulate AMI Strategy in order to determine appropriate type and rate of AMI development	Unclear or contradictory government priorities and policy Incomplete and unreliable data base Inadequate ministerial coordination. Insufficient incentives to manufacturers	5a 5b		Technical assistance to formulate a national AMI task force to develop an AMI data base and to set up a national AMI forum, in order to assess AMI's role in agricultural strategy, together with responsibilities for action and coordination.
Review Government Policy as it affects AMI	Low priority to AMI development. Penalising import taxes and duties Unreliable or irrational licencing, quota and foreign exchange allocations.	5a		Technical assistance (following from AMI review) for reappraisal of Govt AMI and related policies, and recommendations consistent with AMI and national priorities.

Develop regional network for agricultural mechanisation and machinery	Missed opportunities for: transfer of experience and technology between countries of similar or different stages of AMI development economies in research and development, training and industrial extension. Collaboration between manufacturers, especially licencing agreements. Inter regional trade and barter. Pressure on national governments to support AMI.	1c 2b 4c 5c	2a 4c	Technical assistance and funding for regional forum, symposia, training programmes, and collaborative ventures.
Research and development Centre; Small implements improvement project.	Inadequately defined mechanisation needs. Need to adapt available designs to suit local needs, machinery evaluation. Inadequate links between farmers, extension, research and development, credit, and manufactures.	2b 4c		Establishment of a National Agricultural Mechanisation Centre at existing research station, responsible for co-ordinating agricultural mechanisation strategy, especially farming systems research, mechanisation extension, machine design and evaluation, industrial extension to local manufacturers.

Manpower Development in order to provide skills for AMI	Lack of adequately trained graduate, technician, and and craft skills	2b	2a	Training needs assessment with respect to graduate, technicians and craft grades. Reorientation of existing full-time course syllabi to meet needs. Skills development: project for in-service training in particularly -local manufacture and repairs and servicing. -parts procurement and distribution -research and development -management and marketing
Strengthen artisanal and small-scale workshops: in order to improve village-based repairs and servicing and increase the output and quality of simple hand tools and equipment.	Limited buildings, plant and equipment. Limited production and management skills. Limited product designs. Limited supplies and services. Limited institutional support.	1a 1b 1c 2a 2b	1a 1b	Technical assistance and funding. For individual or grouped workshops for buildings, equipment, designs, training, credit. Establishment of Village workshop project; Establishment of training centre for artisan training and industrial extension.
Upgrading of existing small factories in order to increase the output of hand tools, simple hand operated machinery, animal-drawn equipment, and simple stationary engine powered machines.	Limited buildings, plant, equipment, production and management skills. Limited access to improved product designs, and materials training, credit.	1a,b,c	1a	Upgrading of selected small scale units to produce machines suited to local market needs. Emphasis on designs machine tools, production methods, materials supply, and credit training. Technical assistance to identify suitable candidates, and formulate programme of industrial extension.

Tractor rehabilitation in order to improve the supply and sustainability of tractor power.	Large numbers of standard tractor types in derelict or unservicable condition. Inadequate skills in tractor operation/maintenance. Inadequate spare parts supplies, and local sercice facilities.	2a,b 4f		Feasibility Study to assess need for, and type of, rehabilitation project. Selection of tractor manufacturer and local agents responsible for rehabilitation. Credit lines for investment and working capital in rehabilitation workshops and training facilities.
Improve Mechanisation inputs procurement and and distribution.	Inefficient or wasteful system for the procurement, handling, storage and distribution of AMI materials and services.	5a,b 6b,c		Technical assistance and investment funding for improved procurement (sourcing, licencing, foreign exchange allocations, etc.), handling, and distribution of supplies and services, especially as many need to be imported.
Animal Power Development in order to encourage the development, adaption, and diffusion of animal power technology for small-scale "emergent" farmers.	Labour supply limits farm output, land available, some experience of work animals. Limited data base on known animal-power technology.	4f	4a,b,c	Project for animal-drawn development; establishment of animal-power training unit, farm-based animal breeding, instructor and farmer training, information base on animal power technology, technology appraisal and evaluation, adaption, design and technical assistance for local manufacture.

Integrate AMI with other rural development activities	Insufficient attention given to non-field 'mechanisation needs. Lack of knowledge or availability of appropriate technology. Inadequate institutional support to non-agricultural activities Inadequate 'targetting' of mechanisation needs assessment Lack of attention to social organisation and participation.	7a	7e	Technical assistance to assess mechanisation needs of locall relevant activities. e.g. irrigation pumps. rural transport water supply food processing and storage fisheries and fish farming forestry and fuel lots livestock rearing and fattening, dairy household utensils. Particular attention should be paid to 'mechanisation' suited to farmer groups e.g. pump-user associations, and to activities commonly undertaken by women (whether domestic, commercial or subsistence).

4.5 GROUP 4 AMI DESCRIPTION AND STRATEGY

4.5.1 Group Description

This group is described as mainly importing countries (Angola, Burundi, Central African Republic, Chad, Guinea, Liberia, Mauritania, Rwanda, Sierra Leone, Somalia, Sudan,Uganda). Figure 4.4 contains a group profile.

Countries in this group are associated because, at the present time, industrial infrastructure and agricultural machinery production are practically absent. The majority of AMI products are imported. Some of the countries are experiencing or emerging from political turmoil (e.g. Angola and Uganda) which has disrupted both agricultural and industrial progress. Others have not shown any recent increase in industrial development.

AMI is mainly confined to hand tool production by village blacksmiths using traditional methods, often with scrap material. AMI is constrained by limited supply of inputs, skills and services. Ancillary metal working industries are low even by continent standards.

Agriculture is the dominant sector in the economy, accounting for about 40% of GDP, and up to 70% of employment. Agriculture is characterised by traditional systems, with limited use of improved inputs. However, farming systems and the potential for development vary within the group. Four countries lie in the Sahel-Sudan zone with an emphasis on cereals and pulses, another four countries lie in the West African coastal and central belt with predominantly roots, tubers and some swamp rice, and the remaining four have mixed systems which are altitude dependent. In the main, farming systems are based on hand tool technology, but the Sudan-Sahel countries of this group are amongst the groups major users of animal power. For example Sudan and Somalia derive 27% and 40% of farm power inputs from work animals respectively. The Sudan also operates fully mechanised farming systems on its large-scale irrigation schemes. Uganda similarly has mechanised plantation enclaves. Thus whilst AMI development is low, and for the most part

Figure 4.4

Group 4 Country Profile

Mainly Importing Countries

COMPONENTS

ANGOLA BURUNDI C.A.R. CHAD GUINEA LIBERIA SUDAN MAURITANIA RWANDA SIERRA LEONE SOMALIA UGANDA

EXISTING A.M.I.

INPUTS AND SERVICES

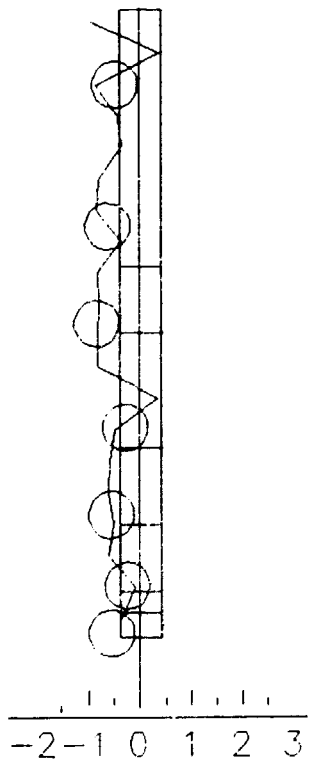
INDUSTRIAL INFRASTRUCTURE

AGRICULTURAL DEVELOPMENT

ECONOMIC RESOURCES

MARKET

GOVERNMENT POLICY



farming is traditional, there is experience of improved mechanisation systems, both using animal and tractor power.

Average population sizes are lower than the all continent average, and low incomes and fragmented markets further restrict market development. Levels of economic development are also low by continent standards, but potentials within the group vary considerably. The political climate in a number of these countries is not conducive to foreign investment at the present time.

4.5.2 Constraints

The main constraints relate to the virtual absence in these countries of both AMI and supporting industrial infrastructure and services; production facilities, material supplies, skills, designs, and distribution systems. Further AMI development is therefore constrained by the need for infrastructural investments elsewhere in the economy.

The countries in the group have low levels of national and per capita income, with limited markets for improved AMI products. They are severely short of foreign exchange. They are also recipients of concessionary aid-in-kind mechanisation inputs which, in the absence of a coherent agricultural mechanisation strategy, can prove difficult to manage. Due to political disruption, current conditions are not favourable to foreign investment.

4.5.3 Enhancements

A number of the countries have long experience with improved forms of farm mechanisation, especially animal and tractor power. There is a medium to long-term potential for locally manufactured improved handtools, animal equipment, and simple stationary machines (especially pumps and post-harvest equipment) but commercial factories development is severely constrained by the constraints previously mentioned. Existing artisanal and small workshops offer potential for the production and servicing of simple equipment. The countries are important targets for international donor agencies.

4.5.4 Strategy

The strategy for this group recognises the severe constraints facing both the agricultural and industrial sectors of these economies which largely preclude any immediate AMI development. The development of AMI will depend on the success of strategies to increase general agricultural and industrial capability and performance.

Table 4.4 lists the strategy and suggested actions for this group. Emphasis should be placed on determining an agricultural mechanisation strategy, in order to determine suitable policies which achieve the desired import/AMI balance. The strategy should emphasise the importance of activities which improve or rehabilitate the industrial sector and urban/rural infrastructure. Manpower development and institutional strengthening with emphasis on training needs assessment and delivery should be an important strategy component.

Two particular activities may be especially relevant in selected member countries. Animal power development should be encouraged where there is experience and/or potential. This would involve technology transfer, and measures to increase adoption by farmers of new techniques. Projects may be needed to strengthen village workshops primarily to service and repair mechanisation inputs, but also to make simple tools and machines.

Table 4.4 Strategies and Suggest Actions for Group 4 Countries

Strategy	Problems	C	E	Special Action
Formulate agric. mech. strategy in order to identify agric. mech. needs and best ways of meeting these	Inadequate definition of agric. mech meeds Inadequate info. base Inadequate or contradictory Govt. policies regarding agric. mech. + AMI development.	5a 5b 5c		Technical assistance to help formulate national agric. mech strategy, and identification of relevant programmes and policies including AMI development. Particular attention should be given to govt. policy review as it affects procurement and distribution ag. mech. and AMI related inputs.
Development Ancillary Industrial sector.	Inadequate metal working, supplies and services sector	3a 7b		Investment funding in foundries, forging, press and machine shop facilities.
Rehabilitate/ improve urban/rural infrastructure	Inadequate roads, communications, and utilities	3b 6c 7b		Investment in rural roads, electricity, water supplies.
Manpower development in industrial and manufacturing	Lack of adequately trained graduate, technical and craft personnel	2b	4d	Training needs assessment Reorientation/or new development of manufacturing and agricultural training programmes.
Animal power development	Experience of work animals; limited range of poor quality implements; livestock husbandry	4a 4c 4f	4b 4c	Animal power development project; animal breeding, equipment evaluation, extension credit, assistance to local manufacturers.

Strategy	Problems	C	E	Special Action
Strengthen village workshops for repairs and servicing and manufacture of simple tools and machines.	Limited buildings production facilities, skills, materials, and credit.	1a 1b 1c 2a	1a	Technical assistance and funding for a village workshop project: industrial extension, designs training, credi credit for
Integrate AMI in agricultural not rural development activities.	Inadequate attention to mech technology and AMI in project design and implementation.		7e	Reference to agricultural mechanisation strategy.

Group 5

4.6

AMI DESCRIPTION AND STRATEGY

4.6.1 Group Description

Group 5 is described as countries with 'small markets for AMI' (Cape Verde, Comoros Islands, Djibouti, Equatorial Guinea, Gambia, Guinea Bissau, Lesotho, Soa Tome). A group profile is given in Table 4.5.

The eight countries in this group are very small, most with less than one million inhabitants. They mainly import their agricultural machinery requirements, AMI is confined to the village blacksmith level. Raw materials, skills and industrial infrastructure are limited. The general level of agricultural development is low, but agriculture is an important source of GDP and employment. Most production involves hand labour systems, although in the Gambia some success has derived from animal power systems development. For most countries GDP does not exceed US$350 per capita. Small populations and low incomes limit the market for AMI products.

4.6.2. Strategy

The strategy for these countries is to seek assistance to help identify local agricultural mechanisation needs, and the best ways for meeting these. In the main, these countries will continue to import mechanisation requirements. There could be scope for improving the blacksmith/artisanal workshop sector, especially for equipment repairs and servicing, and possibly for the manufacture of simple machines. AMI support should be more closely integrated with other agricultural and rural development activities such as improvements in farming systems. Overall, AMI development is likely to be development aid related.

Figure 4.5

Group 5 Country Profile

Countries with Small Markets for AMI

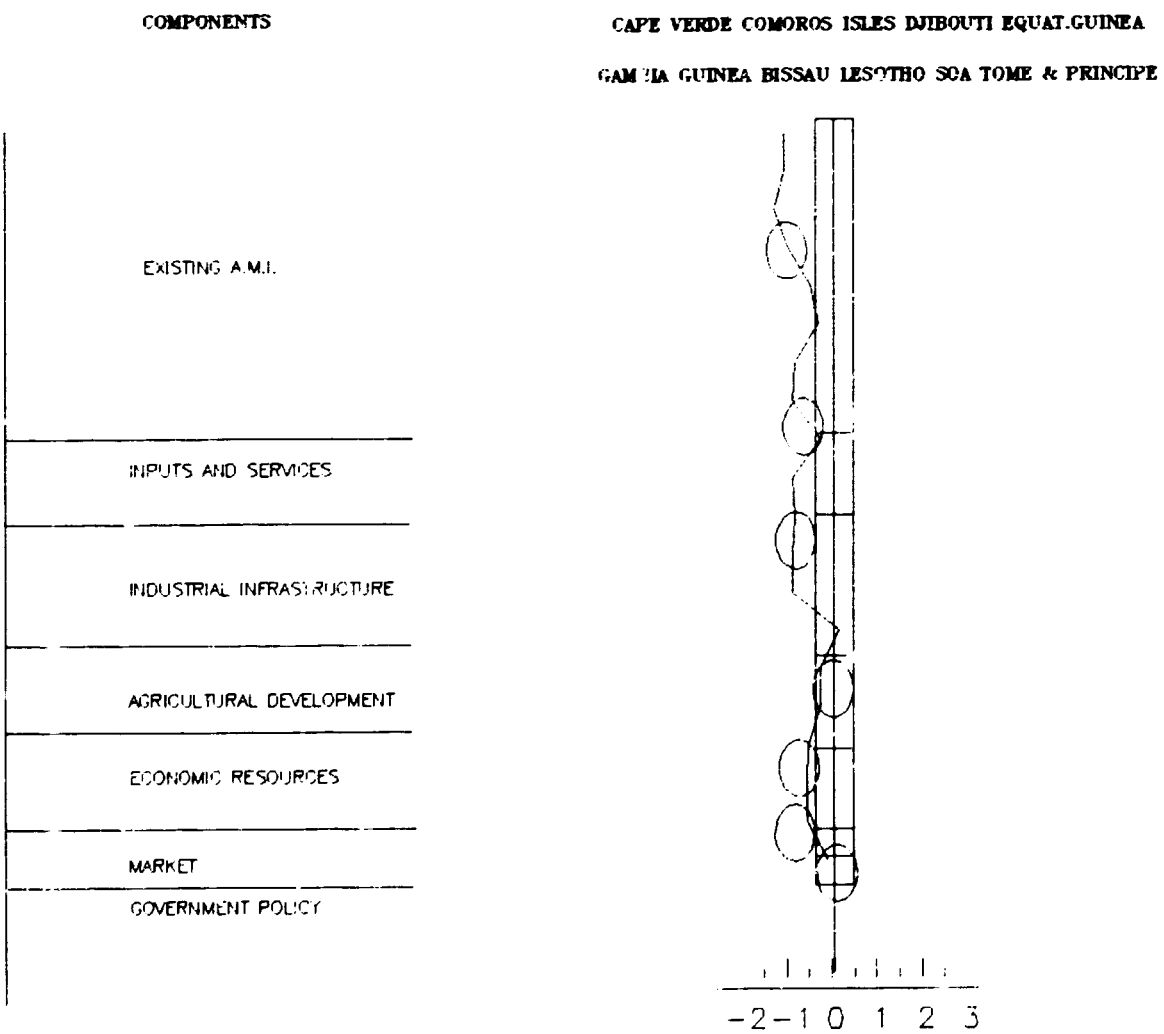


Table 4.5 AMI Strategies and Appropriate Actions for Group 5

Strategy	Problems	C	E	Suggested actions
Formulate agricultural mechanisation strategy in order to identify agricultural mechanisation needs and best ways of meeting these.	Inadequate definition of mechanisation needs, procurement problems. Difficulties in managing concessionary aid.	5a 5b 5c		Technical assistance to help formulate national agricultural mechanisation strategy.
Strengthen blacksmith and artisanal workshops: in order to improve repairs and servicing, and manufacture simple equipment.	Limited buildings, facilities, skills, materials, and credit.	1a 1b 1c	1a	Technical assistance and funding for village workshop project: equipment, training, materials supply, extension, credit.
Integrate AMI with other agricultural and rural development activities.	Subsistence farming, low incomes low level of institutional support to farming, limited availability of appropriate technology.		7e	Agricultural support activities, input supply, extension, credit.

4.6 GROUP 6: AMI DESCRIPTION AND STRATEGY

4.6.1 Group Description

This group is described as countries with low national priority for AMI (Botswana, Congo, Gabon, Lybia, Mauritius, Seychelles, Swaziland, Tunisia). A country profile is given in Figure 4.6.

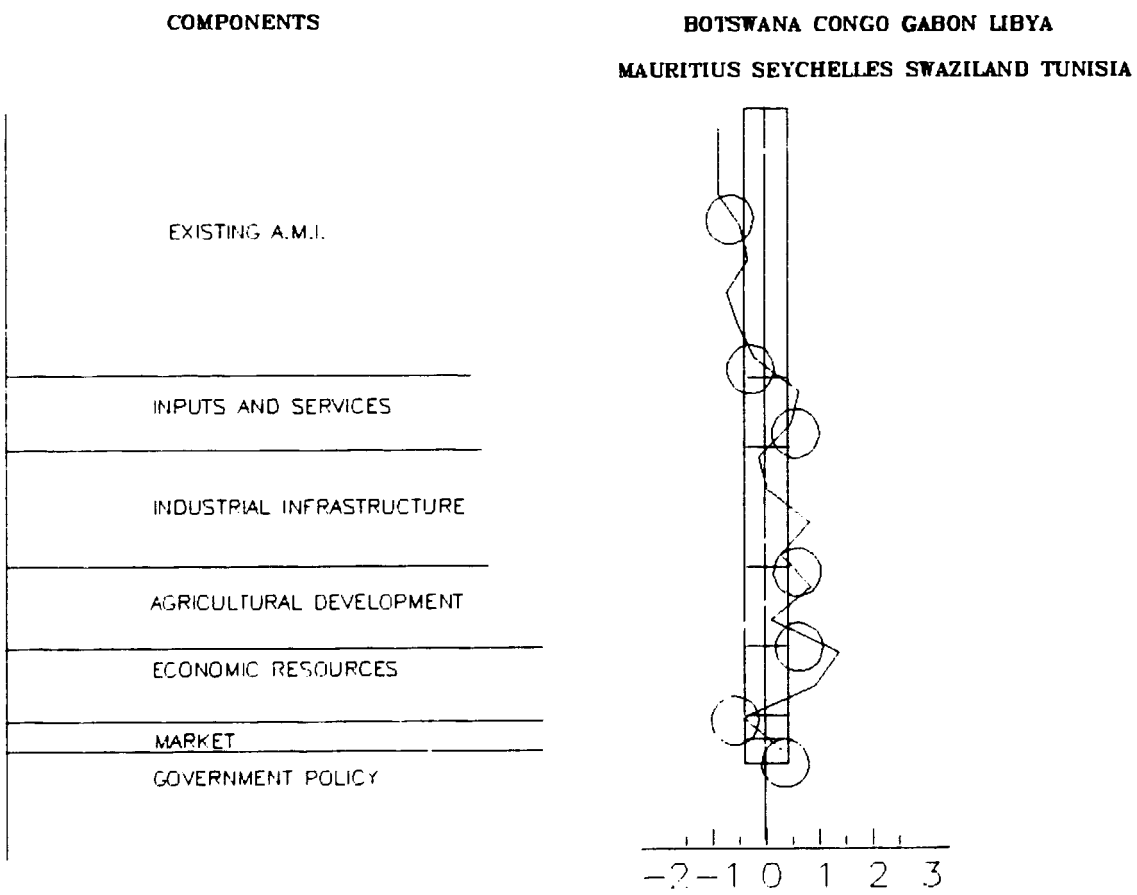
These countries are grouped together because they meet their agricultural machinery requirements mainly by importing. Domestic agricultural machinery manufacturing is limited. In spite of having good capital resources, and in some instances a well established industrial infrastructure, other opportunities for non-agricultural sector developments mean that AMI has not been a priority. There are however exceptions, Botswana has intermittently produced handtools. Swaziland, with government support, produced a small, but expensive, ride-on Tinkabi' tractor, and Mauritius currently exports specialist equipment to mainland Africa. These activities are isolated cases in countries with little AMI development.

The economic bases for the countries are variously oil (Gabon, Libya), forestry (Gabon), mining (Botswana), manufacturing and commerce (Mauritius). This means that the % percentage of national GDP attributable to agriculture is relatively low (10% to 20%) for Africa. However, the use of improved inputs such as fertilisers, tractors, and irrigation is high relative to the continental average. Farming systems vary between group members. Botswana has a large cattle ranching sector. Libya, Mauritius, Swaziland have important commercial farming enclaves with supporting agro-industrial processing, particularly plantation-based sugar production

As a group, average GDP per capita is relatively high; over US$1000. Populations, with the exception of Tunisia, are generally small, thus restricting market potential. There is however a demand for relatively sophisticated agricultural machinery, and the foreign exchange to pay for it. Foreign investment climate is generally good, but this usually means that returns are higher in sectors other than AMI.

Figure 4.6

Group 6 Country Profile
Countries with low domestic Priority for AMI



4.6.2 Constraints

The main constraints for the group relate to the non-existence or underdeveloped nature of local manufacture. There is generally a lack of interest in developing AMI because of alternative investment opportunities in the countries. Furthermore, these countries have relatively sophisticated agricultural sectors, such as sugar plantations, with needs for sophisticated equipment best met by importing.

4.6.3 Enhancement

The strengths of these countries is that for the most part, they enjoy a good climate for foreign investment, a well developed industrial infrastructure, and an entrepreneurial environment. Transport and communication, including port facilities, are generally good. Simultaneously, the governments actively support agricultural development, especially commercial and plantation farming. Demand for specialist machinery is considerable; opportunities exist for improving procurement procedures for acquiring imported finished goods and replacement parts, and for improving the operation and maintenance of equipment. These countries could provide markets for machine exports from within the region. They could themselves exploit their own industrial base for specialist machinery manufacture for export, but this is best left to private entrepreneurial initiative.

4.6.4 Strategy

At the present time, this group does not require major development in AMI. The strategy is largely one of encouraging private initiatives to meet the expressed market demand; whether this involves a continuation of the mainly importing strategy or some local assembly manufacture. Even though AMI is not a current priority, there is a need for a national mechanisation strategy to ensure mechanisation requirements are properly identified, and that the government creates an environment in which these can be best met.

The strategy emphasises the strengthening of agents and

institutions which procure and distribute machinery and spare parts, those which repair and maintain agricultural machinery and those which provide training in machinery use. Technical assistance could be provided for this purpose.

A number of the countries have particular needs reflecting important subsectors (e.g. sugar in Mauritius, Swaziland, arid zone farming in Botswana). An AMI strategy would need to recognise the particular requirements of these sub-sectors.

4.7 SUMMARY OF STRATEGIES AND ACTIONS

AMI Strategies and suggested actions have been identified in broad terms. Refinement of these proposals awaits the completion of the country case studies, and the compilation of indicative AMI development programmes.

Tables 5.7 and 5.8 summarise the strategies in terms of requirements for investment and technical assistance. Group 1 to 3 are those with some existing AMI capability, which provides an opportunity for further development. Group I mainly requires advanced inputs relating to better designs and specialist engineering services and skills. Groups 2 and 3 are prime targets for AMI assistance because of both need and potential. These two groups vary in terms of the emphasis given to each activity. Group 3 requires, for instance, more assistance to build-up its industrial infrastructure compared to Group 2.

Group 4,5 and 6 are for different reasons and considered priority cases for AMI development at present, although Group 4 has a long-term potential. The emphasis here is on rationalising mechanisation imports, and improving internal discussion, repairs and servicing.

Table 4.6 Strategies and Suggested Actions for Group 6 Countries

Strategy	Special problems	C	E	Suggested Actions
Formulate national agricultural strategy in order to identify mech. needs and best ways of meeting them.	Inadequate definition of needs. Inadequate information base. Need to integrate AMI with other agriculture sector developments (esp. irrigation, sugar arid zone farming, etc.)	5a 5b 5c		Technical assistance to help formulate national agricultural mech. strategy, review and recommend appropriate govt. policies; especially regarding acquisition of imported machines and spare par
Review Government Policy as it affects private sector initiatives for import substitution or export production.	Large numbers of different types and makes of machines imported Difficulties of spare parts procurement Uncertainty regarding incentives for machinery exports.	5a 5b	7a 7c 7d	Technical assistance for agricultural machinery evaluation; Technical assistance for international tendering and procurement procedures. Identification of opportunities for inter regional trade.
Strengthen artisan and village workshops	Limited access to facilities, skills materials and parts for repairs and servicing of equipment	1a 1b 1c 2a 2b	1a 1b	Village workshop development programme; extension training, credit.
Manpower development and training in machinery selection and operations development	Inadequate operator skills Inadequate repairs and maintenance of agricultural machinery	2b	2a	In service training for machinery operators and mechanics at existing training centres.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY CONCLUSIONS

This enquiry has described the important features of AMI in Africa, and identified the main factors which explain variations in AMI circumstance and practice. An analysis of available data allowed the clustering of African countries into six groups which were differentiated in terms of AMI status, potential, and need for development assistance. Generalised strategies and appropriate actions to support AMI and related sectors were identified. These country groupings and strategies will be verified during the next stage of the enquiry.

In this respect, the objectives of the enquiry have been met both in terms of deriving AMI typologies and applying the UNIDO programme approach.

5.2 RECOMMENDATIONS

It is recommended that the study should proceed to the next stage. Whereby selected country studies are made in order to verify the AMI typologies, and formulate indicative country-specific AMI development programmes. This latter exercise should include the identification and preliminary assessment of possible project activities.

Given the AMI typologies, and the potential for development, the following countries are recommended for further study.

Group 1.....	Egypt
Group 2	Kenya, Zambia
Group 3	Burkina Faso, Ghana
Group 4	Central African Republic

These six countries also cover the major agro-ecological zones and farming systems in Africa.

Table 5.1 Summary of Group Specific Actions: Investments

	COUNTRY GROUPS					
	1	2	3	4	5	6
AMI						
Upgrading Factories for						
hand tools		*	*			
animal power	*	*	*			
tractor mounted	*	*	*			
engine powered machines	*	*	*			
Artisan Workshops		*	*	*	*	*
Dealership/Distribution		*	*	*	*	*
Tractor Rehabilitation	*	*	*			
Industrial Services						
Technical Training Schools		*	*			
Procurement, Handling and Storage		*	*			
Industrial Extension		*	*	*	*	
Industrial Infrastructure						
Foundries		*	*			
Forges		*	*			
Stamp/Pressing		*	*			
Machine Shops		*	*			
Materials Handling		*	*			
Vehicles		*	*			
Road/Rail/Port Facilities		*	*			
Agricultural Development						
National Agricultural Mechanisation and AMI Centre (R&D)	*	*	*	*		
Animal Power Development	*	*	*	*		
Irrigation and Drainage	depending on country specific needs					
Land Development						
Soil Conservation						
Crop Storage and Processing						
Forestry (& fuel)						
Fisheries						
Livestock						
Water Supply						
Large Scale/Plantation Agriculture						

Table 5.2 Summary of Group Specific Actions: Technical Assistance

	COUNTRY GROUP					
	1	2	3	4	5	6
Governmental Policy						
Agricultural Mechanisation Strategy Formulation	*	*	*	*	*	*
AMI Strategy Formulation	*	*	*			
Review of Government AMI Policy and Incentives	*	*	*			
Promotion of Farmer Organizations	*	*	*	*	*	*
AMI						
Regional Agricultural Mechanisation and AMI Network	*	*	*	*		
Licence Agreements	*	*	*			
Joint Ventures	*	*	*			
Training Needs Assessment and Delivery						
Strategy formulation	*	*	*	*		
AMI Research and Development	*	*	*	*		
Agricultural Mechanisation Research and Development		*	*	*		
Production Engineering		*	*	*		
Procurement and Distribution		*	*	*		
Product Marketing		*	*	*		
Business Management		*	*	*		
Agricultural Mechanisation Extension		*	*	*		
Animal Power Training Programme		*	*	*		
Artisans	*	*	*	*	*	*
Machinery Operators	*	*	*	*	*	*
Research, Development and Technology						
Agricultural Mechanisation Technology	*	*	*	*		
Production Engineering	*	*	*			
Designs for Manufacturers	*	*	*			
Credit and Finance						
Procurement		*	*	*	*	*
Manufacturers		*	*			
Distributors/Dealers		*	*	*	*	*
Tractor Rehabilitation	*	*	*			
Farmers	*	*	*	*	*	*

ANNEX I

Table 2.4

Selected Examples of Factory-level Hand Tool Production in Africa

Ethiopia

The Ethiopia Metal Tools factory has an installed capacity of 330,000 units per year of good quality hand tools manufactured, on a mass production basis. The capacity utilization is declared to be over 70 per cent.

In addition, the Blacksmiths' Co-operative in Addis Ababa is producing
hand tools using traditional methods, with an installed capacity of 170,000 units per year.

Kenya

Kenya has several small- to medium-size enterprises with a total production of some 500-600,000 units per year, using traditional forging. The quality of the production is quite modest so they suffer competition from imported products.

Cameroon

In Cameroon, Tropic is one of the largest African firms for hand-tools. It employs 250 people and produces over one million units per year of quite good quality. Tropic is one of the few enterprises in Africa exporting part of its production (about 20%).

Some 50-60,000 units are produced by several handcraft workshops at a low price but with a medium quality.

Ivory Coast

Hand tools are manufactured as a side activity in a large metalworking enterprise with approximately 400 workers.

Table 2.4 continued

Tanzania

The main producer is UFI which employs 700 people. It is currently manufacturing hand tools and animal-drawn equipment. The output of hand tools is 1,100,000 units per year.

A further one million units are produced by groups of craftsmen scattered throughout the country. Substantial efforts are underway to set up new industrial facilities to achieve an additional industrial production of two million units per year, with the goal of approaching the national demand, which is estimated at 5 to 6 million units per year.

Zaire

In Zaire three industries are manufacturing hand tools, with an estimated total output of two million units per year. The most relevant is UMAZ (250 workers, one million units per year).

An important contribution is also made by craft workshops.

Zambia

One plant is operating with an installed capacity of 300,000 unit per year. A second one, producing mainly animal-drawn equipment, produces an additional 40,000 hand tools per year.

Madagascar

One mechanical engineering enterprise with 250 employees is also manufacturing hand tools, with an output of 144,000 units per year. However, the self-sufficiency level is very low, and imports account for 90 per cent of national demand.

Uganda

Uganda has two factories having a total capacity of about one million units per year. One of them is planning to increase its capacity to two million units.

Table 2.5

Selected Examples of Animal-drawn and Simple Powered

Machinery Manufacturing in Africa

Ethiopia

Cultivation using animal-drawn implements is traditionally widespread in Ethiopia, utilizing very simple wooden ploughs and harrows. However, there are no large-scale production units and the local production is based on some small-scale co-operatives.

Senegal

The SISMAR enterprise is one of the most important industrial producers of animal-drawn equipment and simple hand-operated machines. It employs 350 people, with an output of approximately 150,000 units per year. Although the quality is quite good (the factory is assisted by France), some problems have arisen in the past because of the small size of the market.

Malawi

Some craftsmen co-operatives, with a small number of employees (15-30 each), are the only units producing animal-drawn equipment.

Burkina Faso

The enterprise AMCOMA has semi-industrial production of kits for animal-drawn equipment, which are assembled and distributed through subsidiary workshops. No data are available on the total output, but some exports to nearby countries (Togo) are recorded.

Table 2.5 continued

Kenya

Kenya has five medium-size units, with a total installed capacity of 80,000 units per year of animal-drawn implement. However, due to the high cost of production and the competition with imports, the capacity utilization is very low (about 25%).

Tanzania

The country produces about 35,000 units of animal-drawn equipment in two industrial units; but the capacity utilization, at least for one of the two units, is very low. Some small production units are producing a limited number of units of processing equipment.

Zambia

Zambia has a good national capacity to produce animal-drawn equipment in several industrial units and small enterprises. The most important one has an output of 34,000 units per year. However, internal demand has been suffering in recent years from market problems caused by the lack of credit facilities and the high cost of the machines relative to agricultural product prices.

Zimbabwe

Two large manufacturing plants are operating in Zimbabwe with a total production of approximately 70,000 units of animal-drawn equipment per year. Although a considerable share of production is being exported to Ethiopia, Tanzania, Uganda, etc., the capacity utilization fluctuates between 50 and 10%.