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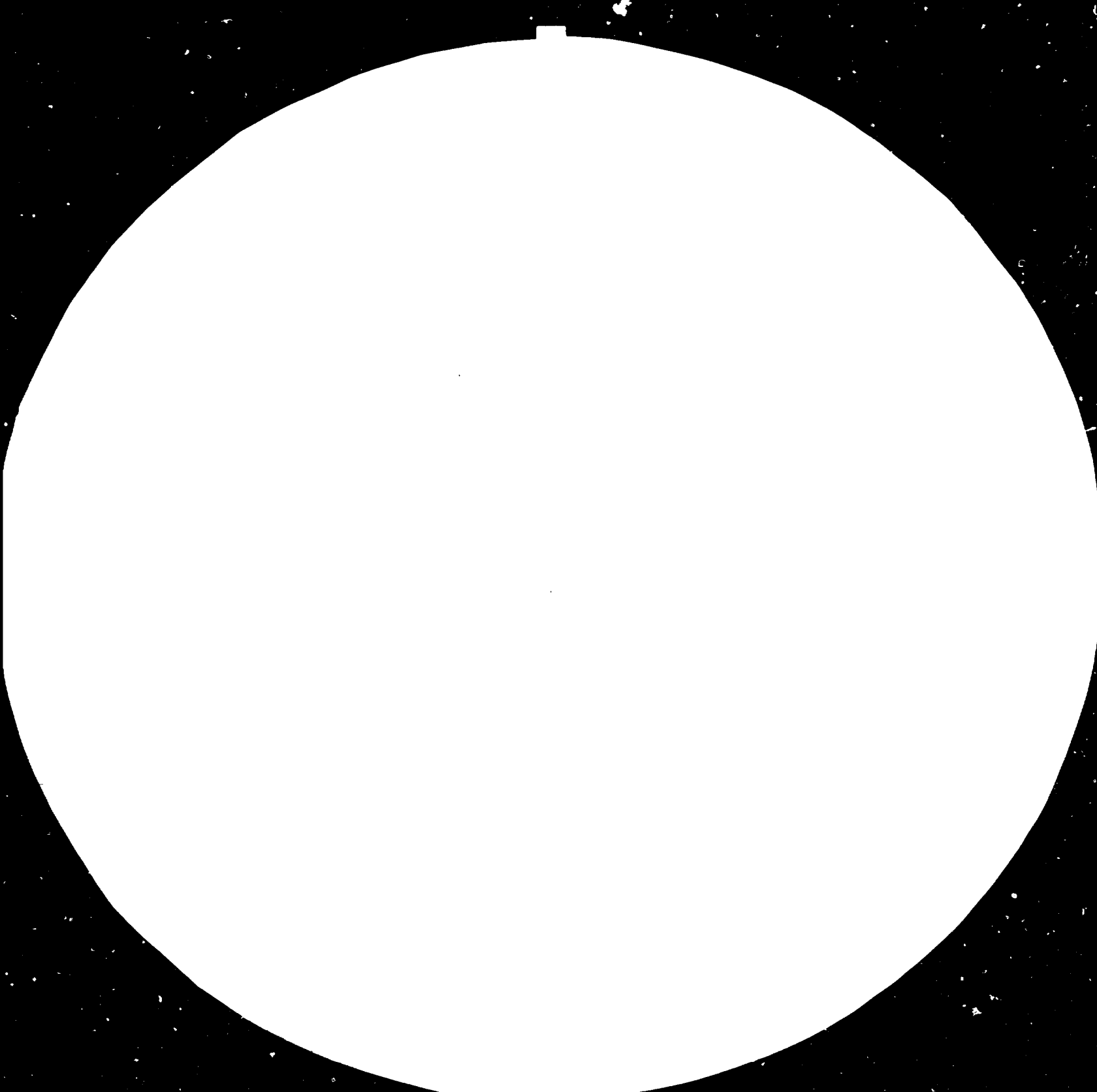
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AGRICULTURAL MACHINERY AND IMPLEMENTS:

TANZANIA CASE<sup>\*</sup>

by

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A. Introduction.

Tanzania is an agricultural country. The subject of agricultural machinery and implements is of vital importance in the production of cash and food crops for the economy of the country. Agricultural machinery and implements used in Tanzania are of various types ranging from simple hand tools to sophisticated tractor drawn machinery. Modern agricultural machinery use is still in limited quantity and expensive. Most of the agriculture is of peasantry. With limited resources the small holder farmers have limited access to agricultural machinery and implements. In order therefore for the farmers to improve their well being and incomes from agriculture improved agricultural machinery and implements are required. This is a subject of discussion whose experience can be shared by other third world countries.

About Tanzania

In order to understand how the development and use of agricultural machinery and implements works, it is important to know the background of the country called Tanzania.

Party and Government

Tanzania is a Republic, led by a President who is also a Chairman of the party. The party is supreme

in all matters of policy that affects agricultural production, land tenure and the economy at large. The government is elected under a free suffrage. Members of the parliament are elected by the people once every five years. This practise has been done ever since independence from Britain in December 1961. The government is led by President Julius Nyerere who is also the Chairman of the party, called "Chama cha Mapinduzi - CCM".

#### Population and Geography

Tanzania has a population of about twenty million people. About fifty per cent of the population are children under sixteen years. The number is fifty-fifty men and women. Tanzania enjoys a free education from first grade to University with a primary education of seven years to every child of school age. The literacy rate is over 80%.

Tanzania is located just south of the Equator and extends to 10° south. It is on the Eastern side of Africa between 29° East and 40° East. It is a country with the three fresh lakes of Africa namely, Lake Victoria, Tanganyika and Malawi. Tanzania has one of the best game reserves in the world with the famous Serengeti National Park situated there. Tanzania also has the highest mountain in Africa namely Mount Kilimanjaro. The climate is rather good but of late, dry climate has affected agricultural production.

### Land Tenure

While some third world countries have limitation to access of land, Tanzania land tenure is that the land belongs to the state. The peasants have the right of occupying the land. With the area of over 900,000 square kilometres, there is enough land for agricultural activities for every person.

### History of Agricultural Machinery and Implements

Agricultural machinery and implements in Tanzania have not been well developed and utilized. For many centuries the peasants used their locally made handtools. With the arrival of foreigners the picture began to change. Introduction of the hand hoe was made. Gradually the oxen-driven implements were brought in the country in late 1930s and early 1940s. This expanded the acreage farmers could cultivate in any particular year. Introduction of the tractor were made by British settlers in early 1950s and the importation of tractors continued to increase for the early years after independence in 1961 until early in 1970s.

The picture of agricultural machinery and implements took on a new shape when a local implements factory was established in 1970 under the assistance from the Peoples Republic of China. Some implements were then locally manufactured. Importation of tractors has always been on the decline after 1973 when the countries purchasing power begun to shrink due to high oil-bills. This trend has not been reversed up to now. In realization of this bottleneck and the deteriorating farmer's ability to get

access to a tractor, the government directed the efforts to utilization of ox-drawn equipment which can be manufactured locally and what farmers can afford. This unfortunately can-not cover the whole country because there are some regions that do not have the experience to keep cattle. The utilization of the tractor and associated implements is also limited. A local factory for assembling tractors "Velmet" has been started with an assistance from Finland. Also a local manufacturing factory for making tractor-drawn implements has been built. Its operation has just begun with assistance from India.

Together with all these efforts, the local population have not taken up large scale farming and a wide use of agricultural machinery and implements. More than 70% of the farmers still use the hand hoe for their agricultural activities. Efforts have been made by the government to move the farmer from the traditional hand hoe to a better implement. Concrete steps that have been taken to this effect include:

- a) Expanding the production capacity of agricultural implement factory at Ubungo - Dar es Salaam.
- b) Establishment of the extension and technical services directorate in the Ministry of Agriculture.
- c) Establishment of the Centre for Agricultural Mechanization and Rural Technology - CAMARTEC in Arusha.
- d) Establishment of two agro-mechanization institutes to train technicians in Agricultural machinery and implements use and maintenance. Also a degree programme in Agricultural engineering has been established with



the University of Dar es Salaam.

- e) Encouraging individual and co-operative manufacturing of agricultural machinery and implements.

With the above efforts, the government is committed to see a change in the quality of tools used in agriculture. These efforts are hampered by the low economic capability of the country. This is where International assistance is required.

B. Present "State-of-the-arts" in Manufacturing as well as Research Activities

B.1 Manufacturing

Manufacturing of agro-hand and agro-oxenization implements started in Tanzania in 1970 by the Ubungo Farm Implements Ltd (UFI), after a long period of research by research institutions. This company, which is a parastatal organization, is also the sole importer of agro-hand and agro-oxenization implements when importation becomes necessary. Implements produced by this company are:

Hand Hoes.

Grass Slashers.

Ground nut shellers.

Mould board ploughs.

Plough Parts, e.g. shares and wheels.

However, due to a number of problems, as shown below, the production of these implements is rather low. The table below shows the production of these implements for the period 1973 to 1979.

Table 1

ITEM	1973	1974	1975	1976	1977	1978	1979
Hand hoe	232,234	327,956	357,685	346,141	440,317	502,483	478,479
Grass - Slasher	16,422	4,066	18,634	41,532	399,682	77,148	28,884
Ground-nut Sheller	61	65	-	84	3	-	-
Mould Board Plough	8,034	5,793	3,813	10,047	3,836	8,583	6,000

Recently (1982) another farm implements factory, the Zana za Kilimo Ltd (ZZK) was opened to manufacture agro-hand, agro-oxenization as well agro-mechanization implements. Hand tools produced include: Hand hoe, pangas, axes, pick axes, sickles, shovels & Hand sprayers. Whereas animal implements produced include: mould board ploughs, plough spares, & disc harrows, and tractor drawn implements produced include: Disc ploughs, Disc Harrows, cultivators and Disc spares.

Annual production capacity of these implements is shown below:

Table 2

Hand-tools	Annual Production
Hand hoe	750,000
* Panga	900,000
Axes	250,000
Pick axes	20,000
Sickles	75,000
Shovels	50,000
Hand Sprayers	20,000

\* Panga: Matchet, straight and curved.

Table 2 continued

<u>Animal Drawn Implements</u>	<u>Annual Production</u>
Mould Board Plough	10,000
Plough spares	Lump sum
Disc Harrows	1,000
<u>Tractor-Drawn Implements</u>	
Disc Plough	800
Disc Harrow	500
Cultivators	200
Disc spares	6,000

In addition to the above main manufacturing factories, there are private entrepreneurs, government parastatal institutions manufacturing agricultural implements on a rather small-scale level. These are:

- i) Small Industries Development Organization (SIDO) which is manufacturing ploughs and ox-carts.
- ii) Centre for Agricultural Mechanization and Rural Technology (CAMARTEC) which is manufacturing:  
Ox-carts,  
Double-Furrow Ox-ploughs,  
Planters,  
Harrows,  
Inter-row weeders.

The table below shows production from 1972 to 1979:

Table 3

Implement	1972	1973	1974	1975	1976	1978-79
Double-furrow Plough	34	40	55	60	80	200
Ox-carts	250	320	360	550	1,000	3,000
Animal-drawn planter	21	25	31	36	40	120
Cultivator	-	-	10	25	40	120
Ridger	-	-	-	10	20	60
Harrow	8	8	5	7	10	50

- iii) Themis Farm Implements which is manufacturing the "Kabanyola" Tool bar with attachments.
- iv) Private entrepreneurs manufacturing implements ranging from ox-carts and ploughs to grinding mills and threshers

Research.

Research on agricultural machinery and implements has been going on in Tanzania for the last 30 years, mainly in government institutions such as the Tanzania Agricultural Machinery Testing Unit (TAMTU) - now absorbed into CAMARTEC - other research institutions with a view to eventual local manufacture. CAMARTEC's work has mainly been on agro-oxenization implements and a number of these have eventually gone into production, as shown in table 3.

Other implements under research by CAMARTEC are post-harvest implements, planters and farm-yard manure spreaders, all of which are in the agro-oxenization category.

Research activities have not been widely spread. Other Institutions which have engaged in Research and development of agricultural machinery and implements include, Uyole Agricultural Centre, and Ukiliguru Institute. The kind of research done here has been that of improving on existing machinery and implements. It has not made much impact toward the manufacturing sector.

C. Major Problems of Manufacturing and Marketing and Ways and Means of Coping with them.

C.1 Manufacturing Problems.

Agricultural machinery manufacturing in Tanzania is a new technology, mainly imported, and is faced with a number of problems. These problems force the country to continue importing agricultural implements inspite of the presence of manufacturing technology in the country. These problems include:

i) Workshop machinery

The machinery installed in the two major agricultural implements factories turned out to be out of date and in many cases second-hand. This resulted in frequent break-downs causing a lot of lost man-hours and high cost of running the factories.

ii) Machinery Spares

In view of the obsolete nature of the machinery in the two factories spares for them are not easy

to come by. This is because the countries from where the machinery were imported no longer manufacture them, hence spares are usually not readily available and have to be manufactured. This, of course, makes the spares very expensive.

iii) Raw Materials.

Almost invariably all the raw materials required for production are imported, and have to be paid for in foreign exchange for which the country is in short supply. In view of this not enough raw materials are ordered and the factories end up in operating under-capacity. Sometimes the raw materials may arrive too late thereby upsetting production targets resulting in the farmers not getting the implements in time.

iv) Trained Manpower

When factory machinery was initially installed in the new factories, there were no trained operators so that trainers of operators had to be called from the countries of origin of the machinery. This of course delayed production start-up and after start-up repair of simple break-down had to wait for the imported expert.

v) Power Cuts.

Frequent power cuts due to fuel shortage resulting in power rationing causes drops in production.

vi) Water Cuts

Water cuts are sometimes a bottleneck in these factories and cause a loss of man-hours.

C.2. Marketing Problems

i) Regional Machinery and Implements Dealers.

Agricultural implements in Tanzania are marketed by Regional Mach. and Implements dealers. These dealers do not have appropriately trained manpower with the required knowledge of the implements they market. They also do not stock enough spares to match the implements they market. An example is the selling of ox-ploughs without stocking plough shares.

ii) Non-acceptability of New Products

Due to the conservativity of farmers and the lack of effective extension service, new products are not easily accepted by the farmers. And when accepted by a few somewhat progressive farmers, problems of proper operation and maintenance always arise.

iii) Transport

Dealers do not have shops in villages. This results in farmers travelling long distances to buy implements and their spares. Transport is not always readily available in villages.

C.3. Ways and Means of Coping with Problems mentioned above.

i) Machinery

This is quite a big problem for it is not easy to return the frequently breaking-down machinery to their manufacturers. The only foreseeable solution is their gradual replacement and the success of this will greatly depend on the locally trained engineers. Another solution is the local manufacture of workshop machinery although this is rather a long-term solution.

ii) Machinery Spares

When new machinery are installed this problem will be reduced. Also the establishment of a machine tools factory in the country - soon to be commissioned - will greatly reduce the importation of machinery spares as a great number of these will be manufactured locally.

iii) Raw Materials

Whilst importation of steel is bound to continue, appropriate designs are now coming up requiring no steel or imported components. An example is the wooden beam of the ox-plough which is at the moment being introduced to replace the steel beam where possible. The success of this depends on the training of local engineers.



iv) Trained Manpower

After the previous experiences the country faced while establishing new agricultural implements factories, proper plans are now laid down whereby engineers required to man factories are trained prior to the establishment of the factory. Also engineers train in the machinery - originating countries prior to the establishing of the factories. Along with in-plant training on the operation and maintenance of the machinery as carried out. This arrangement reduces dependence on expatriate engineers who not only are they expensive but sometimes turn out to be not of the required calibre.

v) Power-cuts.

Electrical power cuts will in the long run be reduced to a bare minimum as electric supply will be by hydro power.

vi) Water cuts

The best way to avoid or at least minimise this problem is the installation of water reserve tanks.

vii) Regional Agricultural Machinery and Implements Dealers

Marketing of agricultural implements by these dealers may succeed by opening up shops in the villages and employing marketing officers with the required technical know-how of the machinery and implements they market. Officers with some agricultural engineering background would be appropriate.

viii) Non-acceptability of New Products.

This should not be a problem at all with the presence of good extension service. This should be established and/or strengthened where present. Dealers also must be advised to have good and proper after sales services.

ix) Transport

With the establishing of shops in the villages transport should no longer be a problem; but availability of transport at times will be required such as in the case of a major break-down.

D. Technology Development and Transfer

National efforts to develop agricultural machinery and implements started in late 1960s. At that time TAMTU - Tanzania Agricultural Machinery Testing Unit started to design and develop some prototypes that are suited to small farmers. Examples of ox-carts, ploughs, planters and post harvest processing were undertaken.

In early 1970s, a village Technology Unit was started to produce units that could be used. These centres were using the various designs that were approved at the testing unit. These centres did not produce many products of each item because of lack of technical advice, machinery and raw materials. The idea was overtaken by the establishment of Rural Craft Workshops. The Rural Craft Workshops are better equipped and have manpower trained at CAMARTEC. There are skilled workers in the fields of metal working and wood-working.

Some designs that have been successfully manufactured include; ox-carts, hand-carts, wheel-barrow, the plough, spike tooth harrows and hand-powered maize shellers.

Improvement of products has been a continuous exercise through R & D. The emphasis in R and D has been on equipment performance, cost reduction by substituting imported raw materials by local raw materials, ease of operation and adaptation of imported machinery to Tanzania's agriculture. Research activities which are of applied nature has now been given emphasis by establishment of the centre for agricultural mechanization and rural technology.

✓  
Collaboration with Outside Centres

The kind of agricultural machinery and implements required in Tanzania have been developed by some countries. In research and development, Tanzania wants to establish linkages with outside countries, especially in developing countries so that those machinery and implements that serve our purpose can be brought into Tanzania. In this regard samples will have to be tested and where modifications are required will be done. Approved samples of those machines can be manufactured locally.

Another important aspect is on exchange of information regarding agricultural machinery and implements. It is through such an exchange that technical staff can improve on their knowledge. Training of staff from one country to another, short study tours and exchange of visits all add up the pool of knowledge. In this regard the idea of Technical Co-operation in Developing Countries should be exploited. More chances are needed to allow such visits, information, training and learning from one another. Resources, especially funds and arrangements for travel with limited restrictions are needed.

E. National Technology Development Policy

Tanzania has yet to develop, the National Technology Development policy. Much has been said and the desire to come up with this policy is eminent. The National Scientific Research Council under the Ministry of Planning handles all matters of research and development in the country. Its governing council draws members from various research institutions, university and government departments. The council in collaboration with the Ministry of Industries, Education and Agriculture will come up with the technology development policy.

Under the Lagos plan of action where African countries established the base for starting giving science and technology a high priority in member countries, Tanzania is bound to come up with such a policy.

The kind of technology policy that is useful in the country is that which improves on local technology, incorporates foreign technology into local institutions of R and D and can finally be taken for large scale manufacturing to cater for local demand. The policy should also utilize available local raw materials and skills. The government has already spelled out the importance of technical education in the country. The target is to have a technical school to every district by the year 2,000.

In formulating the national technology development policy, the emphasis should be that technology which makes a better living to the rural population who comprise over 80% of the whole population. Since these people earn their

living from agriculture, a technology geared towards improvement of agricultural technology is required. Although the policy has not been written, the actual practise in trends of technology development and adoption is in the areas of improved agricultural machinery and implements, renewable energy rural housing and transportation.

Tanzania has an agricultural mechanization policy. Since the subject of today is on agricultural machinery and implements, it is good to state the broad policy guidelines as summarized below.

1. The type, level and role of agricultural mechanization in the agricultural production process in Tanzania will be specific to regions, areas, sectors or conditions.
2. Measures to expand and improve the use of draught animals for agricultural production operations and agricultural level transport will be given highest priority.
3. Further investment in tractors and power equipment by public institutions will only be encouraged where such institutions have developed the capability to efficiently utilize their existing inventory.
4. The introduction and support of mechanical power at village level will be undertaken only after measures to ensure efficient use are taken.
5. In conformity with goals of industrialization and self-reliance and within technical and financial capabilities, agricultural machinery will be manufactured locally to meet local market demands.

6. Importation of machinery, spares and supplies for agricultural mechanization should be systematically organised in accordance with foreign exchange priorities, on the basis of technical evaluation and with clear lines of authority and responsibility for importation and distribution.
7. It is recognized that while credit is an instrument of policy, the purposes for which it is used are policy issues and, therefore, measures will be taken to ensure that credit use is aimed at achievement of specific goals within the broad national policy.
8. To ensure that mechanization contributes to agricultural development, measures both long and short-term, will be taken to train farmers and support staff in management and technical skills.
9. Support for the development and extension of mechanization will be directed towards the improvement in farming systems, of which mechanization is only a part, and will not be carried out in isolation.
10. While ultimately the village community will be responsible for owning and operating its own agricultural machinery; interim mechanical power requirements for selected areas will be provided through machinery hire services.

It can be seen from the agricultural mechanization policy that all types of agricultural machinery are encouraged but with a choice as to who does a particular equipment suit.

F. Industrial Development/Policy.

1. Tanzania has a strategy in industrial development. The industrial development policy since 1967 has been that of establishing manufacturing and processing industries that process raw materials mainly from agriculture. The textile industry that process locally grown cotton is one of the biggest. Implement manufacturing has been mentioned before. Within the policy, location of industries has been by zones. Distribution of industries to other towns apart from the capital Dar es Salaam has increased employment in other areas. The government established the National Development Co-operation in 1967 to facilitate quick industrial growth. Many of the industries have grown to become independent of National Development Corporation (NDC) as they grew in size and managerial capability.

2. Another importance policy break-through was made in 1972 when the Small Industries Development Organization (SIDO) was started. The main aim of SIDO is to promote small scale and private entrepreneurs in the manufacturing sector. Since then, SIDO has made tremendous progress in establishment of Industrial Estates. So far 16 regions out of 20 have SIDO Industries Estates. This has increased employment and availability of commodities on the local market.



3. The industrial policy is towards establishment of mother industries. Tanzania is now looking into the exploitation of iron-ore by establishing a steel industry.

4. The policy of industrial growth in Tanzania is geared towards promotion of industries in rural areas in order to encourage local manufacturing, raw material exploitation and utilization of manpower. This distribution is meant also to limit the rural population migration to urban areas. The local industry is supposed to provide basic needs to the people within that community.

5. Tanzania has always welcomed investors in industry from abroad. There are joint ventures, at national level where both the government and the company owners hold shares.

G. Licensing and Joint Venture Arrangements.

In Tanzania there is a procedure for industrial licensing under the Ministry of Industries. There is a national licensing board which considers applications for licensing for particular manufacturing firms. Foreign investors are encouraged to come and invest in Tanzania and they are protected through the Private Foreign Investment Protection Act of 1964. There are some other incentives that stimulate investments like private investment tax exemptions.

Private investments in agricultural machinery and implements have not been much. When one considers that agriculture is the main source of income to the people and the nation, there ought to be more industries manufacturing agricultural machinery. The range of machinery needed is big because of the varieties of crops grown for food and cash. This is where foreign investors are welcome. The future demand of various agricultural machinery and implements is shown in table 4.1, 4.2, and 4.3:

Table 4.1

Demand of agro-hand implements (In 000)

Implement Type \ Year	1980	1983	1985	1986	1988
Hand hoe (Jembe)	3400	2750	3050	3150	3450
Panga	4000	3480	3740	3840	4140
Axes	170	40	70	90	120
Sickles	90	50	60	70	80
Shovels	190	310	330	370	440
Spade	190	350	370	410	480
Cane-knife	80	120	150	160	190
Sisal Knife	80	120	150	160	190
Prunning Sheares/Saw	7	3	3	3	3
Glass Slasher	30	60	90	100	120
Hand sprayer	80	70	70	70	80

Table 4.2

Demand of agro-animal implements. (In 000)

Flough set	50	54	65	72	87
Harrow set	0.54	-	0.04	0.10	0.25
Ridger	0.54	0.68	0.79	0.85	1.00
Ariana Tooth set	0.043	0.054	0.063	0.063	0.063
Cultivators	0.22	0.28	0.32	0.36	0.40
Planter	0.22	0.28	0.32	0.36	0.40
Weeder	0.22	0.28	0.32	0.36	0.40

Table 4.3

Demand of agro-tractor machinery and implements.

Implement Type	Year	1980	1983	1985	1986	1988
Tractor Plough set		1000	900	1000	1000	1200
		*( 500)	( 450)	( 500)	( 500)	( 500)
Tractor Harrow set		500	240	340	380	520
		*( 400)	( 200)	( 300)	( 300)	( 400)
Tractor ridger		30	30	30	30	30
Tractor Seed Drill		10	10	10	10	10
Tractor shelders Maize		260	260	260	260	260
Ground Nuts		10	10	10	10	10
Planter Maize/neans		40	40	40	40	40

\* Figures in brackets shows effective demand.

The tables above show the potential demand of various agricultural implements. The list above is just an indication on a few implements used in the country. In order to improve on agricultural machinery and implements other machinery have to be introduced from R and D Institutions to meet specific demand.

### Joint Ventures

Joint ventures are welcomed in Tanzania. In the past some private manufacturing in agro-machinery has been done. Burns and Blane for instance has been in business in manufacturing tractor trailers and manure handling equipments. Lately, some private people known as Vitanda Manufacturers of Mwanza have started making ox-drawn ploughs. Investment can be in collaboration with the government as many cases have been, or to a lesser extent with local manufacturers or entrepreneurs.

When outside investors are involved, the local counterpart requests for foreign capital in terms of machinery, raw materials and skilled manpower or management skills. The local partner is ready to pay for buildings, housing for experts and local labour expenses. Other details are covered under individual contracts. The government of Tanzania has issued a booklet on Guide to Investors of 1979 that can be used to enlighten investors in agricultural machinery and implements.

### Projects.

Joint venture projects that are needed in agricultural implements include:

- a) Manufacturing of ox-drawn disc harrows.
- b) Maize- shellers.
- c) Ridgers - ox-drawn.
- d) Wheel-barrows.
- e) Sorghum threshers and decorticators.
- f) Planters.
- g) Wind-mills.
- h) Water-pumps.
- i) Irrigation accessories.
- j) Milk-separators.

These are but a few. Other implements can be added after a more careful evaluation has been done to assess the local market.

H. Entreprise Level Co-operation Among Small Industries in Developing Countries.

Developing countries need co-operation in promoting small industries. Experiences of running small industries gained in India for example can benefit Tanzania and other developing countries. Selected enterprises especially in manufacturing agricultural machinery and implements can be set up in another country using the same design and specifications from another country using the same design and preliminary study and assessment of the viability has been done.

Examples in Tanzania has been noticed in SIDO - Small Industries Development Organization where small scale industries were set-up with assistance from Sweden using the machinery and in some cases with raw materials

from there. Although this example is not from a developing country, there are some lessons to be learnt. Concrete benefits have been in manpower or skill improvement, jobs creation, local raw material utilization and easing pressure on the commodities by making available alternatives.

Selection of enterprises is very important to minimize duplication. Improvement on present level co-operation can be done on country basis when local conditions are understood. In that case, encouragement of exchange of experts to study what is available elsewhere and what is needed in the other country should be done. Developing countries that are better off technologically are requested or should consider those countries that are poorer technologically.

### Conclusion

The importance of agricultural machinery and implements in developing countries is obvious. Food production cannot be increased without using improved machinery. Better tools for agricultural production increase acreage and production per unit and reduces the burden on the farmers. With the rate of increase in population of the developing countries, there will continue to be more demand for improved agricultural machinery and implements at prices most farmers can afford.

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