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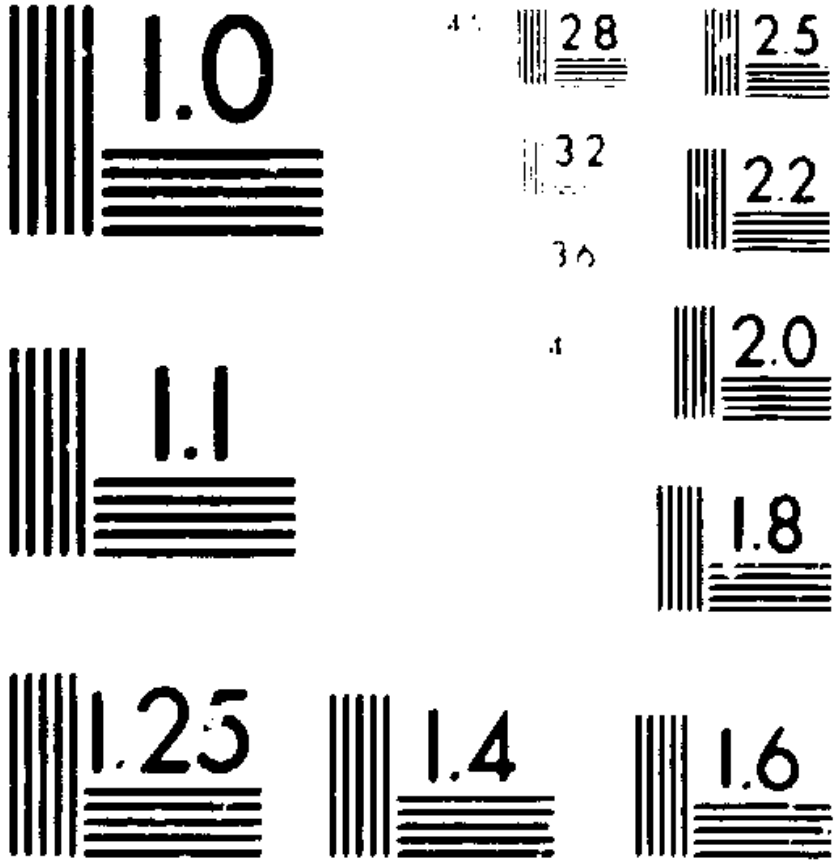

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AGRICULTURAL MACHINES AND IMPLEMENTS IN KENYA*

by

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** National Council for Science and Technology, Nairobi, Kenya.

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1. Introduction

Over 80% of Kenya's population of 16 million people is rural based. The major occupation in the rural areas is agriculture. Agriculture has always and will continue for a long time to play the major role in Kenya's economy. In 1978, its contribution to Gross Domestic Product (GDP) was 35.8% which was equivalent to K£632. There are various reasons to this. Kenya like many other developing countries is faced with population explosion. The present population growth rate estimated at about 3.8% is projected to increase Kenya's population to 30 million people by the turn of the century. This means that more mouths are to be fed every year. The development of metals and other allied industries as well as the chemical industries is at infancy. This means that substantial employment opportunities are found in the reasonably developed agricultural sector, may it be the agro-based industries. Some of the prominent agro-based industries include coffee and tea processing, sugar processing, breweries and a vast range of food processing establishments such as fruit canning, vegetable oil extraction, cereals milling and bakeries. The availability of mineral resources in Kenya is quite limited. Apart from the existence of sizeable deposits of soda ashs, other minerals exist in scattered areas in very small amounts uneconomical to mine.

Out of Kenya's surface area of 585,000 square kilometres only about 17% of it has reliable rainfall. The rest of the land is either arid or semi-arid where without irrigation it is not possible to undertake reliable agricultural activities. Regardless of that, there has been substantial migration into semi-arid and arid areas due to population pressure in the limited arable land located mainly in Central and Western Kenya including Nyanza and parts of Rift Valley provinces.

The Agricultural activities in Kenya are in two quite distinct fields i.e. crop farming and livestock development. As regards to crops, there exists two major divisions defined according to economic values of the respective crop. These are the cash crop farming and food crop farming. The cash crops, led by coffee and tea form the backbone of Kenya's agricultural exports while the food crops which include maize, wheat, and rice are the dominant source of Kenya's domestic food requirements. The competition between cash crops and food crops for the arable land in Kenya is becoming evident. This increases the need to utilize the semi-arid areas for food crops and livestock development.

The farming systems in Kenya can also be defined according to the sizes of individual farm. The small scale farms average about 8 acres while large scale farms are on average over 2000 acres. It is observed that the output per acre is higer for small scale farms than the large scale ones. As a result of this, there exists a Government scheme to slowly acquire the land from large farm holders and distribute it to more needy landless or small farm holders for better productive purposes. The optimum sub-division of these farms has yet to be defined and this is expected to depend on various agricultural requirements such as rainfall, soil quality and other climatic conditions.

At present, most of the work on Kenya's small farms is done mannually with the aid of a variety of handtools such as pangas, matchets, shovels, axes etc. that are considered as traditional agricultural tools. All of them are manufactured in Kenya especially in Nairobi, Mombasa and Kisumu though all the raw materials are imported. Where in Kenya, draft animals like oxen, donkeys and horses are used, the equipment available is generally limited to a simple plough which is used for initial land preparation, furrowing, sowing and weeding. These simple tools make it difficult for farmers to prepare land in advance of rainfall when it is very dry and hard and this delays planting, resulting in reduced yields and therefore improvements are needed.

In case of large scale farms higher degree of farm mechanisation has been attained. The machinery in use by large farm holdings in the year 1970-1978 is given in the table below:

Table I

Agricultural equipment	1970	1971	1972	1973	1974	1975	1976	1977	1978
Wheel tractors	6607	5336	5501	5235	5709	5501	5503	5728	6010
Crawler tractors	710	645	555	527	486	512	479	458	438
Combine Harvesters - self propelled	462	405	407	337	318	289	322	260	251
Combine Harvesters tractor drawn	177	153	141	143	144	144	147	119	113

Kenya's statistical Abstract 1978

It has been observed that the utilization of these sophisticated agricultural machines in the big farms has been very poor. This has mainly been due to long break-downs as the spare parts have to be imported. The spare parts problem has been aggravated due to the fact that these machines are imported from all corners of the world and Kenya has at present not less than fifteen (15) models of tractors.

2. Present state of activites as regards to Agricultural machines and Implements in Kenya

(a) General:

Kenyan economy like any other in the developing countries is faced with the problem of unemployment and underemployment. It is also experiencing a serious constraint in the availability of adequate foreign exchange for purchase of fossil fuel industries and agricultural equipment and machinery required for maintaining the desired rate of economic development and creation of new employment opportunities. One of the logical solutions to this is to have a judicious balance of development of both industrial and agricultural sectors, by maximising the investment for indigenous manufacture of agricultural inputs for intensive agricultural production and for processing agricultural products, both for domestic consumption and for export. This surely embodies local manufacture of simple farm equipment using labour intensive technologies and also importing simpler agricultural equipment and machinery instead of sophisticated and costly high powered tractors and combines.

(b) Nature and Sources of machinery and tools

The farming techniques in Kenya is very varied not only due to varied farm sizes but also due to climatic conditions, social and economic environments. As said earlier the use of high powered and sophisticated equipment is quite prevalent in large farm holdings and plantation areas while most of the rest of the farming community is stuck with traditional tools. Regarding the simple hand tools such as simple ploughs, jembes, pangas, shovels and pick axes as well as simple animal drawn implements and some tractor drawn implements, Kenya has made a good beginning for their local manufacturing.

It is evident from the table below that very little of the hand operated implements are imported today though all the raw materials for their manufacture is imported. The local manufacturers are in a position to export 25-30% of their agricultural machines and implements produce to the neighbouring African countries.

Table II. Import of Hand Operated Agricultural tools

	1976		1977		1978	
Tool description	Quantity	Value Mill Shs.	Quantity	Value Mill Shs.	Quantity	Value Mill. Ksh.
Membes, hoes axes etc.	100	0.005	1,500	0.014	911,000	0.129
Pangas, matchets	3,400	0.078	1,000	0.007	281,500	4.657
Others mainly used for Agriculture	768100	4.354	603500	8.757	271700	3.526

Apart from sophisticated tractors and tractor drawn implements most of the other agricultural machines are either fabricated or manufactured locally as the table below shows:

TABLE III LIST LOCAL AGRICULTURAL MACHINERY MANUFACTURERS

	NAME OF MANUFACTURER	ADDRESS	ANNUAL PRODUCTION	
			ITEMS MANUFACTURED	QUANTITY
1.	Alaf Din Blacksmiths	P.O. Box 45653 Duruma Road Nairobi	(i) Ox-driven ploughs	2,000
			(ii) Plough shares	5,000 pieces
			(iii) Plough laurides	5,000 "
			(iv) Mould Boards	1,000 "
			(v) Plough breests	1,000 "
			(vi) Plough beams	500
			(vii) Plough chump	2,000
			(viii) U-Bolts	2,000 "
2.	Alliance Steel Works	P.O. Box 12377 Butere Road Nairobi	Agricultural Implements	N/A
3.	Almetalo	P.O. Box 362 Coronation Ave. Nakuru	Agricultural machinery	N/A
4.	Biri Engineering Works	P.O. Box 43174	(i) Rain water gutter pipes	N/A
			(ii) Water tanks	N/A
			(iii) Engineering implements	N/A
5.	Bob Harriers Engineering Ltd.	P.O. Box 40 Thika	Windmills	N/A

	NAME OF MANUFACTURER	ADDRESS	ANNUAL PRODUCTION	
			ITEMS MANUFACTURED	QUANTITY
6.	Burns and Blane Ltd.	P.O. Box 45860 Kampala Road Nairobi.	Tractor Drawn implements	N/A
7.	Cassini and Tonolo Ltd.	P.O. Box 14325 Bamburi Road NAIROBI	(i) Sprayers (ii) Ploughs (iii) Harrows (iv) Loaders (v) Cabs (vi) Conversions (vii) Accessories (viii) Others	150 50 30 30 50 150 200 500
8.	Chohan Engineering Works	P.O. Box 175 Makasembo Road Kisumu	Posho Mills Ploughs Spares	N/A N/A N/A
9.	Cooper Motor Corporation	P.O. Box 43070 Kitui Road Nairobi.	Agricultural machinery and coffee machinery	N/A N/A
10.	J.S. Davis and Co. Ltd.	P.O. Box 11335 Moi Avenue Nairobi.	(i) Engines (ii) Pumps (iii) Pump sets (iv) Water treatment Dosers (v) Motors and Generators	87 129 42 88 139

NAME OF MANUFACTURER		ADDRESS	ANNUAL PRODUCTION	
			ITEMS MANUFACTURED	QUANTITY
11.	Dhiaan and Sons Ltd.	P.O. Box 18204 New Pumwani Road NAIROBI.	Coffee and Tea machinery	N/A
12.	Eastern Engineering Works	P.O. Box 45657 Enterprise Road NAIROBI.	Ploughs and agricultural implements.	N/A
13.	George Williamson Engineering Ltd.	P.O. Box 42281 Nkrumah Avenue Nairobi	Tea machinery	N/A
14.	Gian Singh Bansal and Co.	P.O. Box 370 Central Elgon Road Kitale	Agricultural machinery	N/A
15.	Hammers Engineering Ltd.	P.O. Box 18246 Jiroro Road Nairobi.	Agricultural machinery Mechanical Engineering Ploughs.	N/A
16.	Hughes Ltd.	P.O. Box 30060 Kenyatta Avenue NAIROBI.	Ploughs	N/A

	NAME OF MANUFACTURER	ADDRESS	ANNUAL PRODUCTION	
			ITEMS MANUFACTURED	QUANTITY
17.	Ibrahim N. Saksh	P.O. Box 70 Kericho	Water tanks Hand well pumps	N/A N/A
18.	Ideal Casement, E.A. Ltd.	P.O. Box 45319 Dar-es-salaam Road NAIROBI.	(i) Agricultural implements (ii) Jembes	N/A N/A
19	Industrial plants E.A. Ltd.	P.O. Box 44717 Kampala Road Nairobi	Dairy machinery	N/A
20.	International Tractors	P.O. Box 30268 Kampala Road Nairobi.	(i) Agricultural implements (ii) Harrows (iii) Trailors (iv) Tractor parts (v) Lorry bodies	N/A N/A N/A N/A N/A
21.	J.F. McCloy Ltd.	P.O. Box 72014 Kitui Road Nairobi	(i) Coffee driers (ii) Teac machinery (iii) Heavy duty trailors for cattle etc.	N/A N/A N/A
22.	Jandu Workshop	P.O. Box 45186 Butere Road Nairobi	(i) Tea machinery & spares (ii) Sawmilling machinery and spares (iii) Tea machinery & general repairs	N/A N/A N/A

	NAME OF MANUFACTURER	ADDRESS	ANNUAL PRODUCTION	
			ITEMS MANUFACTURED	QUANTITY
23.	Joe Hanben and Sochna E.A.	P.O. Box 30196 Tom Mboya Street Nairobi.	Water pumps	N/A
24.	Kalsi Engineering Works Ltd.	P.O. Box 497 Eldoret - 2459	Agricultural machinery	
25.	K. Kay Engineering Services Ltd.	Jiroro Road Private Bag Nairobi	(i) Tea drying stoves (ii) Tea driers (iii) Coffee pulpers (iv) Boilers (v) Agricultural Trailers (vi) Fans (vii) Conveyors and associated equipment	5 4 3 1 12 20 -
26.	Kenya Engineering Industries	P.O. Box 18331 Likoni Road Nairobi	(i) Pangas (ii) Shovels	N/A N/A
27.	Kismumu Engineering Works Ltd.	P.O. Box 229 Obote Road Kisumu	(i) Cotton ginneries (ii) Sisal machinery	N/A N/A

	NAME OF MANUFACTURER	ADDRESS	ANNUAL PRODUCTION	
			ITEMS MANUFACTURED	QUANTITY
28.	Leading Engineering Works Ltd.	P.o. Box 42131 Dunga Road Nairobi.	(i) Bloughs (ii) Harrows (iii) Mobile saws	50 5 3
29.	Mangal Singh Engineering	P.O. Box 173 McKinson Street Kisumu.	(i) Sugarcane crushers (ii) (both power & ox driven) (iii) Sets of juice cooking pans (iii) Furnace doors, chimneys (iv) Fire Bars, cooling trays (v) Countersheft, pulleys (vi) Couplings and all spares parts	N/A N/A N/A N/A N/A N/A
30.	Modern Industrial and Engineering Works	P.O. Box 383 Makasembo Road Kisumu	Sugarcane crushers	N/A

	NAME OF MANUFACTURER	ADDRESS	ANNUAL PRODUCTION	
			ITEMS MANUFACTURED	QUANTITY
31.	Ndume Ltd.	P.O. Box 62 Gilgil - 223	(i) Harrows (ii) Ploughs (iii) Mills (iv) Seeders (v) Hand mills (vi) Hand planters	60 30 220 10 1,200 N/A
32.	Nyanza Engineering Works Ltd.	P.O. Box 175 Mumias Road Kisumu - 2875	Posho Mills	N/A
33	Paramount Engineering Works	P.O. Box 295 Mumias Road Kisumu	(i) Cane carrying trailers (ii) Nose guards (for tractors (iii) Knave plates for tractor wheels (iv) Hitch saddlers (v) Winches	7 55 243 6 1
34	Reliance Engineering Works	P.O. Box 197 Mumias Road Kisumu	(i) Sugarcane crushers (ii) Maize mills (iii) Ginneries	N/A N/A N/A

	NAME OF MANUFACTURER	ADDRESS	ANNUAL PRODUCTION	
			ITEMS MANUFACTURED	QUANTITY
35.	Shaw R.S. Ltd.	P.O. Box 43617 Bunyala Road NAIROBI	Spares for friction materials viz: (i) brake lining sets (ii) disc pad sets (iii) clutch facing sets	 N/A N/A N/A
36.	Sihra Engineering Works	P.O. Box 16074 Virjee Road	(i) Coffee machinery (ii) Water pumps (iii) Agricultural & irrigations equipment	N/A N/A N/A
37.	Southern Engineering Works Ltd.	P.O. Box 84162 Mbaraki Creek Mombasa	Sugarcane crushers	N/A
38.	Station Engineering Works	P.O. Box 81528 Miji Kenda st. Mombasa	Agricultural equipment	N/A
39.	Tunnel Estate Co. Ltd.	P.O. Box Fort Ternan, TERNAN	(i) Hutchinson Sugar Vats (ii) Hutchinson methane gas plants	N/A N/A

Besides these manufacturing centres, there are numerous other small workshops and repair shops dealing not necessarily with agricultural machines only but also other industrial machinery.

Regarding heavy agricultural machinery the only source is through importation from more than fifteen different countries. It is estimated that there are about 10,000 tractors currently in use along with some other self propelled machinery like combines, dredgers or lavellers and a host of tractor drawn implements in the country. Out of this 50% are owned by individual farmers or public farming organisations while 25% are held by Government Agencies or co-operatives. The rest are in the hands of private contractors who render services for ploughing, cultivation, sowing and harvesting on contract basis.

(c) R and D activities:

The R and D activities as regards to the agricultural machines and implements in Kenya is very limited. Almost all the manufacturers in table III are private establishments whose only interest is to maximise profits. They therefore do not have qualified professional staff who would try to design and develop appropriate tools. Most of the personnel in these establishments are simple technicians, turners and fitters. These establishments do not reserve any funds for R and D. As a result they observe the general country as regards to the tools and intensify their activities in that direction. This is no surprise to the Government as very few private sector establishments are involved in any R and D activities in any field.

However, the Government of Kenya has organised and started various public establishments to undertake R and D in all aspects of industrial requirements. The Agricultural Machinery Testing Unit centred in Nakuru was originally set up in 1956 by colonial governments to take care of the standardisation of all agricultural machines and implements manufacture in Kenya. The Unit remained domant for a long time and between 1977-1981 UNDP and FAO assisted Kenya Government and the project took off. The Unit is now studying 95 simple tools from all over the world to determine their suitability for application and manufacture in Kenya. Out of the 95 tools, the Unit had identified 7 potential tools and simple machines that can with some modifications be manufactured locally.

These include:

(a) A hand-weeder- expected to reduce the number of weeding hours by about 80%.

(b) A maize-sheller that is manually operated.

(c) Three different types of ploughs/weeder including a multipurpose ox-plough.

(d) One hand planter for maize and beans.

(e) An ox-cart wheel and axles.

These simple machines and tools have been tested in the field and their fabrication. Specifications have been clearly defined by the Unit. F.A.O. specialists at the unit are embarking on arranging the manufacturing of the said items under their strict quality control, organise country-wide demonstrations of their operations and train extension services workers who are expected to train farmers and especially small scale ones. A manual on the operations of these items has been prepared and is to be sent to all public and private farming training centres and institutions to be used as teaching guides. The unitais also very much concerned with arranging proper marketing of these machines and implements through the farming training centres all over the country.

Apart from the R and D activities at the Agricultural Machinery Testing Unit in Nakuru, the Government has other establishments such as the Department of Agricultural Engineering of the Nairobi University, Industrial Research and Consultancy Unit that are already involved in designing and developing prototype samples of farm equipment that are later tested at the testing Unit. Kenya Industrial Research and Development Institute, a Kenya Government research establishment is also undertaking R and D activities on industrial machine tools and processes. Other less integrated government and voluntary establishments such as Karen Rural Technology Centre, Appropriate Technology Centre and K. Industrial Training Institute in Nakuru, are involved in development of simple gadgets as maize shellers, simple cereals crushers etc. specifically for rural requirements. In view of all that the R and D activities programmes are not very well harmonised and the research results hardly benefit the very small scale farmer. Either the implements and machines produced are out of his reach or appropriate information on how to acquire, them never reaches him.

3. Problems hindering proper technology development and transfer as well as local manufacturing and marketing of agricultural machines and implements.

There are various problems most of which are typical to developing countries:

(a) Personnel:

As said earlier, most of the private establishment undertaking the manufacturing of agricultural machines and implements are poorly manned. Most of them do not have a single qualified practical engineer who can design and organize production of prototypes for fabrication and commercialization. The management comprises of administrators and salesmen who focus their attention on today and not tomorrow. The technicians involved in this manufacturing do not have enough supportive theoretical background to enable them understand these implements and machines in order to think on positive lines of improvements. The owners of these establishment are not keen to import and adopt any technologies as this would reduce their profit margin and they therefore prefer to use those technologies that are already in free domain.

As regards to the public sectors the situation is similar. There is not enough highly qualified personnel to evaluate and adopt appropriately imported technologies. The incentives to engage into serious R and D activities by most of developing countries scientists are minimal mainly because of poor rewarding. This is definitely so in Kenya. As a result R and D in Kenya is not as vigorous as the Government would wish and this slows the rate of technological development.

(b) Finance:

This is another typical problem with all the developing countries. Most of our resources go into importing very vital capital goods and fossil fuels. Very little is therefore left for the R and D to generate indigenous technologies or adopt imported technologies. The private sectors do not reserve any fund for R and D from their profit earnings. The government however through its various public R and D establishments extends some funds for R and D. However knowing the diversity of R and D activities in Kenya, very little is left to agricultural machines and implements technology development.

(c) Raw materials:

Kenya does not have any metal producing industry. All the raw materials for fabrication have to be imported. This ties very well with financial problems. As well as importing the necessary capital goods, raw materials have to be imported.

(d) Quality control Services:

The quality of both the raw materials and the manufactured end products have to be well monitored. Kenya's raw materials are imported from all over the world and their thorough assessment is never done. It is also difficult to establish the qualities of the final products knowing that over the world and their thorough assessment is never done. It is also difficult to establish the qualities of the final products knowing that over 50 small establishments are involved in various types of manufacturing.

(e) Policy:

Regarding agricultural machines and implements, the Government policy is not very favourable to the manufacturers. This is because the Government imposes taxation of about 25-30% on all imported raw materials while there is no taxation on imported manufactured agricultural machines and implements. This reduces profit margins of the manufacturers and encourages importation of manufactured items.

(f) Technological disseminations:

Proper information of the available appropriate tools and machines hardly ever reaches the very small farmers in the rural areas. There is a time lag between the time appropriate technology is developed mainly in the urban areas and the time it is applied in the rural areas.

(g) Poor performance of extension services workers

The work of the extension services workers is very crucial. They are supposed to be teachers of the small scale farmers and other rural areas workers on how to make use of newly developed technologies. Their effectiveness would very much determine the success of utilization of technologies.

(h) Lack of proper marketing channels:

Most of the marketing centres are in urban areas or in general very far from the small farmers in the country side. Both the farmer and the manufacturer hardly ever know what one requires as they are miles apart. This confuses the manufacturers as they produce the wrong items in surpluses sometimes.

(i) Lack of International and Regional Co-operation

There is substantial duplication of efforts in trying to devise R and D programmes and marketing and manufacturing plans.

This is due to non-cooperation among even some neighbouring countries and worse still even some establishments in the same country. As a result a lot of money is wasted in repeating activities that have been done elsewhere and failed.

4. Technology transfer in the field of Agricultural machines and Implements

As is evident in Table III, there are very many small and medium size establishments doing work on agricultural machines and implements in Kenya. There does not exist a well integrated firm that manufactures the said machines and implements. This clearly shows that the manufacturing is not harmonised and the production technologies are very diversified. Most of these are old technologies that have already entered into free domain and therefore no transfer transations are involved.

Kenya is planning to establish a comprehensive machine tool industry as well as an integrated mini steel industry. It would be perhaps after this, the country would be in a position to also establish an agricultural machines and implements manufacturing industry that would be based on both the imported and local technologies. The more sophisticated machines are all from imports though some industries like the coffee and tea have developed various implements for their specific uses.

5. National Technology and Industrial Development Policies

The technology and industrial development policies in Kenya are formulated in order to meet the objectives of the 1978-1983 Development Plan. The Government plans to minimise technological dependence on foreign sources by developing a national capacity for:-

(a) the development, acquisition, transfer and adaptation of technology;
(b) assessment, evaluation and regulation of any technology transferred to Kenya;
(c) proper industrial management;
(d) engineering and industrial designs for the organization and modification of industrial products and processes;

(e) strengthening the control of standards for manufactured goods and equipment;

(f) maintenance of plant equipment and instrumentation;

(g) manufacture of replacement and spare parts;

(h) efficient utilization of the indigenous natural resources;

(i) export of manufactured and intermediate goods;

(j) facilitating technological transformations and innovations.

The technological policy therefore focuses mainly on the development of a nation capacity to launch and effect the above requirements. This involves a broad cross-section of social economic activities. The industrial policy aims at creating more job opportunities not only in the specialised high categories but also in the lower cadre areas. The dispersion of industries to the rural areas would curb the rural-urban-migration and enhance rural development through utilization of local resources and labour.

Regarding the quality of industrial products the Government feels that over-protection of local industries has caused quality decline and high costs. Therefore the future policy is to minimise unnecessary protection and this will ensure consumer protection and success in export market. The Government also feels that a deliberate action should be taken to integrate the informal industrial sector in the national industrial development strategy. This would call for training and financial facilties for persons engaged in informal sector and development market outlets for their products.

6. Proposed solutions to problems hindering technology development, manufacturing as well as marketing of Agricultural machines and implements

The said problems exist in all developing countries but are felt more in countries whose economic base is agriculture like Kenya. The problem regarding shortage of qualified personnel is typical in all fields in the developing countries. In most cases the training programmes are not well related to the economic requirements and therefore little impact have the graduates, on the technological and economic development during the initial years of employment. Their overall number is quite low and job description in some cases is so diverse that an engineer expected to confine himself on engineering development of industries ends up devoting most of the time in administration. The government therefore should re-formulate the training programmes in all the institutions such that they reflect the technologies and economical requirements of the country.

The industries should also organise to uplift the engineering capabilities of young engineers and technicians by exposing them to appropriate challenging commitments coupled with relevant field training. Presently most of the sophisticated engineering activities in the industries are contracted to overseas engineering firms. The government should also arrange to train more middlemen (technicians) to fill in the gap between well qualified engineers and the subordinate staff. In the past, the role of engineers and technicians has not been clearly defined and it has been common to see technicians doing the work of engineers and vice-versa.

The solution to financial problems is perhaps one of the hardest to tackle. The Government has very little reserves for R and D and therefore many research programmes are never executed or completed. More agencies should show willingness to assist in this without necessarily define the research priorities in the field of agriculture. F.A.O. and UNDP have contributed substantially to the mentioned earlier Agricultural Machines Testing Unit in Nakaru. The government should also devise a method of enforcing the private firms to direct a small proportion of their profits into R and D.

As regards to policy problems, it is the high time the Government redefined its policy as regards to taxation of imported raw materials for the manufacture of Agricultural machines and implements. The current taxation of about 25-30% on raw materials and no-taxation of imported machinery and implements is contradictory. The Government should organize a refund to the manufacturers after certification that the imported materials have been committed into manufacturing of agricultural machines and implements.

In the field of information propagation in general, the Government has a big task ahead. First the training of extension services officials is very critical. The said official should be accessible and able to conduct demonstration work. They should act as marketing agents also. In order to achieve this, the farming training centres in the rural areas should be increased and their roles should include demonstration of the operations of various developed and manufactured farming implements and machines as well as organizing their marketing. This will minimise the time lag in the dissemination of information to the simple farmers and hence quicker adoption of newly developed technologies.

The other problem with spare parts availability in time for agricultural machines and implements is very crucial. Presently such items are obtainable only in big towns like Nairobi, Mombasa, Kisumu, Nakuru, Elderat etc. The farmer in the hinterland has to travel long distances for these items and sometimes the machineries are idle for days. Before the manufacturing of spare parts in Kenya is well harmonised, the earlier mentioned training centres should as well incorporate the distribution and stocking of spare parts. They should also have machinery service personnel to undertake less serious repair works. The regional and international co-operation as regards to manufacturing, marketing and technology development is also crucial. With one country specialising in the manufacture of a definite item, the marketing opportunities are better while with a harmonised R and D programme, duplication of efforts is reduced and the meagre resources available are put in more positive use. It is recommended that all the countries both developed and developing should explore this regardless of their political difference.

7. Improvements of licensing and joint venture arrangements

Every developing country struggles hard to improve its negotiation capacity as regards to industrial licensing and joint venture arrangements. The crucial aspect here is to have qualified personnel, enlightened entrepreneurs and properly formulated government policies. For most developed countries, the joint venture is a means of access to raw materials, low cost manpower and markets. The developing countries should reasonably capitalise on this.

As regards to the gains of an enterprise, the developing countries governments should operate on the basis of the following objectives:-

(a) the gain should be as a result of activities economically beneficial to the nation;

(b) the gain and its division among the promoters should arise from manufacturing and marketing operations not from the enterprise's peripheral activities such as patents grants rendering of services such as patents grants rendering of services or exclusive market rights;

(c) the national promoter should in some manner be compensated for his untangible contributions e.g. bring the national market to the joint-venture etc.

However, the developing countries should not be too rigid in some cases. There are times the countries should be prepared to endorse incentive remunerations for efficient combinations of capital and technology to foreign investment. This however solely depends on individual countries after assessment of socio-economic impact of joint-ventures.

The governments should review and adopt appropriately such national policies governing the establishments of industrial enterprises

(a) legislation prohibiting the setting up of wholly-owned foreign enterprise;

(b) high taxation of wholly-owned foreign enterprise;

(c) erection of barriers on transfer of funds from local subsidaries to parent companies;

(d) encouraging capitalization of technology.

The reviewing should be directed towards the encouraging of joint-venture establishments.

8. Technical co-operation among the Developing Countries T.C.D.C.

The inter-enterprise co-operation among the developing countries can hardly be ignored. The conomic base and social structure of the developing countries are similar to some extent. It would be easier to hit a compromise during negotiations on technology transactions. It is therefore recommended that the developing countries should establish ways and means of information exchange regarding market exploration, technology suitability and overall technology alternatives appropriate to them.

Presently it is difficult for developing countries to venture into European and other developed countries markets successfully, while in actual fact the developed countries have spread their wings all over the world. The small and medium enterprises can hardly venture beyond their town of establishment. The situation must be reversed. The developing countries should give priority to fellow developing countries in all cases of trade and technology transactions,