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FARM MECHANIZATION: PANACEA TO FOOD SECURITY IN NIGERIA - A REVIEW

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Abstract

Agriculture remains the only means of ensuring food sufficiency in any country. To ensure food sufficiency in Nigeria efforts must be made to improve the sector. And the only way to achieve this is to encourage commercial farming through mechanization. Agricultural mechanization is the best way to combat hunger and poverty in developing countries, Nigeria inclusive. This paper examines the causes of food insecurity in Nigeria, importance of agricultural mechanization, problems of agricultural mechanization and Solution to problems of agricultural mechanization in Nigeria.

Key words: Agriculture, Drudgery, Mechanization, Tractorization, Food security

1.1 Introduction

Agricultural productivity in Nigeria is still tedium laden, hence only a few of the youths go into agriculture. Though it is obvious that there is a lot of prosperity in agriculture, yet the rate of the use of old equipment and the antecedent drudgery involved send many away from engaging in agriculture. The story of farming in the developing economy is a completely different one. In Nigeria, agricultural workers make up a very small portion of the population, but agriculture employs anywhere between 50 percent and 90 percent of the population for farming in the developing countries (Oduwole, 2018). Agricultural Mechanization is the best way to combat global hunger and poverty in developing countries, Nigeria inclusive. Agricultural mechanization may be explained in several ways. To some it is the farm equipment and the techniques associated with its use, and to others it is synonymous with tractorization (Enaboifo and Anerua-Yakubu, 2010). It is the act of making judicious use of agricultural inputs

such as seeds, irrigation water, fertilizer, herbicides or insecticides, and farm equipment in order to maximize production with minimum cost. Others simply take it to imply increase in production per worker and per hectare of land cultivated (Onwalu *et al*., 2006).

The Nigeria economy is partly determined by agriculture, which experienced a rapid growth during the past eight years (Ibrahim *et al*., 2012). Agriculture has remained the fastest growing sector in the non-oil sector. It has recorded a growth rate well above 5% in recent years compared with the less than 2% growth of the early 1980s (Falusi, 2008). Nigeria ha a population of about 144 million and a growing rate of 3.2% per annum. If not checked, the population of Nigeria would double in less than 25 years (Oladipupo, 2008). This alarming growth rate is a challenge in a country where more than 90% of the agricultural output is accounted for by small scale farmers with less than two (2) hectares under cropping.

It is estimated that over 86% of Nigerian farmers and over 90% of farm operations, including bush clearing, land preparation, planting, weeding, pest control, harvesting and primary processing are still carried out using hand tools. It is further investigated that, in the North, about 85% of the total area cultivated per year employed hand tools, about 6% employed animal power, while about 8% are cultivated with the use of motorized tractor (Ajav, 2000) and about 30-40% of agricultural produce is lost owing to poor post-harvest handling, storage and processing methods (FAO, 2011). The forgoing underscores the importance of farm mechanization as a policy instrument in the growth and development of Nigeria's agriculture and the need to explore the constraints to agro mechanization. Therefore, there is a need for review of farm mechanization as a panacea to food insecurity in Nigeria.

2 Materials and Methods

Field study was conducted at Saki-west Local Government Council, Area, Oyo-North Senatorial district, Oyo State, Nigeria (8^{o} N 40' 3^{o} 24' E). The community (Saki) hosts several commercial and small-scale farms, majorly specialized in the cultivation of food crops such as maize, guinea corn, cassava, yam and melon.

The materials used for data acquisition include:

i. Survey of the area through distribution of questionnaires and personal interviews with stakeholders which include farmers, operators, technicians and government agencies.
ii. Sampling and collection of data which proven to be instrumental to sampling of tools, implements and machineries in the selected areas
iii. Direct observation of some machinery and implements
iv. Analysis of data retrieved from the questionnaires

The questionnaires focused on the specific points presented in the objectives of the study which include review the existing position of agricultural mechanization in Nigeria and to conduct a field survey of implements, machinery and equipment as well as spare parts available in the workshops where servicing and maintenances of these machinery are being carried out. .

3.0 Agricultural Mechanization

Agricultural mechanization means the application of agricultural principles and technology, by the use of mechanical systems in the process of food, fibre and fuel production, protection, processing, handling and storage (Bologna, 2009). It is also refers to the replacement of manual labour and smple hand tools with human, animal, electrical and internal consisting engine-powered machinery (FAO, 2011).

3.1 Reasons why we mechanize

The reasons why we mechanize are; agricultural machining has got progressively large. It is now feasible for one man to plough in excess of 10 hectares per day with suitable machinery. In 1996 the majority of all tractors were sold above 100 horse power bracket. Mechanized farming is the process of using agricultural machinery to mechanize the work of agriculture, greatly increasing farm worker productivity. The history of agriculture contains many examples of tool used, but only in recent time has the high rate of machine use been at a high level.

Mechanization was one of the factors responsible for urbanization and industrial economies. Besides improving production efficiency, mechanization encourages large scale

production and improves the quality of farm produce. On the other hand mechanization displaces unskilled farm labour, causes environmental pollution, deforestation and erosion.

3.2 Importance of Agricultural Mechanization in Nigeria

Agriculture remains the only means of ensuring food sufficiency in any country. To ensure food sufficiency in Nigeria efforts must be made to improve the sector. And the only way to achieve this is to encourage commercial farming through mechanization. Despite the demerits of mechanization, its benefits supersede the demerits. Here under are a few of the benefits of agricultural mechanization:

i. Food sufficiency

Agricultural Mechanization will improve agricultural production in Nigeria. This will boost the availability of food. And decrease hunger in the country. With the application of engineering principles, there will be season less or non-seasonal production of food, maturation periods of crops will be reduced due to improved agriculture and agricultural seed production and irrigation, There will be sufficiency of food for the teaming population of the country.

ii. Foreign Exchange Generation

Mechanized farming system would improve the foreign exchange earning potential of the country. Excess farm produce (cash crops) as a result of commercial farming would be exported to other countries.

iii. Increased participation

Agricultural mechanization increases the participation of the youth and the educated in farming activities. This is because it reduces the stress arid drudgery involved in farming. And also improves the profitability of farming ventures. This increases the interest of the masses in agriculture.

iv. Improved processing and packaging

Agricultural mechanization also improves the shelf life of farm produce. It equally improves the processing and packaging of farm produce. These reduces food waste, And increases the prices of farm produce.

Other Benefits

The benefits of agricultural mechanization are numerous**.** Further still, the under listed are benefits of agricultural mechanization;

i. Increasing Productivity
ii. Timeliness of Operation
iii. Reduces health hazard due to manual or over labour drudgery
iv. Supplements human power several folds for heavy jobs
v. It saves time
vi. Encourages large scale farming
vii. Promotes specialization of available manpower
viii. Create employment for youth

3.3 Problems of Agricultural Mechanization

The mechanization of the Nigerian agricultural system is constrained by many factors. Some of which are as enumerated below:

i. Land tenure system

The land tenure system in Nigeria to an extent discourages farmers from acquiring enough land for large scale farming. This is due to the fact that the land ownership act encourages fragmentation of farm land. This hinders agricultural mechanization. Because, it is only commercial agriculture that supports mechanization. It becomes cost ineffective to employ big machines to farm a small portion of land.

ii. Poverty and Inaccessibility of Credit

Majority of the Nigerian farmers are poor. So, they lack the fund needed to purchase sophisticated farming machines. The inaccessibility of commercial and federal government loans also worsens this problem. The banks will request for collaterals which the poor farmers don't have in the first instance. Most of the farm lands don't even have Certificate of Ownership

(CofO) which the banks will be asking for. The requirements of both the banks and the government in securing agricultural loans are so stringent that an average farmer will be frustrated along the way.

iii. Scarcity of machinery

Even the few farmers that can afford these sophisticated farming machines suffer setback because these equipment arc not locally manufactured. And importing them from abroad attracts additional expenses in the form of import duty. If the local fabricators and engineers were to be encouraged, some of these machines will be affordable. But a major limiting force in this direction is power availability to carry out the fabrications. Lack of encouragement from the government in using locally made machines and equipment is yet another impediment.

iv. Poor infrastructure

The poor state of infrastructural facilities in Nigeria is also a factor hindering agricultural mechanization. Mechanized agriculture encourages mass production for export and future supply. However, this aim is often defeated by the poor state of infrastructures in the country. For instance, poor road network, electricity and processing facilities lead to food waste.

v. Illiteracy of the farmers

If estimate is anything to go by, we have it that about 60 percent of Nigerian farmers is illiterates. This makes it difficult for them to adopt modem farming techniques. Or operate the machine even when it is available. Illiteracy effects on our farmers cannot be overemphasized. In some cases, they will not even venture into getting credit facilities from the government due to their level of illiteracy.

vi. Lack of Maintenance Technicians

Calibration, tests, analysis, and preventive maintenance during a product's lifecycle provide a wealth of benefits regardless of industry. This means that the operating environment aside, nurture and care is integral. Industrial equipment, machinery, and components require intentional and diligent care since the environments in which these equipment types are used can be harsh and destructive. When this sophisticated equipment are available, there are no technicians to take care or repair them when the need arises. Some of their spare parts are not available in the country; hence no farmer will want to spend his/her hard earned funds on machines that will break down in two years without anybody to fix it.

vii. Inconsistent Government Policies

For decades the government has continuously neglected the agricultural Sector. Funds were not provided for purchase of agricultural equipment. And even when such considerations are made, the political class embezzles the money for personal use. The inconsistent government policies make many farmers not to know how to invest in machinery and consequently mechanization. While many may go into mechanized rice production, the government may wake up tomorrow and import rice, thereby making the investment in rice by the farmer a huge loss.

Other related Problems of agricultural mechanization in Nigeria are;

1. The soil types in Nigeria do not suit the operational techniques of the imported machines.
2. The debris from clearing, stumping and logs pose an obstacle to mechanization.
3. Spare parts are not readily available locally.
4. There is inadequate manpower to service the implements and machines in Nigeria.
5. Many farmers may not afford to buy the expensive machines. This makes mechanization too costly to practice.
6. There are no adequate facilities for the repair of farm implements and equipment.

3.4 Solution to Problems of Agricultural Mechanization in Nigeria

Farmers require the availability of the widest choice of appropriate farm tools, machinery and equipment at affordable prices as well as access to spare parts and service to allow them to make the best choice to suit their business and aspirations. They should be able to freely choose

the type, size and extent of mechanization inputs from a range of mechanization inputs available on the market. The strategy of governments should be to create the conditions whereby industry and commerce is able to provide this choice at competitive and undistorted prices and at physical distances which are within farmer's reach. Apart from the obvious question of farm profitability, there are several issues and strategy components which will have a direct affect on a farmer's investment decisions.

From the above explanations, we can deduce that low penetration rate of mechanization remains a major factor militating against the sector's productivity. Food is a basic necessity of Nigerians. And ways must be sort to improve agricultural productivity in Nigeria. So as to meet the food demand of the increasing populace. As humongous as the problems of agricultural mechanization is, the fact remains that this problem can be solved. The solutions explained hereunder will put an end to the above problems and others:

i. Amendment of the land use decree

The 1978 land use decree should be amended by the government. This will decrease land fragmentation. And enable farmers acquire enough land to support mechanized and commercial agriculture. Uncertainty of ownership leads to lack of investment and commitment. Governments and other involved parties should refrain from speculating on what size and type of farm is most appropriate or economic. Emphasis should be given to creating conditions whereby it is possible for any person, company or group of individuals to create a farm business. It is vitally important that farmers have title to their land so that they feel secure but also so that they have collateral available for borrowing

ii. Farmers' Education, Training and Extension

The government should employ more agriculture extension workers to educate farmers on the use of modem equipment and farming system. Formal and informal education should be encouraged among the farmers. This will enable them to understand the basic principles like accounting, management of resources and so on. This would enable them monitor their progress. And save up, to purchase machines they need. Governments should develop an integrated and inter-linked education, training and extension programme. The

type and level of education and training will need to be geared towards the requirements of the agricultural manufacturing and production sectors.

iii. Training of Maintenance Technicians

Technicians should also be trained to maintain these sophisticated farm machines when and where ever they are available. This may require curriculum adjustment in our polytechnics and universities. This would ensure the continuous operation of such machines. Engineers in the ministry of agriculture should also be sent abroad for special training. Like training on tractor repair and maintenance, and so on

iv. Encourage the local manufacture of farming machines

Local manufacturers should also be encouraged to start manufacturing these farming equipment. Like tractors, harrows, ploughs, sprayers, planters and so on. This will increase the availability of such machines in Nigeria. There are so many ways of encouraging them. The issue of energy or power to run their machines, government encouragement by reduction of duty fees, government patronage of their products and deliberate giving of subsidies to encourage local fabrication and price reduction. Furthermore, such companies could be encouraged through granting those loans or tax holidays.

v. Improved Access to Credit

The major hindrance to agricultural mechanization remains poverty. It will take just a few in a thousand to get an individual farmer that will single handedly own farm machines. Government should encourage banks to give improved access to loans and credit facilities. Government should also invest in agriculture to encourage others. Credit and Finance should be available for all sizes and types of farm operation. Collateral requirements should be realistic and physical access to sources of credit should be facilitated, but with the condition that the business plan and cash flow projections appear realistic and attainable. This may mean the development of rural agricultural banks within easy reach of fanning communities and/or the promotion of other community savings and credit schemes. The providers of credit should, ideally and if necessary, be in a position to assist farmers in the formulation of investment and business plans if a high-risk element exists (small farms, low collateral,

marginal profitability etc) development agencies might be called upon which might be prepared to take on higher risk, This might, for example, apply to marginal agricultural areas. However, in general, credit should not be made available exclusively for farm machinery nor should special conditions be made available for the purchase of farm machinery only. A bias towards particular investments will result in distortions in the agricultural economy and particularly in the rural labor situation.

vi. Improved infrastructure

Government should improve in the provision of infrastructural facilities such as road network, electricity supply, irrigation facilities, storage and processing facilities. It is appalling that rather than build or invest in ranches for livestock, government is still proposing and supporting open grazing in the 21st century. Government should invest in farm settlements; construct storage and processing centres and clusters across the country. All these would encourage commercial farming and decrease food waste.

vii. Choice of machinery

This is essential in a free agricultural economy. Notable in centrally planned economies was the restricted type and sizes of farm machinery available and the low level of technology available. Different farms require different types and sizes of machines. Also what is generally forgotten or overlooked is that individuals wish to be able to be individual in their choice of what they invest in. One farmer may wish to purchase hand and animal draft equipment and rely on these for his farming: another may wish to purchase a tractor both for his own use and to carry out contracting services for his neighbors. As long as both are viable there is no reason why they should not have the choice. Outside persons and agencies should avoid being prescriptive and should concentrate on being informative and facilitative.

viii. Government Policies

Government should make more policies directed towards improving the agricultural sector, see that such policies are implemented and be consistent with such a policy. Funds

meant for the procurement of farming equipments should also be properly utilized. Agricultural development programmes should not be jeopardized. And finally, the government should be sincere with the farmers and their farm inputs properly supplied and evenly distributed.

ix. Credit for Contractors and Group Users of Farm Machinery

Credit should be made available on the same conditions as for farmers. Contractors and other arrangements for the multi farm use of farm machinery, particularly in certain situations, can make an important contribution to agricultural production. These arrangements facilitate an efficient use of machinery and make available to farmers machines, which they might not be able to afford individually. Cultural and other considerations will determine which contracting and other multi-use arrangements will develop. There are many forms of multi-farm use of farm machinery. In its simplest form this might mean an individual farmer undertaking work for his neighbors or a formal group ownership of machines may develop. In some countries there are specialized contracting companies.

x. Farm gate Prices

Prices will influence farmers purchasing decisions. Governments should be continually aware of the profitability of farming and how this affects investment in inputs. Market information systems for farmers are essential for this.

xi. Subsidies and Price Support

Subsidies and Price Support are common in many countries in the world. If countries do decide to use subsidies for farm machinery, then the purpose and time limitations of the subsidies should be clearly stated and understood. Capital subsidies for specific technologies (e.g. providing subsidies or preferential interest rates for tractors) should be avoided. Choice of machine then rests under the farmers control and he is not influenced to purchase a particular type of machine or technology through financial incentives rather than for pure business reasons. Hastily applied and hastily lifted subsidies distort markets

for farm machinery and make financial planning by farmers, dealers and manufacturers very difficult. Farmers and businesses wish above all for present and foreseeable stability.

xii. Farmers' Institutions

In many countries farmers have associations which can provide services to their members and also lobby government on matters of farming interest. Governments should encourage this as it creates a means of dialogue, however, they should be created and organized by farmer initiative.

xiii. Technical Assistance

Technical assistance is required at both farmer level and government level. Farmers require assistance in all aspects of their activities: agricultural advice, financial advice, planning advice. Governments require assistance to develop the above services. This may be through individual ministries or through agricultural banks or other appropriate institutions.

3.5 The adoption process for Mechanization

When receiving the process of applying labour-savings (or labour productivity-enhancing innovation in agriculture), it is a serious but frequently made mistake to assume that this can be achieved only through applying mechanical engineering technology. In this context, nine different stages in the process of enhancing labour productivity may be distinguished (Rijk 1989)

Stage I: Application of Improved Hand Tool Technology. This process started in prehistoric times when early civilizations developed stick and stone tools which were the only means to enhance labour productivity. In many parts of the world, hand tools are the only technology used in agriculture, and even in highly mechanized agricultural systems, improved hand tools are still important.

Stage II: Draft animal power application. At this stage, animal muscle power is substituted for human power, a process which already started in ancient civilizations. A large variety of implements and machines which use animals as the principle power source have been developed.

Stage III: Stationary Power Substitution. Mechanical power is substituted for human and animal power used in stationary operations. Stationary operations are mechanized first because motive power sources required to move across the field are technically more complex and require higher investment. Typically, operations mechanized at this state are paddy dehusking, grain milling, pumping water, and threshing.

Stage IV: Motive Power Substitution. At this stage, substitution of mechanical power for muscle power takes place for field operations. It focuses on power-intensive field operations (for example, plowing), and machinery is of relatively simple design, and easy to operate. Mechanization is still straightforward, and crop production practices are usually unchanged. At stages III and IV, mechanization takes advantage of lower costs of new power sources as compared with traditional ones.

Stage V: Human Control Substitution. At this stage, the emphasis is on substitution of the human control functions. Depending on the complexity of the control function and the degree of its mechanization, machinery becomes increasingly complicated and costly. A potato lifter is simple in design but fruit- and cotton-harvesting machinery is complex and expensive.

Stage VI: Adaption of Cropping Practices. This stage features the adaption of the cropping system to the machine. For example, removing weeds in broadcast crops cannot be done with machines but row seeding and seed drills may be introduced to facilitate mechanization of weeding. Other examples include the increase in row distance to accommodate heavier and larger machinery to speed up field operations.

Stage VII: Farming System Adaptation. The farming system and production environment are changed to facilitate further increase in labour productivity and further increase in labour productivity and to benefit from economies of scales, which necessary to make the investment in expensive machinery financial feasible. An example of this is the rapid decline of mixed farminkg systems in Europe since the late 1960s when farmers specialized in either dairy, poultry, hog, or crop production. Some crops which are difficult to mechanize may disappear if acceptable substitutes becomes available, or if these can be produced in countries with low labour costs. At this stage, investment in land development, land consolidation, and rural infrastructure are often needed to facilitate advanced degrees of mechanization.

Stage VIII: Plant Adaptation. This stage features the adaptation of the plants and animals to the mechanization system. Mechanization has advanced to a stage where engineering alone can no longer provide further gains in labor productivity. Breeders increasingly take into account the suitability of new varieties for mechanized production.

Stage IX: Automation of Agricultural Production. This stage is progressing in countries with high labour costs and sophisticated demands on production and quality. Examples are automated rationing of concentrate feeding for individual dairy cows based on their milk production, and sprinkler irrigation systems activated by soil moisture. Mechanized Agriculture is the answer to Nigeria's economic woes. Vices such as drug abuse, kidnapping, armed robbery and insecurity in Nigeria will be ameliorated if the solutions exhaustively proffered in this paper are fully implemented.

Conclusions

Farm mechanization: panacea to food security in Nigeria has been review and the following conclusions were drawn from the study:

i. Mechanized Agriculture is the answer to Nigeria's economic woes. Vices such as drug abuse, kidnapping, armed robbery and insecurity in Nigeria will be ameliorated if the solutions exhaustively proffered in this paper are fully implemented.

ii. Mechanizing crop production will ensure the availability of raw materials for agro industries

iii. More job opportunities will be created for Nigerian Youths.

Recommendations

The following recommendations should be adopted;

i. The government should encourage farmers in the country by providing agricultural subsidies to them.

ii. Policies that will enhance the acquisition of large hectare of land for mechanized agriculture should be made.

iii Loans should be granted to farmers at low interest rate

iv. Spare parts should be sold at subsidized rate to farmers

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