

MECHANIZING AGRICULTURE IS KEY TO FOOD SECURITY IN NIGERIA (REVIEW)

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ABSTRACT:

The task of assuring food sufficiency is large and complex. Action needs to be taken simultaneously at the household, national and global levels. The Nigerian economy has what it takes to be food-sufficient and secure given the enormous natural endowment in the land, labour, capital, vegetation, etc. Nigeria could be food-secure if it adopts and faithfully encourage and engage in adaptive and innovative research towards the development of indigenous machines for farming and processing techniques. However, appropriate agricultural mechanization technology for Nigeria must evolve from a gradual development of indigenous technology for Nigerian agriculture. The mechanization approach must be an integrated one to include most, if not all, the agricultural production processes and operations and must also be part of and include the essential elements of the overall agricultural and rural development strategies to get to the roots of rural poverty.

KEY WORDS: Mechanizing, Agriculture, Food Security and Nigeria

1. INTRODUCTIONS

A recent United Nations report has indicated that Nigeria's population will surpass that of the United States by 2050, to become the third most populous country in the world. Over the next 30 years, Nigeria, which is currently the world's seventh most populous country and the most rapidly growing, is expected to see its population reach 398 million. Like many other developing countries, Nigeria has experienced a shortage of food supplies due to economic instability, severe drought and persistent conflicts. Constant increases in food prices have also deprived many households of three-square meals per day. The number of people suffering from chronic hunger or regularly not getting enough food to live an active life was estimated to be a total of 842 million in 2011–13, which are around one in eight people in the world (Adesina, 2018).

Forty-nine percent (49%) of Africans or 420 million live under the poverty line of \$1.25 per day (2014). 33% of African children live in chronic hunger; Staggering food net food import bill of USD 35.4 billion per annum (2015); Low-value addition to agricultural commodities and predominantly primary production. As predicted by experts, those living in poverty will rise to 550 million by 2025, 40 million stunted children under the age of 5 years, Net Imports projected to increase to USD 111.0 billion by 2025 (Fregene, 2018).

Food is a basic necessity of life. It is regarded as the basic means of sustenance, and adequate food intake in terms of quantity and quality is a key for healthy and productive life (FAO, 2005). Food accounts for a substantial part of a typical Nigerian household budget. Various foods serve as important vehicles for taking nutrients into the body and bringing about a healthy state, hence the need for food to be taken in the right quality and quantity. To measure the quality of any food taken, there are classes of essential nutrients, which must be combined in appropriate proportions to ensure an adequate food intake. These include carbohydrates, proteins, fats and oil, vitamins, and minerals (Omonona, Agoi and Adetokunbo, 2007). The need for food is topmost in the hierarchy of needs as it is essential for a healthy living. Thus, the achievement of food security is important in any given country.

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preference for active and healthy life (Mohammed, 2003). For food security to exist at the national, regional and local levels, food must be available, accessible and properly utilized. Food availability means that enough safe and nutritious food is either domestically produced or imported from the international market. Food availability does not ensure food accessibility. For food to be accessible, individuals or families

must have sufficient purchasing power or ability to acquire quality food at all times while utilization demands sufficient quality and quantity of food intake (Omonona *et.al*, 2007). These elements of availability, accessibility and utilization in a larger context, embrace the supply, demand and adequacy of food at all times. As a result one of the major challenges to rural development in the country is how to promote food production to meet the ever-increasing demand of the growing population. It becomes very much relevant given the conditions prevailing of high population growth, low labor productivity, recurrent drought and similar dreadful situations the country has been experiencing.

Several methodologies have been devised and applied including the use of improved varieties of crops for improving food production in the country. However, the situation is still dire to a significant part of the population and the whole of the population in general dependent on subsistence-oriented farming systems. Generally, methods of increasing production are farm area expansion, use of external inputs, use of improved seeds, better seedbed preparation and use of other improved farm implements (for increasing farming area or improving technical efficiency).

In the Nigerian context, except in the low land areas expansion of farmlands is overdue to obvious reasons of slope and marginality. Though the use of improved varieties is going it

is solely used and this requires harmony with improving the technical capacity of farmers.

The government has devised a policy that centers on the development of rural areas and transfers to industrialization and urbanization. This is due to reasons of resource availability in agriculture and insignificant industrial base of the country. The policy has formulated several strategies to achieve the development agenda. The strategy stresses commercialization and intensification through the use of other external inputs as a means to ensure food security locally as a means to combat the problem. Up until now, the problem has continued with scanty success stories. Several scholars pointed out that the problem of low production could largely be related to low technical efficiency. This is due to the time old implements and operating systems that are being used in using new crop technologies also. The problem of Nigerian agriculture cannot be primarily explained by natural endowments (Samuel, 2006). By any measure, Nigeria is well endowed at least in part with fertile soil, abundant water resources, and good climatic conditions until recently.

What needs careful analysis is why Nigerian farmers continue to practice essentially the same farming methods with very little technical or management improvement for so long. The low productivity level of Nigerian farmers even compared to African standards could largely be

traced to low technical efficiency along with the decrease infertility of the soil. The methods of improving technical efficiency are through improving management activities. This could largely be achieved through the utilization of appropriate agricultural implements.

However, the government and smallholders including other stakeholders have given little attention to the use of agricultural implements (mechanization technologies). Lack of interest for mechanization is largely blamed for land conditions like fragmentation and small size. However, search for and utilization of appropriate mechanization technologies should be part of the strategy for increasing production and productivity. In this aspect recently the government has drafted a national mechanization strategy.

The strategy aims to 'increase national food production and security through enhanced and sustainable use of agricultural mechanization technologies to support Nigeria's middle-income status. Hence experiences should be re-reviewed and mechanization like the other technologies and inputs of agriculture should be promoted at the highest priority levels. The rationale is due to several reasons accompanying increased productivity and as a means to create alternative livelihoods for the majority of the population.

1.1 Statement of the problem

Although smallholders exert optimum efforts to increase the productivity of crops, the improvement seen is insignificant in relation to the plowed cropland, the trend of population growth and input use. In all parts of the country, the problem of food deficit is not solved. Increasing the technical efficiency, way of increasing productivity by appropriate management could help in the way forward. Moreover, the introduction of medium or low-level mechanization implements and technologies enables the lighten burden of men who contribute most of the labor for agricultural production in Nigeria. It is because it releases labor to be used for other on, off, and non-farm activities, which are the strategies to increase resilience and productivity in the smallholder context in general. The current Nigerian development policy stresses on development push from agriculture to industry based on the use of all means of increasing productivity and production. Hence it adheres to growth and development primarily from agriculture. One of the means of development of agriculture is the intensification of labor. Labor intensive refers both to the employment of all available working labor and maximizing its output. In agriculture, this can be done through the use of management-intensive operations and increasing the productivity through mechanization. Mechanization is a multi-dimensional concept and includes social, economic bases, technical and agricultural engineering, agricultural machinery

engineering, programming, and more importantly management (Bagheri and Moazzen, (2009). Farm mechanization has been helpful to bring about a significant improvement in agricultural productivity. Thus, there is a strong need for mechanization of agricultural operations.

Even though mechanization is part of the Nigerian Research and Extension System, it is sufficient to witness its recognition by the government and other stakeholders only by taking the representation of one research Centre in all the regions where agricultural production takes place and the insignificant attention given at the low administration and agricultural bureaus except in campaign like activities. The factors that justify the strengthening of farm mechanization in the country can be numerous. The timeliness of operations has assumed greater significance in obtaining optimal yields from different crops that have been possible by way of mechanization. Extremely scanty information about local experience affected for full exploitation of the learning experience.

This review is directed to provide information for decision-makers, researchers, and extension workers so that to encourage them to invest optimum efforts for wider promotion of mechanization technologies and create overall awareness about favorable environments for

the rapid adoption of mechanization technologies.

Transformation of the economy: refers to the change of a nation's economy to a more resilient, advanced, managed system where environmental variables are becoming more controlled or otherwise compensated for by engaging in the production of economically comparative or absolute advantages. Academicians and politicians set various indicators of economic transformation of a country based on the current status and desired ambitions.

Rural transformation: This has placed several objectives to achieve the transformation of rural areas focusing on major livelihoods. The transformations include improved infrastructure, increased productivity, diversified employment opportunities, managed ecosystem, conserved biodiversity and low pollution through green agriculture. Hence the above dimensions of rural transformation to achieve the objective of becoming a middle-income country can be achieved in several ways. Utilization of a basket of choices accessible and compatible with local communities is crucial.

Farm Mechanization defined: Agricultural mechanization embraces the use of tools, implements and machines for agricultural land development, crop production, harvesting, and preparation for storage, storage, and on-farm

processing (Rijk, 1989). Others defined mechanization as the application of suitable machines, recognition of technologies and applying suitable methods for production, processing of agricultural products, continuous increase of productivity as the result of the reducing the cost of production, reduction of the losses and increase of efficiency and increase of income (Bagheri and Moazzen, (2009).

Generally, both refer to better farm power input to agriculture. Farm power consists of manual labor, agricultural tools, draught animals, tractors, implements, equipment, and machinery as an essential farm input. In almost any agricultural production system the annual expenditure on-farm power, whether on labor, draft animals, or fuel and depreciation of machines, largely exceeds the costs of other inputs such as agrochemicals and seeds. In many developing countries, agricultural production and food security are adversely affected because of insufficient use of farm power, low labor productivity and/or labor scarcity (Rijk, 1989). The need to improve agricultural labor productivity is increasingly recognized. In the case such as pump sets for irrigation, the need for machinery is undisputed. Rather than agricultural mechanization, it would be preferable to use the term farm power or labor productivity-enhancing technology, to recognize not only the importance of manual labor and hand tools, draft animals, and mechanical power, but also other issues related

to labor scarcity, such as cropping and farming systems.

The term mechanization is unfortunately often very narrowly perceived while its real purpose, namely, enhancing the productivity of land and labor is often not well understood. An agricultural mechanization strategy ought to be part of an agricultural technology or development strategy. In this context, three principal purposes of mechanization may be summarized. The first is an increase in labor productivity. The introduction of machinery to substitute for labor ("labor-saving") is a common phenomenon associated with the release of labor for employment in other sectors of the economy or to facilitate the cultivation of a larger area with the same labor force. The other principal purpose is the increase in land productivity enabling the production of more output from the existing land.

Machinery is a complementary input, required to achieve higher land productivity, for example, through the introduction of pump sets, or faster turn-around-times to achieve higher cropping intensity. However, in labor surplus economies, net labor displacement or replacement should be avoided. The third purpose is to decrease the cost of production. The introduction of a machine may lower production costs or offset increased costs of draft animals or labor. This goes with the strategy that promotes the use of

labor-intensive methods to increase output and productivity.

Generally, improved farm implements and machinery are used for different farm operations to increase the productivity of land and labor through timeliness of operations, efficient use of inputs, and improvement in the duality of produce, safety and comfort of farmers and reduction in loss of produce and drudgery of farmers. As a result, mechanization fostering intensive cultivations on farms gives more food to the excluded group (i.e. landless farmers and agricultural labors with reduced drudgery). Thus, farm mechanization is a boon for farmers and agricultural laborers. Africa needs to achieve a sustainable and structural transformation of its agriculture and rural economy (i.e. a process that involves a move from highly diversified subsistence modes of production towards more market-oriented production systems). This integration will be facilitated by greater specialization, exchange and by the harnessing of economies of scale. Over the long term, resources and employment are to be transferred from agriculture and other sectors producing primary goods to higher productivity (Geoffrey, 2008). As opposed to this, developing countries like Nigeria have been relegating the benefits of mechanization thinking that the costs are high.

The major reason for promoting agricultural mechanization is fear of labor displacement.

The experience of other countries provides great help in devising development alternatives through mechanization. The best example could be the Indian experience. India, without counting the current technological advancement in the urban areas, provides a similar agricultural system with Nigeria. According to Verma, (2016), Indian agriculture is characterized by overwhelmingly small holdings due to higher population density and nearly two-thirds of its population residing in the rural areas coupled with unabated land fragmentation due to the inheritance laws of the country.

2. BENEFITS OF AGRICULTURAL MECHANIZATION

2.1. Agricultural Production and Productivity

The factors that justify the strengthening of farm mechanization can be numerous. The timeliness of operations has assumed greater significance in obtaining optimal yields from different crops, which has been possible by way of mechanization. However, mechanization facilitates timely sowing and thus avoids the loss that could be incurred. Farm mechanization is regarded as a *sine-qua-non* to reduce human drudgery and enhance agricultural productivity (Verma,2016). The quality and precision of the operations are equally significant for realizing higher yields. The various operations such as land leveling, irrigation, sowing and planting, use of fertilizers, plant protection, harvesting and threshing need a high degree of precision

to increase the efficiency of the inputs and reduce the losses. In sum higher productivity of land and labor is the factor that justifies the use of farm mechanization.

2.2. Cropping Intensity

Agricultural mechanization has made a significant contribution to enhancing cropping intensity. A study in India (on 162 farming households) concluded that the cropping intensity showed a consistently positive relationship with tractorization. Within the given size groups, tractor-owning farms had higher cropping intensity as compared to tractor-using or animal operated farms. The time taken to perform a sequence of operations is a factor determining the cropping intensity to ensure timeliness of various operations (Singh, 2015).

2.3. Employment of Human Labor

The problem of unemployment stems in part from the dominance of South Asia in the mechanization literature, but also the low total number of hours in agricultural activities reported in many studies for Africa (Geoffrey, 2008). Almost certainly there is available labor that can and will respond to adequate incentives, as reflected yearly when family members and communities mobilize to meet peak season requirements. It is well known that the livelihood strategies of most African rural households are well diversified. In many areas, arable farming provides half or less of household incomes and in some, substantially

less. Even in areas that are heavily reliant on crop farming, significant amounts of income are derived from beer-making, transport, small trading, brick-making and other activities, as well as wage employment and remittances.

There are, in brief, many competing demands from other activities. Most of these other activities have low real wage rates, but unfortunately, returns to labor in agriculture are often even lower, except in peak periods when labor flows from other activities to agricultural ones. Displaced labor may be absorbed in the other alternatives created by the increased mechanization such as manufacturing, repair and service shops and the sale services. Thus, it only results in the shifting of the labor from one vocation to the other (Singh, 2015). Mechanization accompanied by the use of new seed technology and the adoption of modern cultivation methods had a beneficial effect on employment. Thus, freeing labor for another employment opportunity and increasing productivity through timely operations. Generally, different studies conducted on mechanization indicated that net human labor displacement in agricultural operations was not significant and it was more than compensated by increased demand for human labor due to multiple cropping, greater intensity of cultivation and higher yields.

2.4. Subsidiary and Non-farm Employment

The demand for non-farm labor for manufacture, services, distribution, repair and maintenance as well as other complementary functions increased substantially and helped in relieving rural unemployment to some extent. Mechanization in agriculture provided indirect employment to skilled and unskilled persons engaged in operation, repair and maintenance of prime movers and farm equipment. Besides many subsidiary activities like dairying and poultry keeping got generated Mechanization through the provision of freer time helped in increasing the subsidiary activities that ultimately increase the income of the farm household. Mechanization has generated many non-farming and subsidiary activities among farming households. On one hand, additional employment was created in the manufacture of farm machinery, distribution of the equipment and spare parts, repair and servicing, etc.

2.5. Post-Harvest Technology

Post-harvest management is the handling, processing and preservation of crop produce at the time and after harvesting. Thus, whether the gain in crop yield is marginal or significant, it could be nullified because of inappropriate or unreliable post-harvest management employed, (Grolleaud, 2001). In a country where production is much lower than the national demand and supplemented with the above-stated level of post-harvest loss, shows how much effort is needed in the area of generating technology that minimizes this loss. One way to

overcome this problem is to increase local value-added food products. The thrust of the post-harvest technology is to improve existing small and medium scale processing enterprises (both formal and informal) that produce a wide range of traditional basic food items that are so important for nutrition and food security in many areas of Africa. This includes the vibrant root crop processing sector in West Africa, as well as milling of basic grain staples in Southern Africa. The emphasis is on traditional products that are important in the basic diet of rural and urban people, and on the employment generated through the value added by such processing. Often, the potential exists to make significant advances in value-added (and thus the profitability of these enterprises) through relatively low-cost interventions such as improved grading and packaging as well as storage and processing (Blackden and Bhanu (1999)).

2.6. Contributions to Environment or Promoting Green Economy

Finding solutions to environmental problems in agriculture requires (improved) agricultural tools and machinery, for example for soil tillage and pesticide application, the latter also addressing health concerns. By largely avoiding the use of pesticides, insecticides, and other chemicals it is possible to attain productivity levels through mechanization. This results in saving the natural biodiversity useful to the continuation of man-land nexus. Thus, it is now recognized that

agricultural mechanization is crucial in the fight against hunger and poverty, and at the same time to address environmental and health concerns. Additionally, the freed labor especially man could be directed for natural resource conservation and management works.

2.7. Gross Farm Income and Net Return

Farm mechanization has greatly helped the farming community in the overall economic growth. The studies conducted on the impact of mechanization on farm income support this viewpoint. An immediate goal of agricultural policy in Nigeria is to produce more food. By doing this is to encourage greater output per crop, and per unit area of and labor. Gross farm output is the final agricultural output measures the value of agricultural products which free of intra-branch consumption is produced during the accounting period and before processing, is available for export and/or consumption. The ability of a farmer to improve on his output may be determined by his physical and mental well-being, managerial skill, and exposure to extension services and access to inputs. An average tractor owner and user, despite spending more on cultivation expenses, derived higher net income on a cropped hectare compared to bullock farm. However, this should not be attributed entirely to tractor usage as other factors such as hybrid seeds, fertilizer and irrigation also contributed to it.

3. CONCLUSION

The adoption process for mechanization (labor productivity-enhancing technology) follows stages that our farmers should experience from low too high for better productivity and food security that ultimately enhances the development desired. Various studies concluded that owing to this relatively low displacement of manpower that was unavoidable, mechanization should not be viewed in isolation. Indeed, mechanization opened up new avenues for human employment such as managerial and supervisory jobson the one hand and driving, servicing, maintenance and repair of the machines on the other. Majority of the studies done on the impact of mechanization led to the following broad conclusions; (i) Farm mechanization led to increase in inputs on account of higher average cropping intensity and larger area and increased productivity of farm labor, (ii) It increased agricultural production and profitability on account of timeliness of operation, a better quality of work done and more efficient utilization of inputs and (iii) It increases on-farm human labor marginally, whereas the increase in off-farm labor was much more and displaced animal power but resulted in lesser time for farm work.

4. RECOMMENDATIONS

Based on the findings of the study and the conclusion drawn, the following recommendations were made: Mechanized farm tools and equipment should be provided to

farmers in form of subsidy and ensure that it is the right category of farmers' benefit.

The promotion of mechanization should recognize undertaking a national survey using a multi-disciplinary team for delineation of land suitability for medium and higher level mechanization, devising a clear national agricultural mechanization strategy.

Delivering mechanization based extension services to farmers and undertakes intensive land use and sustainable activities, strengthening the capacity of local actors in developing agricultural implements that could be modified locally and formulation and implementing supporting policy systems including the production of highly calibrated professionals and researchers in both the physical and social sciences of this sector.

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