

# **THE UPSURGE OF FARM MECHANIZATION AND ITS IMPACT ON LAND OCCUPANCY SYSTEM IN NIGERIA**

## **ABSTRACT**

The reinvigorated approach by stakeholders towards Farm Mechanization has given birth to emerging fears in the existing relationship between mechanized agriculture and traditional land occupancy systems in Nigeria. The increased importation of agricultural machines into the country gave room for cropland growth that butt in farm lands acquired by rural farmers through customary ways. This paper examines these fears in four segments. The first segment searches the unstable land occupancy systems in Nigeria that have showed an elegant equilibrium relationship between constitutions and traditional acts. The second observes the acceptance of Agricultural mechanization and the expanding relevance of tractors. The third scrutinizes the different fears, aggravated by population increase, which come in being as mechanization overshoots on traditionally secured lands. These fears result in to the abuse of labour, continuous land seizures, and the imposing of rural farmers into a blank in which few market options live. To assist relief these fears, the final segment recommends the moderating of large Agricultural machines growth and the systematic improvement of land occupancy systems in preparation for more privatization. By marrying land occupancy systems and Farm mechanization, the environments will survive for more judicious evolution in Nigeria.

*Keywords: Farm, Mechanization, Land Occupancy, System, Fears*

## **1. INTRODUCTION**

World-wide today Agriculture is rapidly changing to mechanized. As manufacturing nations, as well as developed and developing countries embrace full mechanization, resulting to normal shifts toward mechanized farming. In Nigeria, Agricultural Technologies are fast switching to mechanization with more challenges. In specific, there are emerging fears between Agricultural land increase as a result of mechanization and traditional land occupancy systems on the opposite. This paper examines these fears by admitting the diverging land occupancy system in Nigeria, the increased acceptability mechanization in the country, and the relationship that evolves between these two happenings.

## **PREPARING THE STARTING POINT**

While Farm mechanization and land occupancy systems in Nigeria have been developing freely over the years, they are not totally separate issues. Largely saying, fear arises when the expansion of mechanized Agriculture begins to invade on the land rights of rural farmers that do not have access to mechanization. This paper argues that, despite the fact that land is still seen as a bumper source of production in Nigeria, mechanization will start having challenges similar to a fast-developing nation, that is the quest the demand for expansion of land area will give way for marginalization of lands by farmers. At this point, both single-farmer plots and village areas, spread within the borders of the country, the emergence of conflict, and the less privilege will likely lose out to the rich. This problem is not so pronounced in Nigeria, but the fears cannot be ignored. From the view of balance economics, the fear between land rights and mechanization is not difficult to solve: increasing mechanization will favour the reasonable against the unreasonable, in as much as land rights are privatized and sellable, unreasonable farmers will have good reasons to desert their land and invest their resources in a another sector of the market economy. Thereby Thus, everyone will be better off.

The challenge, though, is that Nigeria does not fit adequately into the globally connected, market-driven puzzle. According to International Monetary Fund (IMF) statistics, 91.8% of the population relies primarily on subsistence farming for its employment (IMF 2002), which complicates market participation. The current population of Nigeria is 202,601,803 as of Saturday, October 26, 2019, based on World meters' elaboration of the latest United Nations data. Nigeria population is equivalent to 2.61% of the total world population. Nigeria ranks number 7 in the list of countries (and dependencies) by population. The population density in Nigeria is 221 per Km<sup>2</sup> (571 people per mi<sup>2</sup>) and the total land area is 910,770 Km<sup>2</sup> (351,650 sq. miles) and the median age in Nigeria is 17.9 years. (Wikipedia. n.d.)

In addition, Nigerian custom remains strongly attached to its traditions, which include sacred treatment of the land, unconditional respect for elders and traditional leaders, and clearly defined gender roles which hinders to move towards privatizing land holdings that the process of mechanization adheres to.

In spite of all these challenges, the assumption by contemporary development system, aided by mainstream economic thought is that growth is a recipe for reduced poverty, and that commercial activity is the promoter for economic growth. Competition and private ownership are considered essential. It is pertinent, then, as we examine the mechanization-land rights fear as it suffices itself in Nigeria, is to review consider how robust development system fitted into the socially acceptable ways.

The paper starts by examining Farm mechanization, it reviews the rise and status of Farm mechanization in Nigeria, looking at mainly on the increase in importation of the tractor into the country, while believing that mechanization is beginning to have visible effects in Nigeria, having also in mind that there are negative effects. Followed by overview of land occupancy systems as they exist in law and in practice. The revelations is that, Nigeria's agricultural system is sufficient and will so for a very long and that an equilibrium has been reached between constitutional laws and customary practice to sustain the future developments of the prospering of melodious Agricultural communities. The third segment of this article analyzed the fear that arises between Farm mechanization and land occupancy rights. It examines this fear from political, economic, and social perspectives with the aim of convincing the reader that land in Nigeria will not always seem limitless, and that rural farmers face a real danger of being left with nowhere to go. The final segment draws some conclusions and recommendations to solve the mechanization-land rights fear. The paper's final suggestion is that the procedure toward mechanization must be monitored just adequate to make certain that views and laws governing land occupancy have time to meet up to a challenging world market in Agricultural Machinery.

## **FARM MECHANIZATION IN NIGERIA**

The farm mechanization of agriculture is the most essential aspect of this commentary. It has been defined in a number of ways by different people. Perhaps the most appropriate definition is that it is the process of improving farm labour production through the adoption of agricultural machinery, implements and tools. Agricultural mechanization has undergone a revolutionary process of its own and Nigeria show case an interesting case in this regard, because, unlike other African countries, the introduction of mechanized agriculture has been in existence since colonial era. and through very informal processes. Thus, we are able to conduct a pertinent and timely examination of the process in Nigeria, currently in the critical stage after introduction but prior to, and without assuming, widespread use and unanimous acceptance. Thus, when we speak of Farm mechanization, it is primarily the process of Tractorization that is taking place. In a report written by FAO,1988, it stated that these tractors are typically of European and Asian origin, of medium output (between 45 and 85 horsepower), and serve as the only form of tillage in a mechanized field, since fields in Nigeria generally do not receive secondary tilling's.

### **STATUS OF MECHANIZATION IN NIGERIA AND ITS EXCEPTIONALITY**

The argument made for the advancement farm mechanization in Nigeria is relied upon that with non-existent of mechanization of Farm activities, Nigeria will be unable to feed her citizens and also meet their other basic needs. Sanders,(1990,2) observed and reported that Across Africa, just as there was a post-independence push toward increased privatization of land rights, so too was there an urge for more tractors in the Farm setting, an urge perhaps welcomed by African states seeking to put on a modern face and the rise of tractors has also been attributed to the promotional efforts of the former colonial powers. Ahmed,1994, also observed that those colonial efforts have led, and continue to lead, to the importation of machinery whose appropriateness to the African landscape has never been wholly considered. While tractors bring certain advantages, such as increased labour productivity, contract work and rental opportunities for owners, and reduced drudgery (FAO, 1998), there are also significant drawbacks to tractor use in Africa. FAO, 1998, further revealed that the cost of a tractor is typically several times an average farmer's annual income, and this discriminatory factor is compounded by fuel and maintenance costs and a short, unpredictable season and Tractors also require increased training, cause greater soil erosion, and demand large areas of land to ensure that ownership will be cost-effective. Thus, it is not evident that the tractor is the most appropriate tool for African farmers.

Presently in Nigeria, the awareness of comparative advantage of use of mechanization is on the increase as result of different government policies to promote access to Tractor and implements.

The increased limited number of tractors in Nigeria has emerged as the proofs for mechanization have developed in the country. The three most important criteria supporting Agricultural mechanization are adequate levels of income, market opportunities, and a robust cash crop. The income levels in Nigeria have dynamically increasing in both the farming sector and the government service. This allows greater numbers to set aside income for new purposes. Market opportunities have improved as banks and credit institutions have begun to make credit available to Nigerians, though still on a minor scale. Finally, with the help of the government, many crops have been identified to become a well-established cash crop in Nigeria, thus providing farmers with the incentive to mechanize.<sup>3</sup>

It is worthy to be that, the transformation of rural farmers in Nigeria goes hand in hand with Agricultural Mechanization. Contrarily, the actual farmers desire to abscond farming, while fake farmers are coming into the field. Youth farmers while observing the differences between their own traditional way of farming and the ease with which big, mechanized farmers are able to prepare land, increasingly resent the drudgery and seek to escape farming. Gyarteng, (1976, 80) described, that the rising incomes among the educated class gave rise conversely to the possibility of farming as an investment, while (Solbrig 2001, 18)

observed that this situation sparked a higher request tractors and crop land by the commercial farmers elites, resulting to an introduction of “gentlemen” farmers. Thus, although the introduction of tractors in Nigeria has come slowly, the impacts of increased Farm mechanization are no longer insignificant.

## **2. LAND OCCUPANCY SYSTEM IN NIGERIA**

Ajayi, (2018) described the system as a set of the rules, duties, and rights, define the obligations and privileges, of persons in reference to the land. Land occupancy system defines the method of management with regard to distribution, use, acquisition, and exploitation of specific areas of land. There are various forms of land occupancy systems in Nigeria ranging from traditional or customary occupancy, leasehold occupancy system, rent occupancy system, gift occupancy system, and freehold occupancy system.

Land is of fundamental importance in traditional Nigerian society, and is communally owned, although family or corporate ownership existed side by side with communal ownership. It is a source of wealth and is greatly valued as an indispensable factor of production. Agriculture, the oldest occupation of mankind, takes place on land. Traditional Africa in general and Nigeria in particular maintained a liberal system of allocation of land resources. Land was allocated to families and individuals, while the community or clan maintained absolute ownership. The chief or the head of the ancestry or clan was the overseer of the land and His position was that of a trustee, holding the land for the clan or the whole community. These custodians were invested with the power to manage and administer the communal property but in the interests of members of the community. Strangers and people with problems were easily absorbed and settled without discrimination and with land to use at their discretion. These additions were based on the cultural beliefs and attitudes towards life and hospitality.

One has to take into consideration the common traits of traditional or customary, land occupancy systems. The moment this foundation has been established, traditional land occupancy in Nigeria may be examined, with the thoughts there are differences in traditions from country to country, and within regions and ethnics, however Nigeria is no exception. After setting up the effects of the ancestry-based system that exists in traditional Nigeria, this paper will turn to the influences that both colonial forces and international organizations have had on land occupancy systems in the country. This will set the stage for an exploring of the constitutional laws that have been developed to recognize land occupancy in Nigeria. What becomes apparent is the belief that the land is in abundance. as well as an sweet equilibrium between constitutional laws and customary practices which has been a tool for defining land use practice.

### **TRAITS OF TRADITIONAL LAND OCCUPANCY**

In a report by Bruce, (1993,45) stated that, in Africa, traditional land occupancy systems share common characteristics and One of which is a reliance on ancestry in determining who has rights to a plot of land. He further stated that the system of inheritance results in increasing separation of farm plots, as heads of households are required to leave land to more than just one person. Another characteristic is the presence of a chef de terre, or land priest, whose responsibility is to settle disputes and assign land that is not currently inherited.

Traditional land occupancy systems in Nigeria are similar to other neighboring countries and It must also be known that the Land Use Act of 1978 has qualified and recognized that both the customary and non-customary land occupancy systems in Nigeria to the extent that the Act now provides for new uniform occupancy system in Nigeria although it still preserves the

existing title and rights to possession of land. Land is distributed based on relationships to the founding ancestry, and a chef de terre resolves disputes and allocates unclaimed land. The manner in which this is done differs from region to region. In the eastern region, Acquisition of land is either by settlement or conquest of weaker by stronger community. From these emerged land-use and allocations headed by community leaders who grants to family heads etc. In some cases, un-acquired land goes to the community and divided into reserved land for different communal uses. (Osita,2014)

In Northern Nigeria, there are different levels of land—holding, some of which co—exist: there is the Government level, the community level, the family level and the individual level. Land— holding varies to some extent from one ethnic group to another. In such ethnic groups as Birom and Irigwe in Plateau State, and Gwari, Pategi, Lafiagi and Isaragi in Kwara State, village communities 'own' land.

In the south west as described by Adeniyi, (2011:35) that the traditional occupancy system was "shared ownership" amongst the family or community. He also said that "the traditional land occupancy system in South-western part of Nigeria is distinguished in the application of the Land Governance Assessment framework, as; Private Landholding, Family landholding, Customary landholding and Public Landholding.

Generally, the claims of original ownership by communities are based on the early settlement of groups of related families in a given area. Encroachment on another community's land-holding results in disputes. In the village community, authority over land rests with the village head and his council of elders, or with the elders where no chief is recognized. In much of traditional Nigerian society, individual male members of the community, together with their immediate family, are allocated temporary rights over land by the village head and/or the elders. Land held according to traditional practice may change hands in different ways, such as pledge, loan, exchange or sale. Private land ownership is becoming very important nowadays. Thus, while community land-holding is still strong in some areas, it has been curtailed in others. This is all the more so with increased population pressure on land, which enhances the importance of private occupancy and decreases the importance of community rights. As we shall see, this new trend has serious consequences for pastoralists' access to grazing land.

#### **LAND OCCUPANCY LAWS IN NIGERIA**

Nigeria gained independence from colonial rule in 1960 and became a republic in 1963. After independence, private ownership of land by individuals, families and communities was the main land occupancy system in the Southern States of Nigeria while all lands in the territory comprising the Northern States of Nigeria were regarded as owned by the state, based on the provisions of the Land Occupancy Law of 1962. Two major legislations have been enacted to regulate land ownership in Nigeria since independence. These are: -

- (i) The Land Tenure Law of Northern Nigeria of 1962
- (ii) The Land Use Act of 1978

#### **3. ARISING FEARS BETWEEN FARM MECHANIZATION AND LAND OCCUPANCY SYSTEM**

Deeper thoughts about how Agricultural land occupancy system and Farm mechanization might operate under the same atmosphere. The emergence of Fears on several fronts due to; First, the population increase and more demand of tractors affects labour and production in Nigeria, considering the fact that new Agricultural technologies can dictate changing land needs. Second, tractors generate pressure for land acquisition, which raises direct conflicts with systems of land ownership rights. Third, market fears arise between the need for competition and the need for alternative activities in the economy. Finally, political pressures

exist that may make the combination of Tractorization and current land occupancy systems untenable for the future.

### **TRACTOR IMPACTS ON LABOUR AND PRODUCTION**

Evidently with mechanization there is the need for Land expansion; farmers can and must cultivate larger areas to ensure sufficient incentive for their investment in mechanization. The fears that this expansion generates, may be mitigated, of course, if the change leads to less labour exploitation and improved food production. Unfortunately, this has not been the case. An increase in intensity of mechanization is associated with increase in labour expenditure due to larger areas cultivated and employment of skilled labour to operate the machinery. Intensification of mechanization increases hired labour expenditure but decreases amount of family labour used. (Verma,2006)

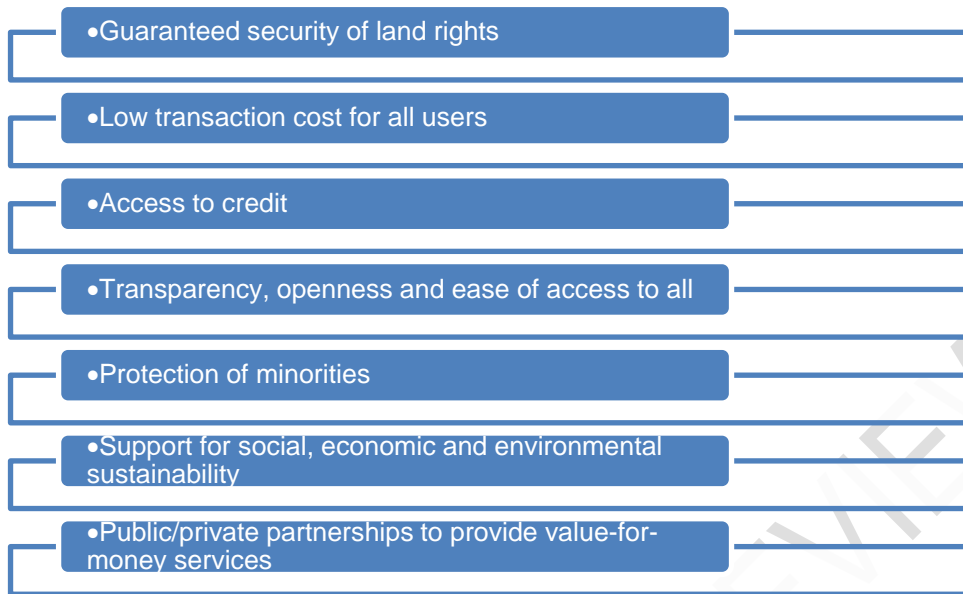
In almost all parts of Nigeria, men prepare the fields and while women mostly do the weeding and harvesting. With mechanization, tractors prepare larger expanses of land with less labour, thereby, rendering the male labourers displaced and their short-term tilling employment is eliminated. Perhaps more significant, however, is the exploitation of women that tractors provoke (Tersiguel 1995, 264). Because harvesting equipment are not affordable to the farmers in Nigeria, women are forced to keep up with the tractors by hand. Thus, just as work is taken away from men, more is demanded of women. They are typically not paid for their work in the fields, as men may be during the intense tilling period. Rather, women in the extended family of a tractor farmer are pressured to "do their part" when harvesting time arrives. The strict separation of tasks between men and women precludes the possibility of reallocating to men the extra harvesting labour that tractor-tilled fields create, so that tractors actually have a harmful, exploitative effect on female labourers. The end objective of farm mechanization is to enhance the overall productivity and production with the lowest cost of production. ... The per cent increase was comparatively low on custom hiring farms as compared to tractor-owning farms due to higher level of inputs and better control on timeliness of operations.

Verma (2006) concurs that mechanization has a positive impact on timeliness (which can result in yield increases as high as 70%) and adds that this can also result in increased cropping intensities (of around 150%).

### **TRACTOR IMPACT ON LAND ACQUISITION**

Land acquisition and use remain a critical issue of great system relevance in developing countries such as Nigeria. Generally, lands are rural and fragmented which imparts significantly on the mechanization potentials of farming households. Similarly, fragmented nature of land systems inhibits the creation of an effective land market, which consequently hinders the emergence and development of an overall equitable distribution of wealth. Land markets should be accessible to all categories of people including women and minority groups.

Dale et al., land markets should possess the following features as presented in figure 1:



**Figure 1: Land Market Qualities as presented by Dale**

Rural-scale farmers dominate rural landholdings with average farm size ranging from 0.5 ha in the South to 4 ha in the North. About 50% of the Nigerian farms are less than 1 ha, while 15% are less than 5 ha. There are three types of land markets in Nigeria. The types of markets are: Formal markets where certificates of occupancy from the government are allocated, Combination of formal and informal markets where transfer of land rights is certificate of occupancy and Informal market where the bulk of the transactions are not documented as title owners do not obtain certificate of occupancy (Dosumu,1977).

The land can be used for different purposes including agricultural production, industrial production, buildings for households and establishment of parks among others. There is location, gender, income-class considerations in the allocation and ownership of land in Nigeria (Elias, 1971). In terms of ownership structure, men typically own more land compared to women in Nigeria and majority of the land owners inherited it from their family, while only 7 and 2.2% of male and female, respectively, reported purchase of land (National Bureau of Statistics; World Bank and Federal Ministry of Agriculture and Rural Development.

#### **CREATION OF AGRICULTURAL MARKET FEARS**

The fears created by market forces are also significant, particularly because Farm mechanization can contribute positively to economic growth and development in a country like Nigeria. As mentioned earlier in this paper, economic growth for Nigeria requires commercial growth in the Farm sector, as this process will spur increased investment. Furthermore, as part of its structural adjustment program with the IMF, Nigeria has been encouraged to strengthen its capacity for privatization and formal occupancy across all sectors (IMF 2002). The result is an increasing dedication to conditions of market-based competition. In this sense, efficient farmers are forcing out less efficient ones, which leads to fewer but larger farms (Paarlberg 2001, iv).

Fear arises here on two levels. First, the pressures of competition are in conflict with the fragmentary nature of traditional land occupancy. The ancestry-based model for land distribution is not economically efficient, but it remains a socially harmonious practice. Second, and critical to the perspective offered in this paper, is the fear that arises for farmers

who are “freed” to pursue other activities, but who have no realistic alternative for making a living. Competitive market forces are arguably part of a shrewd process that ultimately results in higher per capita incomes and improved standards of living. At the same time, however, successful competition is predicated on the existence of alternative market activities (Paarlberg 2001, iv). If the alternatives exist, then competitive forces would be of great value to Nigeria; if they do not, then the security of a large portion of the population is critically threatened.

### **EXPLORING THE SOCIO-POLITICAL FEARS**

A final set of fears worth exploring arises through the socio-political climate in Nigeria. Fortunately, the country has enjoyed several years of relative calm and has received tacit international support for its systems. However, a subtle class struggle has developed as villagers understand the advantages that elites enjoy from their political influence. With respect to the land occupancy debate, villagers are becoming increasingly resigned to the fact that those who obtain land from the government are those who have the ear of political decision-makers, thus assuring them the land they want in the quantities they want. Not coincidentally, these same elites are the big “gentlemen” farmers who own the tractors, which further sparks their desire for land.

#### **Analysis of the Implication of These Fears**

Despite growing land use pressures, arable land is still plentiful in Nigeria. Additionally, privatization and market competition do contribute to economic growth and improved standards of living (World Bank 2002, 273). Furthermore, open conflict resulting from the effect of tractors on land holdings is in no way imminent.<sup>4</sup> This paper does not contest these claims, but rather seeks to reveal that the conditions for conflict exist, and that fears are likely to rise along with population growth as more tractors are introduced in the Farm sector. Tractors, while increasing output through larger cultivated areas, have exploitative impacts on labour and push cultivation away from food production, thus reducing the relative social value of the expanded areas they require. Tractors also create fears concerning land acquisition, since they promote land grabs. This fear is especially strong between adjacent villages. Tractors may soon have the effect of pushing rural farmers out of subsistence farming and into a void where very few market alternatives exist. Finally, tractors may contribute negatively to class struggles at a time when Nigeria’s rising population is making land harder to attain.

This is not to say that there is no place for tractors in Nigeria, only that a potential for future conflict exists at the crossroads of Farm mechanization and land occupancy systems at the village level. The following recommendations seek to enable mechanization and land occupancy systems to develop harmoniously, as part of a prudent development scheme.

### **CONCLUSION**

The rise of Farm mechanization in Nigeria will occur, with or without systems to guide it (FAO 1998). For this reason, it is imperative that the issue be addressed before serious conflicts arise between mechanized farmers and traditional landholders. Threats to land abundance are not urgent now, but this will not remain the case forever. It is wise, then, to confront the mechanization-land occupancy fears in their incipient stages.

To summarize, we first explored the land occupancy systems in Nigeria and saw that the traditional land occupancy system based on village ancestry continues to thrive. Indigenous systems have been incorporated into official laws, and a delicate balance has emerged between the public, the private, and the customary in Nigeria. We then considered the rise of Farm mechanization in Nigeria. Today, there are still very few tractors in the country, and most farmers continue to till their fields manually. However, tractor use is growing quickly, and the impacts that tractors have on Farm land expansion have given rise to fears between mechanization and land occupancy. Looking more closely at these fears, we found that a



gradual adjustment of land occupancy systems toward increased privatization, coupled with government efforts to moderate slightly the expansion of larger tractors, could benefit Nigeria. By promoting market participation in a socially acceptable manner, the conditions should exist for a prudent and sustainable development scheme.

For most countries in the region, however, tractor numbers resemble those in Nigeria, making the present an ideal time to consider the rising fear between traditional land occupancy and Farm mechanization. What is certain is that where subsistence farming remains the predominant source of employment, and where traditional land occupancy is defined by flexible, ancestry-based norms, a significant incursion of tractors will conflict with the land occupancy system. This paper has demonstrated the need to balance market-driven systems with arrangements that respect and suit the unique social structures existing at the village level in African countries.

## **RECOMMENDATIONS**

On the side of Farm mechanization, there has generally been little national or institutional guidance from the government in Nigeria (FAO 1998). Similarly, the government has adopted a hands-off approach to the enforcement of the land occupancy system, setting official guidelines but allowing traditional village leaders to apply the rules in ways that differ little from customary systems of ancestry-based rights. The recommendations below, meant to ease the fear between mechanization and land occupancy before conflict develops, suggest a more active role for the government.

### **Recommendations for the Management of Farm Mechanization:**

Before I go into the ways by which farm mechanization can be improved, it is important for one to state that the change from the use of human and animal power to machine power is a gradual process. It cannot be rushed<sup>4</sup>. The improvement will not happen overnight. But with consistency in applying the methods explained below, Nigeria will experience the situation of improving agriculture through farm mechanization. The following are the ways by which farm mechanization can be improved in the country:

1. Establishment and support of agricultural extension services to enlighten farmers to adopt farm mechanization.
2. Provision of credit facilities which is easily accessible to farmers buy farm machines. 1
3. Increasing the number of farm machines available to farmers.
4. Development of inexpensive locally made machines.
5. Training of farm machinery personnel
6. Establishment of local farm machine factories/workshops.
7. Construction of good transportation networks.
8. Funding of farm machinery research projects.
9. Encouragement of the private sector to partner with the government to improve farm mechanization.
10. Use of renewable energy.

### **Recommendations for Land Occupancy Reform:**

Thomas Bassett notes that any reform of an African occupancy system should be built on the strengths of the indigenous system, because a blind move toward privatization will not ensure increased production and may lead to widespread social disapproval (Bassett 1993, 25). Based on this the following recommendations were drawn:

1. Government should reduce and make the processes to be completed easier in registering lands in Nigeria.
2. The Land Use Act 1978 should be amended to capture prevailing realities around customary laws and informal markets.

3. Multilateral organisations and government should co-create and co-finance innovative interventions to improve activities in the land market.

With this in mind, I offer far reaching recommendations that could establish the conditions for increasing good relationship between farm mechanization and land occupancy system in Nigeria in a socially acceptable manner:

1. Issue national strategies and systems for development in agricultural mechanisation
2. Establish and support mechanisms for co-operations between the stakeholders in the value chain in Nigeria;
3. Provide financial supports to farmers and service providers for investments in farm machinery
4. Strengthen locally mechanical factories for better services on maintenance and repair of agricultural machinery
5. Provide supports to R&D projects to study and apply machinery into agricultural production
6. Organise training courses on design, modification and manufacture of agricultural machinery to locally technical workers and mechanical factories.

The suggested system reforms should serve to mitigate the fear between land occupancy and Farm mechanization, thus softening the social upheaval that could result from either clashing systems or drastic system shifts. Of course, with the introduction of any mechanization, some farms will increase in size, and some traditional farmers may be pushed off of their land. Therefore, these recommendations would be most successful combined with broad government efforts to develop market-based alternatives to subsistence farming. That discussion, however, is beyond the scope of this paper.

#### NOTE

<sup>1</sup>Since rains are often unpredictable, the farmer's prospect of capturing adequate returns on the purchase of the tractor are uncertain at best.

<sup>2</sup>The pastoral Fulfulde ethnicity, responsible for the cattle and oxen, are often in conflict with other farming ethnicities. Often, de-stumping costs make jumping from manual tilling to tractor use inefficient, but the practice is possible in Nigeria due to the prevalence of grassy savannah.

<sup>3</sup>The government of Nigeria has managed the sector ensuring protection for farmers against falling prices. This has led to the planting of more acreage, and as a result, farm incomes actually rose significantly by 2018.

<sup>4</sup>I have resisted the temptation to suggest a restriction on large-size tractors, because, as the current supply is not overwhelming, a better approach is to promote an alternative to these tractors. Ideally, industries in Nigeria would eventually have a hand in the production of the rural machinery that is recommended, but that consideration is too large to address in this paper.

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