

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

## **ABSTRACT**

The reinvigorated approach by stakeholders towards Farm Mechanization has given birth to emerging fears in Nigeria between mechanized agriculture and traditional land tenure policies. With the incursion of tractors into the country, their increasing presence has led to Farm land expansions that encroach on plots granted to small farmers through traditional processes. This write up explores these fears in four main sections. The first section traces the changing land tenure policies in Nigeria that have resulted in a delicate balance between official laws and customary practices. The second considers the rise of Farm mechanization and the growing significance of tractors. The third examines the various fears, exacerbated by rising populations, which arise as mechanization encroaches on traditionally held lands. These fears lead to the exploitation of labour, persistent land grabs, and the forcing of small farmers into a void in which few market alternatives exist. To help mitigate these fears, the final section recommends the tempering of large tractor expansion and the gradual adjustment of land tenure policies toward increased privatization. By harmonizing land tenure policies and Farm mechanization, the conditions will exist for more prudent development in Nigeria.

*Keywords: Farm, Mechanization, Land Tenure, 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 on one hand, and traditional land tenure policies on the contrary. This write up explores these fears by acknowledging the swerving land tenure system in Nigeria, the leap up of mechanization in the country, and the correlation that develops between these two occurrences.

## **ESTABLISHING THE BASIS**

While Farm mechanization and land tenure policies in Nigeria have been developing freely over the years, they are not totally separate issues. Largely saying, fear arises when the spread of mechanized Agriculture begins to encroach on the land rights of small farmers that are not accessible to mechanization. This write up debates that, though land is still considered an abundant factor of production in Nigeria, mechanization will begin to have effects like those of a rapidly developing population, namely that the demand for more area will push people to marginalized lands. Here, as single-farmer plots, and then village areas, expand within the borders of the country, conflict will arise, and the poor will likely lose out to the rich. This situation is not imminent in Nigeria, but the fears are no longer insignificant. From the view of balance economics, the fear between land rights and mechanization is a simple one to settle: swelling mechanization will favour the coherent against the incoherent, so long as land rights are privatized and sellable, incoherent farmers will have profitable reasons to abandon their land and invest their resources in a different sector of the market economy. 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.

Furthermore, Nigerian culture remains tightly wedded to its traditions, which include sacred treatment of the land, unconditional respect for elders and traditional leaders, and clearly defined gender roles. All of these factors complicate the shift to privatized land holdings that the process of mechanization encourages.

Despite these complications in Nigeria and elsewhere, contemporary development policy, guided by mainstream economic thought, assumes that growth is a prerequisite for reduced poverty, and that commercial activity is the catalyst for economic growth. Competition and private ownership are considered essential. What is important, then, as we explore the mechanization-land rights fear as it manifests itself in Nigeria, is to consider how sound development policy might be applied in socially acceptable ways.

The write up starts by examining Farm mechanization it considers the rise and status of Farm mechanization in Nigeria. Focusing on the incursion of the tractor, this article demonstrates that mechanization is starting to have significant impacts in Nigeria, not all of which are positive. Followed by overview of land tenure policies as they exist in law and in practice. The investigation is that 1) Nigeria, presently has adequate Agricultural, but that this will not always be the case, and 2) National or intentional or not, a juggling act balance between official laws and customary practice has been attained that permits for the prospering of melodious Agricultural communities. The third section of this article addresses the fear that arises between Farm mechanization and land tenure rights. It explores 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 small farmers face a real danger of being left with nowhere to go. The final section develops some conclusions and recommendations to mitigate the mechanization-land rights fear. The article's ultimate suggestion is that the process toward mechanization must be regulated just enough to ensure that perceptions and laws governing land tenure have time to adjust to a competitive and privatized world.

## **FARM MECHANIZATION IN NIGERIA**

This is the first critical issue in this dissension: the mechanization of agriculture. Farm mechanization 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 productivity through the use of agricultural machinery, implements and tools. Just as conceptions about land tenure were evolving in Nigeria, Farm mechanization was undergoing a change of its own. Nigeria presents 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. 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 (FAO 1998).

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

The argument made for the improvement of farm mechanization in Nigeria is based on the idea that without the mechanization of Farm activities, Nigeria will be unable to feed her citizens and also meet their other basic needs. Having noted the standard Farm practices in Nigeria, we may now consider the rise of Farm mechanization. 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. The rise of tractors has also been attributed to the promotional efforts of the former colonial powers (Sanders 1990, 2). 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 (Ahmed 1984, 4).

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. 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.<sup>1</sup> Tractors also require increased training, cause greater soil erosion, and demand large areas of land to ensure that ownership will be cost-effective (FAO 1998). Thus, it is not evident that the tractor is the most appropriate tool for African farmers.

Within Nigeria, the rise of mechanization has been very impressive despite introduction of policies to enhance Tractor Acquisition. While other African countries were experimenting with tractors just after World War II, Nigeria at that time was only starting to explore animal traction, an effort that never flourished due to pastoralist and Farmers conflicts.<sup>2</sup>

The small but increasing presence of tractors in Nigeria has evolved as the conditions for mechanization have improved in the country. To support a farming culture based around mechanization, three conditions must be present: 1) sufficient levels of income, 2) market opportunities, and 3) a sound cash crop. The income levels in Nigeria have been improving steadily, not only in the farming sector, but also among the civil 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>

Interestingly, Farm mechanization in Nigeria has also been accompanied by a shift in the identity of the farmer. Paradoxically, the true farmers want to leave farming, while non-farmers are entering the field. Young farmers, seeing the discrepancy between their own traditional efforts and the ease with which big, mechanized farmers are able to till land, increasingly resent the drudgery and seek to escape farming. Conversely, rising incomes among the educated class lead to the possibility of farming as an investment (Gyarteng

1976, 80). This sparks a greater demand for tractors and village land by the city-dwelling elites, leading to an incursion of “gentlemen” farmers (Solbrig 2001, 18). Thus, although the introduction of tractors in Nigeria has come slowly, the impacts of increased Farm mechanization are no longer insignificant.

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

The system can be described as a set of the rules, duties, and rights, define the obligations and privileges, of persons in reference to the land. Land tenure 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 tenure systems in Nigeria ranging from traditional or customary tenure, leasehold tenure system, rent tenure system, gift tenure system, and freehold tenure system. (Ajayi, 2018)

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 policy 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 custodian of the land. 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.

A discussion of land tenure must first consider the common traits of traditional, or customary, land tenure systems. Once this groundwork has been established, traditional land tenure in Nigeria may be explored, keeping in mind that traditions may differ not only from country to country, but between regions within a country, or even from ethnicity to ethnicity, of which there are over 70 in Nigeria. After establishing the impacts of the ancestry-based system that exists in traditional Nigeria, this article will turn to the influences that both colonial forces and international organizations have had on land tenure policies in the country. This will set the stage for an examination of the official laws that have evolved to recognize land tenure in Nigeria. What becomes apparent is an ongoing faith in the abundance of land, as well as a delicate balance between official laws and customary practices that has thus far served as a practical means of managing land usage.

### **TRAITS OF TRADITIONAL LAND TENURE**

Generally, in Africa, traditional land tenure policies share common characteristics. One of which is a reliance on ancestry in determining who has rights to a plot of land. This 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 (Bruce 1993, 45). A second characteristic is the presence of a chef de terre, or land priest, who is responsible for managing disputes and assigning land that is not currently occupied through ancestry.

Traditional land tenure systems in Nigeria are not unlike those in neighbouring countries. It must also be recognized that both the customary and non-customary land tenure systems in Nigeria have been qualified by the Land Use Act of 1978 to the extent that the Act now provides for new uniform tenure 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 The traditional tenure system was “common ownership” which was either within the family or community. The traditional land tenure system in South-western part of Nigeria is distinguished in the application of the Land Governance Assessment framework, Adeniyi (2011: 35) 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 tenure and decreases the importance of community rights. As we shall see, this new trend has serious consequences for pastoralists' access to grazing land.

#### **LAND TENURE 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 predominant land tenure 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 Tenure Law of 1962. Two principal 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 TENURE SYSTEM**

We may now start to think more deeply about how Agricultural land tenure 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 farming techniques can dictate changing land needs. Second, tractors generate pressure for land acquisition, which raises direct conflicts with policies 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 tenure policies 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)

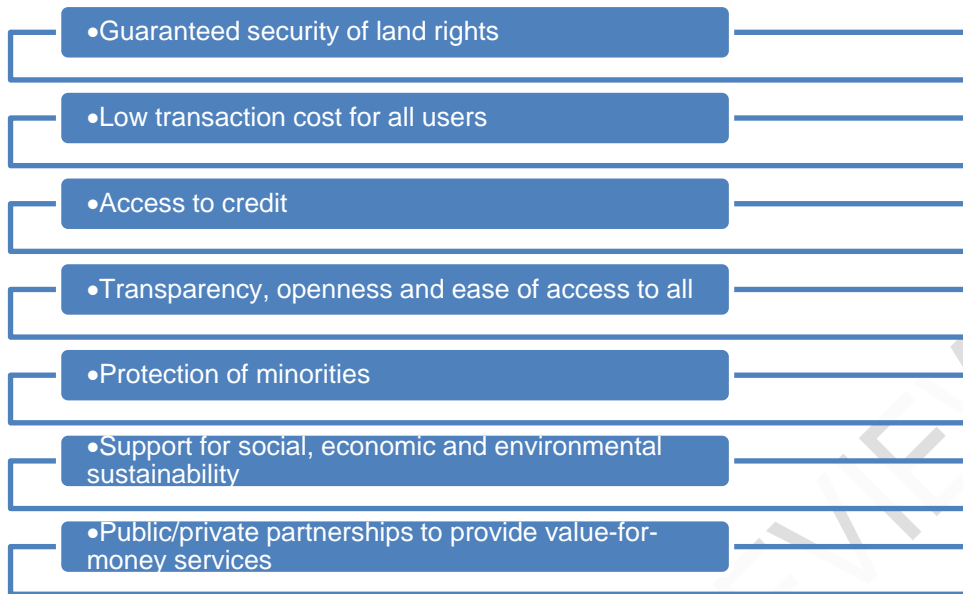
In almost all parts of Nigeria, men till the fields and while women mostly do the weeding and harvesting. With mechanization, tractors till greater expanses of land with less labour, thereby, rendering the male labourers displaced and their short-term tilling employment is eliminated. Perhaps more significant, however, is the exploitation of women that tractors provoke (Tersiguel 1995, 264).<sup>1</sup> 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 policy relevance in developing countries such as Nigeria. Generally, lands are small and fragmented which imparts significantly on the mechanisation 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.

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



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

Small-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 write up, 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 tenure 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 tenure. 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 write up, 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 policies. However, a subtle class struggle has developed as villagers understand the advantages that elites enjoy from their political influence. With respect to the land tenure 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 write up 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 small 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 tenure policies at the village level. The following recommendations seek to enable mechanization and land tenure policies to develop harmoniously, as part of a prudent development scheme.

### **CONCLUSION**

The rise of Farm mechanization in Nigeria will occur, with or without policies 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 tenure fears in their incipient stages.

To summarize, we first explored the land tenure policies in Nigeria and saw that the traditional land tenure system based on village ancestry continues to thrive. Indigenous policies 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 tenure. Looking more closely at these fears, we found that a gradual adjustment of land tenure policies 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 tenure and Farm mechanization. What is certain is that where subsistence farming remains the predominant source of employment, and where traditional land tenure is defined by flexible, ancestry-based norms, a significant incursion of tractors will conflict with the land tenure system. This write up has demonstrated the need to balance market-driven policies 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 tenure policy, 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 tenure 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 Tenure Reform:**

Thomas Bassett notes that any reform of an African tenure 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 tenure system in Nigeria in a socially acceptable manner:

1. Issue national strategies and policies 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 policy reforms should serve to mitigate the fear between land tenure and Farm mechanization, thus softening the social upheaval that could result from either clashing systems or drastic policy 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 write up.

#### 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 small machinery that is recommended, but that consideration is too large to address in this write up.

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