SURVEY ON THE LEVEL OF MECHANIZATION OF SMALL SCALE FARMERS IN MAKURDI AND OTUKPO LOCAL GOVERNMENT AREAS OF BENUE STATE.

BY

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CHAPTER TWO

DECLARATION

I hereby declare that this project is a record of a research work that was undertaken and written by me. It has not been presented before for any degree or diploma or certificate at any University or Institution. Information derived from personal communications, published and unpublished works of others were duly referenced in the text.

18.02.2010

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CERTIFICATION

This project titled "Survey on the Level of mechanization o Small Scale Farmers in Makurdi and Otukpo Local Government Areas of Benue State" by Uloko Patrick Sunday meets the regulation governing the award of Bachelor of Engineering (B. ENG.) of Federal University of Technology, Minna and it is approved for its contribution to scientific knowledge and literary presentation.

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DEDICATION

This project is dedicated to my family who throughout these years have nurtured me in the way of truth.

ACKNOWLEDGEMENTS

My profound gratitude goes to Almighty God, the creator of the heavens and the earth for his protection, guidance, wisdom, intelligence and blessings. He has bestowed upon me unto this day and I pray that He continues to bless me with his kindness and mercy in the many years to come.

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1.0 INTRODUCTION

1.1 Background of the Study

Agricultural mechanization implies the use of various power sources and improved farm tools and equipment, with a view to reduce drudgery, enhance cropping intensity, precision and timeliness, efficient utilization of various crop inputs and reduces the losses at different stages of crop production (Wikipedia, September 2007). The contribution of agricultural mechanization has been well recognized in enhancing the production together with irrigation, biological and chemical inputs of high yielding seed varieties, fertilizers, pesticides and mechanical energy. Farm mechanization plays a significant role in every nation's economy. However, it is often taken as means of modernization, beneficial only to industrialized countries with highly mechanized agriculture. Developing countries often have to rely on a variety of imported farm machines, which are seldom appropriate for small farms (Wikipedia, September 2007).

Agricultural mechanization is not merely the use of tractors and motorized equipment or farming but rather a process of improving and modernizing farm operation and farm structure by the use of hand powered tools, animal-powered implements, engine-powered equipment and other technological devices such as electric motors, pumps, solar driers, silos, irrigation and drainage equipment (Ogieva, 2003).

Mechanization is a significant way of intensifying agricultural production. However, it should be pointed out that machines inspite of their performance, are only tools. The quality of work carried out depends upon the interaction between the tools itself, the type and condition of the soil. The most difficult issue is undoubtedly choosing a suitable tool to use and being able to adapt it to suit local ecological and human conditions, thus controlling the consequences of soil cultivation both from the long and short term parts of view (Olorunfemi,

2008). In relation to subsistence agriculture, mechanical agriculture achieves the objectives of increased production and increased sales. A variety of mechanical implements take over from menial subsistence tools such as hoe and cutlass to cultivate the soil. The principal reason for mechanized agriculture is to lower the cost of production and that of the products. The process helps to create greater productivity, leading to higher standards of living and increased earnings. Mechanized agriculture is not some single indivisible thing. It is a combination of numerous separate elements, each of which can be modified in response to the environment of use as well as market conditions, government regulation and scientific advances (Kaul *et al*, 1999).

Ogieva (2003) Small-scale agriculture is an alternative to factory farming or more broadly, intensive agriculture or unsustainable farming methods that are prevalent in primarily first world countries. Environmental Health Perspectives has noted that "Sustainable agriculture is not merely a package of prescribed methods. More important, it is a change in mind set whereby agriculture acknowledges its dependence on a finite natural resource base--including the finite quality of fossil fuel energy that is now a critical component of conventional farming systems." Small scale agriculture includes a number of sustainable farm practices such as organic farming, which removes all chemical pesticides and fertilizer from agriculture; arable land use; non-arable land use; Rain fed agriculture.

1.1.2 Mechanization in Crop Production

Mechanical power is the main power source that includes the tractor, power tiller, oil engine, and self propelled combine. The oil engine (internal combustion engine) is a good device for converting fuel into useful work. These engines are of two types: diesel and petrol or kerosene. These engines are used either for stationary mode of operation or as motive power source on self propelled machines. These machines are used by farmers for self use and also to provide customs hire services to others. The new models of these prime movers

are light weight, highly fuel efficient and offer trouble free services for a long time. These engines are used as source of power units for variety of jobs and self propelled machines ranging to provide output from 2kw to 200kw (Ojha and Michael, 2003).

The mechanization in crop production can be viewed under the following heading. Pre-planting equipment; Planting equipment; Post-planting equipment (Ojha and Michael, 2003).

1.1.2.1 Pre-Planting Equipment

Pre-planting equipment include the primary and secondary tillage.

I Primary Tillage Equipment

Tillage is the preparatory of the soil for planting and the process of keeping it losses and free from weeds during the growth of crops. The primary objectives and fundamental purposes of tillage is to prepare a suitable seedbed, destroy competitive weed and improve the physical condition of the soil. The equipment used is disk, rotary chisel and subsoil plough (Ojha and Michael, 2003).

II Secondary Tillage Equipment

Means stirring the soil at comparatively shallow depth. In many cases, secondary tillage follows the .deeper primary tillage operation. It is possible to use some of the primary tillage tools to do secondary tillage operation. The objectives of secondary tillage are to destroy weeds on fallow lands, to improve the seedbed by greater pulverization of the soil, to conserve moisture by summer fallow operation to kill weeds and reduce evaporation (Ojha and Michael, 2003).

1.1.2.2 Planting Equipment

Crop planting involves the placing of seeds in the soil a predetermined depth, dropping seeds on the soil surface or setting young plants or cutting in the soil. Seeds are planted mechanically by one of the following methods; Broadcasting-seeds are scattered at random over the surface of the field, Drill seeding-seeds are dropped and covered in furrows to obtain definite rows more seeds, Hill dropping- two or more seeds at a time are placed at about equal interval in rows (Ojha and Michael, 2003).

1.1.2.3 Post Planting Equipment

Post planting-these equipment include, manure fertilizer spreading equipment. Fertilizer can be applied on the soil as manure. The way fertilizer is applied to the soil depends on the stage of development and of crop. Weed control and pest equipment; control of weeds and pest on established crop plants can be achieved by hand, mechanical, chemical or flame methods (Ojha and Michael, 2003). Post planting equipment can be classified under the following headings.

I Harvesting Implement

In most tropical countries crops are harvested by hand using knives sticks sickles. However mechanical equipment is being introduced gradually to ensure that the crop is harvested at the exact time which is appropriate. This minimizes crop losses from bad weather and the effects of pest disease. Harvesting implement is classified by purpose. That is forage, cereals, roots tuber, and fruit which are named according to the crops they are designed to harvest.

II Crop Processing Equipment

This includes machines that are used to dispose of crop residue after harvest and machines to process harvested material and put it into a more usable form. Machines that perform such treatment include shellers, feed grinder and crop dryers

1.2 Statement of the Problem

Large scale mechanization of farm in most tropical countries is uneconomical at present because agriculture is predominantly in the hand of peasant farmers who have only small scattered pieces of land because of the prevailing land tenure system (Ogieva, 2003). The majority of the farmers cannot provide sufficient capital to acquire mechanization and the purchase of implement as well as operating and maintaining them. Most farmers do not know how to operate and maintain these machines because they are illiterate and can not even read the instruction, maintenance and operational manual on the machine and can not do the repairs when there is breakdown of these machines. In the view of this, insufficient capital; illiteracy; and poor maintenance could in a broad level affect the level of mechanization of small scale farmers which could in a long run, inhibit the level and quality of agricultural production.

1.3 Objectives of the Study

1. To determine the contribution and efforts put in place by government agencies into mechanization.
2. To determine the levels of mechanization of small scale farmers as it affects the optimum yield of crops.

1.4 Justification

Farm mechanization plays a significant role in every nation economy and their contribution has been well recognized in production enhancement. Hence the knowledge of the level of mechanization on small scale farmers is important because it helps to determine to a large extent, productivity of land economics return of farmers to increase the effectiveness of a machine, reduced losses and improved quality of food product, working environment and ways to improve on existing benefits to small scale farmers.

1.5 Scope of the Study

Studying the information provided by the farmers in the questionnaire as to know level of mechanization of the small scale farmers in Benue State identifying the impact of farm mechanization on agricultural production and productivity in Benue state as to determine the level of mechanization that will produce optimum yield of agricultural crops.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The current situation of agricultural machinery and status of farm mechanization in Nigeria are analyzed based on three major levels of mechanization technology. Projections are made for future mechanization needs of Nigerian agriculture based on the minimum farm power and machinery requirements for necessary cropping functions and the overall need to promote a gradual evolution of our agriculture from present hand powered subsistence level to one characterized by improved productivity per unit labour and overall economic well-being of the farmer. The development of agricultural mechanization technology in Nigeria has not been pursued systematically in the country. Though federal and every state government in Nigeria within the last three decades highlighted the need to mechanize the Nigerian agriculture. Efforts and programmes for farm mechanization development have not been appreciably effective due to ad hoc nature of agricultural development strategies and programmes pursed in Nigeria due to the ill-motivated, non-integrated and poorly funded Agricultural Science and Engineering Technology Research and Extension Programmes. Despite the huge amounts of money spent in importation and installation of equipment and plants, in local assembling of tractors, in construction of dams for irrigation and rural water supplies and in erection of storage structures by various government agencies using highly inflated quotations and contract awards, the current state of farm mechanization technology systems and management in Nigeria is still woefully inadequate in assisting Nigerian farmers to increase the productivity and profitability of the agricultural sector of the Nigerian economy. Indeed, with recent introduction and implementation of the structural adjustment programme (SAP), essential farm input, including equipment and spare parts have become very scarce and astronomically expensive (Anazodo, 1989).

Analysis of the current machinery situation shows that the projected number of available farm tractors engaged in agricultural activities in Nigeria is 15,906 with average size of 70hp. Future farm tractor requirement have been projected to be 129,428 operational at 70hp for the year 2007 with an annual demand of 16,882. With an expected increase in the cultivated area from $28{,}310\times10^{0}$ha in 2000 to 35.0×10^{0}ha by the year 2007, the national tractorization intensity is expected to increase from 0.0244hp/ha to 0.258hp/ha and its contribution to the overall power available for crop production increased from 23% in 1989 to 74.77% by the year 2000. The ratios of operational farm tractors to the number of associated implements have adjusted not only to achieve a more economic and effective use of the tractors, but also to gradually achieve timeliness in planting, weeding, spraying and harvesting operations. The urgent need for a computer aided development of optimal strategies for overall agricultural mechanization management in Nigeria is recommended, based on critical review of past and present programmes for promoting agricultural mechanization at national, state and rural levels (Anazodo *et al*, 1989).

2.1 Background of Mechanization

The small scale farmer first and greatest aim is to increase the size of his farm and output without greatly increasing his demand for hired labour, this he can do by mechanization. The use of implement to replace his traditional hoe is the first thing to be considered in the way he can increase the output of work in each day from both himself and the family and also from hired help. Some crops are much more easily mechanized than others. The root crops such as yam, cassava are particularly impossible to mechanize. For the small scale farmer, practically all the operation involved in their production have to be done manually the growing of crops however can be mechanized, provided the farmer will change his systems of farming. It will be clear that if farming efficiency and production are to be

increased in Nigeria, there must be the introduction of many farm implement and small hand machines to speed up the heavy work of cultivating the farm and also to reduce the amount of hard work to be done and the lighter work of weeding which is at present largely done by women and children. There are machines which will carry out such operation as corn grinding and millet, groundnut shelling rice threshing, rice hulling, palm oil pressing, grain winnowing, cassava grating and it is important that the use of this type of machineries should be greatly increased in our country at large and out local areas, mechanizing the processing of crops is very similar processes of which great experience has been obtained in most parts of the world (Kuje, 2002).

There are many stages which mechanization could be classified, man in the early beginning of history started farming by collecting fruit in the farm, hunting and fishing. The situation saw the birth of planned agriculture, but was mainly subsistence. The subsistence farmer produces for himself and for maintenance of his family but sell little or none of the farm product. With the development, man started exploiting farm animals' power for draught purpose in the instruction of land. The use of these animals was and is still highly restricted to place where the environmental condition favour their area, later the introduction of tractors and farm implement and presently developed countries use automatic power to replace the high cost and no availability of farm labour (Kuje, 2002).

2.2 Concept of Mechanization

Tools, implements and powered machinery, are essential and major inputs to agriculture; it can be argued that they are one of the most important. The term ***"Mechanization"*** is generally used as an overall description of the application of these inputs. There are three levels of farm power used to provide an energy source for the

utilization of these tools, machines and equipment; manual power, animal draft and motorized power (Ochapa, 1999).

Agricultural Mechanization refers to the development, manufacture, and distribution of all types of machines, infrastructure, and equipment for farm production, post harvest and processing (Ochapa, 1999). Agricultural mechanization aims at sustaining agricultural production by bringing in more lands under cultivation, saving energy and resources, protecting the environment, and increasing the overall economic welfare of farmers. Machines and equipment are major inputs to agriculture. The use and application of these inputs to farm production is one of the management tools to maximize farm production and profit. The level, appropriate choice and subsequent proper use of mechanized inputs into agriculture has a direct and significant effect on achievable levels of agricultural production, the profitability of farming and the environment. In general, in a situation where the expansion of agricultural land is limited, the application of advanced tools and machines does not, by itself, lead to increased unit yields. However, the full benefit achieved through the use of many advanced crop husbandry inputs such as improved seed, fertilizer, and pesticides, cannot be realized without the use of improved tools. Only under certain conditions, where production increases achieved through the use of other improved inputs has come to its limits, can improved tools and equipment by themselves lead to production increases, cost reductions or improvements in the environmental sustainability of farming. In situations where land is not a constraint, increased farm power can lead to direct increases in production by simply increasing the land area or animal numbers that one man can handle (Ochapa, 1999).

In the past, misunderstood concepts and inappropriate selection and use of certain mechanization inputs (mainly tractors and heavy machinery) have, in many parts of the world

led to heavy financial losses and lower agricultural production as well as environmental degradation. Mechanization has often become a burden to the national budget and the farming community rather than being a productive input. This has especially been the case in centrally planned economies, where mechanization was heavily subsidized through the provision of government planned and operated machinery services. Similar models of Government provision of services have been tried in many developing countries and has in every case failed. The development of "appropriate" tools and equipment has also been a favourite subject for development assistance. However, the activities of these projects generally took place in relative isolation in government and university departments and workshops and the resulting prototypes only occasionally found their way into commercial production and onto the market. In virtually every Workshop in University Departments of Agricultural Engineering is to be found a show of improved machines and hand tools which were never developed beyond the prototype stage. Further examples of misapplied mechanization inputs can be found in many technical co-operation projects, which were mostly planned and implemented with the best intentions but in an uncoordinated way and without due consideration of sustainability and economic aspects. It is an unfortunate fact that only very few mechanization projects can claim to have been completely successful (Kuje, 2002).

Ochapa *et al.* (1999) reported that mechanization is not merely the use of tractors and motorized equipment in farming but rather a process of improving and modernizing farming operations and farm structures by use of hand powered tools, animal-powered implements, engine powered equipment and other technological devices such as electric motors, pumps, solar driers, silos, irrigation and drainage equipment. Agricultural mechanization may be interpreted in several ways. To some it is synonymous with tractorization, while others take it to simply imply increase in production per worker and per hectare of land cultivated. Modern

farming includes the use of several inputs to the production cycle. These include seeds irrigation water, fertilizer, herbicides or insecticides and farm equipment. A successful farmer makes judicious use of these inputs in order to maximize production but acts as a device to ensure that other inputs give the desired results. Thus, it may be said that farm equipment and techniques associated with its use broadly constitute the field of agricultural mechanization equipment used in the farm may be divided in to two groups, that is farm power and farm machinery. The two should be properly integrated in any agricultural mechanization programme.

2.3 Agricultural Mechanization Technology

The manufacture, distribution, repair, maintenance, management and utilization of agricultural tools, implements and machines is covered under this discipline with regard as to how to supply mechanization inputs to the farmer in an efficient and effective manner (Ogieva, 2003). Agricultural mechanization in the tropics generally includes three main power sources: Human; Animal; Mechanical (Akinsanmi, 2000).

2.3.1 Human Power

This is the simplest and most basic level of agricultural mechanization. It involves the use of tools and simple implements using human muscles as the main power source. One of the most important variables that decide the successful operations of a farming system is the availability of farm labour and it's use. Within the labour profile, the type of labour is also very important. For heavy operations like land preparation, clearing bunds and threshing, where male labour plays a major role, it's availability within the locality helps keeping timeliness that brings several advantages including high yields. Similarly, the operations such as transplanting and reaping carried out by women as equal as men or even more efficiently than men may suffer in the absence of female labour. It is also approximately calculated that

a woman-day equals 0.8 of a man day- working continuously, a man produces 0.1hp and for a short period, he can produce 0.4hp (Anazodo, 1999).

2.3.2 Animal Power

This refers to the use of implements and machines utilizing animal muscle as the main source of power. The power generated from this source depends on factors such as type of animal, health and physical condition of the animal etc. It is estimated that a pair of cattle can develop 1hp and can work 6hrs a day. The economic life span of cattle is 6-10yrs. A pair of buffalo can develop 1-1.5hp but work slowly. The average field capacity of a pair of animals harnessed to indigenous plough is 0.1ha/day. The buffalo is recognized as an efficient working animal where speed is unimportant. Their economic life is 12-13yrs. In case of buffalo, both males and females are used as work animals where as only male cattle are used for working. The buffalo has a limited work output under the sun for its low heat tolerance (Anazodo, 1989).

2.3.4 Tractor and Engine Power (Mechanical)

Basically, the purpose of using tractors in farming is to avoid the drudgery experienced in field operations. Tractors of hp range 30-50 are popular in agricultural production because of their versatility. Within each of these three sources of farm power, degrees of sophistication must be distinguished. For instance, a simple locally made single axle tractor without differential gears and gear box, a single axle tractor with gear box and power-take-off, and a 70kilowatt tractor are all mechanical power technology but with a large difference in sophistication and capability (Anazodo, 1999).

2.4 Factors Which Aid Progress in Farm Mechanization

In general, effective introduction of farm power and machinery requires the following: A growing desire by the farmers for better machinery and tools; A government with an interest in agricultural development and an understanding of crucial role of agricultural mechanization in modern agriculture and in developing the rural areas; Effective education, research and extension programmes; Continuing research programmes to design and manufacture suitable machines for farm production, storage and processing (Olorunfemi *et al.*, 1999)

2.5 Mechanization Experiences in Sub-Saharan Africa

In sub-saharan Africa, efforts to promote agricultural mechanization through improved tools, draught animals and tractor mechanization dates back to the early 1900s. from 1900 to 1930, the main trust of mechanization was the introduction improved hand tools on the native peasant farms of the European settlers, a combination of hand tools and draught Animal Technologies (DATs) was used. The European farmers settled mostly in the eastern and southern Africa, and the hand tools and draught animal implements were procured largely from south Africa and India. In West Africa, hand tools were largely fabricated by local blacksmiths (Pingali *et al.* 1992).

From the 1930s to the 1950s, mechanically powered mechanization was introduced on European settler farms in the eastern and southern Africa. A number of government operated tractor units were established by the colonial authorities. There were also schemes established to provide native and settler farms with the credit to acquire tractors and farm machinery. Following independence in the early 1960s, most Sub-Saharan countries inherited these projects and expanded them. Also, in the 1930s and 1940s, DAT was introduced in many

parts of sub-saharan Africa , especially in the moist savannah zone where pastoralists settled and began to grow cash crops such as groundnuts (Pingali *et al*, 2008).

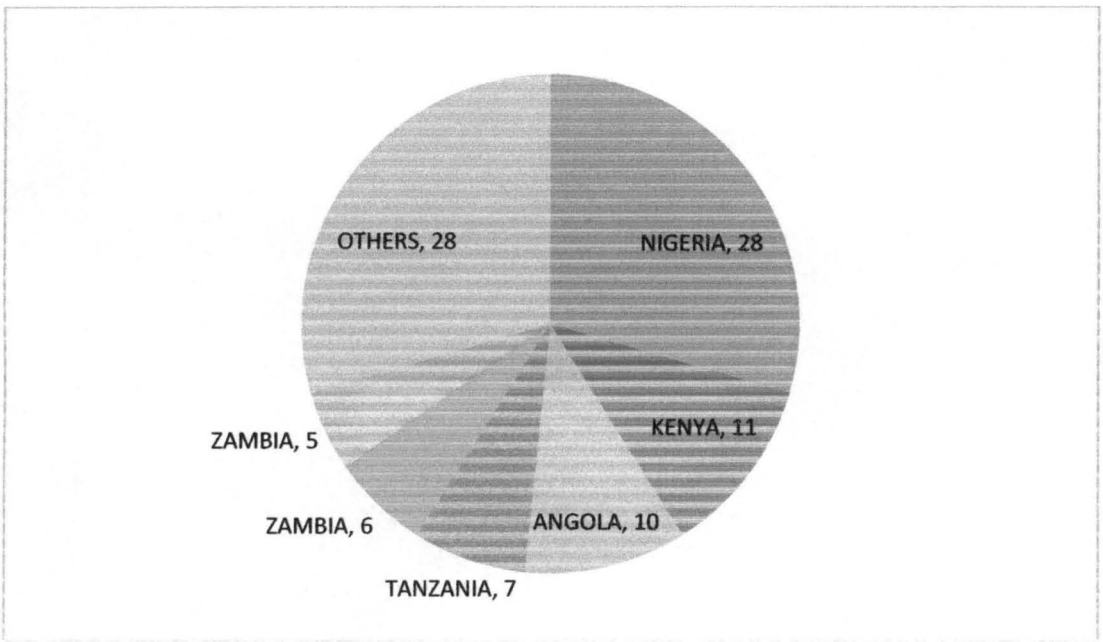
In the 1950s and 1960s tractor mechanization was promoted as part of large scale agricultural schemes for which initially the colonial and subsequently independent nationalist governments directly imported tractors for medium and smaller scale farmers. Tractor hire schemes were launched to spread the fixed cost of the tractors and equipment. In this period, public sector schemes such as co-operative and communal farming, state farms and parastatals were introduced, all of which promoted large scale mechanization. By the late1960s and early 1970s, policy concerns increased in Africa, as elsewhere, over the welfare effects (employment and income distribution) and the economic benefits of tractor mechanization. Studies on the economics of private tractor ownership raised concerns over financial and economic returns, and the distorted incentives as a result of the widespread use of subsidies. Also by the early 1970s, clear evidence had emerged that most government managed and operated tractor hire schemes were not successful. Government run tractor hire schemes prevalent in the 1960 and 1970s were ineffective as a result of management failures, shortfalls of government financial support and poor supporting infrastructure (Geoffrey *et al.*, 2008). Other factors identified in this failure include the absence of economics of scale, low incentives under civil service regulations for tractor drivers to work extended hours, low machinery productivity, low rates of effective machine utilization (because of poor maintenance of tractors and scattered small farms) and civil service bureaucratic systems, which were not conducive for running a business such as tractor hiring.

It should be noted however that while the government tractor hire projects attracted a great deal of attention, the number of tractors in the schemes in many countries was a small fraction of the total number available in the national tractor fleet. Despite the poor record with tractorization programmes, many African leaders remained convinced that agriculture

had to be mechanized if development and ecomomic growth were to occur on the continent. They continued to devote resources although at reduced levels to tractorization programmes up to the late 1980s. most governments were forced by economic Structural Adjustment Programmes (SAPs) to abandon support to such projets by the late 1990s, most governments hire schemes had folded with most of the tractors either abandoned or sold off to the farms and private tractor drivers. (Liljedahi *et al*, 1995).

However, since the start of the 2000s, there has been a little progress and few new initiatives or new ideas on mechanization in sub Saharan Africa. This stands in contrast to the growing number of success stories in Africa that show the vitality and responsiveness of farmers and private sector firms in introducing new enterprises and biophysical technologies when presented with the favourable domestic conditions and policy incentives (Liljedahi *et al* 1995).

Figure: 2.1 Percentage of Tractors in use in Different Countries in Sub-Saharan Africa in the Year 2000



source: FAOSTAT/AGS (2004).

2.6 Level of Mechanization in Nigeria

Progress in successful introduction of mechanized methods in agriculture in Nigeria and other developing countries has been hampered by some arguments against agricultural mechanization. It is argued that since most of the motor powered farm machinery being proposed for the developing countries are designed largely for the labour scarce, capital abundant economic environment of an underdeveloped country "will almost certainly constitute bad economics and will bring with it the seeds of social discontent". Due to some apparent limitation posed by fragmentation of holding; lack of capital; adverse cultural practices and crop types, illiteracy of majority of the farming population; inadequate infrastructure and maintenance facilities; unavailability of spare parts and the lack of sufficient trained manpower to cope with a foreign technology, the protagonist of agricultural mechanization recommend improvement in the hand tools and the introduction of effective land reform (*Kaul et al*, 1991).

Agricultural mechanization is an inevitable consequence of any nation's desire to industrialize. It is often stated, and correctly too, that the spectacular achievements of agricultural mechanization in North America and Japan were largely due to the existence of viable industries and export economics. In absence of such favourable conditions agriculture becomes the base for industry and both must grow, each one complimenting the other (*Kaul et al*, 1991).

Agricultural mechanization may be interpreted in several ways. To some it is synonymous with tractorization, which other takes it to imply increase in production per worker and per hectare of land cultivated. Modern farming includes the use of several inputs to the production cycle. These include seeds irrigation water, fertilizer, herbicide or insecticides and farm equipment. A successful farmer makes judicious use of these inputs in order to maximize production with minimum cost. Farmer equipment does not imply

multiply production (a seeds does) but acts as a device to ensure that other inputs give the desire results. In array farm equipment may be called "Input" for other inputs. Thus, it may be said that farm equipment and techniques associated with its use broadly constitute the field of agriculture mechanization equipment used in the farm may be divided into two groups that is farm power and farm machinery. The two should be properly integrated in any agricultural mechanization programme (Ojia and Michael, 2003).

Although the actual operation or farm task is performed by a farm implement, it can not function unless powered by some means or other, whether it is human power or tractor power. Often there is tendency to treat each in isolation, in the sense that it is often thought that obtaining a tractor is attaining mechanization. Unless the tractor has full set implements for various operations, its full effectiveness is not achieved. Thus the advantage of mechanization over traditional agriculture cannot be over emphasized, hence it leads to efficient use of land, more output and it is a labour saving devices. It can be seen evidently that mechanization is the answer to the problem of food shortage (Oji and Michael, 2004).

Mechanization in any area is characterized into three levels: low, fair, and high. Low mechanization level means that manual power used exceeded 33%. Fair means that animal power utilization ranges from 34% to 100%. High means that mechanical power utilization ranges from 67% to 100% (Rodulfo *et al*, 1998).

Table 2.1 shows the level of mechanization in rice and corn farming operations, expressed in three main sources of power, namely: manual, man-animal and mechanical. The data shows that human power dominates farm operations at an average of 56.53%. Mechanical operations are applied mainly in milling, threshing or shelling, land preparation, and planting. Animals continue to dominate land preparation. Sun drying is still preferred by farmers. In terms of available power expressed as horsepower per hectare (hp/ha), the level of

mechanization stands at 1.68 hp/ha (Table 2.2). This is relatively low compared with other neighboring countries. The reason for this is the abundance of manual labor, which dominates the use of human power in rice and corn cultivation activities. The high hp/ha of power tillers and threshers indicate that the use of mechanical power in land preparation and threshing is increasing. Irrigation, harvesting, and drying have low hp/ha level.

Advance Management Development programme (AMDP), (1998) did a correlation analyses to determine the possible relationship between the two variables. The computed linear coefficient of 0.7645 shows a degree of relationship between the level of mechanization (independent variable) and the production per hectare (dependent variable). However, it does not explain how the level of mechanization affects the production per hectare since there are other factors that could affect production per unit hectare such as farm inputs application and farmer's capability to increase inputs.

Table 2.1 Percentage of Rice and Corn Farms Vs. Source of Power

OPERATION	POWER SOURCE		
	Manual	Man-Animal	Mechanical
Land Preparation	3.15	64.71	23.17
Planting	98.67	1.15	0.16
Weeding	85.20	14.80	0
Fertilizer Application	98.69	1.65	0
Spraying	100	0	0
Harvesting	98.79	0	0
Threshing/Shelling	31.01	0	68.99
Drying (Farm Level)	100	0	0
Milling	0	0	100
Average	56.53	19.25	21.70

Source: Agricultural Mechanization Development Program (AMDP), 1997

Table 2.2 Level of Mechanization in Rice and Corn.

SOURCE OF POWER	Hp/ ha
1. Human Labour	0.24
2. Draft Animal	0.08
3. Four-Wheel Tractor	0.24
4. Engines	
a. Power Tiller	0.56
b. Thresher	0.34
c. Irrigation Pump	0.07
d. Harvesting, Drying and Shelling Equipment)	0.15
Total	1.68

Source: Agricultural Mechanization Development Program (AMDP), 1997

It should be realized here that mechanization is not a stagnant process, there should be an over lapping of levels. Agricultural mechanization therefore involved various sources of power including machines, human, animals or a combination of these on the farm for cultivation, harvesting and processing of crop or animals. The above classification takes into consideration the level attained in any agricultural system, for example in a situation where introduction of animal power is not possible on alternative level of mechanization can be used.

Below shows typical mechanized crop production operation showing the equipment involved at each stage

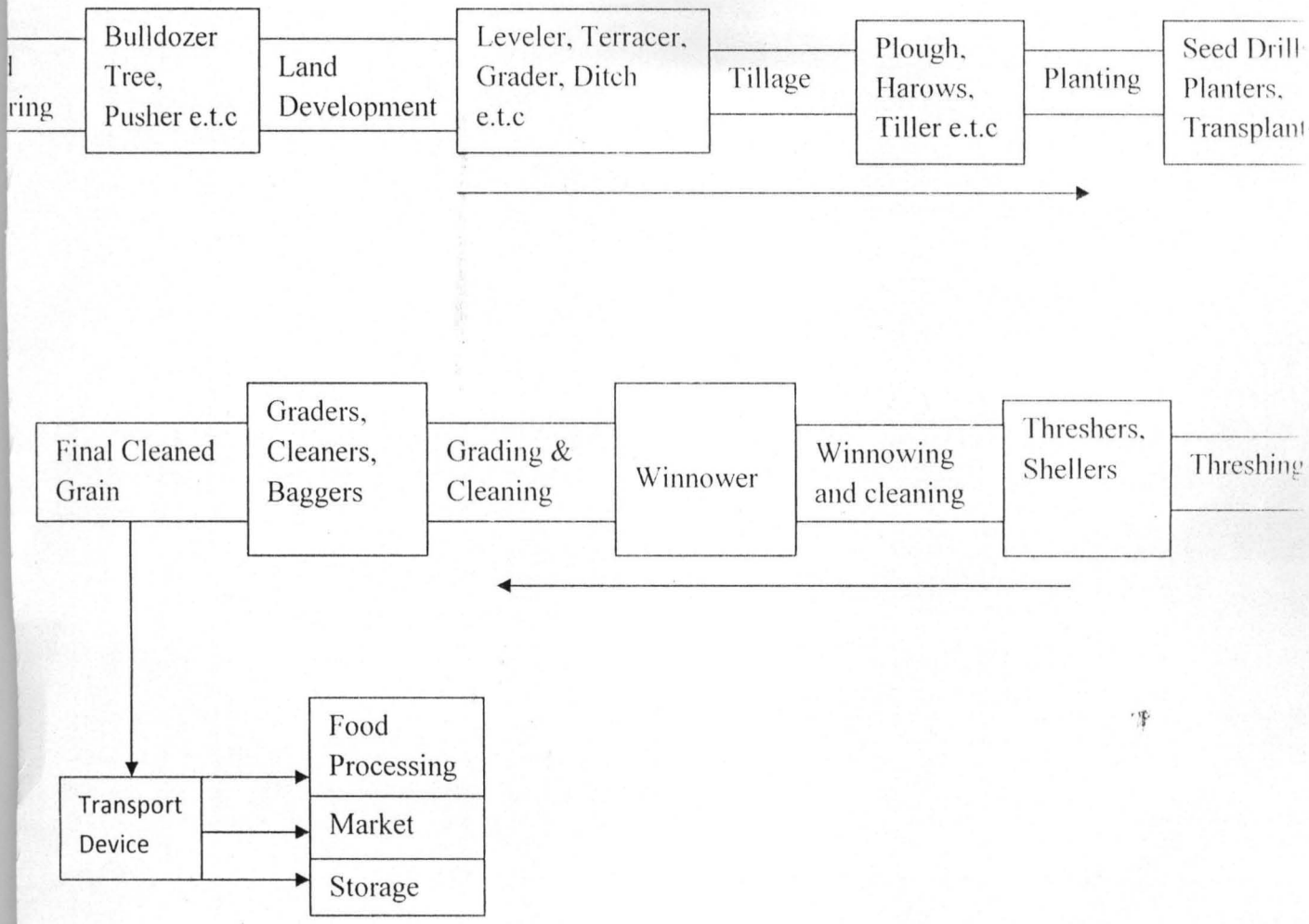


Figure 2.2 Typical Mechanized Crop Production Operation Showing the Equipment Involved at Each Stage

2.7 Mechanization in Benue State.

The Benue State of agriculture made commendable efforts to introduce agricultural mechanization, to this end, an Agricultural Engineering Division was created within the ministry to impact knowledge about the use of agricultural machines like tractors, harvesters, threshers as well as irrigation techniques.

In other to facilitate this, the State Government cleared over 57,000 hectares of land throughout the state which handed over to local farmers cooperatives. The cooperation established a large poultry farm at its headquarters in Makurdi which today remains the major sources of eggs to the town. (BNARDA, 2005)

It also commenced breeding improved varieties and sale of a day-old-chick and to meet the demand as well as those of livestock farmers, it sets up two mills which produces different types of livestock feeds. Some of the raw materials for the feeds mills come its 1,200 hectares at Ojapo in Okpokwu Local Government Area which produces maize and rice.

Some of the notable achievements of the corporation include the agreement with foreign companies which led to their going into partnership with the State Government in a number of agricultural ventures like Ikyogen cattle Ranch, the Ben-willey fish farm at Ber Agbum and Hawaiian Agronomics (BNARDA, 2005))

2.7.1 Benue Tractoor Hiring Agency (BENTHA)

To reduce the labour intensity of the traditional methods of cultivation, and in order to popularize the culture of mechanization of Agricultural production, a Tractor Hiring Agency (BENTHA) was established in 1988 to facilitate the operations of clearing, harrowing and ploughing of farmlands. Tractors provide the power unit which carry the implements to the

field and engage them in operation hence saves time and increases acreages and ensure greater yield. The agency started with one hundred and fifty tractors at the cost of thirty million naire (BENTHA, 2000)

2.7.2 Irrigation in Benue State

Rained Agriculture is the basic practice, average rainfall per annum is 375cm which would be adequate over a six months growing period, although fairly in July and August. This poses the risk of draught in these months when the crop water consumption use is near its peak.

There are two main types of cropping in the state; those based on floodplain soils that are subjected to flooding and those based on upland soils. Flood hazard in the flood plain areas is a common occurrence. (BENTHA, 2000)

2.7.2.1 Pilot Irrigation Schemes in Benue State

The Benue State Government has established four pilot irrigation schemes in the flood plains. These are:

i. MU pilot irrigation, located off Makurdi-Gboko Highway. Only 22ha of land is put to use out of a potential of up to 300ha.
ii. Akaba pilot irrigation scheme on the Eastern bank of katsina-ala River, at Katsina-Ala; 10ha is put to use out of a potential of 400ha.
iii. Gboko pilot irrigation scheme with 10ha, located on the Western bank of Katsina-Ala stream. East of Gboko town.
iv. Allan pilot irrigation scheme with 53ha is located on the Otukpo-Agila road on the left bank of Okpokwu River. (LBRBDA, 2005)

2.8 Advantages and Disadvantages of Mechanization

The main advantage of mechanization as seen by the respondents is the work potential/increased productivity aspect. Increased productivity stems from both an increase in acreage and increased yields. Most respondents find that mechanization is indispensable for increased productivity, increased production and for meeting the fast growing demands for food. The risks and disadvantages, however, are well recognized by both the specialists working in the field and by the farmers. The degradation of soil resources is seen as the most perilous risk of motorized tillage. In methods currently practiced, mechanization damages the natural resources to the extent that there are irreversible environmental effects and, eventually, a negative impact on food production, food security and food self-sufficiency. In general, the status of mechanization is very poor. Farmers and drivers have received little or no training, resulting in malpractice that further increases soil erosion and brake down rates of the machinery. A lack of trained mechanics and spare parts or the purchasing power of farmers to obtain these, further adds to the underutilization of the equipment. Additionally, mechanization is often inadequate for the West African farming systems of many smallholder farms with scattered fields, bad access roads and not fully cleared fields (Odighoh, 2000)

2.9 The Importance of Farm Mechanization

The growth of cities and the concentration of large non-food producing population, in these cities have had a very important effect on present agriculture in Nigeria. Massive indirect agriculture consumption creates substantial demands for agricultural produce in the urban areas of Nigeria, the response of the peasant farmer to his demand is of major important to the economy of the nation up to the present time. The increased demand for export of cash crops and for consumption in the urban areas of Nigeria has been met largely by the present cultivation. To meet the response to the creation of large scale mechanized

agriculture on state forms and by individual entrepreneur such as, large scale mechanized agriculture are at presently being developed to solve the problems of farmer as well as the urban dwellers. A modern efficient agricultural industry must be mechanized to some degree, farm machines are designed to help the hand apply force in the farm preparation and every nation seeks farm mechanization, because it is cheap. Mechanization helps to remove much of the unnecessary drudgery from farm operation and create incentive for young people to remain on the farm to produce for themselves, their families and the nation at large (Olorunfemi *et al,* 2008)

In addition, farm mechanization facilities production of more food produce and improve timely field operation, many farmer have realized that it is more profitable to embark on mechanized agriculture. For example one can produce one hectare of land in one hours working tractor and modern implement, but using hand tools it will take a man up to about seven hours work to produce on hectare of land. Tractor allows more land to cultivation with less hard work. Furthermore, power is available to prepare land at the end of dry season, just prior to the first ran. This allows early planting to achieve higher yield. Mechanization enables farmers to deal with relative cases of some difficult and unpleasant jobs such as treating sewage and utilizing it as water for cultivation of vegetation. The uses of machines can make possible some job, which the farmer could not otherwise undertake, such as rapid clearing of forest or bush land, ploughing in dry season in other to plant with the early rain, manuring of field soak, carry farm yard manure from one place to another. This may result to economy pressure and may cause the distribution of land, and yet will make it possible for the farmer to cultivate many hectare of land during a single season. It also facilitates timely farm operation, it makes it possible to get better yield. Mechanization thus, accelerates and speeds up many farm operations. However it is very expensive in capital cost, and as farms in

West African are poorly cleared of stumps. Thus, operation costs are consequently high (Udigboh, 2000).

2.10 Problems of Farm Mechanization

Large scale mechanization of farm in most tropical countries is uneconomic at present because agriculture is predominantly in the hand of peasant farmers who have only small scattered pieces of land because of the prevailing land tenure system. Economic mechanization required large farm holding. The majority of the farmers cannot provide sufficient capital first to pay for stopping them to buy tractor and implement as well as operate them. If only some farm operations are mechanized and not others unbalanced mechanization may mean seasonal shortages and surpluses of labour. In many countries, there are real difficulties in getting enough people with high mechanical skill or aptitude to operate, repair and maintain the equipment (Udigboh, 2000).

Mechanization may encourage speed at the expense of good farming, which may result in poor crop yields. It may limit production of the crops which are easily mechanized such as these which produce high cost return per hectare like tobacco, over production of such crops would lead to a lowering of their prices and might make the whole operation unprofitable. Many machines lie idle for part of the years because work can only be done on the farm according to the season. The money invested on such machines will therefore not yield very good returns most of the imported agricultural implement are not formulated for tropical condition and as a result the may break down rapidly or impair the soil structure causing erosion. So far, there has been very, few successful experience with the use of tractor for land cultivating in our country. The introduction of mechanization in the cultivation of the soil cause soil erosion, the erosion of the soil can be greatly accelerated by the removal of the soil cover of bush or forest unless very great trouble is layout accurately anti erosion banks,

and then to see that all cultivation are done in strip with ridges on the properly graded, mechanization cultivation requires complete removal of roots of tress and bush from the tropical climate the loss of fertility is extremely rapid, owing to the very quick break down of the soil organic matter it is therefore difficult to obtain high yield of crop under mechanization (Udigboh, 2000).

Finally, many of the tropical crops are far from being fully suitable for mechanization situated. Only certain of the cultivation can be readily mechanized so that hand labour is still to be used for others. Thus mechanization may cause a seasonal labour problem rather than eliminating one machine which can be used for very short season each year. It is bound to be uneconomical, unless they can be made to cover very large areas during that time. Mechanization of soil cultivation may be used in certain specialized crops, which are grown in special condition. The farmer who thinks applying tractor drawn implement to his general mixed farming should take great care to ascertain just what is involved by consulting the agricultural advisory services in his area. A farmer on his own must be able to operate a number of implement over a considerable period of year. It must also have services for supply of spare parts and fuel to keep it going to give best result machines and implement operated by a man who is skilled in the work (Olorunfemi *et al,* 2008).

2.11 Possible Solution to Farm Mechanization

The use if machines can make possible job which the farmer could not other wise undertake, such as rapid clearing of bush land or forest, ploughing in dry season in other to plant with the early rains, measuring application on a field scale, carry farm yard manure from one place to another. In many, it reduces the economic pressure to resort to bad agricultural practices such as the complete burning of all vegetative cover on new land and yet make it possible for the farmer to cultivate many hectares of land during a single reason.

It also facilitates timely farm operations, thus making possible better yield from the crops. Mechanization thus causes and speeds up many farm operations (Ojia and Michael, 2003).

The problem of land tenure system by which a farmer work a few hectares of land scattered here and there must be change; Effective mechanization requires many hectares in a single field to meet the demand of the nation or society; Government should supply simple and less expensive machines to do the same work as present expensive ones are doing; Mechanization should gradually start in area where it is economically feasible and with crops that farmers can obtain considerable benefit from higher production, For example the drying storage of crops such as maize, rice, tobacco, cocoa and groundnut (Ojia and Michael, 2003).

The farmer should be taught to develop the practices of owning and operating farm collectively. The government should establish agricultural engineering station in all town and villages where machines for all kinds of farm operation may be stocked. These machines could be given to the farmers at subsidized loans.

2.12 Agricultural Mechanization Strategy

The purpose of an agricultural mechanization strategy (AMS) is to create a policy, institutional and market environment in which farmers and other end users have the choice power and equipment suited to their needs within a sustainable delivery and support system. "Farmers and others" refer to all end users of farm power, tools and equipment, such as small family operated farms, commercial farm business, farmers organization, irrigation groups, contractors, government operators and primary agricultural produce processors (FAO, 1997). According to (Anazodo, 1989) an AMS deals with manual, draft and mechanical power, the utilization of tools, implements, machinery, their supply and maintenance. He also reported that the strategy may cover importation and domestic manufacture relevant training and

extension programs, improvement of draft animal health services and breeding programs, and promotion of financing systems for purchase of draft animals and machinery.

2.12.1 Agricultural Mechanization Strategy Formulation

Within a general agricultural policy, governments develop strategies to achieve policy objectives. A strategy on mechanization should be just one of a number of strategies leading to the achievement of overall government policy. AGSE commenced work several years ago in the field of Agricultural Mechanization Strategy formulation and studies have been carried out in several countries in Latin America, Africa, Asia and Eastern Europe. Recently, with the changes occurring due to structural adjustment programmes, the concepts of Agricultural Mechanization Strategies have been further developed and adapted (FAO, 1997).

The philosophy behind the Agricultural Mechanization Strategy work of AGSE is that national governments should provide the basic conditions for a largely self sustaining development of the agricultural subsector of mechanization within a policy of minimum direct intervention. The purpose of any interventions should be clearly identified and should fall within the objectives of the strategy. However, that does not mean that agricultural mechanization can be neglected in the formulation of national policy. On the contrary, very special attention should be paid to the effects that other policies have on the level and use of engineering inputs in agriculture (FAO, 1997).

2.13 Critical Factors for Successful and Sustainable Mechanization

2.13.1 Improving Rural Livelihoods

Broad-based poverty reduction in Africa simply will not occur without a vibrant agricultural sector providing income, employment and affordably priced staple foods (FAO, 2000). All Africans share a concern that the farming population in Africa increasingly

comprises older and poorer people. Younger Africans see farming as a last refuge, leading to a life of drudgery for those who cannot find other types of work. A shift to tractor and other machine powered equipment therefore can be seen as part of a broader strategy to make agriculture attractive for new energetic and innovative generation of farmers and other entrepreneurs.

In many parts of Africa, farmers continue to walk long distances to their fields, sometimes requiring two or three hours each day. Powered equipment and transport that can elleviate some of the hard work would make a substantial, direct contribution to improve livelihoods and release labour for other, more remunerative activities, particularly for women who continue to bear the greatest burden of household tasks. (Anazodo *et al*, 1989)

2.13.2 Employment Generation

One of the persistent concerns raised with respect to mechanization is over labour displacement. Almost certainly, there is available labour that can and will respond to adequate incentives, as reflected yearly when family members and communities mobilize in order to meet peak season requirements. 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. Introduction of mechanization to address peak season labour constraints could consequently be expected to have two benefits leading to an increase in employment and wages. One is the substitution of capital for labour when meeting peak season labour constraints, thereby allowing household members to continue to engage in their non-farm activities that are put on hold during peak season though otherwise remunerative. The second and more important is the increase of labour demand in agriculture in the non-peak seasons thorough increases in scale and/or increases in land productivity because of more timely and high quality land preparation. Based on studies he reviewed from

the 1950s, to the 1970s, Ruttan *et al* (1998) estimated that reduction of the extreme seasonality of labour in agriculture could lead to an increase in time devoted to agricultural production from 15 percent up to 50 percent

2.13.3 Machinery and Equipment Supply Chains and Services

The availability of machinery, equipment, spare parts and other supplies is essential for successful and sustainable mechanization. Consequently, agricultural mechanization include the development of local industries for the production of machinery and implements and where production is not feasible, the establishment and development of local franchise holders to import them. Even more important is the need to establish efficient and effective distribution channels for the equipment, spare parts and repair services, as well as other supplies such as fuel and oil. Viewing mechanization as including development of supply chains and services ensures a better choice of equipment for particular types of users and uses, while guaranteeing the availability of spare parts and technical assistance (FAO, 1989). Reijntjes *et al* (1992) reported that Priority attention needs to be given to establishing reliable and low-cost supplies of tractors and related equipment, as well as other engine powered machines. A strategy with potential might be to consider establishing supply chains for agricultural machinery and spare parts from Asia. The people's republic of China and India, in particular have become important global suppliers of low-cost, appropriate equipment.

2.13.4 Development of Local Industry:

Developing of local industry for manufacturing equipment is a feasible option and has the advantage of generating alternative employment, reducing dependence on imports, saving foreign exchange and facilitating the supply of parts and services (Ogieva, 2003).

2.13.5 Training and Human Resource Development

Another high priority is to rethink, adjust and increase training and human resource development programmes for the agricultural sector (FAO/GTZ, 2004). Entirely new skill sets are needed, not for the machinery and equipment users, but also for the suppliers and service providers in the entire input supply and output marketing chains. Training needs include not only technical skills, but the development of business and managerial skills. The following are among the highest priorities for human resource development in order to accelerate mechanization. Establish or upgrade training and extension facilities for the users of mechanical equipment, be it manual, animal draught or motorized; Strengthen the entrepreneurial skills of commercial farmers and agro-business managers in Africa for better decision making; Provide technical training for mechanics, technicians and engineers who design mechanical equipment, conduct mechanization, research and supervise mechanization programmes; Provide training to accelerate mechanization which should address the importance of farm financing for machines, implements and draught animals. (FAO/GTZ, 2004).

2.13.6 Research and Development

Research and development is needed to provide sound guidance on mechanization policies and programmes, to increase the pool of appropriate machinery and equipment and to better match mechanical technologies to specific needs of specific farmers and farms in specific locations (Anazodo *et al.,* 1989) The formulation of mechanization strategies and programmes require a systematic approach towards the interdependence between mechanization and specific economic, social and environmental conditions. Singh (1998) reported that an essential area of research for strategy formulation is assessing farm power requirements under different agro-ecological and farm conditions. Experience with the

implementation of mechanization on small farms, medium size commercial farms and through tractor hiring schemes need to be gathered and analyzed with the objective of arriving at good practices to formulate and implement mechanization strategies and programmes.

This survey is targeted at evaluating the level of Mechanization of small scale farmers and the supportive effort put in place by government to enhance and encourage the activities of small scale farmers in the area of mechanized farming,

CHAPTER THREE

3.0. MATERIALS AND METHODS

3.1. Description of the Study Area

Benue State derives its name from the River Benue, the second largest River in Nigeria. The state is located in the middle belt of Nigeria, approximately between latitudes 6.5^0 to 8.5^0N and longitudes 7.5^0 to 10^0E. The State shares boundaries with five states, namely Nasarawa to the North, Taraba to the East, Crossriver to the South, Enugu to the South-West, and Kogi to the West. The South Easthern part of the state also shares boundary with the Republic of Cameroon. The State is also bordered on the North by 280km of River Benue, and is transverse by 202km of River Kastina-Ala in the inland areas. The state has a total area of about 30,955 square kilometers and administratively it is divided into 23 local governments.

Benue State has a tropical climate which manifest two distinct seasons. The rainy season is from April to October, while the dry season is from November to March. Annual average rainfall varies from 1750mm in the Southern part of the state to 1250mm in the North. In the mountain region of kashimbila area average rainfall rises up to 4000m, the hot season comes in mid April with temperatures between 32^0 C and 38^0 C with high humidity. The State stretches across the transition belt between the forest and savanna vegetation. Much of the area consist of undulating hills or grassy open space on the North and derived Savanna in the South.

Benue state is referred to as the food basket of Nigeria because of the boundaries of its agricultural resources. About 80% of the State population is estimated to be directly involved in subsistence agriculture. The state is a major producer of food crops like yam, soyabeans, rice, sorghum, and maize. Other includes cocoyam sweet potatoes, millet, beans cassava and a wide range of other crops like groundnuts ginger and sugar cane. The State is

the only notable producer of soya beans in the country. Tree crops like oil palm, cashew, mango, coconut, bananas and citrus also grow very well in the state. Irrigation farming along the banks of river Benue is becoming a common feature.

Below is a map of Benue State showing locations of the twenty three (23) Local Government Area of the State?

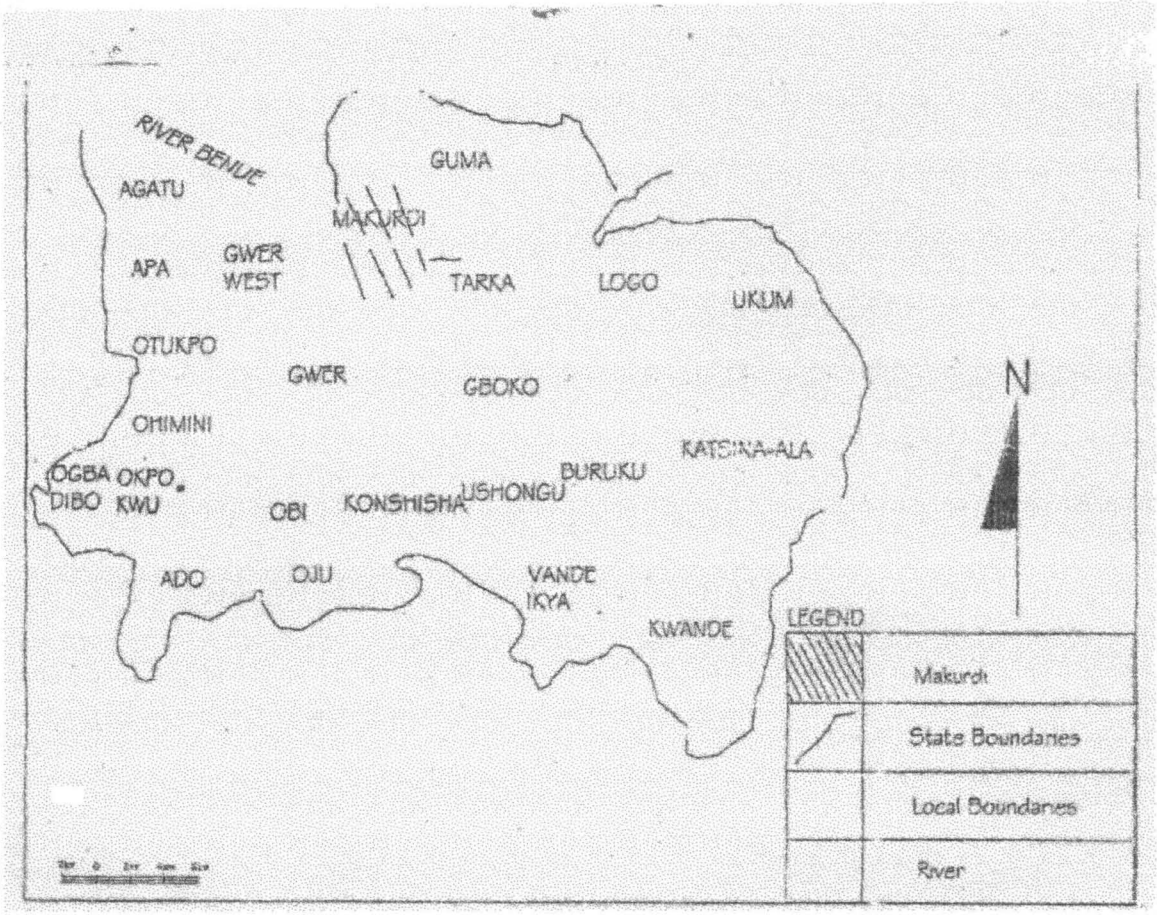


Fig 3.1: Above is a Map of Benue State showing its local Government Areas

3.2. **Methodologies and Data Collection**

In this chapter, attention is drawn to the research method or approach used in collecting the data. The sources of data and interview questions are also looked into in addition to the method of investigation.

Based on the scope of this project which is within the boundary of Benue state, interview questions were distributed to staff and management of the agricultural agencies visited. Also some Local Government Authorities were visited and farmers were interviewed on the method of their farm operations.

3.3 Method of Investigation

For full accomplishment of this research, an investigative approach is being designed to investigate the level of mechanization in crop production in Benue state. Other data collection approach undertaken includes:

i. Physical observation through visit to small scale farmers.

ii. Personal interview, enquiry and discussion with Agricultural Agencies in the State like Benue Tractor Hiring Agency (BENTHA), Benue Agricultural and Rural Authority(BNARDA), Agricultural Development Corporation Ministry of Agriculture.

iii. The examination of existing record.

3.4 Sources of Data

In the course of this research, three major sources were used which were:

3.4.1 Personal Interview

Views granted by some junior, senior, and management of the Agricultural Agencies like Benue Tractor Hiring Agencies (BENTHA) are rate at which tractors are hired or loan out to farmers and the types of tractors needed to carry out different farm operations which is represented in Table 4.1 and Table 4.3, also views granted by Benue Agricultural and Rural Development Authority (BNARDA) include tractor hiring services and hiring plant and vehicle or Equipment which is shown on Table 4.2, and Lower Benue River Basin Development Authority (LBRBDA) granted interview on how irrigation should be carried out on Mechanized farms.

3.4.2 The Use of Questionnaires

This is the major approach in building up this project. Questionnaires were administered on small scale farmers in the two ecological zones of Benue state which are Otukpo and Makurdi zones. The questions for the interview were carefully selected with greater emphasis on the objectives of this study particularly as regards to level of mechanization used in crop production. In addition to the questionnaire, personal interviews were conducted. The questions asked in both the questionnaire forwarded "yes" or "no" answers and answers in short statement and short sentence were also required in some instances.

A sample of questionnaire is attached as Appendix A

3.4.3 The Use of Journals

These are second hand information which are previous work of others. In the course of this project, information was obtained from journals, and textbooks.

3.5 Evaluation of Level of Mechanization

It is calculated for as;

Level of Mechanization on each farm operation:

$$\frac{farms\ involved\ in\ mechanization}{total\ farm\ size\ surveyed} \times \frac{100}{1} \qquad 3.1$$

level of mechanization on total farm operations:

$$\frac{Total\ farm\ size\ surveyed\ (ha)}{Total\ level\ of\ farm\ mechanization} \times 100 \qquad 3.2$$

3.6 Problems Encountered

The most important problem encountered in the course of this work was that of obtaining some of the right information. It was discovered that most of the staff in the Agricultural Agencies were unwillingly to discuss and disclose information which is vital to this research work. Another problem was the level of literacy and language barrier. Many of the farmers

could not complete the questionnaires because of inability to read and write. These problems were however overcome by hiring an interpreter to bridge the language barrier.

CHAPTER FOUR

4.0.RESULTS AND DISCUSSION

4.1.Data from Personal Interviews

Some information and data as it relates to this study/survey was gotten through personal interviews with government agencies on agriculture such as Benue State Tractor Hiring Agency (BENTHA), Benue State Agricultural and Rural Development Agency (BNARDA), and Lower Benue River Basin Development Authority (LBRBDA). Tables 4.1 show the operations and corresponding hiring rates for 2008/2009 cropping season.

Table 4.1: Farming Operations and Hiring

Operations	Rates
Ploughing	₦ 2000/ha
Harrowing	₦ 2000/ha
Ridging	₦ 1500/ha
Trailing	₦ 8000/day/600/hr
Leasing	₦ 6000/hr

Source: BENTHA, 2000

Tractor hiring services are also rendered by the Benue Agricultural and Rural Development Authority (BNARDA) within and outside the state. This is due to the fact that the few individuals operating small-scale farms find it very difficult to engage these services regularly.

The services have undergone several restructuring over the years, however, the primary and operational mode are unchanged. Table 4.2 below shows the hiring rates of plant and vehicle or equipment during the 2008/2009 cropping season.

Table 4.2: Hiring of Plant and Vehicle or Equipment

Operation	Rates	Location
Rig	₦100,000/Bore hole	
Compressor	₦5000/day	
Bulldozer	₦12000/day	Benue State
	₦18000/day	Kogi State
Pay Loader	₦6000/day	Benue State
	₦8000/day	Nasarawa State
Load Loader	₦10000/day	Benue State
	₦15000/day	Kogi State
Grader	₦7000/day	Benue State
	₦10000/day	Nasarawa State
Roller	₦5000/day	Benue State
	₦8000/day	Kogi State
Crane	₦5000/day	Benue State
	₦8000/day	Kogi State
Trailer	₦600/day	Benue State
	₦600/day	Nasarawa State
Tipper	₦2000/day	
Fork	₦3000/day	

Source: BNARDA, 2005

Table 4.3: Types of Machinery Available for Mechanized Operations

Local Government Area	Type	Total Number	Number Functional	Number Non-Functional	
				Refurbishable	Non- Refurbishable
Makurdi	Tractor	49	5	29	20
Gboko	Tractor	29	Nil	12	17
Katsina-Ala	Tractor	32	Nil	25	7
Otukpo	Tractor	22	2	9	11

Source: BENTHA, 2000

Table 4.3 above showed the total number of tractors in Makurdi is 49 with 5 functional tractors, out of which 29 of the tractors can be refurbished and while the remaining 20 cannot be refurbished because it is more expensive to transport out of the country for repairs instead importing new tractors are advisable.

In Gboko, the total number of tractors is 29, out of which 12 can be refurbished and the remaining cannot be repaired here in Nigeria due to inadequate man-power.

Katsina-Ala has 32 tractors in all, of which 25 out of them can be refurbished while the remaining 7 cannot be refurbished.

Otukpo also has 22 tractors in total, of which 9 out of them can be refurbished while 11 cannot be refurbished.

Correlation results showed that only 7 out of the tractors available in Makurdi, Gboko, Katsina-Ala and Otukpo are functional out of the 132 tractors including refurbished and non-refurbished tractors. This shows that more tractors are needed to enhance Agricultural activities.

4.2 Discussion

4.2.1 Animal Traction in Benue State

Agricultural Development Co-operation (ADC) does not lease or hire out its tractor and implements rather they are meant for internal use. The machineries are used to cultivate ADC's farms. The agricultural produce such as maize, soya beans, etc. from the farms are processed into animal feeds; these feeds are fed to livestock. ADC's operations centre on livestock productions which are sold to the public.

The only place that an attempt has been made and practiced made on animal traction in Benue State is at Mbatse in Buruku Local Government Area. The programme was initiated late 1993. The scheme is a World Bank sponsored project; its operations and programmes are organized by Benue State Agricultural and Rural Development Authority (BNARDA). The venture started on small scale in 1994; on the whole, there are fourteen bullocks (castrated bull) used for the various farm activities on the farm; these animals are sourced from Bauchi State, Nigeria.

Prices of these animals are higher than the normal ones (untrained ones) since they are trained to carry out operations on the farm.

Crops predominantly grown there are maize and soyabeans; others are rice and groundnut. Tuber crops such as yams and potatoes are not planted. The bullocks are used for making ridges only; the animals make ridges when in a pair. A pair of bullocks can ridge a good land of about two hectares per day when the animals are properly taken care of and in good health.

4.2.2 Data from Survey Questionnaire

Interactions with small and medium scale farmers via a survey questionnaire (see appendix A) provided useful Data and information which collated cumulatively. Table 4.4 shows an average involvement in mechanization for various farming operation in eighteen (18) data points (farms), which involved a total of one hundred and twelve (112) hectare.

Table 4.4.1: Makurdi Local Government Area

Farms Visited	Farming Operation (Hectares)						
	Maize	Cassava	Millet	Soyabeans	Groundnut	Rice	Yam
1	1	3	1	3			1
2		3	1		1.5		2
3	1.5	1					
4	2			3			2
5	3	2		1			
6		2	2				2
7	2		1		1		
8	1	3	1	2			1.5
9		2	1	1	1	1	

Table 4.4.2: Otukpo Local Government Area

Farms Visited	Farming Operation (Hectares)						
	Maize	Cassava	Millet	Soyabeans	Groundnut	Rice	Yam
1		2	1	3	2		2
2		3		1			2
3	3	1	1				
4		1		2.5			1
5	3	1		1			
6	3	1			1		1
7	1		1		1		
8		2		3		1	1
9	2	1	1			1	1

Table 4.5: Collated Questionnaire Data

Farming Operations	Total Farm Size Surveyed (ha)	Total Data point (farms visited)	Points(farms) Involved in Mechanization	Level of Mechanization (%)
Pre – planting	112	18		
Land clearing			3	16.7
Ploughing/Tillage			10	55.6
Ridging/Mounding			6	33.3
Planting	112	18		
Planting			2	11.1
Post – planting	112	18		
Fertilizer App.			2	11.1
Harvesting			0	0
Processing			12	66.7
Storage			6	33.3
Total				227.8

Irrigation was not put into consideration because small scale farmers are not perennial; they only grow crops during the rainy season and leave the land fallow during the dry season.

From 3.5 Above,

$$Level\ of\ farm\ \ operations = \frac{Total\ farm\ size\ surveyed\ (ha)}{Total\ level\ of\ farm\ mechanization} \times 100$$

$$\frac{112}{16.7 + 55.6 + 33.3 + 11.1 + 11.1 + 0.0 + 66.7 + 33.3} \times 100 = 49.2\%$$

The total data point is evaluated from the total number of small scale farmers interviewed and data collated. The total hectarage and points involved in mechanization is source from the information provided in no.1 of section B and no.3 of section B in the questionnaire respectively.

Figure 4.1 below shows graphical representation of information in Table 4.4.

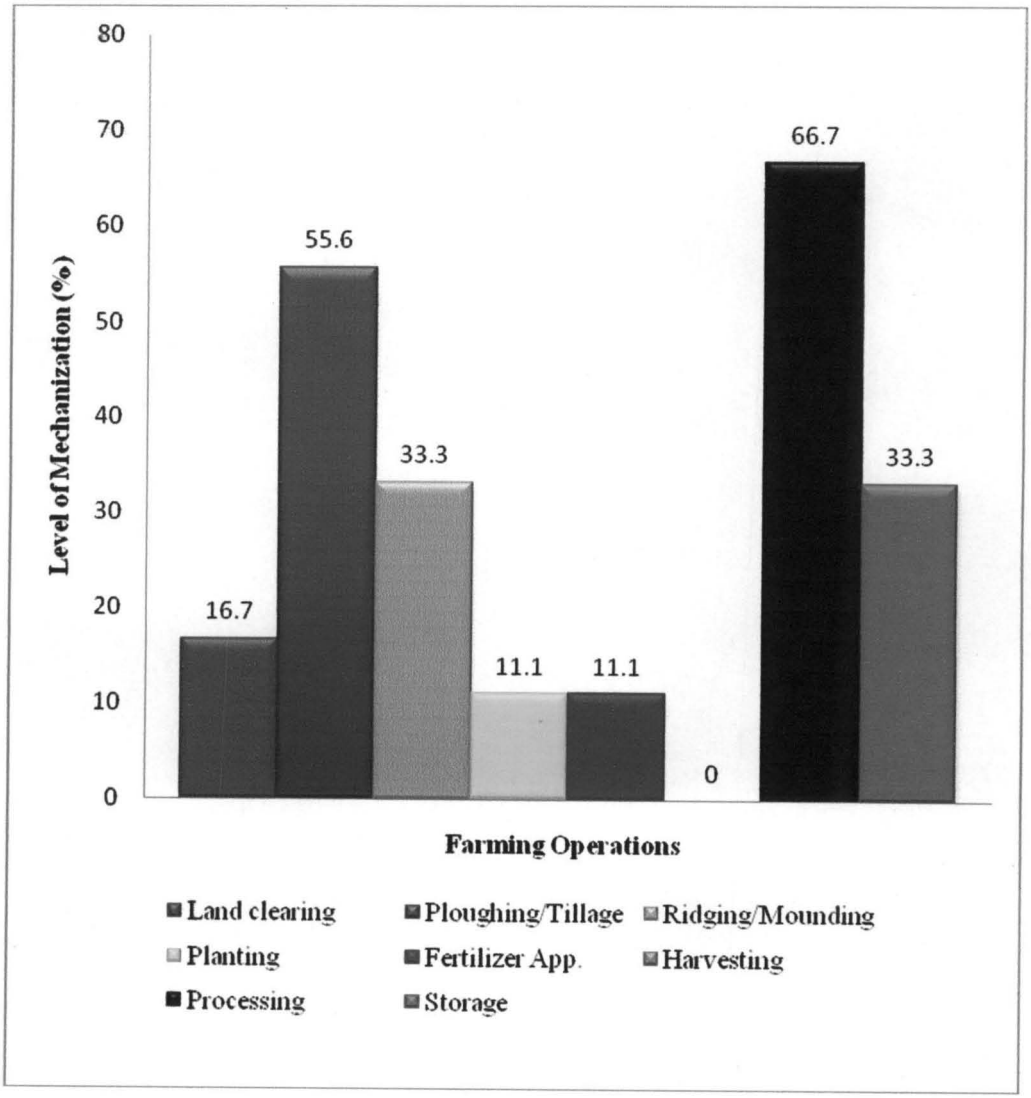


Figure 4.1: Average Level of Mechanization of Small-Scale Farmers in Benue State

From the above Figure, mechanized practiced is average considering the chain of operation in Fig 2.2. From the information gathered in the course of the survey, In the noticed that apart from harvesting which is at 0% mechanized, other farm operation were employed. From the figure, ploughing/tillage and processing was employed in about 50% of farm visited. This is due to the fact that Benue State is composed of a hard compacted soil which would require a mechanical power to break the clods.

Since Mechanization is not employed in harvesting, there will time wasted in harvesting, most crops get spoiled before they are harvested manually hence the yield of the crops will be less when compared with mechanized harvesting. Tilley Gyado Farm in Makurdi and Aha Farm in Atilo Otukpo had employed and made good use of mechanization.

From Table 4.5 above, level of Mechanization was evaluated to be 49.20%

The Figure 49.2% clearly shows that amongst the eighteen farms visited, no farm employs mechanization during harvest while other forms of Mechanization were employed for farm operations. This is due to low literacy level, fear of encountering loses in the involvement of machines and some farmers complained of the type of crop they grow (tubers). The general and major constraint that hinders mechanization of the interviewed farmers is the cost of hiring equipments and lack of government support.

CHAPTER FIVE

5 CONCLUSION AND RECOMMENDATION

5.2 Conclusion

Based on the analysis of data collected from the Research Conducted, it is concluded that the level of mechanization is average (49.2%). In Makurdi and Otukpo Local Government Area, illiteracy and lack of capital inhibit farmers to practice mechanization fully from the research conducted, it will be observed that Government Agencies contributes positively but the cost of service is high, for instance, operating cost for ploughing is 2000/ha, which can not be affordable by most farmers in the rural areas. The survey also looked at the level of mechanization of small scale farmers as it affects the optimum yield of crops since harvesting was not employed, it will take a longer time before crops can be harvested manually and there will be loss in some of the harvested crops due to spoilage which to level of mechanization in harvesting as zero (0%) Mechanization.

5.3 Recommendation

1. Farmers should be well educated through an extension agent on the use of improved agricultural inputs and practices and the application of agricultural machineries in the production of crops.

2. The Government should subsidize the price of hiring Tractors so that the poor can fully engage in full mechanization.

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APPENDIX A

SURVEY QUESTIONNAIRE ON LEVEL OF MECHANIZATION OF SMALL-SCALE FARMERS IN OTUKPO, MAKURDI, BENUE STATE

SECTION A

SOCIO-ECONOMIC CHARACTERISTICS

1. Farm location (Local Government Area)……
2. Name of respondent ……
3. Farm size (If any)……
4. Sex of respondent (Tick appropriately) Male Female
5. What is your age? (Tick were appropriate)

Age (years)	Tick Appropriately
Less than 20	
20-30	
30-40	
40-50	
50 and above	

6. Are you married?

Marital Status	Tick Appropriately
Single	
Married	
Widowed	
Divorced	

7. i. Number of wife/wives……

   ii. Number of children……

   iii. Number of dependent(s)……

   iv. Total number in the household……

8. What is your educational qualification? (Tick were appropriate)

Educational Level	**Tick Appropriately**
Never attend school	
Primary school (Uncompleted)	
Primary school (Completed)	
Secondary school (Uncompleted)	
Secondary school (Completed)	
Higher institute of learning (specify)	

SECTION B

1. What type of crop do you predominantly grow on your farm(s) and of what size is your farm(s). (Fill into the Table below)

Crops Grown	**Hectarage**
i.	
ii.	
iii.	
iv.	
v.	

2. Tractor (Tick the boxes below appropriately)

   i. Available YES ☐

   NO ☐

   i. If Yes, then specify source by ticking the appropriate box shown below

      a. Private ☐

      b. Government ☐

      c. Government and private ☐

3. What farming system (mechanized and non-mechanized) do you practice and to what extent do you averagely employ them in the following operations lettered below. (Write the letter(s) designating the following operations in the appropriate boxes shown below).

   a. Land clearing

   b. Ploughing

   c. Ridging

   d. Mound making

   e. Planting

   f. Harvesting

   g. Processing

   h. storage

Systems of Farming	**Operations**	**Level Employed (%)**
Mechanized		
Non- Mechanized		

4. To what extent do you think your farming operations are mechanized

   a. Full ☐

   b. Average ☐

   c. Below average ☐

   d. none ☐

5. What are your constraints to mechanization (mark if applicable)

   a. Inadequate money

   b. Poor access road

   c. Lack of government's interest to mechanization

   d. Nature of the soil

e. Lack of machinery

f. Lack of operational technique

g. Lack of transportation

h. The topography and relief of the area

i. Others (state below)

_____

_____

6. To what extent has your production improved.

a. Full ☐

b. Average ☐

c. Below average ☐

d. none ☐

7. What is the cost of hiring a tractor in your L.G.A for farm operations (fill the Table appropriately)

Type of Work Done	**Amount (₦)**
Ploughing	
Harrowing	
Ridging	
Harvesting	

8. Accessibility to medical facilities (Tick appropriately)

YES ☐

NO ☐

APPENDIX B

$$Level\ of\ each\ Farm\ Operation = \frac{Farms\ involved\ in\ Mechanization}{Total\ Farm\ size\ surveyed} \times 100$$

a. $Land\ Clearing = \frac{3}{112} \times 100 = 16.7\%$

b. $Ploughing = \frac{10}{112} \times 100 = 55.6\%$

c. $Ridging\ and\ Moulding = \frac{6}{112} \times 100 = 33.3\%$

d. $Planting = \frac{2}{112} \times 100 = 11.1\%$

e. $Fertilizer\ Application = \frac{2}{112} \times 100 = 11.1\%$

f. $Harvesting = \frac{0}{112} \times 100 = 0.0\%$

g. $Processing = \frac{12}{112} \times 100 = 67.7\%$

h. $Storage = \frac{6}{112} \times 100 = 33.3\%$

$$Level\ of\ farm\ \ operations = \frac{Total\ farm\ size\ surveyed\ (ha)}{Total\ level\ of\ farm\ mechanization} \times 100$$

$$\frac{112}{16.7 + 55.6 + 33.3 + 11.1 + 11.1 + 0.0 + 66.7 + 33.3} \times 100 = 49.2\%$$