ANALYSIS OF PROFITABILITY AND RESOURCE USE EFFICIENCY IN CASSAVA FARMING IN BENUE STATE OF NIGERIA

BY

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF SCIENCE DEGREE IN AGRICULTURAL ECONOMICS

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DECLARATION

I hereby declare that this dissertation titled "**Analysis of Profitability and Resource Use Efficiency in Cassava Farming in Benue State of Nigeria"** has been written by me and it is a record of my research work. No part of this work has been presented in any previous application for another degree or diploma at any institution. All borrowed ideas have been acknowledged in the text and a list of references provided.

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CERTIFICATION

This dissertation titled **"Analysis of Profitability and Resource Use Efficiency in Cassava Farming in Benue State of Nigeria"** carried out by **Margaret Alache OKOH** meets the regulations governing the award of the degree of Master of Science in Agricultural Economics of the Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This dissertation is dedicated first and foremost to God Almighty, and then my late parents Mr. and Mrs. Philip Adakole Okoh.

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ABSTRACT

The study was conducted to analyze the profitability and resource use efficiency of cassava farming in Benue State. A multi-stage sampling technique was used to select one hundred and eighty-six (186) cassava farmers from three local Government Areas. Primary data were collected with the aid of structured questionnaire. Descriptive statistics, production function analysis, farm budgeting techniques and multiple regression analysis were employed to analyze the data. The results showed that the mean age of farmers was 46 years. About 72% of the cassava farmers were male. The average household size was 9, average years of farming experience was 15 years and average farm size was 1.28 hectares. The results of the input and output levels used showed that, farm size was about 1.28 hectares, cassava cuttings was about 144 kg/hectare, fertilizer (N.P.K 15:15:15) was about 439.27 kg/hectare, agro-chemical (glyphosate) was about 7.46 liters/hectares and labour was 232.62 mandays/hectares. Average output was 9.15 tonnes of fresh tubers/hectare. The results of the Cobb-Douglas production function analysis showed that all the variables (cassava cuttings, labour, farm size, fertilizer and agro-chemicals) in the model were all important in explaining the variations that occurred in the output of cassava at 51% level of variation. The results of resource use efficiency showed that cassava cuttings and farm size were under-utilized while labour, agro-chemicals and fertilizer were over-utilized. The sum of elasticities coefficient (that is, returns to scale estimate) is 0.824 and this indicates a positive decreasing returns to scale. The net farm income per hectare was ₦59,077 with a return on investment of 0.27. The major constraints faced by cassava farmers in the study area were identified among others to be poor storage facilities, inadequate supply of improved planting materials, and inadequate capital. It was recommended among others, that agricultural policy measures should be taken towards provision of ready market with stable prices for cassava produce through marketing boards. In conclusion, farmers are encouraged to go into cassava farming as it is a profitable enterprise in the study area.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Cassava was introduced into Central Africa from South America in the 16th century by the early Portuguese Explorers (Ohadike, 2007). It was probably the incapacitated slaves who introduced the cassava crop into southern Nigeria as they returned to the country from South America. Cassava however, did not gain importance in the country until the end of the nineteenth century when processing techniques were introduced as many slaves returned home (Odoemenem and Otanwa, 2011). In Nigeria, cassava is grown in all the ecologicalzones; the crop is planted all year round depending on the availability of moisture (Odoemenem and Otanwa, 2011).

Cassava is an important staple food in several tropical African countries, especially in Nigeria where it plays a principal role in the food economy (Agwu and Anyaeche, 2009). Cassava has the ability to grow on marginal lands, especially in drought-prone conditions and in low-fertility acid soils, where cereals and other crops do not thrive (Gobeze et al., 2005 as cited in Obayelu, *et al.,* 2013). Cassava roots can also be stored in the ground (while still intact on the growing plant) for up to 24 months or more, so harvest may be delayed until market, processing or other conditions are favourable (International Institute for Tropical Agriculture, 2009). This comparative advantage over other staples serves to encourage its cultivation especially by resource-poor farmers. According to the Food and Agricultural Organization Statistics (FAOSTAT, 2011), Nigeria is the world's largest producer of cassava with about 37 million metric tonnes and it ranks second after yam in extent of production among the root and tuber crops of economic value in Nigeria.

Benue State is a leading producer of cassava in Nigeria (Benue State Ministry of Agriculture and Natural Resources, 2003). Apart from the ecological support for cassava growth and production, Benue State has mounted deliberate strategies such as distribution of improved cassava varieties to sustain its leading role in cassava production in the country (BMANR, 2003). Cassava is a very versatile crop with numerous uses and by-products. Each component of the plant can be valuable to its cultivator. The leaves may be consumed as a vegetable, or cooked as a soup ingredient or dried and fed to livestock as a protein feed supplement. The stem is used for plant propagation andgrafting. The roots are typically processed for human and industrial consumption. Cassava is traditionally consumed by processing the fresh roots into *garri, fufu,* and *flour* (Adebayo *et al*., 2003a; Adebayo *et al.,* 2003b). Data from the Collaborative Study of Cassava in Africa (COSCA) show that 80% of Nigerians in rural areas eat a cassava meal at least once weekly (Nweke *et al*., 2002).

1.2 Problem Statement

The problem of declining crop productivity in Nigeria is important (FACU, 1992; FDA, 1993 and 1995, as cited in Ukoha *et al.*, 2010). The agricultural problem in Nigeria relates to the inefficiency with which farmers use resources on the farms (Bamidele *et al.,* 2008). It also borders on how the various factors that explain farm efficiency could be determined through research so as to improve cassava production in the country (Bamidele *et al.,* 2008). Farmers' output must therefore be expanded with existing levels of conventional inputs and technology to meet the increasing demand for cassava.

Cassava farmers in Nigeria are small-holders characterized by very low level of productivity (Bamidele *et al.,* 2008). These smallholder and traditional farmers who use

rudimentary production techniques, with resultant low yields, cultivate most of this land. They are also constrained by many problems including poor access to markets, land and environmental degradation and inadequate research and extension services (Manyong *et al.*, 2005).

Simonyan *et al*. (2010), as cited in Nandi *et al.* (2011) stated that Nigerians are poor and hungry despite efforts made by various governments in improving agricultural productivity and efficiency of the rural farmers who are the major stakeholders of agricultural production. Given the various government programmes such as the National Accelerated Food Production Programme (NAFPP), Operation Feed the Nation (OFN), the Agricultural Development Projects (ADPs), Cassava Multiplication Programme (CMP), and Root and Tuber Crop Expansion Program (RTEP), implemented over the years to raise farmers' efficiency and productivity in cassava farming, productivity for cassava is still low. For example, the actual yield of cassava ranges between 8 and 15 tonnes per hectare, compared to a potential yield of 30 tonnes per hectare – a yield gap of 275 and 100 percent respectively (FAO, 2011 as cited in IITA, 2015). And also, given the increasing interest of more nations in buying cassava products from Nigeria, the prospects for enhanced foreign exchange is becoming high (Ogisi and Alimeke, 2013). It then becomes necessary to economically analyze the profitability and resource-use efficiency of cassava farmers. This study seeks to find answers to the following research questions:

i. What are the socio-economic characteristics of cassava farmers in the study area?

ii. What are the costs and returns for cassava farming in the study area?

iii. What is the technical relationship between inputs and output in cassava farming in the study area?

iv. How efficiently are resources used by cassava farmers in the study area?

v. What is the relationship between cassava farmers' socio-economic characteristics and their output?

vi. What are the elasticities of production and returns to scale for cassava farming in the study area?

vii. What are the major constraints faced by cassava farmers in the study area?

1.3 Objectives of the study

The main objective of this study is to evaluate the profitability and resource-use efficiency in cassava farming in Benue State, Nigeria. The specific objectives are to:

i. describe the socio-economic characteristics of cassava farmers in the study area.

ii. estimate the costs and returns of cassava farming in the study area.

iii. estimate the production function for cassava farming in the study area.

iv. determine the resource use efficiency in cassava farming in the study area.

v. determine the relationship between cassava farmers' socio-economic characteristics and their output.

vi. estimate the elasticity of production and returns to scale in cassava farming in the study area.

vii. identify and describe the major constraints faced by cassava farmers in the study area.

1.4 Research Hypotheses

The hypotheses put forward for this study are:

i. There is no significant relationship between the cassava farmers' socio-economic characteristics and their output.

ii. Cassava farming is not a profitable enterprise in the study area.

iii. Resources are not efficiently used by cassava farmers in the study area.

1.5 Justification for the Study

Agricultural productivity, growth and resource-use efficiency are the core elements of sustainable crop production as inefficient use of inputs can endanger food availability and security (Udoh *et al.,* 2006).

It is clear that the rural sector consisting of farm families, offer great potential for employment generation for the teeming population. However, this potential will not be achieved if productivity and efficiency are not increasing within the rural sector. In achieving this within the rural sector, particularly among small-scale farmers, a good knowledge of the current efficiency or inefficiency inherent in the sector as well as factors responsible for this level of efficiency or inefficiency is required (Amos, 2009).

The results of this study will be of immense benefit to the farmers and other stakeholders in the agricultural industry, as it will help highlight those variables that could be better managed to improve the productivity of cassava farming. The results of this study will also guide policy makers in making policies for the improvement of the welfare of cassava farmers, which will give room for the expansion of cassava production.

It will also provide relevant data for governments to address problems relating to cassava production in Benue State and the country as a whole.

The results will also elicit interest by students who will carry out further research on cassava production.

CHAPTER TWO

LITERATURE REVIEW

2.1 Nigeria's Cassava Production Trend

Cassava is one of the most important crops in Nigeria. Indeed, cassava is grown by almost every household. It is the most widely cultivated crop in the Southern part of the country in terms of the area of land devoted to it (that is, 59% of the total area under cultivation), while in the northern part of the country, the area under cultivation is 40% (Okoro and Ujah, 2009). It has also increased in importance in the Middle Belt in recent years.

FAOSTAT (2014) showed that Nigeria is the largest producer of cassava in the world with a production of 32, 010,000 metric tonnes in 2000. There was also an increase from 32, 068,000 metric tonnes in 2001, to 34, 120,000 metric tonnes in 2002, production further increased from 36,304,000 metric tonnes in 2003, to 38,845,000 metric tonnes in 2004, there was a further increase to 41,565,000 metric tonnes in 2005, production yet increased to 45,721,000 metric tonnes in 2006, but declined to 43, 410,000 metric tonnes in 2007, an increase of 44, 582, 000 metric tonnes was witnessed in 2008, it then declined to 36, 822,250 metric tonnes in 2009, but increased to 42, 533, 180 metric tonnes in 2010, further increased to 46,190,250 metric tonnes in 2011, increased to 50,950,291 metric tonnes in 2012 and 53, 000, 000 in 2013 (Table 2.1).

Table 2.1: Nigeria's Cassava output from 2000 to 2013

Year of Production	Output(Metric Tonnes)
2000	32010000
2001	32068000
2002	34120000
2003	36304000
2004	38845000
2005	41565000
2006	45721000
2007	43410000
2008	44582000
2009	36822250
2010	42533180
2011	46190250
2012	50950291
2013	53000000

Source: FAOSTAT, 2014

2.2 Importance of Cassava production

Cassava gained prominence in Nigeria in the year 2002 following the pronouncement of a Presidential initiative on Cassava production and export (Adebayo, 2009). The initiative was aimed at using cassava production as the engine of growth in Nigeria (Bamidele *et al.*, 2008). Based on this, the Federal Government of Nigeria promulgated a law, making it mandatory for bakers to use composite flour made up of 10% cassava and 90% wheat for bread production in Nigeria. This new regulation, which came into effect in January 2005, stipulated that the large flour mills that supply flour to bakeries and confectioneries must mix cassava flour with wheat flour (CTA, 2005, as cited in Bamidele *et al.*, 2008).

In Nigeria, as in most other developing countries, cassava is one of the most important carbohydrate sources. A large population of Nigerians depends on cassava daily as their main food in the forms of *garri* and *fufu.* The leaves of cassava are also consumed as

vegetable, and contain appreciable amounts of proteins, minerals and vitamins (Nandi *et al.*, 2011).

Cassava is important not only as a food crop but as a major source of animal feed. Its use in the industry for production of livestock feed is not well known, but is gradually increasing especially as import substitution becomes prominent in the industrial sector of the economy (FMANR, 2000).

As a cash crop, cassava generates cash income for the largest number of households in comparison with other staples. According to Nweke (2004), cassava is also less expensive to produce. It tolerates poor soil, adverse weather conditions, and pests and diseases more than other major staples. Cassava stores its harvestable portion underground until needed; it is therefore a classical food security crop (Asogwa *et al.*, 2006).

Every part of cassava is useful. As noted by Nweke (2004), the roots are processed and prepared as a subsistence crop for home consumption and for sale in village markets and urban centres. Cassava is also one of the richest fermentable substances for the production of alcohol. Cassava produces much more alcohol (150 litres/tonne of fresh roots) than sugarcane (48 litres/tonne) but has been used as a source of raw material for brewing alcohol without much success in Nigeria (Bamikole, 2002, Bamikole, 2003 as cited in IITA, 2004). A distillery using cassava to produce alcohol can operate all year round because cassava is always available.

Nweke *et al.* (2002) maintained that cassava performs five main roles: famine reserve crop, rural food staple, cash crop for urban consumption, industrial raw material and foreign exchange earner.

2.3 Socio-economic characteristics of farmers influencing agricultural productivity

The socio-economic characteristics of farmers are known to have influenced their productivity. This is reviewed further:

2.3.1 Age

A study carried out by Nandi *et al.* (2011) found that farmers within the ages of 30 – 59 were more productive than farmers who were 60 years and above because they are still active and very energetic. Udoh *et al.* (2006) found that the age of farmers positively affected their technical efficiency. They noted that as the farmers advanced in age, their expertise in combining resources and curtailing wastage increases thereby leading to increased technical efficiency.

2.3.2 Farming experience and crop productivity

Years of farming experience is another factor that influences productivity among farming households in Nigeria. Farmers with more of years of farming experience have been observed to have higher farm outputs than those with lesser years of farming experience (Udoh *et al.,* 2006). Older farmers with more years of farming experience have also been observed to have higher productivity than younger farmers, with fewer years of farming experience. For example, Ajibefun and Abdulkadri (2004) and

Ajibefun *et al.* (2002) observed that productivity in the humid forest and moist savannah agro-ecological zones of Nigeria was positively associated with more experience in farming. This is so because, the farmers tend to have acquired more skills and trainings as they spend more years in production which culminates in increased productivity.

2.3.3 Gender

Although women are less productive in farming because of their relatively limited access to factors of production than men, the general consensus is that they are no less efficient than men in their use of resources. Saito *et al.* (1994) in a study in Kenya found that the gross value of output per hectare from male-managed plots was 8 percent above that of female-managed plots. They further noted that if women were to use the same resources as men, their productivity would increase by about 22 percent.

Nweke *et al.* (2002) found that women's labour inputs for production, harvesting, transport and processing of cassava are very substantial and were on the increase. They suggested that targeted policies with regard to credit, gender-sensitive extension services and technological and institutional changes geared towards women would further increase cassava output.

A study carried out by Okoye and Ukoha (2008) in Imo State showed that women were more labour-productive than their male counterparts in cassava production because the women tended to manage their resources more efficiently than the men.

2.3.4 Education

The need for education in agriculture cannot be overstressed since the level of education of a farmer not only increases his productivity but also enhances his ability to

understand and evaluate new production techniques (Amanze *et al.*, 2010). Findings of studies by Ajibefun and Abdulkadri (2004) and Ajibefun et al. (2002) showed that education was key to enhanced productivity among farming households in Nigeria and in New England. This is because good education propels farmers to adopt new innovations and technologies that are vital to enhancing farm productivity. Bamidele *et al.* (2008) also noted that when farmers are educated, they would appreciate improved technologies and even use them appropriately in order to enhance their output of cassava. Adeyemo *et al*. (2010) revealed that education will obviously improve the efficiency of farmers as it will enable them to access improved technologies and select the best available ones, thereby increasing their level of output.

2.3.5 Farm size

Onubuogu *et al.* (2014) observed that farmers are mainly smallholder farmers operating on less than or equal to 1.5 hectares of farmlands. This could be attributed to predominant land tenure system or due to the increasing population. They also found that large farm size increases agricultural productivity and improves farmers' technical, allocative and resource use efficiency. Okike (2006) reported that farm size contributed positively to cassava farming. Indicating that cultivation of larger hectare of land leads to increase in cassava output.

2.3.6 Labour

Ogundari *et al.* (2006) noted that labour is a significant factor that influences changes in crop output. Hence, if labour is increased, cassava output will also increase.

Ajibefun and Abdulkadri (2004), Ajibefun et al. (2002), Amaza and Olayemi (2002), Ogundele and Okoruwa (2006), and Dittoh (1991) all assessed how labour affected farm productivity by using analytical tools such as the Cobb-Douglas production function, the normalized profit function approach, and the stochastic frontier production function model. Amaza and Olayemi (2002), and Dittoh (1991) observed that the use of hired labour reduced output of cassava when not properly utilized in the sense that it will only lead to an increase in the cost of production without commensurate addition to the output.

Ajibefun and Abdulkadri (2004), Ajibefun et al. (2002), and Ogundele and Okoruwa (2006), however, found that hired labor contributed positively to farm output.

2.3.7 Access to fertilizer, agro-chemicals and improved planting materials

Access to fertilizer, agro-chemicals and improved planting materials has proven an important driver of agricultural production among farmers. In their study of the determinants of total factor productivity among small-holder cassava farmers in Abia state, Ukoha *et al.* (2010) found that an increase in fertilizer use will bring about a higher output. Using the stochastic frontier model, Ogundele and Okoruwa (2006) observed that the use of fertilizer increased the agricultural productivity of crop farming in the dry savannah and humid forest agro-ecological zones of Nigeria.

Ogundele and Okoruwa (2006) also found that the use of herbicides had a positivecorrelation with technical efficiency or productivity of farmers.

2.3.8 Household size

Shehu *et al.* (2007) in their study on productivity and technical efficiency of small-scale rice farmers in Adamawa State of Nigeria found that the coefficient of household size was positive (0.155), meaning that increases in household size led to increases in

technical inefficiency. That is, as number of people in a household increases, household consumption expenditure increases, thereby making little money available for purchase of necessary farm inputs and meeting other farm financial obligations, which consequently results in decreased farm output. Obinne (1989) as cited in Amanze *et al.* (2010) argued that large household sizes in some cases are advantageous because labour may be easy to getat affordable rates, hence an increase in output. In a similar view, Awoniyi *et al.* (2009) also noted that large household sizes assistin providing family labour for cassava farmers, thus leading to a more efficient use of resources and higher output.

2.3.9 Extension contact

The findings of studies by Apata *et al.* (2008) revealed that there was a significant relationship between contact with extension services and adoption process of cassava farmers, indicating that the more the cassava growers have access to extension facilities, the higher their adoption of improved cassava technologies which would lead to a higher farm output. Asogwa *et al.* (2006) noted that extension contacts are significantly and positively relatedwith the technical efficiency of cassava farmers. Increased extension contacts would lead to more knowledge on improved cassava technologies, which will in turnhave a strong influence in increasing cassava output.

2.3.10 Off-farm income

Off-farm incomes create positive spillover effects on farm incomes as these off-farm incomes help defeat market failures in agriculture, particularly for credit issues as the farmers have other sources of income apart from farming activities (Janvry *et al.*, 2005). Nandi *et al.* (2011) in their research found that off-farm income was inversely related to

cassava output, meaning that as non-farm income increases, cassava output decreases. They further noted that as the farmer generates more income from other activities, his concentration on cassava farming reduces, thereby decreasing output.

2.4 Production Function Analysis

In any production process, inputs are converted to outputs. What is put into the production process comes out as either a product or in the form of a waste (Olukosi and Ogungbile, 1989). In agriculture, the physical inputs which we deal with are usually land, labour, capital, management, and of recent, water resources. These resources can therefore, be organized into a farm-firm or a producing unit, whose ultimate objectives may be profit maximization, output maximization, cost minimization, or a combination of all these motives of enterprise (Olayide and Heady, 1982).

In its simplest form, a production function stipulates the technical or physical relationship between inputs and outputs in any production process. There are various functional forms that can be used in a production function analysis, depending on the problem at hand and the assumptions made in determining the suitable functional form to use (Sankhayan, 1988). Production functions may be estimated either by using the single or simultaneous equations (Sankhayan, 1988). However, most studies on farm productivity have used the single equation approach and Ordinary Least Squares (OLS) estimating procedures (Sankhayan, 1988).

In mathematical terms, a production function is assumed to be continuous and differentiable. Its differentiability enables a production economist to establish the rates of return, marginal physical productivity (MPP) of inputs, rates of technical substitution (RTS) of one input for another and elasticities of production with respect to each of the inputs. A production function is expressed mathematically as:

$$Y = f(X)$$

Where:

Y = output, and

X = input.

That is, output is a function of input.

2.4.1 Production functions commonly used in crop production studies

According to Ekpebu (2002), as cited in Akighir *et al.* (2011), there are many functional forms that could be used to describe production relationships, but in practice, the commonly used forms are linear, quadratic and Cobb-Douglas functional forms.

i) The linear production function: this is used to measure linear relationships between inputs and outputs. For two variable inputs, the function can be mathematically expressed as: $Y = a + b_1X_1 + b_2X_2$

Where:

Y = output,

X_1 and X_2 = variable inputs,

b_1 and b_2 = the parameters to be estimated and they determine efficiency of the inputs on output, and a= constant.

According to Kalaitzandonakes *et al.* (1992), as cited in Akighir *et al.* (2011), the linear function is not a good measure of an optimum production because the coefficients assume constant marginal productivity.

ii) **The quadratic production function:** this is used to measure the direct effects of inputs on output (Olayide and Heady, 1982). For two-variable inputs, the quadratic function can be expressed as:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_1^2 + b_4X_2^2 + b_5X_1X_2$$

Where:

Y = level of output,

X_1 and X_2 = variable inputs,

b_1 and b_2 = the measure of the direct effect of the level of inputs on output,

b_3 and b_4 = the measure of the rate of change , b_5 = the coefficient of interactive effects, and

a = constant term.

The quadratic production function has the advantage of being differentiated twice thus making it possible for first and second condition for optimization to be established (Olayide and Heady, 1982). Akighir *et al.* (2011) pointed out that the quadratic function can never show both marginal product at low levels of inputs and decreasing marginal product at higher levels of input in the same equation.

iii) **The Cobb-Douglas production function:** this functional form is the most widely used in data analysis than the linear and quadratic functions (Akighir *et al.*, 2011). For two-variable inputs, the Cobb-Douglas function can be expressed as:

$$Y = b_0 X_1^{b1}. X_2^{b2} U$$

Where;

Y = level of output,

b_0 = constant,

X_1 and X_2 = variable inputs, and

$b_1$and b_2 = coefficients of variable inputs,

U = error term

Upton (1979), as cited in Akighir *et al.* (2011), observed that the Cobb-Douglas production function cannot show both increasing and diminishing marginal productivity in a single response curve and as a result, it does not give a technical optimum and may lead to the over estimation of the economic optimum.

Akighir *et al.* (2011) stated that despite these disadvantages, researchers still find the Cobb-Douglas production function useful in analysis of surveys, where many variable inputs are involved and it is necessary to measure returns to scale, intensity of use of factors of production and overall efficiency of production. They also stated that the Cobb-Douglas production function is used more than the other two because it satisfies the economic, statistical and econometric criteria of many studies than the others.

2.5 Agricultural Productivity and Resource use Efficiency

Productivity is seen as a measure of the efficiency of all resources put to use in any farming operation (Udoh *et al.,* 2006). Productivity could as well be measured in terms of marginal physical product (MPP) in which case, the interest is in the addition to total product resulting exclusively from a unit increase in the use of an input (Udoh *et al.,* 2006).

Agricultural productivity may be defined in general terms as the ratio of the value of total farm outputs to the value of total inputs used in farm production (Olayide and Heady, 1982). Since one of the main objectives of any society is the attainment of an optimally high standard of living with agiven amount of effort, any increase in productivity of resources employed in farm production amounts to an increase in the standard of living (Oni *et al.,* 2009). Increases in agricultural productivity will, therefore, contribute to the well-being of the economy asa whole. According to Oni *et al.* (2009), the ultimate objective ofthe interest of economists in productivity should be that of finding ways of increasing output per unit of input, and of attaining desirable inter-firm, intra-firm, and inter-sector transfers of production resources, thereby providing the means of raising the standard of living.

A meaningful assessment of productivity depends upon a clearand precise definition of inputsand outputs in such a way that their movements over time are not equal (Oni *et al.,* 2009). Determining which inputs and outputs are consistent withthe particular concept of productivity in question is important. Sometimes one is faced with separate and distinct conditions when measuring labour, capital, land, or management productivity (Oni *et al.,* 2009). In other words, resource productivity may be defined in terms of an individual resource input or in terms of a combination of such inputs. Thus we shall define labour productivity as the ratio of total output to labour inputs.

Similarly, “land”, “capital”, “water” and “management” productivities can be defined as the ratio of total output to inputs of land, capital, water and management respectively. Maximum resource productivity implies obtaining the maximum possible output from the minimum possible set of inputs (Oni *et al.,* 2009). Optimal productivity of resources implies an efficient utilization of resources in the production process (Oni *et al.*, 2009). This means that productivity and efficiency are inseparable (Olayide and Heady, 1982).

Efficiency is a very important factor of productivity growth especially in developing agrarian countries where resources are meagre and opportunities for developing and adopting better technologies are dwindling (Adeyemo *et al.*, 2010).

Olukosi and Erhabor (1989) referred to efficiency as the quantity of output (Y) per unit of input (X) used in the production process. That is, the average physical productivity (APP).

Symbolically, efficiency is shown as APP = Y/X

Where: Y = quantity of output, and X = quantity of inputs.

Farrel (1957) defined efficiency in three related terms. First, he defined “technical efficiency” as the measure of a farms’ success in producing maximum output from a given set of inputs. This indicates all undisputed gains that can be obtained by simply organizing management better. A farm is said to be technically efficient if it can increase output without changing its input level and/or can achieve the same output with fewer inputs. Secondly, he defined “price or allocative efficiency” as the measure of a farm’s success in choosing an optimal set of inputs. This is an indication of the gains that can be obtained by varying the input ratios on certain assumptions about the future

price structure. An efficient level of output will be generated at minimum possible cost using the most appropriate technology with the least cost input mix. Thirdly, he defined "overall or economic efficiency" as the simple product of the technical and allocative efficiencies. Hence, in order to be economically efficient, a firm must be both technically and allocatively efficient.

According to Mesike *et al*. (2009) as cited in Akighir *et al.* (2011), one of the strategies for increasing agricultural production is a combination of measures designed to increase the level of farm resources as well as make efficient use of the resources already committed to the farm sector. Obayelu *et al.* (2013) stated that resource use efficiency is generally associated with possibility of farms producing a certain optimal level of output from a given bundle of resources or a certain level of output at least cost.

2.6 Farm Profitability Analysis

Costs and returns usually form the basis for farm profitability analysis. This involves itemizing the costs and returns of production and using them to arrive at such estimates as the gross margin and the net farm income.

2.6.1 Production costs

According to Olukosi and Ogungbile (1989), production costs are generally of two types: the fixed and variable costs. Fixed costs are those costs incurred on fixed inputs which do not change as production changes. Examples are buildings, fences, land, hoes and cutlasses. Variable costs are those costs that relate directly to the level of production. These are costs incurred on variable inputs such as, seeds, fertilizer, feeds,

labour, agro-chemicals and capital. Total costs of production are usually obtained by summing up the total fixed and variable costs of production.

2.6.2 Gross revenue

Revenue is defined as the income accruing to the producer and can be measured on per unit input or per unit output basis (Olukosi and Ogungbile, 1989). It is also measurable in total, average or marginal quantities. These are obtained by multiplying the physical quantities of output by the unit price of output. That is,

TVP = TPP* Py

MVP = MPP*Py

AVP = APP*Py

Where:

TVP = total value product (Naira/ha),

MVP = marginal value product (Naira/ha),

AVP = average value product (Naira/ha),

Py = unit price of output (Naira),

TPP = total physical product,

MPP = marginal physical product, and

APP = average physical product.

2.6.3 Gross margin

Gross Margin (GM) is one of the budgeting tools used in evaluating the costs and returns of a firm. Gross margin analysis, according to Olukosi and Erhabor (1988) involves evaluating the efficiency of an individual enterprise or (farm plans) so that comparison can be made between enterprises or different farm plans. It is useful where

the value of the fixed cost is negligible as is the case in subsistence agriculture. It is usually expressed as Gross Income or Total Revenue (TR) minus Total Variable Cost (TVC).

Gross Margin is expressed thus: GM = TR - TVC

2.6.4 Net Farm Income (NFI)

Net farm income is a budgeting tools used in evaluating the costs and returns of a farm (Olukosi and Erhabor, 1988). Unlike the Gross Margin, it takes into account fixed costs of production. The Net Farm Income is defined as Total Revenue (TR) minus Total Cost (TC).

Net Farm Income is given as: NFI = TR - TC

2.7 Constraints Associated with Cassava Farming

Cassava farmers face a lot of difficulties and these affect their productivity and ability to use resources efficiently. The constraints in cassava production include a wide range of technical, institutional and socio-economic factors (FMANR, 2000). These includes pests and diseases, use of low-yielding varieties,and low soil fertility, lackof access to improved planting materials, poor access to markets, lack of improved post-harvest processing and storage facilities, inefficient or ineffective extension delivery systems, poor access to financial services, labor shortage due to migration to urban centres, and poor health (FMANR, 2000).

2.7.1 Pests and diseases

The major pests which attack cassava include the mealy bug, green spider mite (GSM), white flies and the large grain borer (which attacks dry chips of cassava in storage). In Nigeria, the major diseases of cassava include cassava mosaic disease (CMD), cassava bacterial blight (CBB), cassava root and stem rots, cassava anthracnose disease and *Cercospora* leaf diseases (Hillocks and Wydra, 2002). White ants (termites) destroy stems that are planted before they sprout, thereby reducing the output of cassava. The menace of rodents is a regular occurrence in the field where cassava is planted (FMANR, 2000). These pests and diseases pose a threat to Nigeria's cassava production and can create a food crisis in the world's largest cassava-producing nation, if immediate preventive measures are not taken. Any reduction in cassava production will have a huge negative effect on the Nigerian economy and on the lives of the millions of Nigerians for whom cassava is the major starchy staple food (IITA, 2004).

2.7.2 Use of low-yielding varieties

The local varieties of cassava used by most farmers often yield less than 10tonnes per hectare (FMARD, 2003). These local varieties are also susceptible to pests and diseases, yet consumers and processors still prefer them for specific uses because they are readily available when needed and less expensive to purchase (FMANR, 2000).

2.7.3 Low soil fertility

This is a major problem in many cassava-growing areas as fallow periods have become shorter due to pressure on arable land resulting from increasing population. For example, the soils in the humid zone of southern Nigeria are nutrient-deficient because of high acidity and very low reserves of primary minerals. For example, to obtain a yield of over 30 tonnes/hectare, 164 kilogrammes of nitrogen, 31 kilogrammes of

phosphorus, 200 kilogrammes of potassium, 80 kilogrammes ofcalcium, and 31 kilogrammes of magnesium are removed from the soil at harvest (Asher,1980, cited in IITA, 2004). Applying soil amendments such as inorganic and organic fertilizers can solve the problem of low soil fertility. But this technical fact seems not to be economically feasible under the circumstances of most cassava farmers because they are smallholder farmers (FMANR, 2000).

2.7.4 Lack of access to improved planting materials and other inputs

Although improved cassava varieties with high yield potentials have been developed for cultivation in Nigeria, the national average on-farm yields are still low (FMARD 2003). The yield stability of cassava is highly dependent on the quality of planting materials, and there is evidence that the initial use of healthy cuttings is a very important factor in the subsequent attainment of good yields. Conversely, cuttings with low vigor and infested with pests and diseases often limit cassava production. Ogundari *et al.* (2010) in their research found that most farmers were forced to substitute labour for pesticides or herbicides for basic post-planting operations such as weeding on the farms. This was due to the high cost of inputs such as fertilizers, seeds, agro-chemicals and herbicides.

2.7.5 Poor access to markets

Marketing can be a problem for rural farmers, especially those living in villages with poor feeder roads and may not have resources to transport their commodities to the market. Typically, rural farmers transport cassava on their heads, on bicycles, or in lorries. With poor market access, marketing cassava can be particularly problematic

because of its bulky nature, especially as unprocessed roots. Poor roads also make the movement of goods and people difficult, particularly during the rainy season. The roads linking the major towns are usually quite good but the rural feeder road networks are poorly developed or absent in some places. This has significant implications for marketing, cost of inputs, access to health facilities and other social services, and has adverse effects on cassava output and therural standard of living (IITA, 2004).

2.7.6 Lack of improved post-harvest processing and storage facilities

Freshly harvested cassava roots are bulky and the shelf life rarely exceeds 2 days after harvesting due to enzymatic reactions. The bulkiness and high perishability of harvested roots call for immediate processing of the harvested roots.

Simple processing like pounding, grating or chipping are essential for detoxifying the tuberous roots, and allowing farmers or processors to convert the highly perishable cassava roots into dry, stable, and safer products. Processing also adds value to cassava and extends the shelf life by converting freshly harvested roots into a freely traded commodity (IITA, 2004).

The present cassava-processing methods are highly labor-intensive and expensive. One of the principal constraints to cassava processing is the absence of efficient dryers, peeling machines, and storage facilities (IITA, 2004). Because of this, cassava is used mainly for consumption.

2.7.7 Poor extension delivery systems to farmers

The present extension delivery system in Nigeria is ineffective. The Agricultural Development Programmes (ADPs) are responsible for extension delivery at every State level. For most of the ADPs, the target ratio of extension agents to farmers of 1: 1000 could not be realized due to problems ranging from underfunding to the non-availability of adequate and appropriately trained personnel. This has had a negative impact on the effectiveness and coverage of the various cells/circles in a given locality (FMANR, 2000). There is also the problem of shortage of human resources necessary to implement the Training and Visit extension management system. Another problem is the defect in the use of contact farmers. In principle, contact farmers are expected to have multiplier effects on the adjacent farmers. However, the contact farmers selectively adopt recommended practices and are often unrepresentative of the general farming population (FMANR, 2000). Only a few contact farmers are able to pass on the information to other farmers on a regular basis, which means that only a few farmers are being exposed to new technologies.

2.7.8 Poor access to financial services

The inaccessibility of small-scale farmers to credit is a major constraint to agricultural growth and development. Their personal savings are low and disposable incomes are grossly inadequate to finance farm activities. The majority of the farmers lack access to formal credit sources. These farmers do not borrow from commercial banks because of high interest rates as well as their lack of tangible collateral (IITA, 2004). A study by Okoh (2008) revealed that small-scale farmers faced a lot of constraints when trying to acquire credit from the formal credit sources due to the following reasons: lack of tangible assets to use as collateral for credit, lack of knowledge about formal credit availability and long loan-processing time of financial institutions.

2.7.9 Labour shortage

Shortage of labour is a major impediment to agricultural growth. This problem is mainly caused by high levels of urbanization in the country as the young and able-bodied youths leave the rural areas to seek for white-collar jobs in the urban areas. The quality of labor available in the rural area is low because it is mainly provided by old people and children (IITA, 2004). Diseases such as malaria and the HIV/AIDS epidemic affect the quality of labour and subsequently contribute negatively to the productivity and efficiency of farmers.

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study Area

This study was conducted in Benue State of Nigeria. Benue State derives its name from the River Benue, which is the second largest River in Nigeria. Benue State is located in the North-Central geo-political zone. The State lies between latitudes $6^0$30 North to 8^0 10 North of the equatorand longitudes 6^0 35 East to 10^0 East of the Greenwich Meridian (Okwu *et al.,* 2011). The State shares boundaries with five States, namely, Nasarawa to the North, Taraba to the East, Cross River to the South-East, Enugu to the South-West, and Kogi to the West. The Southern part of the State also shares boundary with the Republic of Cameroun.

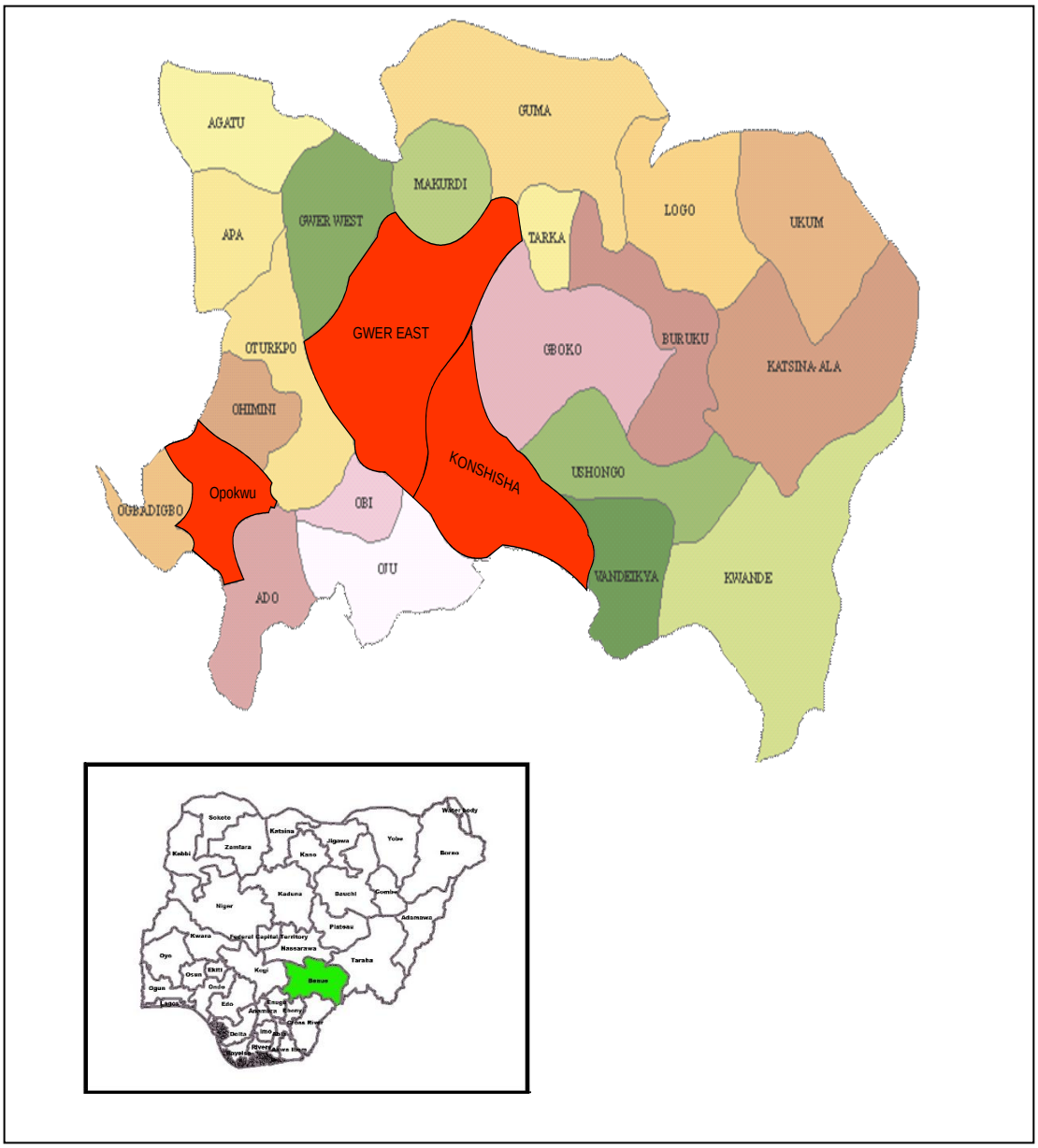
Benue State has an estimated population of about 4, 353, 228 people, using a population growth rate of 3.2% based on the 2006 population Census (NPC, 2006). Benue State occupies a land mass of 33,955Square kilometers. Benue state is made up of twenty-three (23) Local Government Areas with Makurdi as its capital. It is divided into three agricultural zones; namely, Zone A (Eastern Zone) with seven (7) local governments, Zone B (Northern Zone) with seven (7) local governments and Zone C (Central Zone) with nine (9) local governments. There are three (3) Agricultural Development Projects (ADP) zones in the state, with headquarters in Adipko (Zone A), Gboko (Zone B) and Otukpo (Zone C) respectively. Tiv, Idoma and Igede are the major languages spoken in the State. Benue State possesses a rich and diverse cultural heritage which finds expression in colourful cloths, exotic masquarades, music and dances.

Benue state has a tropical climate, with two distinct seasons, namely, the rainy season from April to October and the dry season from November to March. Average annual rainfall varies from 1750mm in the southern part of the state to 1250mm in the Northern part. The hot season comes in mid-April with temperatures between 32^0C and 38^0C.

About 75% of the population lives in the rural areas and their main occupation is farming. With farmers predominantly engaged in rain-fed subsistence farming. The average farmer in Benue state has a farm holding of between 1.5 to 2.0 hectares (BNARDA, 1999). Benue state is referred to as the "food basket" of Nigeria because of the abundance of its agricultural resources.

The State is a major producer of food crops like yam, sesame, rice, sorghum, cassava, sweet potatoes, millet, beans, and a wide range of other crops like vegetables, groundnut, ginger and sugarcane. 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 in the State. Benue State also has large stock of livestock and fisheries resources.

Fig 3.1 Map of Benue State Showing Selected Local Government in Red



3.2 Sampling Technique

A multi-stage sampling technique was used for this study. In the first stage, one Local Government Area from each of the three agricultural zones (A, B and C), was purposively selected based on their relative importance in cassava production. Out of the total output of cassava produced in Benue State between years 2009 and 2011 (about 11,133,030metric tonnes), the selected Local Government Areas contributed as follows;

Konshisha L.G.A produced about 22% (2,449,266.6 metric tonnes), Gwer East L.G.A produced 15% (1,669,954.5 metric tonnes), and Okpokwu L.G.A produced about 18% (2,003,945.5 metric tonnes) (BNARDA, 2012). In the second stage, two villages from each of the three selected Local Governments Areas were randomly selected. Finally, 10 percent of the population of cassava farmers in each of the villages was randomly selected. A total sample size of 186 respondents was therefore used for the study (Table 3.1). The cassava farmers were identified with the help of the State's ADP Staff and Cassava farmers' Association in the selected local governments.

Table 3.1: Distribution of respondents in the study area

Agricultural Zones	**Selected Local Governments**	**Selected Villages**	**Population of Cassava Farmers***	**10% of the Farmers**
A	Konshisha	Mbagbem	420	42
		Mbanor	320	32
B	Gwer East	Taraku	240	24
		Alaide	210	21
C	Okpokwu	Ai-okpe	350	35
		Eke	320	32
Total			**1860**	**186**

*Based on Reconnaissance survey, 2012

3.3 Method of Data Collection

Primary data were collected and used for this study. The primary data for 2012/2013 farming season were collected using structured questionnaire. Data collected included:

(a) the farmers' socio-economic characteristics such as; age, gender, household size, educational level, farming experience, farm size, methods of land acquisition,extension contact, amount of credit obtained, and membership of cooperatives.

(b) production data such as farm size, type and cost of labour, quantities of fertilizers, agro-chemicals, and planting materials and prices, quantity of farm output and problems associated with cassava production. Inputs were procured from the open market.

3.4 Analytical Technique

The following tools of analysis were employed to achieve the objectives of this study.

3.4.1 Descriptive Statistics

These tools were used to achieve objectives i, and vii. This involved the use of measures of central tendency such as mean, median, frequency distribution, ratios and percentages and measures of dispersion such as ranking, standard deviation and coefficient of variation.

3.4.2 Production Function Analysis

The production function analysis was used to achieve objectives iii, iv and vi. Production function analysis gives the technical relationship between inputs and outputs in any production system (Olayide and Heady, 1982). Three functional forms (linear, semi-log and Cobb-Douglas) were fitted into the data and the one that gave the best fit was selected, based on the following;

i. The value of the coefficient of multiple determination (R^2)
ii. Appropriateness of the signs of the regression coefficients
iii. Significance of the t-value
iv. Significance of the F-value

Generally, the three functional forms are expressed as follows:

(a) Linear form:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + U$$

(b) Semi-log form:

$$Y = b_0 + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + U$$

(c) Cobb-Douglas form:

$$Y = b_0\, X_1^{b1}.\, X_2^{b2}.\, X_3^{b3}.\, X_4^{b4}.\, X_5^{b5}\, U$$

When the Cobb-Douglas form is made linear, it takes the form of:

$$\text{Log}Y = b_0 + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + U$$

For all the functional forms:

Y = Output of cassava tubers (tonnes)

b_0 = constant,

b_1 to b_5 = estimated regression coefficients.

X_1 = Cassava cuttings (kilogrammes)

X_2 = farm size (in hectares)

X_3 = labour (in man days)

X_4 = quantity of fertilizer (in kilogrammes)

X_5 = quantity of agro-chemicals (in litres)

U = Error term

To evaluate the efficiency of resource usage, the Marginal Value Product (MVP) for each resource was derived and compared with its respective factor cost (that is, the marginal factor cost, MFC). The MVP of a resource was computed as follows:

$$MVPx_i = MPPx_i.Py$$

Where:

$MVPx_i$ = Marginal Value Product of input X_i

$MPPx_i$ = Marginal Physical Product of input X_i

Py = Unit price of output

The MPP and MVP values were derived using the following:-

Linear: $MPP = \frac{dy}{dx} = b_i$; $MVP = b_i.Py$

Semi-log: $MPP = \frac{bi}{\bar{x}}$; $MVP = \frac{bi}{\bar{x}}.Py$

Double-log: $MPP = \frac{}{\bar{x}}$; $MVP = \frac{}{\bar{x}}. Py$

Resource Use Efficiency (r) = $\frac{MVP}{MFC}$ or $\frac{MVP}{Pxi}$

Where:

b_i = Regression coefficient

$\bar{y}$ = Mean output of cassava tubers

$\bar{x}$ = Mean value of inputs

$\frac{dy}{dx}$ = Derivative of y_i with respect to x_i

Pxi = Unit price of input resource

Py = Unit price of output (cassava)

MFC = Marginal factor cost

Decision Rule:

If: r = 1, there isoptimal utilization of resources

r <1, there is over-utilization of resources

r >1, there is under-utilization of resources

3.5 Farm Budgeting Technique

This was used to achieve objective ii. Farm budgeting enables the estimation of the total expenses (costs) as well as total receipts (revenue) within a production period (Olukosi and Erhabor, 1988).

Net farm income is a budgeting tool used in evaluating the costs and returns of a farm (Olukosi and Erhabor, 1988). The Net Farm Income is defined as Total Revenue (TR) divided by Total Cost (TC) minus 1.

Net Farm Income is expressed as: NFI = TR – TC

Where:

NFI = Net Farm Income

TR = Total Revenue (total income realized from sale of cassava)

TC = Total Cost (summation of total variable cost and total fixed cost)

3.6 Multiple Regression Analysis

This was used to achieve objective v. The model is specified as shown below:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + U$$

For all the functional forms:

Y = Output of cassava tubers (tonnes)

b_0 = constant,

b_1 to b_5 = estimated regression coefficients.

X_1 = Age (years)

X_2 = Sex (Number of males and females)

X_3 = Education (level)

X_4 = Farming experience (years)

X_5 = Cooperative membership (years)

X_6 = Extension contact (number of visits)

X_7 = Household size (number of members)

X_8= Credit (amount obtained in Naira)

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of the Respondents in the Study Area

This section describes the socio-economic characteristics of the cassava farmers such as age, gender, farming experience, household size, educational level, farm size, mode of farmland acquisition, number of extension visits, amount of credit obtained and cooperative membership.

4.1.1 Age distribution of the respondents

The age distribution of the cassava farmers in Table 4.1 shows that 7.53 percent were less than 20 years of age, 28.49 percent were between 21-30 years of age, 30.65 percent were between 31-40 years, 24.19 percent were between 41-50 years, 7.53 percent between 51-60 years and 1.61 percent were between 61-70 years of age. The modal age group was 31– 40 years while the mean age of the farmers was 46 years. This indicates that most of the farmers were young and are likely to be more receptive of new technologies for increased agricultural production. Dercon and Krishnan (1996) argued that age affects the rate of household adoption of innovations because the younger a farmer is, the easier it is to adopt newly introduced innovations which, in turn, increases household productivity and livelihood improvement strategies.

Age is associated with more experience and knowledge of the farming system (Shiferaw and Holden, 1998). Age has a significant influence on the decision-making process of farmers as younger farmers tend to be more flexible in their decision and adopt improved agricultural technologies more readily than older people (Adubi, 1992).

Table 4.1: Distribution of the respondents based on their age

Age (Years)	Frequency	Percentage
Less than 20	14	7.53
21-30	53	28.49
31-40	57	30.65
41-50	45	24.19
51-60	14	7.53
61-70	3	1.61
Total	**186**	**100.00**
Average	**46**	

4.1.2 Sex of the respondents

The distribution of the respondents by their sex showed that 72 percent (134) were male and 28 percent (52) were female. This implies that more men were engaged in cassava production than women in the study area. This may be attributed to the fact that women are more involved in processing than production. Hence, if more women are encouraged to go into the production of cassava, output of cassava will increase by an appreciable amount.

4.1.3 Household size of the respondents

The distribution of the respondents by household size in Table 4.2 shows that 7.50 percent had between 1-4 members, 57 percent had between 5-9 members and 26.30 percent had household size of 10-14 members, 6.50 percent had between 15-19 members, 2.20 percent had between 20-25 members and 0.50 percent had above 25-29 members. The average household size was 9 members. This result implies that the

cassava farmers had access to family labour for cassava production. The significance of household size in agriculture hinges on the fact that, the availability of labour for farm production, the total area cultivated to different crop enterprises, the amount of farm produce retained for domestic consumption, and the marketable surplus are all determined by the size of the farm household (Amaza *et al.*, 2009). On the other hand, large household size is associated with increased household consumption expenditure, which reduces the money that could be used for production purposes (Ahmed, 2011).

Table 4.2: Distribution of the respondents based on their Household size

Household Size	**Frequency**	**Percentage**
1-4	14	7.50
5-9	106	57.00
10-14	49	26.30
15-19	12	6.50
20-24	4	2.20
25-29	1	0.50
Total	**186**	**100.00**
Average	**9**	

4.1.4 Farming experience

The results of the distribution of respondents based on years of farming experience in Table 4.3 show that 29-03 percent of the cassava farmers had between 1-9 years of farming experience, 39.79 had 10-19 years of farming experience, 20.97 percent had between 20-29 years of farming experience, 6.45 percent had between 30-39 years of farming experience, and 3.76 percent had between 40-49 years of farming experience. The mean years of farming experience for the farmers was 15 years. Farming experience plays a significant role in agricultural production. It is expected that the

higher the farmers' experience in farming, the better will be the production capacity of the farmers (Adeyemo *et al.,* 2010). Productivity increases with years of experience in farming as farmers master the techniques of production and avoid previous mistakes (Audu, *et al.,* 2013). Farming experience is an important factor determining both the productivity and the production level in farming activities as it enables the farmer to select the right crop varieties (Ajani, 2000) and farm management practices that are most suitable to their environment (Salau *et al.,* 2012). The farming experience of a farmer determines his ability to make effective farm management decisions with respect to input combination or resource allocation, thus enhancing productivity and income (Salau *et al.,* 2012).

Table 4.3: Distribution of the respondents based on their farming experience

Farming Experience	**Frequency**	**Percentage**
1-9	54	29.03
10-19	74	39.79
20-29	39	20.97
30-39	12	6.45
40-49	7	3.76
Total	**186**	**100.00**
Average	**15**	

4.1.5 Educational level of the respondents

The results presented in Table 4.4 show the distribution of the educational level of the respondents in the study area. That 36 percent of the respondents had no formal education, 35.50 percent had primary school education, 19.90 percent had secondary school education, and 8.60 percent had tertiary education.

Onu and Edon (2009) in their work on comparative economic analysis of improved and local cassava varieties in selected Local Government Areas of Taraba State found that 33.3 percent of the farmers who cultivated improved cassava varieties did not have formal education. According to Gama (2013), the levels of awareness and adoption of agricultural innovations are affected by the literacy status of farmers. Those who are literate are expected to be more innovative because of their ability to get information more quickly and their ability to take more risk. Ogundari (2006) noted that education is needed to enhance productivity among farming households in Nigeria. Educational level of farmers is very important in farm management because a high literacy level of the respondents would afford them the opportunity to understand and adopt modern farm practices, thereby enhancing productivity and profitability.

Table 4.4: Distribution of the respondents based on their level of education

Education	**Frequency**	**Percentage**
No formal education	67	36.00
Primary	66	35.50
Secondary	37	19.90
Tertiary	16	8.60
Total	**186**	**100.00**

4.1.6 Distribution of respondents based on farm size devoted to cassava farming

The distribution of the respondents based on their cassava farm holdings is shown in Table 4.5. The results revealed that 56.50 percent had farm size of between 0.1-1.0 hectare, 32.30 percent had between 1.1 and 2.0 hectares, 9.10 percent had between 2.1-3.0 hectares and 2.10 percent had between 4.1 and 6.0 hectares. Average farm size is 1.28 hectares. This implies that the cassava farmers are predominantly small-scale farmers. According to Olayide (1980), small-scale farms range from under 0.10 hectare holdings to 5.99 hectare holdings.

Table 4.5: Distribution of the respondents based on their cassava farm size

Farm Size (hectares)	**Frequency**	**Percentage**
0.1-1.0	105	56.50
1.1-2.0	60	32.30
2.1-3.0	17	9.10
4.1-5.0	1	0.50
5.1-6.0	3	1.60
Total	**186**	**100.00**
Average	**1.28**	

4.1.7 Mode of farmland acquisition

The results of mode of land acquisition in Table 4.6 show that 78.50 percent of the respondents in the study area obtained their farmland through inheritance, 15.10 percent obtained their farm land through gift, 4.30 percent obtained their farmland through purchase, and 2.10 percent rented their farmland. The predominant mode of land acquisition in the study area is through inheritance. This implies that fragmentation of farmlands would be very common, leading to small farm sizes available for cassava farming which will result to low productivity in the area.

Olukosi and Erhabor (1986) stated that in some subsistence farming communities, pieces of land are acquired through inheritance, passed from one generation to another while others are either bought or rented. This implies that only small portions of land would be available for cassava production.

Table 4.6: Distribution of the respondents based on mode of farmland acquisition

Mode of farmland acquisition	Frequency	Percentage
Purchased	8	4.30
Gifted	28	15.10
Rented	4	2.10
Inherited	146	78.50
Total	**186**	**100.00**

4.1.8 Number of Extension Contacts

The results of distribution of respondents by contact with extension services in Table 4.7 show that 25.30 percent had no contact with extension, 62.40 percent of the farmers had 1-4 contacts with extension services per season, 10.20 percent had 5-9 contacts per season, 1.60 percent had 10-14 contacts per season and 0.50 percent had 15-19 contacts per season. Increased extension contacts would lead to more knowledge on improved cassava technologies which are expected to lead to increased productivity and profitability. The farmers had the opportunity of: learning how to combine given set of inputs for maximum output; being aware of improved cassava farming technologies and subsequent adoption of the technologies. Umar *et al.* (2009) argued that higher extension contacts would increase adoption of improved farm production technologies. They further argued that the frequency of extension contact is very essential as it guides the farmers from awareness to the adoption stage.

Table 4.7: Distribution of the respondents based on the number of extension contacts

Number of extension contact per season	Frequency	Percentage
No contact	47	25.30
1-4	116	62.40
5-9	19	10.20
10-14	3	1.60
15-19	1	0.50
Total	**186**	**100.00**
Average	**3**	

4.1.9 Amount of credit obtained

The results of the amount of credit obtained in Table 4.8 show that 4.80 percent did not have access to credit, 76.90 percent received less than ₦50,000, 5.40 percent received between ₦50,000-₦100,000, 1.10 percent received between ₦101,000-₦150,000, 3.20 percent received between ₦151,000-₦200,000, 1.60percent received between ₦201,000-₦250,000 and 7 percent received between ₦251,000-₦300,000. These results imply that a greater percentage of the cassava farmers had access to credit which will enhance their access to inputs for increased output. Majority of the farmers acquired credit from their cooperative groups, only a few acquired credit from financial institutions such as Banks.

Credit is needed to expand the scale of farm operations as it empowers the farmers to buy farm inputs and improved technologies which would make them produce at optimal capacity and increase their labour utilization at minimum cost which would in turn promote steady flow of income and boost their profitability (Audu *et al.*, 2013).

Table 4.8: Distribution of the respondents based on the amount of credit obtained

Amount of credit obtained (Naira)	Frequency	Percentage
0	9	4.80
< 50000	143	76.90
50000-100000	10	5.40
101000-150000	2	1.10
151000-200000	6	3.20
201000-250000	3	1.60
251000-300000	13	7.00
Total	**186**	**100.00**
Average	**53156**	

4.1.10 Years in membership of cooperative groups

The results presented in Table 4.9 shows the distribution of the respondents by their years of membership of cooperatives. The results showed that 37.60 percent did not belong to any cooperative group, 29.60 percent had between 1-4 years of cooperative membership, 21 percent had between 5-9 years of cooperative membership, 9.70 percent had between 10-14 years, 1.60 percent had between 15-19 years and 0.50 percent had between 20-24years.The average years of cooperative membership was 2 years. According to Akinnagbe (2010), being a member of a cooperative would enable the farmers have access to timely funds and materials needed for production and access to information on improved technologies and markets for farm produce. Membership of cooperatives can also enhance the accessibility of farmers to credit facilities and serve as a medium for exchange of ideas that can improve farm activities (Oyewole, 2012).

Table 4.9: Distribution of the respondents based on years of membership of cooperatives

Years of membership	Frequency	Percentage
0	70	37.60
1-4	55	29.60
5-9	39	21.00
10-14	18	9.70
15-19	3	1.60
20-24	1	0.50
Total	**186**	**100.00**
Average	**2**	

4.2 Costs and Returns of Cassava farming in Benue State

The results in Table 4.10 show the costs and returns of cassava farming in the study area. The total cost of variable inputs used (cassava cuttings, labour, fertilizer and agro-chemicals) was estimated to be ₦205,267.72 per hectare. The total revenue generated was ₦274,500 per hectare. The Net Farm Income (difference between total revenue and total cost of production) was ₦59,077 per hectare. This shows that cassava farming is a profitable enterprise in Benue State.

The return on investment (ratio of total revenue to total cost minus 1) was 0.27, implying that for every ₦1 invested in cassava farming there was a return of 27kobo. This implies that cassava farming was profitable in the study area. This finding is consistent with that of: (i) Bassey, *et al.* (2014), who, in their study on determinants of cassava output among small scale farmers in Nigeria: a survey of Akwa Ibom state farmers found cassava farming to be profitable with a net farm income of ₦125,590 and a return on investment of 0.73.

Table 4.10: Costs and Returns of cassava farming per hectare

Cost/Return Items	Average quantity kg/hectare	Unit price (₦)	Value (₦/ha)	Percentage
(A) Variable Costs				
Cuttings (kg)	144.00	5.98	861.12	0.42
Labour (man-day)	232.62	700.00	162834.00	79.33
Fertilizer (kg)	439.27	80.00	35141.60	17.12
Agro-chemical (litre)	7.46	850.00	6431.00	3.13
Total Variable Costs			205267.72	100.00
(B) Fixed cost				
Rent on Land			8000.00	
Hoe			243.90	
Cutlass			453.40	
Sprayer			668.92	
Wheel Barrow			789.26	
Total fixed cost			10155.48	
(C)Total cost			215423.20	
(D) Total Revenue (output)	9.15	30000.00	274500.00	
(E) Net Farm Income			59077.00	
(F) Return on investment = $\frac{TR}{TC} - 1$			0.27	

4.2.1 Test of the profitability of Cassava farming in the study area.

The null hypothesis that suggested that cassava farming was not profitable in the study area was significant (4.5***) at 1% level of probability. This implies that cassava farming was profitable in the study area.

Table 4.11**:** Test of significance of the profitability of cassava farming in the study area

Hypothesis	Test-statistic	Test-statistic value	Decision
Profitability of cassava farming	T-statistic	4.5***	Rejected

*** $P \leq 0.01$

** $P \leq 0.05$

* $P \leq 0.10$

4.3 Production Function for cassava farming in Benue state

4.3.1 Input level

The results in Table 4.12 show the inputs used for cassava production in the study area. The inputs used were cassava cuttings, farm size, labour, fertilizer and agro-chemicals. The average quantity of cuttings used by cassava farmers was 144 kg per hectare which is lower than the recommended rate of 250 kg per hectare as reported by Ohen *et al.* (2014). This may be because of the scarcity of disease-free cassava cuttings.

The average farm size used for cassava production in the study area is 1.28 hectares showing that majority of the farmers are smallholders. The average labour used was 232.62 man-days per hectare which is (27.11%) higher than the national average of 183 man-days per hectare as reported by Nweke *et al.* (1988). This may be attributed to the fact that majority of the farmers in the study area had large household sizes and could have depended heavily on family labour to do most of the farm operations. The average quantity of inorganic fertilizer (N.P.K 15:15:15) used by cassava farmers was 439.27kg per hectare, which was higher than the recommended rate of 400kg per hectare (Braima

et al., 2000). This could be because of the farmers' poor knowledge about the right applications of this input due to illiteracy and inadequate access to extension services. The average quantity of agro - chemicals used by the cassava farmers was 7.46 litres per hectare, which was higher than the recommended rate of 4-5litres/hectare (Omeh, 2013). The rate of agro – chemicals used being higher than the recommended rates could be attributed to the farmers' inadequate knowledge on the right applications of this input due to illiteracy and inadequate access to extension services. The quantity of cassava cuttings used varied the most (1.49%) while the use of agro – chemical varied the least (0.44%).

Table 4.12: Inputs and Output level in cassava farming per hectare

Inputs and Output	**Minimum**	**Maximum**	**Average**	**Standard Deviation**	**Coefficient of Variation (%)**
Inputs					
Farm size (ha)	0.1	6.0	1.28	0.86	1.48
Cassava Cuttings (kg)	18.0	1250.0	144.00	96.55	1.49
Labour (man-day)	34.0	1660.0	232.62	234.30	0.99
Fertilizer(kg)	0	600.0	439.27	60.36	0.65
Agro – chemicals (litre)	0	4.0	7.46	0.86	0.44
Output (tonnes)	0.40	80.0	9.15	8.30	1.102

4.3.2 Output level

The average output of cassava in the study area was 9.15 tonnes of fresh tubers per hectare (Table 4.12). This average output is lower than Nigeria's potential yield of 45 tonnes per hectare as reported by Hauser (2013). This could be as a result of the use of low-yielding local varieties of cassava, use of immature stem cuttings, and incidences of diseases and pests (Onwueme and Sinha, 1991).

4.3.3 Technical Relationship between inputs and output of cassava farming

The results in Table 4.13 show the technical relationship between inputs and output of cassava. The Cobb-Douglas production function was selected as lead equation or line of best fit. The R^2 value which measures the proportion of the variation in dependent variable (Y) that is explained by the independent variables included in the model was 51percent. The F-value was 15.16 and this was significant at 1 percent level of probability. This implies that all the variables included in the model were all important in explaining the variations that occurred in the output of cassava in the study area. The estimated parameter for cassava cuttings (0.253) was positive and significant at 10percent level of probability. This implies that an increase in cassava cuttings would increase the output of cassava in the study area.

This finding agrees with that of Yakasai (2010) who, in his study ontheeconomic contribution of cassava production in Kuje Area Council of the Federal Capital Territory, Abuja, Nigeria found that the coefficient of cassava cuttings (0.131) was positive and significantly related to the output of cassava at 1 percent level of significance.

The coefficient of labour (0.351) was found to be positive and significant at 1percent level of probability. This implies that labour is very essential in cassava farming but must be used appropriately in order to aid an increase in cassava output in the study area. This result is similar to that of Adinya *et al*. (2011) who, in their study on economic analysis and adoption of improved cassava technologies in Obubra Local Government Area of Cross River State found that the coefficient of labour was positive (1.237).

The coefficient obtained for farm size (0.448) was positive and significant at 5 percent level of probability implying that an increase in farm size would lead to an increase in output of cassava in the study area. This result is similar to what was obtained by Yakasai (2010) in his study on economic contribution of cassava production in Kuje Area Council of the Federal Capital Territory, Abuja, Nigeria, who found the coefficient of farm size to be 0.452. The result also agrees with that of Adinya *et al*. (2011) who, in their study on economic analysis and adoption of improved cassava technologies in Obubra Local Government Area of Cross River State found the coefficient of farm size to be positive (0.130). Fertilizer was negative and significant at 1percent level of probability, meaning an increase in fertilizer by one unit will bring about decrease in cassava output by 0.113 units. This is because the excessive fertilizer application tends to favour shoot growth at the expense of tuber growth (Onwueme and Sinha, 1991). The average quantity of fertilizer used by farmers in the study area (439.27kg) was higher than the recommended rate of 400kg per hectare. Thus, fertilizer was misused in the study area. This result agrees with that of Odoemenem and Otanwa (2011) who in their work on economic analysis of cassava production in Benue State of Nigeria found that fertilizer had negative relationship with cassava output (-0.114). Agro-chemicals were

also negative (-0.155) and significant at 10 percent level of probability, meaning that a one unit increase in agro-chemicals will result in 0.155 decrease in the output of cassava. Since the average quantity of agro-chemicals used per hectare (7.46 litres) was higher than the recommended rate of 4 -5 litres per hectare, the over-application or misuse of this input will have an adverse effect on cassava output.

Table 4.13: Estimated Cobb-Douglas Production Function for Cassava Farmers in Benue State

Variable	**Coefficient**	**Standard Error**	**t-ratio**
Intercept	6.228	0.700	8.90***
Farm size (X_1)	0.448	0.179	2.50**
Cassava Cuttings (X_2)	0.253	0.150	1.69*
Labour (X_3)	0.351	0.079	4.44***
Fertilizer (X_4)	-0.113	0.032	-3.53***
Agro-chemicals (X_5)	-0.155	0.175	0.89*
R^2 =	0.51		
F-value =	15.16		

*** $P \leq 0.01$

** $P \leq 0.05$

* $P \leq 0.10$

4.4 Resource Use Efficiency in Cassava farming

The results presented in Table 4.14 show the marginal value productivity and efficiency of resource use in cassava farming in the study area. Labour, fertilizer and agrochemicals over-utilized while farm size and cassava cuttings were under-utilized in the production of cassava.

The over-utilization of labour could be attributed to the use of labour-intensive technologies as against the use of labour-saving devices such as the tractor (Saito *et al.,* 1994; Ogungbile *et al.,* 1999). This result agrees with that of Obasi *et al.* (2013) who, in

their work on factors affecting agricultural productivity among arable crop farmers in Imo State of Nigeria found that labour was over-utilized with an efficiency ratio of 0.086. The over-utilization of fertilizer and agro-chemicals could be linked to subsidies on these inputs and to the fact that majority of the farmers (87.7%) were poorly educated and so probably were not knowledgeable on the recommended rates of application of fertilizer and agro-chemicals. This result of over-utilization of fertilizer agrees with that of Adeyemo *et al.* (2010) who in their work on economic efficiency of small-scale farmers in Ogun State of Nigeria found that fertilizer was over-utilized with an efficiency ratio of -0.152. The result of over-utilization of agro-chemicals agrees with that of Ogunniyi *et al*. (2012) who, in their work on resource-use efficiency in cassava production in Atakunmosa Local Government Area of Osun State found that agro-chemicals were over-utilized with an efficiency ratio of 0.034. The reason for the under-utilization of cassava cuttings could be attributed to scarcity of the cassava cuttings resulting in the use of less than the recommended number of cuttings per hectare. The under-utilization of farm size could be attributed to the fact that farmland was acquired mainly by inheritance in the study area and the sharing of land among the heirs of deceased leads to fragmentation of the farmland which could result in smaller farm sizes (Ogungbile *et al.*, 1999). These results are consistent with those of Ogunniyi *et al*. (2012) in their work on resource-use efficiency of cassava production in Atakunmosa Local Government Area of Osun State of Nigeria where cassava cuttings and farm size were found to have been under-utilized with efficiency ratios of 1.043 and 3.528, respectively.

Table 4.14: Resource Use Efficiency in Cassava Farming

Variable input	MPP	MVP	MFC	R
Farm size (X_1)	3200.94	64018.75	5000.00	12.80
Cassava Cuttings (X_2)	68.21	407.88	5.98	68.21
Labour (X_3)	14.58	291.71	700.00	0.42
Fertilizer (X_4)	-16.58	-331.67	4000.00	-0.08
Agro-chemicals (X_5)	-2574.71	-51494.20	850.00	-60.58

4.4.1 Test of the resource use efficiency of cassava farmers in the study area.

The test of the null hypotheses suggested that the resources used by cassava farmers were not efficiently utilized were all significant at 1, 5 or 10% level of probability except that of labour. It can be concluded that as a whole, the resources were not efficiently utilized by cassava farmers in the study area.

Table 4.15: Test of hypothesis suggesting that resources were not efficiently used by cassava farmers in the study area

Hypothesis	Test-statistic value	Decision
Farm size	1.89*	Rejected
Cassava cuttings	2.01**	Rejected
Labour	1.63	Accepted
Fertilizer	3.1***	Rejected
Agro-chemicals	2.67***	Rejected

*** $P \leq 0.01$

** $P \leq 0.05$

* $P \leq 0.10$

4.5 Relationship between Farmers' Socio-economic Characteristics and their Cassava Output in the Study Area

The results in Table 4.16 show the relationship between the socio-economic characteristics of farmers and their cassava output. The results revealed that farmers' age, gender, education, farming experience and years of cooperative membership were

significantly related to their output. Age was negatively related to cassava output but gender, education, farming experience and cooperative membership were positively related to output. The negative coefficient (-0.208) obtained for age implies that an increase in age would lead to a decrease in cassava output.

The reason is that older farmers seem to be somewhat less inclined to adopt new farm practices that would increase farm output than younger ones (Voh, 1979). Gender had a positive coefficient (3.165) which implies that it is also a key player in cassava farming activities as women were also found to play the central role of cassava production, processing and marketing. Women are found to be active in cassava farming but are usually constrained by access to available credits from financial institutions which might lead to reduced scale of production (Makarau, *et al.* 2011). Education was positive (0.071), which implies that an increase in years of education would lead to an increase in the output of cassava. The explanation for this is that more education promotes the adoption and use of yield-increasing technologies and encourages more efficient farm management practices thus leading to increases in farm output (Mbam and Edeh, 2011). Farming experience had a positive coefficient (0.345), which implies that an increase in this variable will lead to a significant increase in cassava output. This reason is that increase in years of farming experience increases the farmers' level of assimilation, understanding and acceptance of relevant information leading to the adoption of improved methods of production and the expansion of production (Akpoko and Yiljep, 2000; Udoh *et. al.,* 2006). Years of cooperative membership also had a positive coefficient (0.665). This implies that an increase in years of cooperative membership would lead to an increase in cassava output. The reason for this is that cooperative membership enhances access to information on improved technologies,

material inputs of the technologies such as fertilizers and agro-chemicals, and credit for purchase of inputs and payment of hired labour (Njoku, 1991).

Table 4.16: Relationship between Socio-economic Characteristics of Cassava Farmers and their Output

Variable	Coefficient	Standard Error	t-ratio
Intercept	9.399	4.064	2.312***
Age (X_1)	-0.208	0.090	-2.303**
Sex (X_2)	3.165	1.411	2.242**
Education (X_3)	0.071	0.124	0.571**
Farming Experience (X_4)	0.345	0.099	3.48***
Years of membership (X_5)	0.665	0.160	4.137*
Extension contact	0.179	0.224	0.800
Family size	1.122	0.188	5.951
Credit	0.460	0.564	0.819
R^2 =	0.48		
F-value =	13.69		

***P ≤ 0.01

** P ≤ 0.05

* P ≤ 0.10

4.5.1 Test of the significance of relationship between the cassava farmers' socio-economic characteristics and their output

The T-Statistic under the null hypothesis of no relationship between the cassava farmers' socio-economic characteristics and their output was rejected at 1% level of probability (13.69***). In order words, the socio-economic characteristics of the cassava farmers' socio-economic characteristics were significantly related to their output.

4.6 Elasticity of Production and Returns to Scale in Cassava farming

The results presented in Table 4.17 show the elasticities of production of the inputs used in cassava farming. The estimated input elasticities of production for farm size, cassava cuttings and labour are less than one, indicating that output of cassava grows less than proportionately with any increase in these inputs.

The elasticity of production for fertilizer and agro-chemicals were less than zero, indicating that output decreases as a consequence of using more of these two inputs.The returns-to-scale estimate (0.824) obtained from the summation of the coefficients of the estimated input elasticities is less than one (0.824), indicating decreasing returns to scale.

This means that output increases less than proportionately with any increase in inputs. This shows that if all the inputs included in the production function model are increased equally by 1 percent, cassava output will increase by a lesser amount of 0.824 percent. The result is consistent with that of Ogunniyi *et al*. (2012) on their work on resource-use efficiency of cassava production in Atakunmosa Local Government Area of Osun State of Nigeria where it was found that the returns to scale was less than one (0.141), indicating decreasing returns to scale.

Table 4.17: Elasticities of Production of Inputs and Returns to Scale in cassava farming

Variable	Production elasticities
Farm size (ha)	0.448
Cassava Cuttings (kg)	0.253
Labour (man-day)	0.351
Fertilizer(kg)	-0.113
Agro-chemical(litre)	-0.155
Return to Scale	0.824

4.7 Constraints Associated with Cassava farming in the Study Area.

The results presented in Table 4.18 shows the constraints associated with cassava farming in the study area. These problems, ranked in percentage terms from the highest to the lowest were: poor storage facilities, inadequate improved planting materials, inadequate capital, poor marketfor cassava, problem of pests and diseases, inadequate extension delivery and inadequate labour-saving devices.

4.7.1 Poor storage facilities: About 84 percent complained of lack of good storage facilities for cassava. Cassava is a bulky and perishable agricultural crop, and poor storage facilities translate into huge post-harvest losses.

4.7.2 Inadequate supply of improved planting materials: About 63.4 percent of the respondents complained of inadequate supply of improved planting materials. Improved planting materials would enhance cassava output. The reason behind this constraint could be that many of the released improved varieties are yet to be multiplied on a large-scale and made available to the farmers as well as the farmers' inability to preserve planting materials properly (FMANR, 2000).

4.7.3 Limited capital: About 58.6 percent of the respondents reported having limited capital for farm investment. This problem may be associated with limited access to credit facilities by the farmers in the study area, on account of lack of collateral by the farmers. Farmers are then forced to depend on their meagre personal savings to finance cassava farming.

4.7.4 Poor access road to markets: Poor access road to markets was mentioned by 55.9 percent of the farmers. Most rural roads are bad and therefore make movement of inputs, produce and people difficult. Farmers had to transport inputs and produce on their heads, bicycles or motorcycles especially during the rainy season when most of the rural areas are inaccessible by vehicles. In addition to the problem of poor access roads to markets, marketing of cassava can be particularly problematic because the crop cannot be stored for a long time after harvest and must be utilized or processed within a day or two after harvest.

4.7.5 Pests and diseases: The problem of pests and diseases was reported by 32 percent of the farmers. Cassava is plagued by pests and diseases such as the cassava mosaic disease, bacterial blight, leaf rollers, termites, anthracnose, root rot, mealy bugs, spider mites, white flies, rodents, stem girdlers, green spider mite (GSM) and the large grain borer which attacks dry chips of cassava in storage (Adeniji *et al.,* 2005). Pests and diseases reduce the quantity and quality of cassava output.

4.7.6 Inadequate extension access: About 25 percent complained of inadequate access to extension. This can be attributed to the shortage of extension staff needed to give proper attention to all farmers as well as inadequate field and office facilities. The implication of this is that there will be limited access of the farmers to improved cassava

farming methods and also limited transfer of farmers' problems back to the research system.

4.7.7 Inadequate labour-saving devices: About 23.7 percent of the farmers complained of inadequate supply of labour-saving devices. This may be due to the poor financial status of the cassava farmers in the study area which makes it difficult for them to procure labour-saving devices such as tractors.

Table 4.18: Constraints associated with Cassava farming in the study area

Constraints	**Frequency***	**Percentage***	**Rank**
Poor storage facilities	157	84.4	1
Inadequate supply of improved planting material	118	63.4	2
Inadequate capital	109	58.6	3
Poor access road to markets	104	55.9	4
Problem of pests and diseases	60	32.3	5
Inadequate extension delivery	48	25.8	6
Inadequate labour-saving devices	44	23.7	7
Total	**640**	**344.1**	

***The frequency was more than 186 and the percentage above 100 due to multiple responses from the cassava farmers.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The study was conducted in Benue State to evaluate the profitability and resource use efficiency of cassava farming.

The specific objectives of this study were todescribe the socio-economic characteristics of cassava farmers in the study area, estimate the costs and returns of cassava farming in the study area, estimate the production function for cassava farming in the study area, determine the resource use efficiency in cassava farming in the study area, estimate the elasticity of production and returns to scale in cassava farming in the study area, determine the relationship between cassava farmers' socio-economic characteristics and their output,and identify and describe the major constraints faced by cassava farmers in the study area.

A multi-stage sampling technique was used to select 186 respondents for this study. Primary data was the main instrument for this study and it was collected from the respondents through the interview method by the researcher using sets of structured questionnaire with the aid of enumerators from the Benue State Agricultural and Rural Development Agency (BNARDA). The data were analyzed using Descriptive statistics, Production function, Multiple regression analysis and Gross Margin analysis.

The results of the socio-economic characteristics of the farmers revealed that majority of the farmers (30.65percent) were within the active age group of 31 – 40 years.
72 percent of the cassava farmers were male and 28 percent were female. 57 percent had household size of 5 – 9 and 26.30 percent had household size of 10 – 14.

Most of the farmers had farming experience of 10 – 19 years. 64 percent of the farmers had formal education while 36 percent had no formal education.

The results of this study further showed that 76.90 percent obtained credit less than 50,000 naira and only 4.80 percent had no access to credit. 62.40 percent were members of cooperative association. The result also revealed that majority of the cassava farmers (56.50 percent) cultivated on farm sizes of about 0.1 to 1.0 hectare while only about 2.10 percent had farm sizes of 4.1 to 6 hectares. And their farm land was mostly acquired by inheritance (78.50 percent). Majority of the farmers (62.40 percent) had contact with extension services, only about 25.30 percent had no extension contact.

The results of the relationship between the farmers' socio-economic characteristics and their cassava output revealed that farmers' age, gender, education, farming experience and years of cooperative membership were significantly related to their output. Age was negatively related to cassava output while gender, education, farming experience, and cooperative membership were positively related to cassava output.

The negative relationship for age implies that, an increase in age would lead to a decrease in cassava output while the positive relationship for the other variables implies that, as these variables increases, the output also increases.

The results of the input and output level in cassava production revealed that the average cuttings used by cassava farmers were 144kg per hectare. The average labour used was 232.62 man-days per hectare. The average land area under cassava production in the

study area is 1.28 hectares. Average inorganic fertilizer used by cassava farmers was 439.27kg per hectare.

The average chemical used by cassava farmers was 7.46 litres per hectare. The average output of cassava in the study area was 9.15tonnes per hectare.

The Cobb-Douglas production function was selected as the line of best fit and its results revealed that the coefficient of cassava cuttings was positive and significant at 10 percent level of probability. Labour was positive and significant at 1 percent level of probability. Farm size was positive and significant at 5 percent level of probability. Fertilizer was negative and significant at 1 percent level of probability. Agro-chemical was negative and significant 10 percent level of probability.

The results of the efficiency of resource use in cassava farming show that labour, fertilizer, and agro-chemical had resource use efficiency ratios less than unity (0.42, -0.08 and -60.58 respectively) which implies that these resources were over-utilized during the production process. But cassava cuttings and farmland had resource use efficiency ratios greater than unity (68.21 and 12.80 respectively) meaning that these resources were under-utilized. The sum of elasticities coefficient (that is, returns to scale estimate) is 0.824 and this indicates a positive decreasing returns to scale which is within stage two of the production process. This means that output increases less than proportionately with increase in input. This shows that if all the inputs included in the production function model are increased by one percent, cassava output will increase by lesser amount of 0.824 percent.

The results of costs and returns revealed that total costs of variable inputs (cassava cuttings, labour, fertilizer and agro-chemical) were estimated to be ₦205,267.72 of which labour constituted about 79.33%. The study recorded a Net Farm Income of ₦59,077 per hectare.

The return on investment was 0.27 implying that, for every one naira invested, there would be a profit of 27kobo.

The constraints associated with cassava farming in the study area were identified to be poor storage facilities, inadequate supply of improved planting materials, inadequate capital, poor access roads to markets, pest and diseases, inadequate access to extension delivery services, and inadequate supply of labour-saving devices.

5.2 Conclusion

Cassava farming was found to be a profitable enterprise in the study area because it recorded a Net Farm Income of ₦59,077 per hectare and a return on investment of 0.27 which implies that for every Naira spent in cassava farming, a profit of 27kobo is realized. The results of this study revealed that resources were not efficiently used by the cassava farmers in the study area. Some resources were under-utilized while others were over-utilized. The farmers should be encouraged through technical training on production techniques/ practices that will improve their productivity especially in those areas of inefficiency and underutilization of inputs. This study has also revealed that revealed that the cassava farmers' age, gender, education, farming experience and years of cooperative membership were significantly related to their output. Farmers are encouraged to go into cassava farming as it is a profitable enterprise in the study area.

5.3 Recommendations

Based on the findings of this study, the following recommendations are made:

(i) Government should develop cost effective storage facilities for these famers in order to make products readily available on demand and also to reduce post-harvest losses due to lack of adequate storage facilities.

(ii) Agricultural policy measures should be taken towards provision of ready market with stable prices for cassava produce through creation of marketing boards by the government.

(iii) Labour was found to be the variable that accounted for the highest cost of production and it was over-utilized. Attempts at reducing labour cost will lead to greater Net Farm Income and subsequently, the overall profitability of the enterprise.

(iv) Relevant infrastructures such as good access roads from farm gates to markets, electricity and good water supply should be made available by either the government or private sectors.

(v) Since the government does not have and will probably may not have for a long time, enough extension staff and resources for the current extension system, alternative extension strategies such as group extension methods, more cooperative groups, etc should be evolved to complement the existing system.

5.4 Contribution to Knowledge

This study has provided the following information:

(i) Not all the resources were efficiently used by the cassava farmers in the study area. The efficiency ratios of labour, fertilizer and agro-chemicals were less than unity (0.42, -0.08 and -0.60.58 respectively), indicating that they were over-

utilized. While the efficiency ratios of cassava cuttings and farmland were greater that unity (68.21 and 12.80 respectively) indicating that they were under-utilized.

(ii) Cassava farming was found to be a profitable enterprise with a net farm income of ₦59,077 and return on investment of 0.27.

(iii) The major constraints faced by cassava farmers in the study area are poor storage facilities (84.4%), inadequate supply of improved planting materials (63.4%), inadequate capital (58.6%), poor access roads to market (55.9%), problem of pests and diseases (32.3%), inadequate extension delivery (25.8%) and inadequate labour-saving devices (23.7%).

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ANALYSIS OF PROFITABITY AND RESOURCE USE EFFICIENCY IN CASSAVA FARMING IN BENUE STATE, NIGERIA.

(FARMERS' RESEARCH QUESTIONNAIRE)

Dear respondent,

This questionnaire will be used by a student of the Agricultural Economics Department of Ahmadu Bello University Zaria. Please tick where necessary. All information will be treated with utmost confidentiality and will strictly be used for the purpose of research. Thanks for your cooperation.

Zone…… Local government……. Village…… Questionnaire No……..

A. SOCIO-ECONOMIC CHARACTERISTICS

1. Name……

2. Gender: Male ( ) Female ( )

3. Age (years): ……..

4. Level of education

(a) No formal Education [ ]

(b) Primary Education [ ]

(c) Secondary school Education [ ]

(d) Tertiary Education [ ]

5. Family size (indicate the number of people depending on you for a living)……

6. How many years of experience do you have in cassava farming……....years.

7. (a) Are you a member of any cooperative/common initiative group? Yes [ ] No [ ]

(b) If yes, for how many years? .....

8. (a) Are you engaged in off-farm activities? Yes [ ] No [ ]

(b) If yes, what are the off-farm activities? List them.

(c) How much to did you earn from each of these activities?

i……. ii…….iii……..iv…….....(Naira)

9. Were you visited by, and did you visit any extension agent? Yes [ ] No [ ]

(b) If yes, how many times.....per year?

10. Amount of Credit or Loan received…… (Naira)

B. INPUT USED

(I) Farm size (Ha)

1. How many cassava farm lands do you have?.....

1b. Indicate the size of each farm below:

Farm I……(Ha) Farm II……(Ha) Farm III……..(Ha) Farm IV……...

2. How did you acquire your farmlands? (a) Inheritance [ ] (b) Lease [ ] (c) Gift [ ] (d) Purchased [ ] (e) Borrowed [ ] (f) Others (Indicate) [ ]

Indicate the number of farms acquired by each of these methods.

3. What does it cost to rent one Hectare of land per season in your village?.....Naira.

4. How much did you purchase the land?.....naira.

(II)Cassava cuttings

1. What bundles of cassava cuttings did you use on your farm? .....(bundles)

2. How much did you buy one bundle of the cassava cuttings? .....Naira

3. Where did you buy your cuttings from?

(a) ADP [ ] (b) Seed company [ ] (c) Open market [ ] (d) Others (specify)……

(III) Fertilizer

1. Did you use fertilizer in producing cassava? Yes [ ] No [ ]
2. Indicate the type(s) used N: P: K [ ] SSP [ ] Others (specify)……..
3. How many bags did you apply on your farm?.....Kg
4. How much did you buy one bag (50Kg) of fertilizer?.....naira

(IV) Herbicides

Please specify the type and price per litre of herbicides you used on your farm.

TYPES	QUANTITY(litres)	PRICE PER LITRE (naira)
Primextra		
Glyphosate		
Gramozone		
Others(specify)		

(V) Labour Used

(a) Hired Labour

	ADULT MALE		ADULT FEMALE		CHILDREN	
	No of persons	**No of days**	**No of persons**	**No of days**	**No of persons**	**No of Days**
Clearing						
Ridging						
Planting						
Fertilizer application						
Spraying						
Weeding						
Harvesting						
T**ransportation**						
Others (specify)						

(b)Family Labour

	ADULT MALE		ADULTFEMALE		CHILDREN	
	No of persons	**No of days**	**No of persons**	**No of days**	**No of persons**	**No of Days**
Clearing						
Ridging						
Planting						
Fertilizer application						
Spraying						
Weeding						
Harvesting						
Transportation						
Others (specify)						

1. How much does it cost to hire labour per day in your village?
   (a) One adult male per day……..naira
   (b) One adult female per day……...naira
   (c) One child per day……naira

C. OUTPUT INFORMATION

a. How many tonnes of cassava did you harvest from each of the farm locations mentioned? Farm I…… Farm II...…… Farm III……. Farm IV…… Others (indicate)…….

What was your total harvest?……tonnes

b. What was the farm gate price of one bag of cassava tubers?.....naira.

D. CONSTRAINTS FACED IN CASSAVA FARMING

Which of the following problems did you face in cassava farming?

a. Pests and diseases [ ]
b. Lack of access to improved planting materials[ ]
c. Poor access roads to markets [ ]
d. Lack of improved post-harvest processing and storage facilities [ ]
e. Inefficient or ineffective extension delivery systems [ ]
f. Poor access to financial services [ ]
g. Labor shortage [ ]
h. Others (Name them)……