

**RESOURCE PRODUCTIVITY AND TECHNICAL EFFICIENCY OF
CASSAVA PRODUCTION IN ARDO-KOLA AND GASSOL LOCAL
GOVERNMENT AREAS OF TARABA STATE**

BY

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**AN M.Sc RESEARCH THESIS PRESENTED TO THE
DEPARTMENT OF AGRICULTURAL ECONOMICS AND
EXTENSION, SCHOOL OF AGRICULTURE AND
AGRICULTURAL TECHNOLOGY, FEDERAL UNIVERSITY OF
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AUGUST, 2012

DECLARATION

I hereby declare that this work titled: “Resource Productivity and Technical Efficiency of Cassava Production in Ardo-Kola and Gassol Local Government Areas of Taraba” has been carried out and duly presented by Yuguda, Regula Manga (M.Sc/AE/07/0381) and being my original work and has been approved as meeting the requirements of School of Post- Graduate Studies, Federal University of Technology, Yola

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CERTIFICATION

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ACKNOWLEDGEMENTS

I hereby thank God Almighty for giving me the grace to pursue this work to this level. I am grateful to my supervisor, Prof. (Mrs.) E.F. Adebayo for her guidance, criticisms, suggestions and support which ensured that this study meets the academic standard. I am also grateful to the following lecturers; Dr. A.A.U. Jongur. Head, Department of Agricultural Economics and Extension, Prof. J.I. Onu, Dr. S.I. Mshelia, Dr. A.A. Ndaghu, Dr. A.K. Tashikalma, Dr. U.M. Bakari, Dr. D.C. Maurice, Mal. H. Lawal and Mr. J. Stephen.

My gratitude further goes to my dear husband, Mr Peter Yuguda for his love, support both morally and financially to make me realize my dream. I am also indebted to my children who had to take care of themselves because I was not there to do that for them, though they understood with me because they knew where I went to.

My thanks go to my parents Pah and Momi Lucas Munyah who laid the foundation of education for me to build on. It pains my heart that Pah Lucas Munyah did not leave to see building of the foundation he laid. I pray that his gentle soul rest in the bosom of the Lord. I appreciate my mother for her fervent prayers and moral support. I also want to acknowledge my dear sisters Mrs. Isabella Bantai for sisterly love and encouragement during my years of studies. Miss Benedicta Lucas, my brother Wilfred Fai Lucas, Gabriel Shey Lucas and baby last of the family Kevin Nfor Lucas for their support in the course of my study. I must not forget Auntie Agatha Jauro, the National President of The Kambu Women Wing for her motherly advise and support. Others are my landlord in Yola Mr. and Mrs. James who made sure that there was always light in the compound so that I can read. I am greatly indebted to Dr. Giroh Ginus who ran the

stochastic analysis for me. Others are Dr. Joyce Moses, Zainab, Khadiza, Dr. Edon Aboki, Mal. Yahaya, and Mrs. Jimjel.

DEDICATION

This work is dedicated to God the father, God the Son and, God the Holy Spirit for blessing me with the gift of life.

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ABSTRACT

This study determined the resource productivity and technical efficiency of cassava production in Ardo-Kola and Gassol Local Government Areas of Taraba state. The specific objectives were to describe the socio-economic characteristics of cassava producers in the study area, determine profitability of cassava farmers as well as factors affecting the technical efficiency of cassava farmers, determine use and indentify the constraints to cassava production in the study area. Data were collected from 115 respondents using a structured questionnaire covering 2010/2011 farming season. The data were analyzed using descriptive and inferential statistics, stochastic frontier production function and gross margin. The results revealed that male farmers constitutes the majority with 62.2 % and mostly are married with no formal education accounting for over 67 %. The study further shows that majority of the respondents (about 53 %) have farming experience of 11 years and above and most of them are small-scale farmers cultivating an average of 2 hectares of land. About 60 % of the respondents have farming as their main occupation using their personal savings to finance their production. The result of the maximum likelihood estimate of the stochastic frontier production function showed that farm size, hired labour, herbicides, fertilizer and cassava cuttings were statistically significant and positively affected cassava output. The technical efficiency (TE) of the farmers was 68 % indicating that there is scope to increased technical efficiency of cassava production by 32 % in the short run. The gross margin also revealed that cassava production is profitable as an average farmers makes ₦113,749.77 per hectare and for every one naira invested, he gets .90 kobo. However, cassava production have some constraints, prominent among which are; inadequate finance accounting for 50.43 %, unattractive price of cassava recording 24.3 %, and high cost of inputs, like fertilizer, herbicides, improved cassava cuttings accounting for 8.7 %. Others are labour shortage, inadequate extension agents, pests and disease infestation. The research recommended public private partnership (PPP) to sensitize and educate farmers to enable them benefit from the new innovations and technology that abound in the agricultural sector.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Cassava (*Manihot esculentus*) belongs to the family Euphorbiaceae (Cock, 1985). According to Ross (1999), cassava originated from Brazil where it is the major staple food of the people. The cultivation and consumption of cassava is now world wide with distribution through out Africa, America, Europe, Asia and other part of the world (IITA, 2005). The World production of cassava root was estimated to be 184 million tonnes in 2002. The majority of production is in Africa with 99.9 million tonnes. 51.5 million tonnes, were grown in Asia and 33.2 millions tonnes in Latin America and the Caribbean. Almost 70 percent of the world production is concentrated in five countries that is, Nigeria, Indonesia, Brazil and Congo Democratic Republic (CBN, 2005).

The cultivation of cassava in Africa started in 1598 (Awoyinka *et al.*, 1995). Furthermore consumption of cassava was introduced first to the people living along the African coast and nearby island by the Portuguese explorers. Nigeria is the number one world's largest producer of cassava with an estimated annual production of over 40 million metric tonnes (FAO, 2005; Yisa, 2009). About 90 percent of cassava produced in Nigeria is however consumed as food. The food and Agricultural Organization of the United Nations (FAO) in Rome (FAO, 2004a) estimated 2002 cassava production in Nigeria to be approximately 34 million tonnes. The trend for cassava production reported by Central Bank of Nigeria mirrored the FAO data until 1996 and there after rises to the estimate production at 37 million tonnes in 2000 (FMANR, 1997; CBN, 2004).

Expansion of cassava production has been relatively steady since 1980 with an additional push between the years 1988 – 1992 owing to the release of improved IITA varieties.

Cassava together with yams (*Dioscorea sp*) and sweet potatoes (*Ipomea batatas*) are important sources of food in the tropics. Cassava plays important roles in the developing countries farming especially in sub-Sahara Africa – due to its ability to thrive well on poor soils and with low rainfall because it is a perennial crop that can be harvested as required. Its wide harvesting window allows it to act as a famine reserve and is invaluable in managing labour schedules. It also offers flexibility to resource – poor farmers because it serves either as a subsistence or as a cash crop. As part of the agricultural development strategies, the Federal Government in 1999 announced the need for immediate action in five agricultural sub sectors viz cassava, rice, vegetable, livestock and tree crops. The choice of cassava as one of the priority crops by the Federal Government is justifiable as Nigeria will soon be generating huge income from the non oil sector as plans are on the way to realize about U.S \$5.0 billion from cassava marketing (Adepegba, 2006).

Nigeria has a land mass of 924,768 square kilometers which is about 98 millions hectares of land out of which 74 millions hectares are arable land (NPC, 2004). Out of the hectares of arable land available in the country only 30 million hectares are under cultivation of various crops with cassava representing 3.5 million hectares of the total hectares of arable land (CBN, 2005; FAO, 2005). This implies that the arable land available would need to be properly planned and managed so as to raise the level of productivity in order to maintain a suitable level of cassava output in the country.

Recognizing Nigeria's tremendous agricultural potentials, the Government has accepted the view that there should be a resolve to make agriculture the main stream of the economy. This is why the successive Governments had various agricultural revolutionary programmes, such as; the National Accelerated Food Production Programme (1972), Agricultural Development Programme ADP (1975), Operation Feed the Nation (1976), National Seed Service (1977), Agriculture Credit Guarantee Fund Scheme, ACGFS (1977), River Basin Development Authority, RBDA (1977), Green Revolution (1980), Directorate of Food, Road, and Rural Infrastructure, DFRRI (1986), National Fadama Development Project (1992), National Agricultural Research Project, NARP (1992), National Agricultural Land Development Authority (1993), National Research Project (1999), Nigerian Agriculture, Cooperative and Rural Development Bank (2000), National Agriculture Development Fund (2002), Commodity Marketing and Development Company (2003) and the Presidential Initiative on Cassava Production (2002) just to mention but a few (Oredipe and Akinwumi, 2000; Babatunde and Oyatoye, 2004). Despite the significant role of agriculture in our National economy, Food is still imported; its productivity level still remains low compared with the result of the productivity in the past decades (FMARD, 2001). In other words, surpluses without appropriate processing may bring about significant increase in post harvest regime losses which can enormously reduce expected productivity and income in agricultural sector (RUSEP, 2002).

1.2 Problems Statement.

Agriculture remains the panacea to unemployment, poverty alleviation and human development. It is a fact that when Nigeria depended on agriculture, our pounds was at par with British pounds sterling in the 1960s and 1970s (Onucheyo, 1998).

The agricultural sector contributed then, greatly to the Gross Domestic Product (GDP) and an average of 56 percent was recorded between 1960 – 1964. It declined to 47 percent in 1965 – 1969 and further declined to 35 percent in 2003 – 2004, (Amaza and Maurice, 2005). The overall agricultural situation deteriorated creating wide gap between demand and supply of food which in turn created other economic problems like inflation. Revenue from the agricultural sector dwindled and the Government was faced with huge food import bills and at the same time industries continued to import agricultural raw materials. This also affected the foreign exchange earnings. This is attributed to the discovery of oil (Igben, 1988).

It is against this background that Nigerian Government adopted different agricultural programmes and policies especially the Presidential Initiative on cassava production in 2002 in order to raise productivity and efficiency of the agricultural sector. These programmes and policies however, placed the small farmers in focus because the nation's agriculture had always been dominated by small farmers who represents a substantial proportion of the total farming population and produced over 90 percent of the total agricultural output in the country (Ajibefun *et al.*, 2002).

With the successive introduction of various programmes and policies to avert eminent starvation due to poverty by the Government, none of these measures had been able to solve the food problem since the desired objectives had not been achieved and

productivity of food crops have remained low (Nweze, 2002). In a study conducted by Adebayo (1993), she observed that in an attempt to transform agricultural production and achieve self sufficiency in food production, the agricultural development programme was charged with the responsibility of providing input delivery, infrastructure development, extension services, adaptive research, distribution of improved seeds, credit and cooperative assistance and marketing development just to mention but a few.

It is very glaring that ADPs did not live up to its expectation as far as these responsibilities are concern. What characterized was lack of access to bank loans, inadequate supply and high cost of inputs, inadequate tractor hiring services, inconsistency in government polices, poor supervision of inputs delivery, poor extension services, lack of modern simple tools and implements, poor resource allocation and management (Ikejimba, 1993; Adebayo and Onu, 1999).

Agricultural production, marketing and trade serve as major sources of employment, income and foreign earnings before Nigeria became independent. The agricultural sector provided the basis for the agro–industrial development and contributed significantly to the commercialization, monetization and integration of rural sector. In spite of the availability of the abandoned land and human resources in Nigeria, yield per hectare from cassava production had been on the decline over the years (RMRDC, 2004). In view of the above, there is need to improve the productivity and efficiency of cassava production.

The Presidential Initiative on cassava 2002 has been commissioned to identify potentials contribution of agricultural marketing policy to agricultural development. What is observed across the country is that, there is gross inability to achieve self sufficiency in

local food production for example cassava, yam, rice among other crops. According to Idachaba (2004) over 40 percent of the Nigerian population is food insecure. Several studies by Onyewaku and Ukeagbu, (1987) and Okuneye (1988) have shown that the wide food deficit in the country has been attributed to low resource productivity and disincentives induced by the macro-economics.

To reverse this trend, there is an urgent need to improve the production and efficiency of resource use among farmers. There is also the need to find out the nature of productivity and technical efficiency in cassava production when this is done, and productivity is increased, farmers will earn more income which will lead to increase in standard of living and more people will be employed. This will lead to increase in the Gross Domestic product (GDP) which will also lead to increase in foreign earnings.

1.3 Research Questions

This study answered the following research questions:

- i. What are the socio – economic characteristics of cassava farmers in the study area?
- ii. Is cassava production a profitable enterprise?
- iii. Are cassava farmers technically efficient?
- iv. Are cassava producers efficient in their inputs utilization? and
- v. What are the constraints to cassava production in the study area?

1.4 Objectives of the Study

The broad objective of the study was to analyze resource productivity and technical efficiency of cassava production in Ardo Kola and Gassol Local Government Areas of Taraba state. The specific objectives were to;

- (i) describe the socio – economic characteristics of cassava producers in the study area;
- (ii) determine the profitability of cassava production;
- (iii) determine the technical efficiency of cassava producers in the study area;
- (iv) to determine the productivity of input use, and
- (v) Identify the constraints to cassava production in the study area.

1.5 Hypothesis of the Study

The study proposes the following hypothesis stated in the null forms

H₀₁ The socio – economic characteristics do not affect the technical efficiency of cassava producers.

H₀₂ The various inputs used in cassava production do not affect cassava output.

1.6 Justification of the study

The need to investigate the resource productivity and efficiency of cassava producers in Ardo-Kola and Gassol Local Government Areas of Taraba state came to mind owing to the demand of local companies and consumers involved in processing and addition to foreign exchange earnings.

The study also became necessary because of the potentials of the area in terms of soil fertility and rainfall pattern which favours the cultivation of the crop. The study will be justifiable in the sense that when completed, it would be useful to the small holder farmers especially when policy recommendations are adhered to. It will increase their per capita income, subsequently improves standard of living. The result of this study on completion will be useful to policy makers in the formulation of policies for efficient cassava production. Also, individuals and researchers wishing to carryout similar or related study in the future will find this work useful.

CHAPTER TWO

LITERATURE REVIEW

2.1 Cassava, origin, description and distribution

Cassava (*Manihot esculenta*) originated in the Amazonian region of South America. It is a shrub with an average height of 1 metre, and has a palmate leaf formation. Cassava belongs to the family of rubber plant with white latex flowing out of its wounded stem and leaves stalk. The stem is the planting material from the root and shoots. Cassava produces bulky storage root with heavy concentration of carbohydrate about 80 percent. The shoot grows into leaves that constitute a good vegetable rich in protein, vitamins and minerals. New knowledge of the bio chemistry of the crop has proof that the protein embedded in the leaves has equal quality to the protein in egg. Cassava leaves and roots if properly processed can therefore provide a balanced diet protecting millions of African children against malnutrition (IITA, 2004).

The different types of cassava are described by the term cultivar or varieties. There are many varieties of cassava which can be distinguished by such features as size, colour and shape of the leaf, plant height, colour of stem and petiole, tuber shape, size and colour, maturity time of the root tuber, and yield. That is amount of the tuber produced per plant, and so on. There are also cultivars and varieties described by the nutritive content (levels and quality of food materials) such as starch, protein, minerals etc (Table 2.3). In Nigeria, many varieties are cultivated. Apart from the local cultivars, some of the best-known improved varieties are: TMS 30572, TMS 30211, XR 8082, TMS 30555 and NR 8083. This is because of their resistance to pest and diseases such as

green spider mite, cassava mealy bug and cassava mosaic virus as reported by the National Root Crops Research Institute (NRCRI, 1983).

Cassava is a wooden shrub of the Euphorbiaceae (spurge family) native of South America. It is the third largest source of carbohydrate for human food in the world. Cassava can be classified as sweet or bitter depending on the level of toxic cyanogenic glucosides. Improper preparation of bitter cassava causes a disease called *kanso*. Farmers often prefer the bitter variety because it deters pests, animals and thieves.

The name “cassava” is sometimes spelled casaba or cassada. In English language publications, the plant may be occasionally called by local names such as mandica, aipim, or maccaxeira (Brazil), kassav Haiti, Mandio (Paraguay), Gari or Akpu or Ugburu (Nigeria), Bankye (Ghana), Mongo or Mihogo (Swahili – speaking Africa), Singkong (Indonesia), Mushu (China) and so many others. Cassava came to Africa through the Portuguese (Stephen, 1995).

In Nigeria, cassava is known by different names among various ethnic groups. Among the Igbo’s, it is called “akpu”, “abacha” or “jibo”; Efik’s “Iwa unene”. While the Hausa’s, “Rogo” or doyar kudu”; Yoruba’s “Gbagudo” or “Eyes”; the Bini’s, “Gari” and Ijaw’s “Babuni” (NRCRI, 1983). The cassava root is long and tapered with a firm homogenous flesh cased in a detachable rind about 1mm thick, rough and brown on the outside. Commercial quantity can be 5 – 10 cm in diameter at the top, and 50 – 80 cm long. The fresh can be chooped white or yellowish. Cassava roots are very rich in starch and contain significant amount of calcium, phosphorous and vitamin C as shown on the Table 2.1.

Table 2.1: Nutritional Content of cassava tuber

Nutrients	Content
Calcium	50 mg
Phosphorus	40 mg
Vitamin C	25 mg

Source: FAO, 2006

However, the roots are poor in protein and other nutrients. In contrast, cassava leaves are good source of protein if supplemented with the Amino acid, methionine despite the cyanide content. Cassava production has been widespread in the country as indicated in Table 2.2.

Table 2.2: Cassava Production in Nigeria by Zones 2002 – 2004 (Tonnes)

Zone	2002	2003	2004
South West	499,380	566,361.1	588,380.5
South South	626,811.4	653,394.4	632,167.4
South East	538,413.	554,241.2	586,310
North West	243,521.1	239,554.3	234,000
North Central	711,692.0	724,397.0	740,564.0
North East	165,344	141,533	140,620
Total	2,636,309.9	2,752,101.6	2,793,804.9

Source: FAO, 2004

The North Central produces over 7 million tonnes of cassava a year from 2000 – 2004. South- South produced over 6 million tonnes of cassava a year while the South West and South East produced just less than 6 million tonnes a year. The North West and North East are still by comparison at 2 and 0.14 million tonnes respectively. On per capita basis, North Central is the highest producing state with 0.7 tonnes per person in 2004, followed by South East with 0.56 tonnes per person, South South with 0.34 tonnes per person, North West with 0.10 tonnes per person and finally North East with 0.1 per person. National per capita production of cassava is 0.32 tonnes per person as at 2004. With Benue and Kogi states in the North Central zone being the largest producers of cassava (IITA, 2004). Cross River, Akwa Ibom, Rivers and Delta states dominate the cassava production in the South-South. Ogun, Ondo and Oyo dominate in the South West and Enugu and Imo states dominate production in the South East. Kaduna alone in the North West and with little currently produced cassava in the North East with Taraba state dominating.

Yisa (2009) stated that Nigeria is likely to meet the target of 150 million tonnes by 2020 with the improved varieties introduced by IITA and the simple linear time trend to National cassava area illustrates an increase of 100 million hectares and over 4 million hectares by the year 2010. Since Nigeria has made the target in production and area, a significant increase in National yield is required. Sixty million tonnes on 4 hectares of land will require an average yield of 15 tonnes per hectare as against the stagnant 10 tonnes per hectare.

The country is yet to fully harness the socio-economic potentials of cassava that would translate to higher ranking of cassava next to petroleum as major contributor to the

Gross Domestic Product (GDP). The Presidential initiative on cassava production in 2002 has set in motion the process of achieving an annual basic of 5 billion U.S Dollars from export of cassava in the next 3 – 5 years. This plan also involves building of domestic productive capacity of efficiently profitable and sustainable output to satisfy the new market with the quality and quantity required to realize the objective.

One of the strategies put in place to realize this noble objective is the establishment of 6 – farm gates primary processing centres of which one is located in Ardo Kola Local Government of Taraba state. However, lack of funds to procure essential processing machinery and equipment which will create demand for cassava product has been a problem. Evidence has shown that cassava production has been on the increase from 1999 to date (Nweke,1994; FMARD, 2004), however, post harvest system such as processing, packaging, marketing, storage, distribution and transportation have constrained sustainable cassava production in recent times (RUSEP, 2000). This has resulted into substantial losses which complicated food insecurity status of household in terms of available calorie dietary consumption. Studies have shown that efficient marketing system stimulates agricultural production (Awoyinka and Ikpi, 2005; Adesope *et al.*, 2005). However, marketing of food in Nigeria has been characterized with a lot of deficiencies (Adekanye, 1970; Abdullahi, 1983) which have affected sustainable agricultural development in one way or the other.

Mayong *et al.* (2003); have stated that the Presidential Initiative on cassava, only identified potential contributions of agricultural marketing policy to agricultural development, but have failed to incorporate strategies for combating perennial constraints to effective and efficient food marketing in Nigeria.

2.2 Cassava cultivation and harvest

Cassava is a tropical root crop, requiring at least 8 months of warm weather to produce the crop. It is traditionally grown in a Savannah climate, but can be grown in extreme of rainfall. In moist areas, it does not tolerate flooding. In droughty areas, it loses its leaves to conserve moisture, producing new leaves when rain resumes. It takes 18 or more months to produce a crop under adverse conditions such as cold or dry weather. Cassava does not tolerate freezing conditions. It tolerates a wide range of soil pH 4.0, 8.0 and is most productive in full sun.

Cassava is one of the most drought-tolerant crops and can be successfully grown on marginal soils, giving reasonable yields where many other crops do not thrive. Cassava is adapted to zones within latitude 30° north and south of the equator and altitude of not more than 2000 m above sea level, and temperature range of 15 - 25 °C with 50 – 5,000 mm of rains annually.

Before the development of National and International breeding programmes with cassava, there were relatively few cultivars or producers. This is because cassava is propagated vegetatively as clones. Recent releases from breeding programmes include clones resistant to many of the major diseases and pests militating against cassava production, cassava is planted using 7 – 30 cm portion of the matured stem as propagule. A selection of healthy disease – free and pest – free propagule is essential. The stem cuttings are sometimes referred to as “stakes”. In areas where freezing temperatures are possible, the cuttings are planted as soon as dangers of frost are over. The cuttings are planted by hand in moist, prepared soil. The cuttings are laid and covered with 2 – 3 cm soil (Stephen, 1995).

Mechanical planters have been developed in Brazil to reduce labour inputs. The top of the cutting must be placed up. Typical planting spacing is 1m by 1m, cutting produce root within a few days and new shoots soon appear at old leaf petiole axes on the stem. Cassava yield varies with cultivars, season of planting, soil type and fertility. With improved varieties and under good management practices they can reach 20 – 25 tonnes per hectare (FAO, 2004).

Early growth is relatively slow, thus weeds must be controlled during the first few months. Although cassava can produce a crop with minimal input, optimal yields are recorded from fields with average soil fertility level for good crop production and regular moisture availability, optimal growth and productivity of the plant is relative to its harvest index. Roots weight divided by total plant weight. The desirable indexes range from 0.5 – 0.7. Responses to macro – nutrients vary with cassava responding most to P and K fertilization. Vesicular–arbuscular (VA) mycorrhizae benefit cassava by scavenging for phosphorus and supplying the roots. High N fertilization, more than 100 kg of actual N/ha may result in excessive foliage production at the expense of storage root development and fertilizer is only applied during the first few months of growth. Commercially produced fungicides and pesticides are seldom used with none being registered for use in the U.S.A (RMRDC, 2004).

Cassava is vegetatively propagated from stem cuttings. The best stems or stakes for planting are obtained from plants 10-12 months old. However, stems can be cut and supplied to farmers or cassava growers from 6 to 7 months old cassava plants. In this case, the roots are not uprooted. The plants are cut at 20 – 25 cm from the ground level and allowed to regenerate. This process is called “rationing”. For rapid multiplication of

cassava plant materials, the stem is cut about six months later from the ratoon. As many as three rations can be done in a cassava farm. However, the number of rations depends on the variety of the cassava, soil nutrient status, weed control and field maintenance (NRCRI, 1983). The cassava stems are stored under shade for 2 to 4 days before cutting them into planting setts. This is done to reduce moisture that may promote rotting of planting setts. The process also allows the stems to sprout faster than planting them immediately they are freshly cut from the field. Cassava stem cuttings (setts) are planted at 1m x 1m part on the crest of mounds or ridges. This will give a plant population of 10,000 stands per hectare. However, it has been observed that in Nigeria; the plant population in the farmers' field range from 7,000 to 8,800 stands per hectare (Nweke *et al.*, 2002).

Cassava stems are planted in a slanting position or angular position (45°) in which case, the stems are buried in the soil with one-third of their parts above the soil surface. The stems are buried in such a way that the buds point upwards, from where the stem sprouts. Stems can also be planted in a horizontal position in which case, they are completely buried in the soil to about 5 cm depth.

Nnodu (1997) recommend the most simplest and practical method to store cassava stem effectively. The stems are tied into bundles with the basal ends having the same level. The bundles are placed under the roof in a well ventilated shed or under a well developed tree providing a good shade. The basal ends of the stems are inserted into the soil and water may be applied to the soil; stems can be stored in this way for up to 2 to 3 months before using them for planting. There is no matured stage for cassava. Plants are ready for harvest as long as there are storage roots large enough to meet the

requirement of the consumer. Under the most favourable condition, yield of fresh root reach 90 tonnes per hectare while average yield from mostly subsistence agricultural system are 9.8 tonnes per hectare. Typically, harvesting can begin as soon as 8 months after planting. In the tropics, plant can remain unharvested for more than one growing season, allowing the storage root to enlarge further. However, as the root age, the central portion becomes woody and inedible (Stephen, 1995).

Most cassava is harvested by hand lifting the lower part of stem and pulling the roots out of the ground then removing them from the base of the plant by hand. The upper part of the stem with the leaves is removed before harvest. Levers and ropes can be used to assist harvesting. A mechanical harvester has been developed in Brazil. It grabs into the stem and lifts the root from the ground. Care must be taken during harvesting process to minimize damage to the root, as this greatly reduces shelf life. During the harvesting process, the cuttings for the next crop are selected. This must be kept in a protected location to prevent desiccation.

2.3 Cassava utilization

Worldwide cassava utilization increased from 130 million tonnes (in fresh root equivalents) 1984 to 162 million tonnes in 1994. Cassava is grown for its large starch filled root which contains nearly the maximum theoretical concentration of starch on a dry weight basis among food crop. Fresh root contain about 30 percent starch and very little protein. Roots are prepared much like potatoes, they can be peeled and boiled, baked or fried. It is not recommended to eat cassava uncooked because of potentially toxins concentration of cyanogenic glucosides that are reduced to innocuous levels

through cooking. In traditional setting of the America, roots are grated and the sap is extracted through squeezing or pressing. The cassava is then further dried over a fire to make a meal or fermented and cooked. The meal can then be re hydrated with water or added to soup or stew.

In Africa, roots are processed in several different ways. They may be first fermented in water then they are either sun – dry for storage or grated into dough that is cooked. Alcoholic beverages, medicine, animal feed and so many others can be made from the root (Stephen, 1995).

2.3.1 Food Uses

Cassava- based dishes are widely consumed where the plants is cultivated. Some of these dishes have regional, national or ethnic importance. Cassava must be cooked properly to detoxify it before it is eaten. Cassava can be cooked in various ways. The soft boiled roots have a delicious flavour and can replaced boiled potatoes in many uses. It can be made into meal dishes, or made into pureés, dumplings soups, stew, gravies, etc. Deep fried (after boiling or steaming), it can replace fried potato with a distinctive flavour. Tapioca and Fufou are made from the starch cassava flour. Tapioca is an essentially flavourless starchy ingredients, or fecula, produced from treated and dried cassava (*Manioc*) root and used in cooking. It is similar to sago and is commonly used to make milky pudding. Similar to rice pudding, cassava flour also called *Tapioca* flour or *Tapioca* starch, can replace wheat flour and also used by some people with white allergies or coeliac diseases (Dorosh, 1988).

Boba Tapioca pearls are made from cassava roots. It is also used in cereals for which several tribes in South America have used it extensively. It is also used in making cassava cakes, a popular pastry, bread, and most confectionary products.

The juice of the bitter cassava, boiled to the consistent of thick syrup and flavoured with spices is a delicacy called cassareep. It is used as basis for various sauces and as a culinary flavouring, principally in tropical countries. It is exported cheaply from Guyana. Cassava is also used in bubble drinks in East Asia, (Stephen, 1995).

The leaves can be pounded to fine chaff and cooked as a palaver sauce in Sierra Leone, usually with palm oil but vegetable oil can also be used. Palaver sauce contains meat and fish as well. It is necessary to wash the leaves chaff several times to remove the bitter taste. In Congo Democratic Republic, the leaves are used in a stew called pondou. Cassava flour can also be used in bread making. The bulk of global cassava utilization in the form of food – fresh root and processed products such as flour and fermented meal preparation is largely concentrated in Africa especially in Nigeria. Both cassava leaves and roots are suitable for human consumption. Cultivars are classified as sweet or bitter depending on their cyanide content, bitter variety are specially suitable for industrial and feed purposes, because of their higher starch contain while sweet variety are generally prepared if the root is to be consumed as food. A typical cassava root has the following composition, as revealed in Table 2.3.

Table 2.3: Cassava Composition

	Composition
Moisture	70%
Starch	24%
Fibre	2%
Protein	1%
Other Elements	3%

Source: FAO, 2005

As seen in Table 2.3 cassava contains 70 % moisture, 24 % starch and only 1 % protein. Because of its high water contents, the root is bulky and highly perishable, so processing is normally carried out within 48 hours of harvest, thus processing permits to enhance the value of the product by removing the naturally accruing toxic found in the roots. It reduces the weight of the products thereby facilitating its transportation to the market. It lessens post harvest losses arising from breakage of the roots. On a per caput basis, growth in global cassava food consumption on average has been dwindling and has even fallen in Latin America, Caribbean and Asia. Such a pattern attests to the decline of cassava production for low income consumers but also highlight that the development of new food product through processing has been insufficient to counter the fall in fresh root consumption with increasing income and with migration to our urban centres. The table below shows the consumption rate globally.

Table 2.4: Global Consumption Rate of Cassava

Food Consumption	1970	1980	1990	2000	2003	Annual growth rate % 1970 - 2000	Growth Rate % 2000 - 2003
World	39.3	39.2	40.00	42.6	43.6	0.3	0.7
Developing	55.3	53.3	52.7	54.2	55.2	-0.1	0.5
Africa	211.0	201.9	214.5	209.7	207.8	0.1	-0.3
Latin America & Caribbean	106.8	74.9	62.7	57.2	52.7	-2.0	-2.2
Asia & Pacific	18.2	20.0	15.9	16.7	17.8	-0.7	2.1

Source: FAO, 2005

2.3.2 Cassava Products as Animal Feeds

The use of cassava as animal feed account about 20 percent of cassava utilization in Africa. It is widely used in most tropical areas for feeding pigs, cattle, sheep and poultry (Dorosh, 1988). Ospina and Weatley (2005) revealed that production of dried cassava in Brazil is an appropriate way to improve the regions self sufficiency in feeds for animal production. In Europe about 6 million tonnes of dried cassava peels of cassava roots are fits to livestock while raw or boiled are mixed into a mashed with protein concentration such as maize, sorghum, groundnuts or oil palm kernel meals and mineral salt for other livestock. Many feeding experiments have shown that cassava provides good quality carbohydrates, which may be substituted for maize or barley as ration for swine, dairy cattle and poultry (Ospina and Weatley, 2005).

Cassava products were long use as a raw material for compound feedstuffs in Europe until the use decline after the Second World War when grains became cheaper than cassava products which are close substitutes for grains. In Europe, the highly developed compound feed industry rely on dried cassava roots as an ingredient for which large quantities of cassava chips, pellets and meals are imported (Ospina and Wheatley, 2005). Of a total production of 87 million tonnes annually in Africa in 1999, only 6 % of this was used in livestock production mainly in traditional system. In Latin America, 32.4 % of its cassava was used for livestock feeding while in Asia, over 40 % of its products is exported in form of chips and pellets for the European Union (EU) livestock industry with 2.9 % used for domestic livestock production (IFAD/FAO, 2000).

Cassava hay is produced at a 2 - 3 young growth stage, 3 – 4 months, harvested about 30 – 45 cm above the ground, and sun dried for 1 – 2 days until it has final dried matter of at least 85 percent crude protein content (20 – 27 percent crude protein) and condensed further 1.5 – 4 percent (C.P) . It is used as roughage sources for dairy, beef, buffalo, goats and sheep by either direct feeding or as a protein source in the concentration mixtures.

2.3.3 Bio-fuel from Cassava

According to NRCRI (1983) cassava has been shown to have a good raw material for ethanol production. This is because it contains high level of fermentable sugars based on its high amylose. The amount and quality of ethanol released and recovered depends to a great extent on the efficiency of the enzymes used, the management of each stage and the equipment used at each production process. In many countries, significant research has begun to evaluate the use of cassava as an ethanol fuel. Under the

development plan for renewable energy in China, the target is to increase the application of ethanol by non grains feed stock to 2 million tonnes and that of the bio diesel to 200,000 tonnes by 2010. This will be equivalent to a substitute of 10 million tonnes of petroleum. As a result, cassava (*Tapioca*) chips have gradually become major source of ethanol production. On December, 22nd 2007, the largest cassava ethanol fuel production facility was completed in Beihai with annual output of 200,000 tonnes which will need an average of repeated invested U.S \$51.5 million in a new bio fuel facility that is expected to produce 33 million gallons a year by ethanol from cassava plants (Ospina and Wheatley, 2005). Table 2.5 shows the current ethanol demand in Nigeria.

Table 2.5: Ethanol Demand in Nigeria

Industry	Animal consumption (million litres)
Liquor Blending	40.4
Plastics	12.9
Petrol – Chemical	78
Cosmetics	6.9
Paints	3.6
Brewing / Bottling	17
Others	5.5

Source : Obasanjo Cassava Initiative, 2006

Table 2.5 shows the liquor bleeding recorded 40.4 million liters of ethanol annually.

2.3.4 Medicinal Uses (Ethno medicine) of Cassava Production

The medicinal uses of cassava products are not well documented but Wikipedia (2000) highlighted some of the medicinal uses of cassava as follows;

- The bitter variety of Manihot is used to treat Diarrhoea and malaria.
- The leaves are use to treat hypertension, headache and pains.
- Cuban commonly uses cassava to treat irresistible bowel syndrome.

2.3.5 Other Uses of Cassava Products

Cassava starch is used as raw materials for wide range of food products and industrial goods, including paper, carbon paper, textile plywood, glue and alcohol. Most of cassava starch industries are located in Asia. In this region, processing of cassava into starch is carried out by large scale factories in Thailand, Vietnam and China. In the first country, industries for the production of cassava modified starch have been set up since the mid – 1990s often under joint venture with Japanese firms (FAO, 2005).

In Africa, a number of cassava starch industries have been set up in countries like Tanzania, Madagascar, but they are not currently operational. One major constraint to the industry is the unavailability of regular supply of raw materials or root for processing. The potential utilization of cassava as inputs in industries is far from being tapped in most regions and only in Thailand has there been progress in developing a well established cassava starch industry to meet domestic and export requirements, This may imply some imports substitution for completing products especially if protected by the supplying countries as in case of potatoes starch from European Union.

2.4 Cost and Return in Agricultural Production

Cost refers to the values of inputs used in production while profits and returns are obtained by subtracting the cost from the Revenue (Adegeye and Dittoh, 1985). The more one reduces the revenue, the more the cost. Every production is geared towards profits maximization or cost minimization or maximizing output or maximizing utility or a combination of some or all of these (Olayide and Heady, 1982). This cost can be either of variable inputs or factors of productions such as labour, fertilizers, tools e t c while fixed cost refers to the cost of physical assets, such as tractor, building, rent interest on capital and breeding stock (Olukosi and Isitor, 1990).

Idama (2000) asserted that revenue generation is perhaps the most important responsibility of modern Government. As the welfare needs of the people increase, source of generating revenue to meet the needs must be found. He is of the opinion that if investment is heavily geared towards wealth generating activities as cassava and other agricultural businesses a lot of farmers would have improved.

According to Langyinto (1999) transport cost, infrastructural facilities like roads network, proximity to market locations, price of the commodity and activities of commercial agents affects profitability of cassava production or farming in Nigeria. Cassava can be marketed in form of dried chips, fresh roots, starch and other processed forms.

Eyo, (2004), observed that in Nigeria agricultural sector, the small operators face pure competition both at production and marketing stages, because of this structure, output is sold at industry – determine price and profits are maximized at the level of output where marginal cost equals marginal revenue ($MC = MR$). However, the size of

the profit depends on how large the per unit output price is compared to the unit cost of production. If the per unit prices is large, the operators earn pure profit in the short run.

Spurlock and Gillis (1997) found that variable costs are those that the management control in the short-run and that will increase as total planned production is increased. A study by Gaytengioglu and Sureta (2000) stated that labour and rent accounted for the greatest share of production cost and that rice production cost varied depending on farm size and is higher on smaller farms than on large farms. Labour cost as reported by Ohajiana (2003) is a major component of the total variable cost in rice farming. Similarly Chikwendu and Tologbonse (2003) reported that human labour was the most significant cost item in paddy rice production. Rahman and Lawal recommended that labour saving technologies should be introduced to farmers to cut down cost of labour.

2.5 Concept of Agricultural Productivity

Productivity is often described as a secret of business success, economic progress and increasing wealth. Amaza, (2000) defined productivity as a measure of the ratio of inputs, which is utilized in the relevant production process. According to Alimi (2000) products requires the use of resources to obtain output and these resources could be aggregated into land, labour, capital and management in agriculture. He said that in order to achieve optimum production level, resources must be available in and what ever quantities, available resources must be used efficiently. Successful and result oriented farm planning and policies require the knowledge of farm resources to know the resources whose quantity and rate of use should be increased or decreased. Moreover,

according to him, increasing the level of farm size, technology, capital and increasing the rate of family labour will increase production and profit of farmers.

Agricultural productivity is the index of the ratio of output to input used in the production process, which is synonymous with resource use productivity (Olayide and Heady, 1982). The computation of this important productivity statistics include the average products (AP), marginal product (MP), marginal rate of substitution (MRS), elasticity of production (EP), and return to scale (RTS). This analysis has made a delineation of three economic stages of production function that enables us to know the point of efficient utilization of resources in the production process possible.

Efficiency of resources use is the ratio of useful output to the total inputs that gives maximum value of output from any given total inputs (Shepherd, 1985). Also, Helfoned, (2003) reiterated that the analysis of efficiency with the possibility of farm producing a certain optimal level of output from a given bundle of resources or certain level of output at least cost. Productive efficiency can be seen to be the attainment of production goals without waste. However, the fundamental idea underlying all efficient measures is that of the quantity of goods and services per unit of inputs (Ajibefun and Daramola, 1999).

2.6 Socio – Economic Characteristics of Cassava farmers

Some of the socio – economic features of the farmers which may affects their productivity level include age, educational level, marital status, land ownership, access to credit facilities and many others (Adebayo and Onu, 1999).

The level of farmer's education is believed to influence the use of improved technology in the agricultural production and hence farm productivity (Awolola, 1995). According to Reneto and Euan, (2004) education was found to be one of the significant variables associated with the technical efficiency of farmers, thus implying that human capital is an important factor of carrying out production and managerial task on cassava farms.

Olaf *et al.*, (2003) observed that several characteristics of farm operation such as age and education, ratio of adult in the farm household and income from non – farm activities have significant effect on the technical efficiency of the farm Adewumi and Okunmadewa, (2001) reported that the economic efficiency level of farmers is significantly affected by farming experience, farm distance, education and extension services. In a study conducted by Giroh and Adebayo (2007) they observed that the socio-economic characteristics of respondents revealed the preponderance of young tappers in tapping profession means that productivity is expected to be high since they are expected to be active and energetic. This was in line with the findings of Wuranti (2004) who noted that farmers in their young active years were more productive and can easily adopt agricultural innovation.

2.7 The Concept of Efficiency in Agricultural Production

Production efficiency is concern with the relative performance of the process used in transforming inputs into outputs. Efficiency analysis is generally associated with the level of output produced given certain level of inputs. Maximum efficiency is attended when it becomes impossible to re shuffle a given resource combination without

decreasing the total output (Adeoti, 2001). The reason behind measure of efficiency is that farmers are not making efficient use of existing technologies, and effort designed to improved efficiency would be more cost effective than introducing a new technology as a means of increasing output (Shapiro, 1983). There are three types of efficiency. Technical efficiency (TE) is the achievement of maximum potential out put from a given quantity of inputs under a given technology. Adebayo (2007) stated that technical efficiency provides a good ground to find out the sources of inefficiencies, in the study area. It may arise from socio-economic variables existing technology, managerial decision just to mention a few.

According to Upton, (1996), efficiency is concern with relative performance of the process used in transforming given level of inputs into output. In other words, technical efficiency is the ability to achieve a higher level of output given similar level of production inputs. A farm is technically more efficient compared to other farms if it produces a larger output from the same level of inputs.

Allocative efficiency is concerned with the extent to which farmers make their efficient decision by using inputs up to the level of which their marginal contribution value is equal to the factor cost. It has to do with appropriate choice of inputs combination. A farm is allocative efficient if production inputs are allocated according their relative prices. That is when production occurs at point where marginal value product is equal to marginal factor cost.

According to Jondrow *et al.* (1982) economic efficiency is the ability to produce a given level of output using a cost minimizing inputs ratio. It is also the product of technical and allocative efficiencies. The achievement of either technical or allocative

efficiency is a necessary but not a sufficient condition for economic efficiency. The sufficient condition occurs when relationships are employed to denote maximization of other economic objectives.

Ogunjobi, (1999) stated that efficiency measurement is important because it is a success indicator and performance measure by which production units are evaluated. Secondly, identification of sources of inefficiency is important to the institution of public and private policies designed to improve of a production system or units. Thirdly, it leads to a sustainable resource savings, which have important implications for policy formulation and farm management. Furthermore, it determines the extent to which it is possible to raise productivity by improving the neglected resources. The study of productivity efficiency started with the pioneering work of Farrel (1957) as cited by Ojo and Imodu three types of efficiency were identified: allocative efficiency, technical and economic efficiencies. Technical efficiency (TE) is the achievement of maximum potential output from a given quantity of inputs under a given technology. It is the attainment of production goal without wastage. Jondrow *et al.* (1982); Olayemi (2002). Abdourahmane *et al.* (2001) defined economic efficiency (EE) as the ability to produce a given level of output using a cost minimizing input ratio. The production function stipulates the technical relationship between input and output used in the production process. This function is assumed to be continuous and differentiable in mathematical terms. Economists used it to determine rate of return to the various factors of production.

The concept of efficiency is concerned with the relative performance of the processes used in transferring given input to output. Technical efficiency is defined as the ability to achieve a high level of output given similar level of production inputs while

allocative efficiency has to do with the extent to which farmers make efficient decision by using input up to a level at which their marginal contribution value is equal to the factor cost. Economic efficiency (EE) is the combination of both technical and allocative efficiencies and it occurs when a firm chooses resources and enterprises in such a way as to attain economic optimum (Adesina and Djato, 1997). Technical inefficiency arises when less than maximum output is obtained from a given bundle of factors.

Bravo-Ureta and Rieger (1991); Ogunjobi (1999) enumerated the importance of efficiency as follows: firstly, it is a success indicators and performance means by which production unit are evaluated. Secondly, the exploring of hypothesis concerning the source of efficiency differential can only be possible by measuring efficiency and separating its effects from the effect of the production environment. Identification of source of inefficiency is important to the institutions of public and private policies designed to improved performance.

There are two types of frontier models; these are deterministic and stochastic models respectively. The term deterministic is used to describe group of method that assumed a parametric form of production frontier along with a strict one sided error term (Coelli, 1995). The deterministic frontier takes no account of possible influence of measurement error and other noise upon the shape and position of the estimated frontier. Since all observe deviations from the frontier are assumed to be the result of technical inefficiency (Coelli, 1995; Aigner and Chu, 1968 and Meeusen and Van den Broeck , 1977) considered estimation of a parametric frontier production in input (output, space and specified a Cobb-Douglas production in logarithm for sample of n firms as

$$\ln(Y_i) = f(X_i; \beta) - U_i, \dots \dots \dots$$

Where $i = 1, 2, \dots, U$

Aigner *et al.* (1977) and Meeusen and Van den Broeck (1977) independently proposed the stochastic frontier production function, when noise account for the adding a symmetric error term (V_i) to the non-negative error of the deterministic model. The parameters of this model are estimated by the maximum likelihood estimate (MLE) and corrected ordinary least squares (COLS). The development of and availability of automatic maximum likelihood makes the ML estimator more preferred to the COLS estimator (Tran *et al.*, 1993; Coelli, 1992).

Stochastic production frontier is widely used as a tool of analysis in agricultural studies in both developed and developing countries of the world. Tadesses and Krsihnamorthy (1997) estimated technical efficiency in paddy farms in Tamil Nadu using stochastic frontier model. The paddy shows that 90 % of the variation in pit put among paddy farms is due to difference in technical efficiency, land, animal and fertilizer have significant influence on the technical level of the farmers.

Adebayo (2007) conducted a research on efficiency of dairy pastoralist in Adamawa state and concluded that the technical efficiency with respect to experience ranges from about 81 percent from farmers with lower than 30 years of experience to about 89% with farmer with 40 -49 years of experience. The technical efficiency of the sampled pastoralist is less than one, indicating that the pastoralists were not operating on the efficiency frontier. The minimum (TE) index was 0.87 suggesting that the pastoralist output could be improved by 13 % through improved resource allocation.

2.8 Gross Margin Analysis and Net Farm Income

This tool was employed to determine the profitability level of the cassava enterprise in the study area. The Gross Margin (GM) is the difference between the gross farm revenue (GFR) and the total variable cost ($X_i P_{xi}$) incurred in the cassava production. Olukosi and Erhabor (1988) defined net farm income (NFI) as the difference between the gross farm revenue and the total cost (TVC) and the fixed cost (FC) incurred in the production process. This was used to achieve objective (2) of the study area. The equations for the gross margin and the net farm income are specified as follows;

$$GM = \sum Q_y P_y - \sum X_i P_{xi} \dots\dots\dots 3.1$$

$$NFI = \sum Q_y P_y - (\sum X_i P_{xi} + \sum X_{ii} P_{Xii}) \dots\dots\dots 3.2$$

2.9 The Stochastic Frontier Production Analysis

This production function was proposed independently by Aigner *et al.* (1977) and Meeusen and Van den Broeck (1977) in Amaza (1999). The Stochastic frontier function was used to achieve objective 3. The frontier production function differs from production function in the sense that its disturbance term has two components. One to account for technical inefficiency and the other to permit random events due to measurement error (Tran *et al.*, 1993; Amaza, 1999).

Mathematically, it is expressed as follows:

$$Y_i = f(X_i; \beta) + (V_i - U_i) \quad i = 1, 2, 3 \dots\dots\dots N \dots\dots\dots (3)$$

Where:

Y_i = Production of the i^{th} farmer

X_i = Vector of input quantities of the i^{th} farmer

$\beta\delta$ = Vectors of unknown parameter

V_i = Assumed to account for random factors such as risks, weather and measurement error

U_i = Are due to technical inefficiency.

2.10 Trend of Cassava Production in Nigeria

Cassava is grown in all the states of the Federation with current production level of about 45 million metric tonnes per annum, a figure expected to double by the year 2020. Nigeria is the leading cassava producer in the world, producing a third more than Brazil and almost double the production capacity of Thailand and Indonesia (FAO, 2006).

The situation of cassava production and the land allocated for cassava production in Nigeria for the period between 1970 – 2004 is represented in the Table 2.6. Cassava output declined with negative annual growth rate from about 5,000,000 tonnes in 1970 to 500,000 tonnes in 1983 (CBN, 2004 and FAO, 2005). According to them, the decline in output was attributed to low productivity as the land increased from 857,000 hectares to 1.1,000,000 hectares with marginal annual growth rate of about 2 percent in land area cultivated. During the period, productivity in yield per hectare decline from 6.1 million tonnes in 1970 to 500,000 tonnes in 1983. This was attributed to predominant (traditional practice), of intercropping cassava with other crops coupled with high incidence of pest and diseases which characterize the period (CBN, 2004 and FAO, 2005).

They further explained that after 1983, output was in the increase by more than 2200 percent from 513000 tonnes in 1983 to 11,800,000 tonnes in 1984 (Table 2.5). This

sharp increase in the cassava output was attributed to the success recorded by the research institute in the development of high yielding and Cassava Mosaic Disease (CMD) resistant, “elite” varieties of cassava planting materials. They observed that this period also mark the beginning of modern trend of cassava cultivation as sole crop by farmer in order to reap maximally from the commercial successes the crop begins to benefits.

CBN (2004), and FAO (2005) noticed that beginning from 1987, output in cassava increased from about 14 million tonnes to 44 millions tonnes in 2004. Apart from the over 16 percent annual growth rate recorded in 1991, 1997, 1998, 1999, (36.5%, 16.9%, 28.5% and 16.5% respectively), an annual average of between 3% and 5% output growth rate was estimated. Increase in output was partly as a result of expansion in land area cultivated from about 1.3 million hectares in 1983 to 3.5 million hectares in 2004 and also improved from productivity which stood between 10 and 13 tonnes per hectare during 1987 – 2004 period.

Furthermore, they pointed out that, cropping pattern of farmers, use of different varieties of planting materials, change in Government policies on agriculture, change in land cultivated and yield per hectare and some of the factors associated with occasional changes in output between 1970 and 2004. In the north east geopolitical zone, Taraba seems to have the highest output (tonnes) of cassava (Table 2.6).

Table 2.6: Trend in Cassava Output, Land Area Cultivated Yield per Hectare in Nigeria (1970 – 2004)

Year	Output of cassava in tonnes (000)	Annual growth rate in output (%)	Land cultivated in Ha (000)	Annual growth rate in land area cultivated (%)	Yield in tonnes per Ha
1970	5224	-	857	-	6.1
1971	4516	-3.6	900	5.0	5.0
1972	2573	-43.0	960	6.7	2.7
1973	2912	13.1	970	1.0	3.0
1974	3582	23.0	1050	8.2	3.4
1975	2912	-18.7	1050	0.0	2.8
1976	1786	-38.8	1080	2.9	1.7
1977	1656	-7.3	1100	1.9	1.5
1978	1620	-2.1	1100	0.0	1.5
1979	1446	-10.1	1150	4.5	1.3
1980	942	-34.8	1200	4.3	0.7
1981	620	-34.1	1200	0.0	0.5
1982	942	51.9	1250	4.2	0.8
1983	513	-45.5	1100	-8.0	0.5
1984	11800	2200.0	1259	14.5	9.2
1985	13500	14.4	1075	-14.6	12.5
1986	12388	-8.2	1095	1.8	11.3
1987	13876	12.1	1288	17.6	10.8
1988	15540	11.9	1347	4.6	11.5
1989	17404	11.9	1371	1.7	12.7
1990	19043	9.4	1472	7.3	12.9
1991	26004	36.5	2551	7.4	10.2
1992	29148	12.1	2755	7.9	10.6
1993	30128	3.4	2844	3.2	10.6
1994	31005	2.9	2944	3.5	10.5
1995	31404	1.3	2944	0.0	10.7
1996	32950	4.9	2546	-1.4	12.9
1997	33510	16.9	2697	5.9	12.4
1998	43092	28.5	3042	5.7	14.1
1999	35950	16.5	3072	9.9	11.7
2000	36750	2.1	3136	2.1	11.7
2001	37949	3.3	3136	0.0	12.1
2002	39410	3.8	3455	10.2	11.4
2003	40853	3.7	3490	1.1	11.7
2004	44693	9.4	41180	17.9	10.8

Source: Adapted from (CBN, 2004; FAO, 2005) data

Table 2.7: Actual production of cassava in Borno/Taraba states from 2000 - 2004

S/No.	State	2000	2001	2002	2003	2004
1	Borno	135,000	130,000	860,000	750,000	500,000
2	Taraba	126,510	18,743	100,000	110,000	603,485

Source: State ADP submission, 2004

2.11 Problems and Prospects of Cassava Cultivation in Taraba state

The production of cassava in Nigeria has faced different problems such as land acquisition, fertilizer application, level of education of producers and production inputs (Emokaro and Erhabor, 2006). World Bank (2006); Okieze and Kosikowski, (1982) observed that different prospects exist for cassava production in Nigeria. The decline in production may be related to losses arising from livestock (mainly cattle, goats), pests and diseases, and or level of soil fertility. Unless fenced round, cassava field could be destroyed by cattle and other domestic animals during dry season. Negative market forces, for example low prices for fresh roots may also reduce production. The general increase in production of cassava could be related to rapid population growth and hence increase market demand for cassava based foods. As at now, there is relatively low industrial demand for cassava for the production of the various industrial products in Nigeria. However, there is increase in demand for cassava foods such as gari, fufu and lots more (Okoli *et al.*, 1996).

According to Emokaro and Erhabor, (2006) cassava is mainly grown on fragmented parcel of land due to the poor land acquisition pattern in Nigeria (mainly communal and inheritance). This practice of land acquisition makes mechanization difficult. They further stated that for the present level of cassava production and

efficiency to be improved, mechanization should be encouraged through cultivation of vast expanse of land. This can be achieved by improving on the current land acquisition pattern in the country with the view to make land available on continuous basis for commercial cassava production. They also observed that farmers seldom apply fertilizer in cassava production as an economic waste, since cassava thrive well in soil with marginal fertility, where other crops may not do well. They attributed these to the level of education of cassava producers. They advocated for sensitization on the use of fertilizer.

Erhabor and Emokaro, (2007) observed that cassava farmers are small holder farmers, resource – poor and are unable to afford the basic requirements for improved production of the crop such as, improved varieties of planting materials, mechanized tillage implements, agro –chemical and access to credit facilities have also acted as some of the major constraints to cassava output in Taraba state in particular and Nigeria at large.

World Bank, (2006) observed that the uneducated farmers find it difficult to adopt to improved technology in their production process. He also observed that the output of the educated farmers is about 13 percent higher than that of the uneducated farmers. According to him the educated farmers has more advantage of knowing little promptings rules of application of production inputs in order to achieve optimum yield.

World Bank, (2006) further observed that farmer ratio to extension workers also contributes greatly to farmers low rate of adopting improved production technology and also increase in the number of extension workers will also bring about improvement in the participation of farmers in cassava production which will in turn improve farmers level of adoption of improved technology and consequently, increase in cassava output.

As the cassava sub sector trend increase towards commercialization especially with the presidential initiative on cassava production in 2002, there is need for more active and responsive private sector agricultural market (Okezie and Kosikwoski, 1982). Yisa, (2009) in his assessment of the Presidential Initiative observed that with the transition from traditional subsistence practice of mixed cropping to the modern commercialized production of sole cropping on a large scale, the producer needs credit facilities to facilitate his enterprise.

Giroh and Adebayo (2007) reported profitability analysis of natural rubber tapping in their study that transportation ranked fourth major problem for rubber tappers. Inadequate means of transportation limits tappers early arrival at task location. Another problem they pointed out are health risk as dangerous reptiles (snakes), plantation management constraints just to mentions but a few.

2.12 Potentials of Cassava Production and Marketing in the Economic Development of Nigeria

The potential of cassava marketing to agriculture and overall economic development are immense (RUSEP, 2007). These include;

- Contributing to economic and social development through the reduction of inefficiencies including friction between trading partners, wasted effort by producers and others and food wastes thereby leading to more efficient production and marketing of existing and new food producer.
- Generates a vacuum for wealth creation and improvement in socio – economic welfare of the citizenry.

- Development of entrepreneurship in order to create a vacuum for individuals creativity and innovation that can accelerate sustainable industrial growth.
- Diversification in terms of the product, technology as well as the size of the firm in cassava sub sector.
- Value added to cassava may lead to export oriented industrialization through chain of grading.
- Improve post harvest system with strong linkages between crop- producers and end users not only generates added value but also create employment opportunities in rural areas thereby contributing to the economic growth and poverty reduction.
- It may lead to increase in prices of cassava tuber due to local cartelization of cassava, which *ceteris paribus* increases income of the farmers.
- Employment generation in all spheres of cassava marketing. The indirect advantage is rewardable employment in farming activities and reduction in rural – urban migration.
- Processing activities that were initially labour intensive can in the long run confirm to the dynamic comparative advantage of most developed nations. Small holder farmers will escape from the syndrome of producing low value and poor quality products.
- Guarantee supply of farm product to the firms may stimulates expansion in farm production activities.

2.13 Highlights of Review

Cassava like any other agricultural product faces competition both at production and marketing stages. What is outstanding is cassava cultivation is the attention that the present and present regimes have given to cassava production.

The Obasanjo's administration advocated for incorporation of 20% of cassava flour into wheat flour for bread making and the Goodluck administration advocated for incorporation of 40% of cassava flour into the wheat flour. When this is fully implemented all things being equal; cassava cultivation will increase leading to increase in income of cassava farmers and there is a tendency that the product will be exported the more.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 The Study Area

The study was carried out in Ardo-Kola and Gassol Local Government Areas of Taraba state (Fig. 3.1). Taraba state is located in the north east part of Nigeria. The state lies between latitude $6^{\circ} 30'$ and $9^{\circ} 36'$ N of the equator and longitude $9^{\circ} 10'$ and $11^{\circ} 50'$ E of the Greenwich meridian (Taraba state Government Diary, 2008). The state has a land area of about fifty nine thousand four hundred square kilometers ($59,400 \text{ km}^2$).

The state shares a common boundary with Bauchi state in the north and Gombe state in the north east, Adamawa state in the east and Plateau state in the North West. Tarasba state is further bounded to the west both by Nasarawa and Benue state, while it shares an international boundary with Cameroon Republic to the south and south east (Taraba State Diary, 2008).

The state has a tropical climate marked by dry and rainy seasons. The rainy season starts in April and ends in October. The wettest months are August and September. The dry season starts in November and ends in April. The mean annual rainfall ranges from 800 mm in the north to over 2000 mm in the south. The mean minimum daily temperature recorded is 14.8°C and the mean maximum daily temperature recorded is 34.4°C (TADP, 2004).

The dominant soil groups in the state are ferruginous (gleyric, luvisol, eutric, regosol and ferric luvisol) found in the north and entisols along the southern parts. The central part of the state is covered with vertisol and ultisol group (TADP, 2004). The vegetation of the state is the Guinea savannah type.

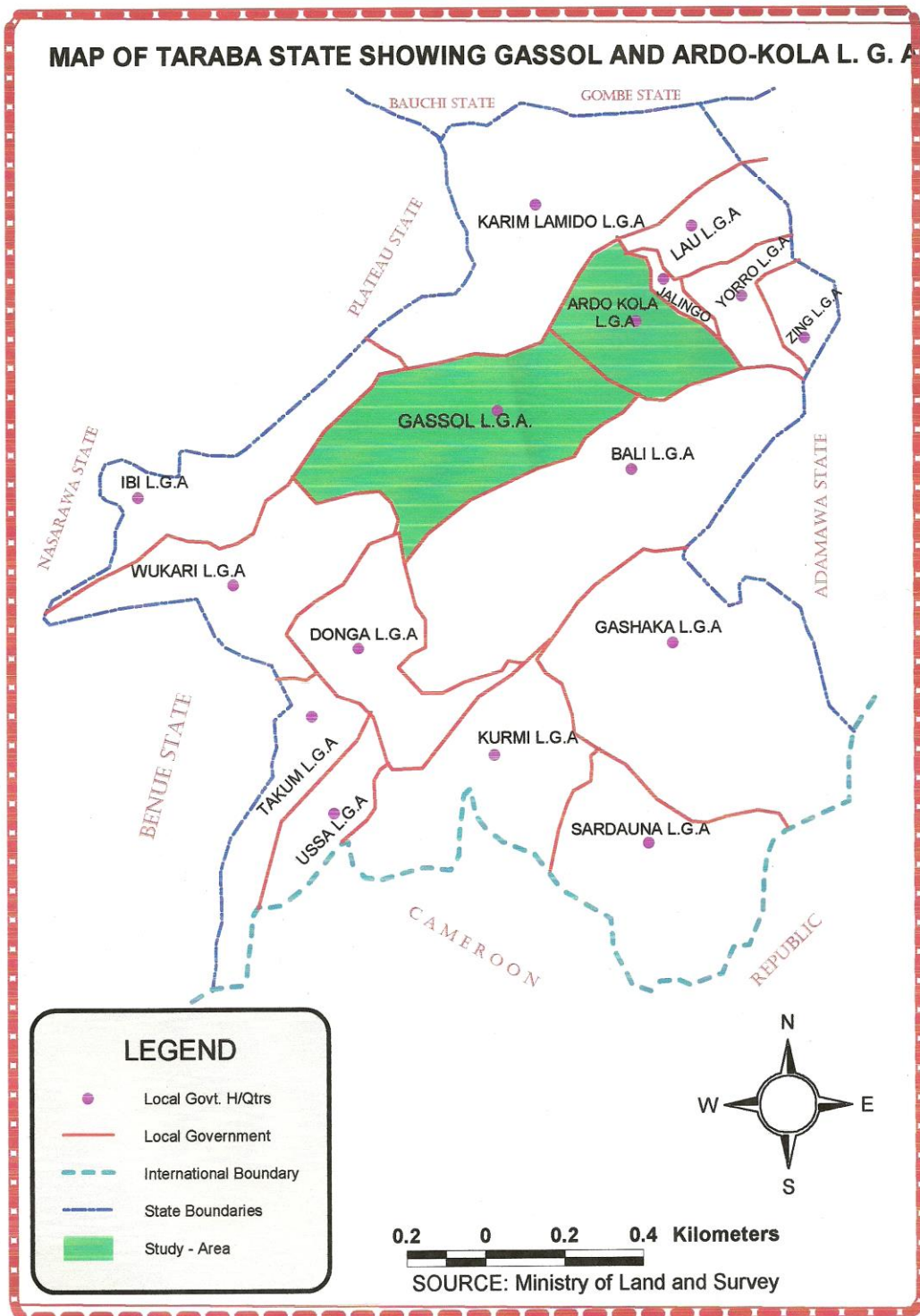


Fig 3.1. Map of Taraba State Showing the Study Areas

The topography is essentially marked with mountains land transverse by big River valleys such as Benue, Taraba, Donga and Bibinu. The valleys of Mambila and Fali mountains form part of this undulating landscape of the state. Figure 1 shows the map of Taraba State, the shaded portion indicate the study area. The study area is Ardo Kola and Gassol Local Government Areas of Taraba state. Ardo Kola and Gassol local government areas are the two local governments that make up the sixteen local government areas of Taraba state. Ardo Kola local government area shares boundaries with Bali, Gassol Local Government Areas in the South and Lau, Jalingo, Yorro and Karim-Lamido local government areas in the north. The Local government has a total land area of 2,312.186 km². Gassol local government area shares boundaries with Ibi, Wukari, Donga and Bali local government areas in the south and Ardo Kola, Karim-Lamido local government areas to the north. Gassol LGA has a total land area of 5,665.131 km².

The state is predominantly agrarian in nature, with about 80 % of its inhabitants depending on subsistence agricultural practices mainly in food crops (TADP, 2004). The climate, soil and hydrology of the study area provide a conducive atmosphere for the cultivation of most staple food crops, grazing of animals, fresh water fishing and forestry. The rich alluvian tract of soil found in most part of the state makes Taraba state conducive for growing various foods and cash crops. The main farming system practiced in the area is either mono cropping or mixed cropping.

The major ethnic groups found in the state are Ichen, Jukun, Kuteb, Jenjo, Mumuye, Wurkun, Bandawa, Chamba, Hausa, Fulani, Kambu, Panso, Kaka, Mambilla and among others.

3.2 Nature and Sources of Data

The data for this study were obtained from primary and secondary sources. The primary data was obtained from the cassava farmers in the selected wards in Gassol and Ardo Kola Local Government Areas of Taraba state. Questionnaire and personal interviews was used to collect the primary data needed from the cassava farmers. The primary data collected covered relevant information on socio - economic characteristics of the cassava farmers and other important information on the output and the inputs used in the production process. The secondary data was obtained from the Taraba State Agricultural Development Programme (TADP).

3.3 Sampling Technique

A purpose and random sampling techniques were employed in the selection of the sample farmers in the study area (Ardo Kola and Gassol LGA) using multi stage sampling procedure. In the first stage, two local government areas were purposively selected and three wards were purposively selected from each of the two local government areas based on their importance in cassava farming. A total of 18 villages were selected for the purpose of this study.

The second stage involved a simple random sampling of respondents from each local government area and villages based on the list provided by the Root and Tuber Production Unit of the Taraba State Agricultural Development Programme (TADP). A total of 120 cassava farmers were randomly selected. The sampling procured is presented in table 3.1 below.

Table 3.1 Ardo Kola and Gassol LGAs Wards and Villages to be sampled

LGAs	Wards	Villages	No of farmers
Ardo Kola	(a) Jauro Yinu	a) Garin Mallum – 5	
		b) Sibre – 6	
		c) Jauro Yini – 6	
	(b) Iware	a) Iware – 7	
		b) Pam petel – 5	
		c) Jauro Angulu – 8	
	(c) Lamido Borno	a) Lamido Borno – 8	
		b) Mallum – 6	
		c) Garin Ali – 7	
Gassol	(a) Mutum Biyu	a) Mutum Biyu – 9	
		b) Doro – 7	
		c) Gunduma – 6	
	(b) Namnai	a) Namnai – 6	
		b) Badakosi – 5	
		c) Garin Abba – 4	
	(c) Sabon Gida	a) Sabon Gida - 10	
		b) Dinya – 9	
		c) Sansani Gassol – 16	
TOTAL			120

A total of 120 cassava farmers were selected from the two Local Government Areas. Structured questionnaire was the main tool used in the collection of primary data. The researcher was assisted by the Extension workers of TADP and any other trained personnel.

3.4 Analytical Techniques

Both descriptive and inferential statistics were employed in the analysis of data collected.

3.4.1 Descriptive Statistics

The descriptive statistics used included; mean frequency distributions and percentages. The descriptive statistics was used to capture objectives (1) and (4) which were socio- economic characteristics and constraints facing the cassava farmers in the study area.

3.4.2 Gross Margin and Net Farm Income

This tool was employed to determine the profitability level of cassava enterprise in the study area. The gross (GM) is the difference between the gross farm revenue (GFR) and the total variable cost ($X_j P_{xi}$) incurred in the cassava production.

Where:

GM = Gross margin (in ₦ / ha)

Q_y = Cassava output (kg/ha)

P_y = unit price of cassava output (₦/100kg bag)

$Q_y P_y$ = total farm revenue generated from cassava production (₦ / ha)

X_i = Quantity of the i^{th} variable input used in cassava production (kg/ha)

X_{ii} = Quantity of the i^{th} fixed input (in ₦ or ha)

P_{Xi} = price per kg of the i^{th} variable input (₦)

P_{Xii} = price of the i^{th} fixed input (₦)

$X_i P_{Xi}$ = total variable cost spent on the i^{th} variable input per hectare $X_{ii} P_{Xii}$ = total fixed cost spent on the i^{th} fixed input

Σ = addition sign

NOTE: The fixed cost here refers to the depreciating values of the fixed cost used, since the fixed cost of the items like hoe, sprayer, cutlass, axe and so many others are only used within a farming season. While variable cost here refers to the inputs used which varies along with output.

3.4.3 The Empirical Stochastic Frontier Production Model

Stochastic Frontier Production Model was independently propose by Aigner *et al.* (1977) and Meeusen and Van den Broeck (1977). It employs a Cobb-Douglass production function to simultaneously estimate the random disturbance term (V_i) which is outside the control of the production unit and the inefficiency effects (U_i) as proposed by Batesse *et al.* (!996). The stochastic frontier production function used is specified as follows:

$$\text{Log } Y_i = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + V_i - U_i \quad (4)$$

Where:

Y_i = Output (of cassava tubers)

X_1 = Farm size in hectare

X_2 = Cassava cuttings (kg/ha)

X_3 = Hired labour (in man days)

X_4 = Fertilizer (kg/ha)

X_5 = quantity of herbicides in litres

X_6 = Expenses on ploughing (tractor and animal draught)

$V_i = \text{Random noise (white noise)} N(0, \delta^2 v)$

$U_i = \text{Inefficiency effect which are non-negative, half normal distribution, } N(0, \delta^2 u) \delta^2 = \delta^2$

$V + \delta^2 + u$

The technical efficiency of cassava production for the i^{th} farmer, defined by the ratio of observed product as to the corresponding frontier production associated with no technical inefficiency was expressed as;

$TE = \text{Exp}(U_i)$ so that $0 \leq Te \leq 1 \dots\dots\dots$

The inefficiency model is defined by

$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5$

Where

$U_i = \text{Inefficiency effect}$

$Z_1 = \text{Gender of the respondent (1=female, 2= male)}$

$Z_2 = \text{Age of the farmers (in years)}$

$Z_3 = \text{Literacy level (in years)}$

$Z_4 = \text{Family size (Number of people in farmer's household)}$

$Z_5 = \text{Visits of Extension offices (1=contacted, 0=otherwise)}$

$\delta_0 - \delta_5 = \text{Are parameters to be estimated.}$

The maximum likelihood estimate (MLE) for all parameters of the Stochastic frontier production function and the inefficiency model defined above and the technical efficiency were obtained using programme Frontier 4.1 computer programme (Coelli, 1994; Ajibefun, 1998).

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the results and discussion of analyzed data. These include; socio-economic characteristics of the cassava farmers, constraints associated with cassava farming, and the technical efficiency of cassava farmers in the study area.

4.1 Socio-Economic Characteristics of the Respondents

Socio-economic characteristics is an economic and sociological combination of what measures a person's economic and social position relative to other bases on gender, age of respondents, occupation, marital status, family size, literacy level and cost of labour of the respondents in the study area. These characteristics as they relate to respondents are discussed.

4.2 Distribution of Respondents According to Gender

Table 4.1 reveals that 62.6 % of cassava farmers in the study area are male, while the rest 37.4% are female. This result shows that there are more males in cassava production though women are also engaged in cassava farming.

Table 4.1: Distribution of Respondents According to Gender

	Frequency	Percentage (%)
Female	43	37.4
Male	72	62.6
Total	115	100.00

Source: Field Survey, 2011

4.3 Family Size of the Respondents

Table 4.2 shows that more than half (about 59 %) of the respondents have family size of 11 – 15 people, 19.13 % of the respondents have family size of 1 -5 people, while 13.04 % and 8.7 % represent respondents with family size of 6 -10 people. The expectation here is that, the larger the family size the higher the tendency of contributing more to the family labour, since family labour is hardly paid for in African society. Okoruwa and Ogundele (2006) stated that family labour constituted the major proportion of the aggregate labour use in Nigerian agriculture. They opined that in rice farming the amount of person-days of family labour that can be engaged by farmers depends on the household size. The average mean family size is 11.

Table 4.2: Distribution of Respondents According to Family Size

Family Size	Frequency	Percentage (%)
1 -5 people	22	19.13
6 – 10 people	15	13.04
11 – 15 people	68	59.13
16 above	10	8.7
Mean family size	11	
Total	115	100.00

Source: Field Survey, 2011

4.4 Marital Status of the Respondents

Table 4.3 indicates that about 82 % of cassava farmers in the study area married people while 8.7 % are single (unmarried). The remaining 9.60 % account for widow/widower and divorced/divorcee. The contribution of marital status on agricultural production can be explained in terms of the supply of agricultural family labour. Family labour would be more where the household leaders are married. The single depend more on their parents for food and or meals while they carter for their personal needs.

Table 4.3: Distribution of the Respondents According to Marital Status

	Frequency	Percentage (%)
Single (unmarried)	10	8.7
Married	94	81.7
Widow/Widower	3	2.6
Divorce/Divorcee	8	7.0
Total	115	100.00

Source: Field Survey, 2011

4.5 Literacy Level of the Respondents

Table 4.4 shows that majority of the respondents representing 67.8% of cassava farmers lack formal education, and these set of farmers hardly accept innovation as asserted by Ajala (1992). Okoro (1991) stated that there exist a positive relationship between education and adoption of new innovation. About 25 % of the cassava producers had at least primary or secondary school education, with the remaining 7 % accounting

for those with tertiary education. The implication of this is that, there is every likelihood that adoption of new innovations by the farmers would fail as asserted by Obibuaku (1983) that high level of education tend to foster favourable attitude towards adoption of improved technological practices. Education is one of the important factors that determines the ability of farmers to understand polices, programmes and innovations of their time. Education affects productivity through choice of better inputs utilization of such inputs and faster adoption of better agricultural innovations.

Table 4.4: Distribution of the Respondents According to Literacy Level

Educational Level	Frequency	Percentage (%)
No formal education	78	67.8
Primary Education	20	17.4
Secondary Education	9	7.8
Tertiary education	8	7.0
Total	115	100.00

Source: Field Survey, 2011

4.6 Farming Experience of the Respondents

The result of farming experience shows that 53 % of cassava farmers in the study area have 11 years farming experience and above (Table 4.5), while 31.3 % of the farmers have experience of 1 -5 years and 15.7 % account for those with 6 – 10 years experience in farming. This indicates that most of the cassava farmers in the study area have good knowledge of cassava farming. This finding concurs with Ogundele and

Okoruwa (2006) who stated that, the longer a person stays on a job, the more likely the person is to become an expert. They went further to say that farming involves a lot of risks and uncertainties, hence, to be competent enough to handle all the vagaries of farming a farmer must have stayed on the farm for quite some time. A farmer who have been growing cassava for, say, 10 years is likely to be more knowledgeable about the pattern of rainfall, the incidence of pest and diseases, and other agronomic conditions of the area than a farmer who is just coming into the business irrespective of their level of education.

Table 4.5: Distribution of the Respondents According to Cassava farming Experience

Farming Experience	Frequency	Percentage (%)
1 -5 years	36	31.3
6 – 10 years	18	15.7
11 and above	61	53.0
Total	115	100.00

Source: Field Survey, 2011

4.7 Farm Size of the Respondents

Table 4.6 indicates that 60.9 % of the cassava farmers in the study area cultivates between 2 – 5 hectares of land, 33.9 % cultivate not more than 1 hectare of land. The table also reveals that 5.2 % cultivate more than 5 hectares of land. This shows that the cassava farmers in the study area are small scale farmers. According to NBS/FBS (1999)

and Awoke ad Okorji (2004) small scale farmers are farmers who cultivate between 0.1 – 4.99 hectares.

Table 4.6: Distribution of Respondents According to Farm Size

Farm Size (ha)	Frequency	Percentage (%)
1 ha	39	33.9
2 – 5 ha	70	60.9
6 ha above	6	5.2
Total	115	100.00

Source: Field Survey, 2011

4.8 Main Occupation of the Respondents

The main occupation of cassava farmers in the study is presented in Table 4.7. This includes farming, civil service, tailoring, trading and 60 % of the cassava farmers in the study area are full time farmers. 31.3 % of the farmers in the area are civil servants while 8% are tailors and traders. This occupational distribution of the respondents shows that farming is the most common activities in the area. It is a truth that the agricultural sector is the highest employer of labour and so there is need for both the government and public private partnership to increase investment in this sector so as to develop the agricultural sector with new technology and improved inputs in order to boost the sector.

Table 4.7: Distribution of Respondents According to Main Occupation

Main occupation	Frequency	Percentage (%)
Farming	69	60.0
Civil Servant	36	31.3
Tailoring	3	2.6
Trading	7	6.1
Total	115	100.00

Source: Field Survey, 2011

4.9 Respondents Contact with Extension Agents

Table 4.8 shows that 95.7 % of the cassava farmers had no contact with extension workers or agents while only 4.3 % of the respondents had contact with the extension agents. This goes to say that cassava farmers in the study area may not be aware of new innovations in cassava production

Table 4.8: Distribution of the Respondents According to Contact with Extension Agents

Contact with Extension Agents	Frequency	Percentage (%)
Yes	5	4.3
No	110	95.7
Total	115	100.00

Source: Field Survey, 2011

4.10 Method of Land Acquisition of the Respondents

Land is one of the factors of production. It helps in the production of goods and services. The methods or way of acquiring land may depend on the farmers. Table 4.9 shows that 53 % of land acquisition for cassava cultivation is acquired through inheritance, 43.5 % of them use rented land, while 3.5 % is purchased. This implies that with greater percentage of land being inherited by the respondents, fragmentation of farm lands would be very common in the study area.

Table 4.9: Distribution of Respondents According to Land Acquisition

Method of Land Acquisition	Frequency	Percentage (%)
Inheritance	61	53.0
Rent	50	43.5
Purchase	4	3.5
Total	115	100.00

Source: Field Survey, 2011

4.11 Source of Labour of the Respondents

Labour is one of the factors of production which involves physical and mental effort to accomplish a task sometimes for monetary reward. In agriculture, labour is very vital as it is required from land preparation to harvesting. It is very true that an agricultural activity especially in the study area is labour intensive. Table 4.10 reveals that 62.6 % of cassava farmers in the study area used hired labour. However, 28.7%

engage in cooperative labour (gayya) while family labour constitutes only 8.7 %. This implies that family labour do not contribute as much as hired labour in the study area.

Table 4.10: Distribution of Respondents According to Sources of Labour

Source of Labour	Frequency	Percentage (%)
Family labour	10	8.7
Hired Labour	72	62.6
Cooperative (gayya)	33	28.7
Total	115	100.00

Source: Field Survey, 2011

4.12 Sources of Capital of Respondents

Finance or capital is the live wire that moves the tempo of agricultural activities. Table 4.11 shows that 72.2 % of the respondents source of capital were from their personal savings and sales of cassava. However, 17.4 % sourced their capital from banks and money lenders. This indicates presence of banks and government activities with regard to farming in the study area. However cassava farmers in the study area need more financial assistance or support in order to move to the next level which is medium scale farming as the financial assistance would help in increasing the number of hectares and purchase of inputs.

Table 4.11: Distribution of Respondents According to Sources of Capital

Sources of Capital	Frequency	Percentage (%)
Personal savings	83	72.2
Borrowed from friends/ relatives	20	17.4
Loan from banks	2	1.7
Loan from money lenders	10	8.7
Total	115	100.00

Source: Field Survey, 2011

4.13 Respondents Sources of Market

Table 4.12 indicates that 97.4 % of the cassava produced are sold in rural markets, while 2.6 % of the cassava produced by respondents are sold in both rural and urban markets. This implies that the cassava farmers do not have to travel long distances in order to sell their produce. Philips *et al.* (2000) explained that market is an essential ingredient for the development of the cassava industry. Olayemi (1972) also upheld that tackling the problem of improved marketing should act as one of incentives for promoting commercial production of agricultural commodities (cassava inclusive).

Table 4.12: Distribution of Respondents According to Sources of Market

Sources of Market	Frequency	Percentage (%)
Rural Market	112	97.4
Urban Market	2	1.7
Both	1	0.9
Total	115	100.00

Source: Field Survey, 2011

4.14 Methods of Storage of Cassava by Respondents

Storage in agriculture is one of the most important key to achieve sustainable agriculture or food security as all that is stored must be safe to consume. Table 4.13 shows that 71.3 % of cassava farmers store their produce in bags of 100 kg. However, 20 % of the respondents store theirs in form of unharvested roots. While 8.7 % store theirs locally. This implies that the cassava farmers have a way of preserving cassava.

Table 4.13 Distribution of Respondents According to Storage of Cassava

Method of Storage	Frequency	Percentage (%)
Local Storage of cassava tubers	10	8.7
Storage in bags (100 kg)	82	71.3
Unharvested roots	23	20.0
Total	115	100.00

Source: Field Survey, 2011

4.2 Gross Margin Analysis

Gross margin analysis for cassava farmers in Ardo Kola and Gassol Local Government Area of Taraba state is indicated in Table 4.14. The average variable cost/ha for cassava was N30,250.33. The total fixed cost was ₦19,320.14 and the total cost of producing cassava was ₦49,570.37 per hectare. The total revenue (TR) is ₦144,000, Gross margin (GM) ₦113,749.77 and Net farm Income (NFI) of cassava production is ₦94,429.63 per hectare.

Table 4.14 indicates that cassava cultivation is profitable because the return to naira invested is a positive sign ₦1.90. This shows that for every one naira invested, the farmer makes a profit of 90 kobo.

Table 4.14: Average Cost and Return of Cassava Production (per hectare)

Items	Unit	Quantity/ha	Price/unit	value
Revenue				
Output	Kg	80	1800	144,000
Total revenue				144,000
A Variable cost				
(i) Labour	Mandays	20	700	14,000
(ii) Planting material	kg	50	50	2500
(iii) Fertilizer	kg	105.3	70	7371
(i) Chemicals	Litre	3.23	1200	3876
(i) Empty sacks	Naira			1351.00
(ii) Loading and transportation	Naira			1152.25
Total Variable Cost (TVC)				30,250.25
B Fixed cost				
(i) Purchased land	Ha	2	5000	10,000
(ii) Rented land	Ha	2	2500	5,000
(iii) Farm implement				4,320.14
Total fixed cost (TFC)				19,320.14
TC (TFC + TVC)				49,570.37
Gross margin (TRC – TVC)				113,749.75
Net Farm Income (GM – TFC)				94,429.61
Rate of Transfer (ROT)				.90 ₦

4.3 Resource Productivity

The result in table 4.15 shows the maximum likelihood estimates parameters of the stochastic frontier production analysis of cassava farmers in the study area. Table 4.15 shows that most of the estimated coefficients of the parameters of production function are positive except expenses on ploughing. This indicates that cassava output increases as the quantity of each variable input increases. All the inputs used in the model are statistically significant level except expenses on ploughing.

From Table 4.15, farm size is the most important factor of production having an elasticity coefficient of 0.492 indicating that output of cassava production is inelastic. An increase of 5% in farm size used in production of cassava all things being equal, there would be a corresponding increase in the total output by 4.92%. This implies that land is a significant factor associated with variation in cassava production. This agrees with the findings of Eyo and Igben (2002), Maurice *et al.* (2005). Cassava cuttings have an elasticity efficiency of 0.726 and are positively related to total output of cassava. A 5% increase in the quantity of cassava cuttings would bring about a corresponding increase of cassava output per hectare.

Table 4.15: Maximum Likelihood Estimate of the Parameters of the Stochastic Frontier Production Function of Cassava Farmers

Variable	Parameters	Coefficient	t-ratio	Standard error
Production factors				
Constants	β_0	0.1784	6.715	0.0265
Farm Size (X_1)	β_1	0.4929	1.809**	0.2725
Seed or Cassava cuttings (X_2)	β_2	0.7264	2.014**	0.3605
Hired Labour (X_3)	β_3	0.7839	8.238*	0.9515
Herbicides (X_4)	β_4	0.3157	2.610**	0.1209
Fertilizer (X_5)	β_5	0.2627	2.956*	0.8798
Expenses on Ploughing (X_6)	β_6	0.6037	-8.348	0.7231
Inefficiency Effect				
Constant	δ_0	-0.2814	-2.8163	0.9993
Gender (Z_1)	δ_1	-0.6345	-6.3613*	0.9975
Age of farmer (Z_2)	δ_2	-0.2511	-9.1372*	0.2748
Literacy level (Z_3)	δ_3	-0.5257	3.128	0.7680
Family size (Z_4)	δ_4	-0.1119	-1.487**	0.7528
Extension Contact (Z_5)	δ_5	-0.5620	-2.916*	0.1926
Variance Parameter				
Sigma squared	δ^2	0.8606	1.8107**	0.4752
Gamma	γ	0.8564	2.2172**	0.3862

Source: Computer output from Frontier 4.1

* Significant at 1%; ** significant at 5% level

Productivity is the index of the ratio of output to input in the production process. productivity is synonymous with resource use productivity the computation of this important productivity statistics include the elasticity of production (ϵ_P) return to scale (RTS), marginal rate of technical substitution (MRTS), Average Product (AP), Marginal Product (MP).

This agrees with Olayide and Heady (1982) who stated that agricultural productivity can be increased through increase in the quantity of a particular input. Herbicide has an elasticity coefficient of 0.315 and was statistically significant at 5%. This means that an increase in the quantity of herbicide would increase the output by 3.15%.

Fertilizer is one of the most important factors with an elasticity coefficient of 0.262 and is statistically significant at 1%. Fertilizer plays an important role in increase and improving agricultural output per hectare. Expenses on ploughing were statistically insignificant because it have a negative sign (-0.834). This does not mean that ploughing of land for cultivation was not important but it could be that it has been underutilized. The result of the inefficiency effect indicates that the coefficients of gender, age of farmers, literacy level, family size, and contact with extension workers have the expected negative signs and that means that the variables have a positive effect on efficiency.

Hired labour has an elasticity efficiency of 0.783 and is positively related to the total output of cassava. A 5 % increas⁴ hired labour will bring about an increase in the level of output. The use of hired labour is a major feature of agricultural production in Africa where mechanized farming is very low. Amaza *et al.* (2006) and Khai *et al.* (2008) revealed that labour is a significant variable in agricultural production.

4.4 Technical Efficiency of Cassava production

Efficiency of resource used is the ratio of useful output to the total inputs that gives maximum value of output from any given level of output. Producing optimally at a least cost. It is the attainment of production goals without waste. The technical efficiency sign is explained in the opposite direction. The negative sign indicates increase of technical efficiency and positive sign decreases efficiencies.

From table 4.16 shows that all coefficients have the expected sign (-ve) indicating increase in technical efficiency among cassava farmers.

Gender

The estimated coefficient of gender carried a negative sign -0.634 and was statistically significant at 1% indicating that gender increases the technical efficiency among cassava producers.

Age

The estimated coefficient -0.251 and is statistically significant at 1% indicating that cassava farmers are more technically efficient as when they are older. This however agrees with the *apriori* expectation that older farmers are more efficient than younger farmers.

Literacy Level

The estimated coefficient of literacy level among cassava farmers -0.525. This indicates that education reduces technical inefficiency among cassava farmers as it is an important factor in adopting technology. Educated farmers are more receptive to improved farming techniques and are more likely to be highly technically efficient than non educated farmers.

Extension Contact

The estimated coefficient of extension contact carried the expected sign and was statistically significant at 1%. This reveals that extension contact is one of the approaches use to improved agricultural productivity in Nigeria (Olukosi and Atala, 1991). Tashikalma (2010) also found out in his study that extension contact increases technical efficiency of irrigated rice farmers in Adamawa state.

The sigma squares (δ^2) is 0.86 and statistically different from zero at 5% level of significant. This indicates a goodness of fit and correctness of the specified distributional assumption of the composite error term. Gamma (γ) is estimated as 0.856, the existence of technical inefficiency among the farmers account for over 85% of the variations in the output level of cassava.

Table 4.16: Technical Efficiency of Cassava Farmers

Efficiency Level	Frequency	Percentage (%)
0.10 – 0.30	4	3.48
0.31 – 0.40	4	3.48
0.41 – 0.50	11	9.57
0.51 – 0.60	19	16.52
0.61 – 0.70	24	20.87
0.71 – 0.80	19	16.52
0.81 – 0.90	19	16.52
0.91 – 1.00	15	13.04
Total	115	100
Mean	68	
Minimum	01.0	
Maximum	0.963	

Source: Computer printout from Frontier Analysis 4.1, 2011

The distribution of technical efficiency derived from the analysis of the stochastic frontier production function is shown on Table 4.16. The technical efficiency of the sampled farmers was less than 1.00 indicating that the cassava farmers in the study are producing below the maximum efficiency frontier from the observed range of technical efficiency across the sampled farmers. The best farmers have the technical efficiency of 0.963 (96.3 %) while the worst farmer has a technical efficiency of about 0.10 (10 %). The mean technical efficiency is 0.68 (68 %), indicating that on the average, the farmers were able

to obtain 68 % of optimal output from cassava production given certain quantity of inputs. This implies that, there is room for increasing technical efficiency in cassava production of about 32 %.

From Table 4.16, the distribution of technical efficiency of farmers shows that about 16.53 % had technical efficiency less than 50 %, while about 40 % had technical efficiency of 51 – 70 %; 46.08 % of the farmers had technical efficiency of 70 % and above.

4.5 Constraints to Cassava Production in the Study Area

Cassava production in Ardo Kola/Gassol Local Government Area of Taraba state is faced with numerous challenges affecting the productivity which can also result in various levels of inefficiency. The result on Table 4.17 shows that most serious challenges affecting the cultivation of cassava in the study area

Inadequate funds

Funds forms the back-borne of every business and inadequate of it will affect the business negatively. This has been the problems in the study area. The result of the sources of finance in Table 4.17 shows that 1.7 % account for source of loan from banks, this is very insignificant. This indicates that the farmers gets very little financial support outside personal savings.

Unattractive price

With the launching of the Obasanjo initiative on cassava, a lot of farmers in the study area went into its production with the hope that it will be exported, unfortunately, they were no market sufficient enough to buy-off their products. Ultimately, there was

cassava glut that resulted to poor price being offered to farmers couple with lack of processing machines to add value to the cassava tubers harvested.

Extension Service/Agent

According to Olukosi and Ajala (1991), agricultural extension has been one of the approaches used to improve agricultural production in Nigeria. Tashikalma (2010) also found out that extension contact increases the technical efficiency of irrigated rice farmers and regularity in extension visit has been found to enhance farmers adoption of agricultural innovations. However, the opposite was the case in the study area as only 3.5% account for extension contact. This reveals that the cassava farmers might not be technical efficient this constitute a problem.

High cost of Farm Inputs

From table 4.17, high cost of input ranked 4th among the problems affecting cassava production, as cassava yield cannot be easily increased due to high cost of inputs. High cost of improve seeds (cuttings) have been identified as a critical factor in the quest to increase food production. Fertilizer application will lead to the improvement and fertility of soil that could increase cassava yield. An increase in the quantity of fertilizer used will result to an increase in output and vice versa. This revealed by the works of Adeoti (2001) and Onyeweaku (1994).

Land acquisition

Most of the respondents acquire land through inheritance. This poses serious problems because in African society and especially in the study area, women do not inherit land. Secondly, inheritance leads to fragmentation of land according to the number of people that are suppose to inherit the land and this will lead to reduction in

farm size this will eventually reduce cassava output. The implication of this is that farm size cannot be expanded in order to maximize productivity. As reported by Adebayo *et al.* (2010), who stated that access to productive resource especially land served as a source of collateral in acquisition of credit for farmers in Africa.

Table 4.17: Problems Affecting Cassava Production

Cassava production Constraints	Frequency	Percentage (%)	Ranking
Unattractive Price	33	24.3	2
High Cost of Input	20	8.7	4
Labour Shortage	17	10.4	3
Inadequate Funds	60	50.43	1
Lack of Extension agent	14	3.47	5
Land Acquisition	12	1.7	6
Pest, Disease & Infestation	6	0.9	7
Total	162*	100.00	

Source: Field Survey, 2011

* = multiple response

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Major Findings

The study examined the resource productivity and technical efficiency of cassava production in Ardo Kola and Gassol Local Government Areas of Taraba state. The specific objectives of the study were to describe the socio-economic characteristics of cassava farmers, determine the profitability of cassava production, determine factors affecting the technical efficiency of cassava farmers, determine the productivity of input utilization and identify the constraints to cassava production in the study area.

Data were collected from 115 respondents using a structured questionnaires covering 2010/2011. The data were analyzed using descriptive and inferential statistics, stochastic frontier production function and gross margin analysis.

The finding revealed that male cassava farmers constituted the majority with 62.2%. The respondents were mostly married people with no formal education accounting for about 67%. Most of the respondents representing about 53% have farming experience of 11 years and above and most of them are small scale farmers cultivating an average 2 hectares of land. About 60% of the respondents are full-time farmers who use their personal savings as source of finance.

The analysis of technical efficiency revealed a mean efficiency of 68 % for respondents, indicating that there is an opportunity of increasing cassava output by 32 % efficient utilization of the existing inputs. Such as farm size, fertilizer, cassava cuttings (seed), herbicides and hired labour are made. While the socio-economic characteristics such as gender, age of farmers, literacy level, family size, and contact with extension

workers were found to have influenced positively the farmers technical efficiency in cassava production. The minimum technical efficiency of farmers in the study area was 10 % while the maximum was 96 %.

The challenges found to be associated with cassava production in the study area include; inadequate fund, unattractive cassava price, high cost of inputs, labour shortage, lack of extension workers, land acquisition method and effects of pests and diseases infestation. Despite these challenges, the gross margin analysis revealed that cassava production was profitable and for every one naira invested in cassava production, a return of 90 kobo.

5.2 Conclusion

From the study, farmers involved in cassava production have more than average technical efficiency and this means there is opportunity to increase cassava production in the study area. Furthermore, the study revealed that cassava production was profitable.

5.3 Recommendations

Based on the findings of this research, the following recommendations are proffered:-

1. Public Private Partnership (PPP) should be explored by government so as to help the education of farmers with regard to new technology and innovations. More so, new management skills need to be addressed so as to minimize negative tendencies that are capable of aggravating inefficient use of resources.

2. Government should ensure better funding of the extension service (i.e. workers) in the State through more training through workshops and seminars, provision of mobility such as motorcycles and motivation so as to boost their productivity and to enable adequate and timely supervision by supervisors with a view to make them extend knowledge to farmers.
3. The provision of agricultural inputs such as fertilizer should be liberalized so as to allow the target group to access fertilizer. Also, the voucher system of fertilizer procurement, already in practice in some states, should be extended to other farm inputs so as to boost agricultural production.
4. Machines for planting cassava cuttings and harvesting of roots should be provided so as to reduce the drudgery involved in cassava production which will ultimately improve farmers technical efficiency. Financial institutions and the private sector should be encouraged to establish cottage type processing facilities in the study area that will include storage and packaging facilities so as to add value to cassava produced in order to meet the export specification of cassava product.
5. Non Governmental Organizations (NGOs) should sensitize farmers on the formation of cooperative groups so as to benefit from the Nigeria Incentive-based Risk Sharing System for Agricultural Lending (NIRSAL) and also to enable them benefit from loan from commercial, agricultural and rural cooperative banks.

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APPENDIX

Farmer's Questionnaire

Federal University of Technology, Yola
School of Agric. and Agricultural
Technology,
Department of Agric. Economics and
Extension

PROJECT TOPIC:

**Economics of Cassava Production in Ardo Kola and Gassol Local Government
Areas of Taraba State.**

Dear Sir/Madam,

I am a post graduate student of the above named institution wishing to under take a research work on the above topic.

I am soliciting for your kindest assistance by providing me with the appropriate information on the questions contained in the questionnaire to enable me execute the research work with ease. Be informed that the information you supply will be used purposely for this research work and will be treated confidentially.

Thank you for your cooperation,

Yours Sincerely

Yuguda Regula Manga (Mrs)

Section A: Socio Economic Characteristics of Farmers

Instructions: Kindly tick in the spaces provided or state correct information where necessary.

1. Name of Village/District/Ward.....
2. Gender of Respondents (a) Male [] (b) Female []
3. Main occupation (a) Farming [] (b) Civil Servant [] (c) Trading [] (d) Tailoring [] Others please specify.....
4. Age.....years
5. Marital Status (a) Married [] (b) Single [] (c) Widow [] (d) Divorce [] Others please specify.....
6. How many children do you have?.....
7. How many people are there in your household?.....
8. Educational attainment (a) No formal education [] (b) Primary education [] (c) Secondary school education [], (d) Tertiary school education [], (e) Others please specify.....
9. How long have you been in the cassava farming business?years.

Section B Information of Cassava Production

10. How many hectares of cassava do you cultivate in a year?.....
11. How do you acquire land? (a) renting [] (b) inheritance [] (c) purchase [] (d) Others please specify.....
12. If the mode of land acquisition is through renting, how much do you pay per hectare per year? ₦.....

Section C: Labour Data

13. Which type of labour do you use? (a) Family labour [] (b) hired labour []

(c) cooperative labour (Gayya) [] (d) Others please specify.....

14. If family labour, kindly provide answers to the questions in the table below.

Table 15(b): Information on hired labour on cassava production

Farm operation		Adult male				Adult male				Children			
		No engaged	No of days worked	No of hours worked/day	Wage rated/day food money	No engaged	No of days worked	No of hours worked/day	Wage rated/day food money	No engaged	No of days worked	No of hours worked/day	Wage rated/day food money
i	Land clearing												
ii	Tillage												
iii	Planting												
iv	Weeding												
v	Fertilizer application												
vi	Chemical application												
vii	Cutting, picking/bagging												
viii	Transportation												
ix	Others												

Section D: Cost of Production

16 (a) Please fill in the following information on inputs used for 2009/2010

Input	Amount/Quantity per hectare	Cost of inputs used (N)	Transportation Cost (N)	Total Cost (N)
i. Seed				
ii. Fertilizer				
iii. Insecticides				
iv. Tractor hiring				
v. Animal traction				

16 (b): Fixed Capital Asset

Item	Year of purchase	No owned	Cost per unit	Life span (year)	Total cost (N)
Hoe					
Axe					
Cutlass					
Rake					
Sprayer					
Bullock					
Other					
(a)					
(b)					

Section E: Information on Yield and Sales

17. Kindly provide answers to the questions in the table below

- i. Total farm yield per hectare (kg).....
- ii. Price per 100 kg bag (N).....
- iii. Total Revenue (N).....
- iv. Transportation cost (N).....
- v. Time of sales in (months).....
- vi. Other cost (please specify).....

18. Do you have ready market for cassava? (a) Yes [] (b) No []

19. In which type of market do you sell your cassava? (a) rural market [] (b) urban market [] (c) both [] (d) others specify.....

20. Were you satisfied with the price offered to you in 2008/2009? (a) Yes [] (b) No [].

21. If No why?.....

22. Do you store your cassava before selling? (a) Yes [] (b) No []

23. If yes, how do you store your cassava? (a) local storage means [] (b) bags [] (c) unharvested cassava root [] (d) others specify.....

Section F: Information on sources of finance for cassava farming

24. What are your sources of money for cassava farming? (a) personal savings [] (b) borrowing from friends and relations [] (c) loan from banks [] (d) loan from money lenders [] (e) Others specify.....

Section G: Problems Associated With Cassava Production

25. Have you been visited by an Extension officer? (a) Yes [] (b) No []

26. If Yes, how often? (a) once a week [] (b) twice a week [] (c) once a month []
(d) more than once a month [].

27. Which body renders Extension service to you? (a) TADP [] (b) Ministry of
Agriculture and others [].

28. What are your major problems in cassava production and marketing in your area?

- a) Unattractive price of cassava []
- b) High cost of inputs []
- c) Labour shortage []
- d) Inadequate funds []
- e) Lack of Extension agents []
- f) Land tenure system []
- g) Pest and disease and infestation []
- h) Others specify

29. Suggest measures to be adopted to solve the problem mentioned above.

- a)
- b)
- c)
- d)