ECONOMIC ANALYSIS OF PLANTAIN PRODUCTION IN SAGBAMA LOCAL GOVERNMENT AREA, BAYELSA STATE, NIGERIA

BY

Phillip Prekeme OJOKOJO
(MSc/Agric/1014/2010-11)

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

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY
FACULTY OF AGRICULTURE
AHMADU BELLO UNIVERSITY
ZARIA, KADUNA STATE,
NIGERIA

FEBUARY, 2016

DECLARATION

I hereby declare that this dissertation titled **"Economic Analysis of Plantain Production inSagbama Local Government Area, BayelsaState, Nigeria"** has been written by me, and it is a record of my research work. No part of this work has been presented in any previous application for another degree or diploma in this or any other institution. All borrowed informationhas been duly acknowledged in the text and a list of references provided.

_____ _____

Philip Prekeme OJOKOJO **Date**
Student

CERTIFICATION

This dissertation titled **"Economic Analysis of Plantain Production inSagbama Local Government Area, BayelsaState, Nigeria"** by Philip Prekeme OJOKOJOmeets the regulation governing the award of the degree of Master of Science in Agricultural Economics of theAhmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

_____ _____

Prof Z. Abdulsalam **Date**
Chairman, Supervisory Committee

_____ _____

Prof S. A. Sanni **Date**
Member, Supervisory Committee

_____ _____

ProfZ.Abdulsalam **Date**
Head of Department
Agricultural Economics and Rural Sociology

_____ _____

ProfK. Bala **Date**
Dean, School of Postgraduate Studies
Ahmadu Bello University, Zaria.

DEDICATION

This dissertation is dedicated to Almighty God and in memory of my beloved brother, Brig. Gen. Jimmy Ojokojo, who slept in the Lord on the 31st Day of August, 2010

ACKNOWLEDGMENTS

I wish to express my gratitude and praises to the Almighty God. My genuine appreciation goes to my supervisors; Prof. Z. Abdulsalam and Prof. S. A. Sannifor their constructive comments, guidance and encouragement towards the success of this work.

I thank Prof Z. Abdulsalam,the Head of Department and all the lecturers in the Department for their scholarly advice and contributions which madethisresearch work a huge success.

I wish to express my appreciation to all my colleagues and friends for their understanding and friendship during the period of my M.Sc. programme and to everyone who has contributed towards the success of this research work. Specifically, I am grateful to my friends: M. Ahmed, A. Anthony, E. Nwachokor, N. Bukar, O. Oyinbo, S. Adeyokunnu, U. Sambo, O. Odanaogun and others for their support and understanding.

I extend my deepest appreciation to my lovely wifeMrs. E. D.Ojokojo, my sons Oyindoubra and OyinprebiOjokojo, my boss at work,Mr. O. Folarinand my siblings Engr. R. O. Ojokojo, Yinkore and Porbaniforbeing patient and supportive throughout the period of my studies.

I am grateful to Mrs. Agnes Walong who took time to type this work, Dr.M. A. Damisa course Coordinator for his brotherly advice during the programmeand Mr.Suleiman for his encouragement and support. God will sustain you with His strength.

TABLE OF CONTENTS

Content **Page**

TITLE

PAGE…….....i

DECLARATION…….,…..ii

CERTIFICATION……..……... iii

DEDICATION……..……...iv

ACKNOWLEDGEMENT……..……..v

TABLE OF CONTENT…….…….....vi

LIST OF TABLES……..……....vii

LIST OF FIGURES…….viii

LIST OF APPENDICES……...ix

ABSTRACT……..…x

CHAPTER ONE 1

INTRODUCTION…….....1

1.1 Background to the Study……1

1.2 Problem Statement……2

1.3 Objectives of the Study…….....4

1.4 Justification of the Study……....4

CHAPTERTWO6

LITERATURE REVIEW…….....6

2.1Economic importance of plantain in Nigeria…….6

2.2Plantain Production trends……..8

2.3Plantain production and utilization…..……..…9

2.4Analytical framework……..……10

2.4.1Farm profitability analysis…….…….....10

2.4.2Factors affecting profitability…….....12

2.4.3Empirical measurement of efficiency……..…… 14

2.4.4Parametric methods……...…….....15

2.4.5The non-parametric methods …….....16

2.5Stochastic frontier analysis……..18

2.6Empirical Studies Utilizing the Stochastic Frontier Approach……... …...20

2.7Problem of efficiency measurement……..…….……22

CHAPTERTHREE24

METHODOLOGY…….....24

3.1 Description of the Study Area……..24

3.2 Sampling Procedure and Sample Size……..26

3.3 Data Collection…….26

3.4 Analytical Techniques……..27

3.4.1 Descriptive statistics……..27

3.4.2 Net Farm Income……...…….....27

3.4.3Stochastic Frontier Production Analysis…….……28

3.5 Definition and Measurement of variables ……..……..32

CHAPTERFOUR35

RESULTS AND DISCUSSION...……..35

4.1 Socio-economic characteristics of the respondents in the study area……. …..35

4.1.1 Age of the farmers……35

4.1.2 Educational Level of the Farmers…….36

4.1.3Household size…….37

4.1.4Farming Experience……..……..38

4.1.5Farm size…….……..39

4.1.6Number of Times of Extension Visit ……40

4.1.7Amount of Credit Obtained……41

4.1.8Cooperative Participation ……..…….……...41

4.2Profitability of plantain production in the Study Area……... ….42

4.3 Input-output relationship in plantain production…….. ….44

4.4Resource use efficiency in plantain production ……....……46

4.4.1 Technical and economic efficiencies of the farmers……...…..…….. ……46

4.4.2 Frequency distribution farm-specific efficiency levels…….……..50

4.4.3Allocative efficiency estimate……..……...…..……...51

4.4.4Allocative Efficiency Index (AEI) estimate……..……....52

4.5Constraints Faced by Farmers in Plantain Production ...……53

4.5.1 Poor market price……53

4.5.2 High cost of fertilizer……..54

4.5.3 Bad road……..54

4.5.4 Inadequate farm land……..54

4.5.5 Theft……55

4.5.6 Low extension contact……55

CHAPTERFIVE56

SUMMARY, CONCLUSION, RECOMMENDATIONS AND CONTRIBUTION TO KNOWLEDGE…….....56

5.1 Summary……57

5.2 Conclusion…….....58

5.3 Recommendation……..58

5.4 Contribution to knowledge…….....60

REFERENCES……61

LIST OF TABLES

Table **Page**

2.1: Plantain production trend in Nigeria…….....8

3.1: Population and sample size of farmers……..…….....26

4.1: Distribution of the respondents based on their age…….……..36

4.2: Distribution of the respondents based on their level of education.……....37

4.3: Distribution of the respondents based on their Household size ……..38

4.4: Distribution of the respondents based on their farming experience…….....39

4.5: Distribution of the respondents based on their farm size ……...…….40

4.6: Distribution of the respondents based on the number of extension visits ……..40

4.7: Distribution of the respondents based on the amount of credit obtained ……41

4.8: Distribution of the respondents based on years of membership of cooperative…42

4.9: Costs and returns of for plantain production…….……43

4.10: Maximum likelihood estimate of stochastic frontier production function……..46

4.11: Determinants of technical and economic inefficiencies……..…….50

4.12: Frequency distribution of farm-specific efficiency levels ……....51

4.13: Estimation of Allocative Efficiency Index ……...53

4.14: Distribution of farmers based on constraints associated with plantain production in the study area……...……....55

LIST OF FIGURES

Figure **Page**

3.1 Map of Bayelsa State showing the Study area 25

LIST OF APPENDICES

Appendix **Page**

1: Research Questionnaire…….……68

ABSTRACT

The study investigated the profitability and efficiency of plantain production in Sagbama Local Government Area of Bayelsa State, Nigeria. A multi-stage sampling technique was used to select 195 plantain farming household for this study.Datacollected with the aid of structured questionnaire was analysed using descriptive statistics, net farm income, stochastic frontier production function, and allocative efficiency index.The result shows that the respondents had an average farm size of 0.82 hectares and a net farm income (NFI) of ₦157, 521.20/ha. The return per naira invested was ₦2.26 for the plantain farmers implying that for every one naira invested in plantain production is realized. The farm specific allocative efficiency was estimated to be 0.863. This indicates thatallocative inefficiency contributed 86% to the short fall in plantain production between maximumpossible (frontier) level of production and recorded output.Specifically, the result indicates that 13.7% reduction in plantain production from maximum possible (frontier) output is attributed to allocative inefficiency. Furthermore, estimation from the allocative efficiency index indicated that the planting material, fertilizer, agrochemical and farm size were underutilized as their allocative efficiency index were found to be >1 while labour was over utilized as the allocative index was found to be <1. Profitability has positive implications for investment opportunities for individuals and corporate organizations and thus, improved household incomes. Adjustments in the production inputs such as farm size, increase and efficient utilization of fertilizers and herbicides and their cost of acquisition could lead to increased production of plantain. Farming experience, membership of cooperative societies, accessibility to credit, extension visits and education were significant variables that influenced efficiency. Technical and economic efficiencies in plantain production in the study area ranged between 0.52 and 0.98 with a mean of 0.84 and 0.63 and 0.93 with a mean of 0.72 respectively.Specifically, the result indicates that 16.5% and 27.9% reduction in plantain production from maximum possible (frontier) output is attributed totechnical and economic inefficiencies respectively. Planting material, fertilizer, agrochemical and farm size were underutilized. To maximize output, the planting material, fertilizer, agrochemicals and farm size should be increased, while less labour should be used.Farmers should be encouraged to join cooperative society and extension service should be strengthened or intensified to train farmers on improved plantain production. Also, fertilizer should be supplied at subsidized rate.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Agriculture is the main stay of Nigerian economy. It involves small scale farmers scattered over wide expanse of land area, with small holding ranging from 0.5 to 3.0 hectare per farm land. It is characterized by rudimentary farm systems, low capitalization and low yield per hectare(Ojo, 2005). The roles of agriculture remain significant in the Nigeria economy despite the strategic importance of the oil sector.Despite the importance of petroleum as a major contributor to gross domestic product (GDP), the role of agriculture remains most significant in Nigeria economy since independence. Agriculture provides employment for most rural dwellers and accounts for more than one third of total gross domestic product (GDP) and labour force for the majority of rural Nigerians (Akinyemi*et al.*, 2009).

The agricultural sector contributes about 41% of the gross domestic product and employs about 65% of the total population and about 80% of Nigerian rural populations (Adegeye. 1985). Agriculture also provides about 90% of the nation's total food requirements and merits priority attention from policy makers not only because of its economic significance but also because of its importance in the war against hunger and poverty, and its significant role in rural development (Ega, 2010).

The annual output of 2.4million metric tonnes (MT) which comes mainly from the southern states with humid and sub-humid climatic conditions, makes Nigeria the largest producer of plantain in West Africa (Ogazi, 1996; FAOSTAT, 2013). The main plantain production

comes from the plants which are components of the multi-storey cropping systems in homestead gardens, backyard farms in urban and peri-urban areas and in intercropping with food and cash crops in the outlying (distant) farms (Okigbo 1983; Oso*et al.*, 2014).

Plantains represent the world's second largest fruit crop with an annual production of 28,000000 metric tons (FAOSTAT, 2013). They rank as the sixth most important global food commodity after rice, wheat and maize in terms of gross value of production (FAOSTAT, 2013).Nigeria is one of the largest plantainproducing countries in the world anddespite its prominence, Nigeria does notfeature among plantain exporting nations because it produces more for local consumption than for export (FAO, 2011). The growing of plantain is left in the hands of subsistence farmers who account for about 80% of Nigeria's agricultural output. The crop is grown in the backyard or home stead and recently in plantations for the commercial market (Aina*et al*., 2012). Plantain is a versatile food in the kitchen as well as a raw material for many popular delicacies and snacks. This reason and the growing population of Nigerialeads to an enormous increase in demand for the crop in the consumers market (Aina*et al*., 2012). Among plantain products are plantain flower, chips, beer and ethanol. The ripe ones are sliced and fried in oil as "dodo". Over-ripe ones are both compacted and fried in oil as "dodo Ikire" or mixed with plantain flour to make "ekuru", a delicious local dish (Aina*et al*., 2012).

1.2 Problem Statement

Plantain production is becoming asignificant economic activity for incomegeneration for both large scale and small holderfarmers in the country, especially for those whoproduce it within their home compounds or gardens. Though, the gains derivable fromplantain are

numerous, its level of production inNigeria has been inconsistent and low (Fakayode*et al*., 2011). Evidences have shown that the yield per hectare in plantain production took a downward trend for almost a decade (FAO, 2011). For instance, the trend of plantain production in Nigeria between 1990 and 2009 showed that yield per hectare consistently made a downward move from 7.54 tonnes per hectare in 1992 to 4.94 tonnes per hectare in 1999; then 5.10 tonnes in 2000 to 4.90 tonnes in 2001 and 6.31 tonnes in 2007 to 5.90 tonnes in 2008. Conversely, an unsustainable increase in the area cultivated / harvested steadily rose from 162,000 hectares in 1990 to 481,000 hectares in 2009. However, increase in price per tonne rose from ₦5,300 in 1991 to ₦116,597 in 2008 (FAO, 2011). In the same vein, plantain was becoming more and more expensive in Bayelsa State (Alagoa, 1999). Yet, the products are also staple food and raw material for the emerging cottage food processing industries in Southern humid forest zone of Nigeria (Afro News, 2003; FDA, 2000).

To harness the export potential ofplantain, the current level of its production mustbe improved. This implies that the limitedresources available to plantain farmers have to beoptimized. The poor plantain output problem inNigeria therefore centers on the efficiency withwhich farmers use resources on their plantainfarms. It also borders on how the various factorsthat affect plantain production can be examinedso as to improve plantain production in thecountry. This quest therefore raises the following researchquestions:

i. What are the socio-economic characteristics of plantain producers?

ii. How profitable is plantain production?

iii. What is the relationship between inputs and outputs in plantain production?

iv. Are the available resources efficiently utilized?

v. What are the problems associated with plantain production?

1.3. Objectives of the Study

The broad objective of this study was to examine the economics of plantain production in Sagbama Local Government of BayelsaState. However, the specific objectives are to:

i. describe the socio-economic characteristics of plantain producers in the study areas;
ii. estimate the costs and returns associated with plantain production in the study area;
iii. estimate the input/output relationship in plantain production;
iv. determine the resource use efficiency in plantain production;
v. describe the problems associated with plantain production in the study area.

1.4 Justification for the Study

Agricultural productivity is determined by certain factors which can be categorized as physical (land area, soil and climate), technological (know-how to be disseminated) and human factors (socio-cultural behaviour). Productivity however, could be enhanced by expanding the area planted to crops, raising the yield per unit area of individual crop enterprise, and growing more crops per year. Productivity can also be enhanced by increase in quality of inputs, changes in techniques, substitution of capital for labour, better trained labour, better organization of production and new ideas even when there are no changes in the quantity, or proportions of factors.

The efficiency with which farmers use existingresources and technologies in traditional plantain production systems are important. This is more so wherefarmers are not making efficient use of existingresources, in the face of geometrical growth inpopulation, increasing pressure on naturalendowed resources diminishing traditionalfallows and fast shrinking land frontiers. Plantain production as a business like every other enterprise is aimed at profit maximization by the farmer. The choice of plantain farm enterprise for this study cannot be over-emphasized as the crop is one of the staple foods and one major crop in the crop mixture of the cropping system of Bayelsa State.There is therefore the need to have an understanding of the economic return on production investment of this crop. Inan economy where resources are scarce andopportunities for new technologies are lacking,efficiency studies can show the possibility ofraising productivity by improving efficiencywithout expanding the resource base. Plantainfarmers can thereby maximize profit and producemore, leading to food security and competitiveness in plantain production. Thisstudy will therefore serve as a guide to farmers, policy makers, researchers, government agencies as well as international agencies interested in improvement ofagricultural production with specific regards to plantain productioninvestment decisions.

CHAPTER TWO

LITERATURE REVIEW

2.1 Economic Importance of Plantain in Nigeria

The demand for plantain within the country is high, with supply struggling to meet demand. This has hampered the status of this crop as a foreign exchange earner. It remains an important staple food, as well as the raw material for many products. It also serves as a source of revenue for many people and as raw material for industries producing value-added products in many parts of Nigeria. Plantain occupies a strategic role in rapid food production, being a perennial ratoon crop with a short gestation period (Akinyemi*et al*., 2010). The crop ranked third among starchy staples after cassava (*Mahihotescultenta*) and yam (*Dioscorea spp*.). It is a major source of carbohydrate for more than 50 million people. In Nigeria, all stages of the fruit (from immature to overripe) are used as a source of food in one form or the other. The immature fruits are peeled, sliced, dried and made into powder and consumed as 'plantain fufu'. The mature fruits (ripe or unripe) are consumed boiled, steamed, baked, pounded, roasted, or sliced and fried into chips. Overripe plantains are processed into beer or spiced with chili pepper, fried with palm oil and served as snacks ('dodo-ikire'). Industrially, plantain fruits serve as composite in the making of baby food ('Babena' and 'Soyamusa'), bread, biscuit and others (Ogazi, 1996; Akyeampong, 1999).

Though fruits are produced all year round, the major harvest comes in the dry season (November to February), when most other starchy staples are unavailable or difficult to

harvest. Thus, it plays an important role in bridging the hunger gap (Wilson, 1986) as well as assisting farmers in having cash at hand through sales of plantain. In Nigeria, plantain peels are used as feed for livestock, while the dried peels are used for soap production. The dried leaves, sheath and petioles are used as tying materials, sponges and roofing material. Plantain leaves are also used for wrapping, packaging, marketing and serving of food.

In comparison with the situation in the past three decades, where plantain was regarded as food for the elite in the cities or food for birds in some villages, plantain products (chips, flour) are now flooding the streets, even in the dry, non-plantain regions of Nigeria. Presently, unlike in the past few years, processing of plantain has turned into a big business, both in major cities and small towns in the Southern parts of Nigeria. There are over 2,000 small scale plantain chips processing businesses and several medium scale producers in the Lagos metropolis alone. In the Southwestern part of Nigeria, several plantain flour processors are developing and the market seems to be expanding each day (Akinyemi*et al*., 2010).

One of the advantages of plantain cultivation is thatit does not require the use of heavy and costly farmmachinery. Ndubizu (1985) noted that the otheradvantages of plantain crop production are its gestationperiod of between 14-20 months that can be consideredextremely low when compared with other permanentcrops.Cost is incurred only once and as a perennial crop,several harvests can be made from one planting unlikeother annual crops, harvesting costs and on farm processing costs are minimal, income per hectare fromplantain is higher than what is obtained in othercarbohydrate food staples (Ndubizu, 1985). Marriot andLancaster (1993) claimed that the cost of production ofplantain in terms of cost per

hectare per tonne and per unitof food energy is the lowest compared with other cropsgrown in traditional agricultural system. Since one of themain goals of an entrepreneur is profit maximization, anycrop that has a relatively average to low cost ofproduction is worth examining for possibility of profitenhancement.

2.2 Plantain Production Trends

Plantain production in Nigeria has witnessed a fluctuating movement for more than 20 years. As of 2004, the country produced 2.421 million tonnes harvested from 389,000 ha which subsequently rose to 2.991 million tonnes from 443,799 ha in 2007 and later dropped to 2.8124 million tonnes from 494,671 ha in 2012 (FAO, 2013).

Table 2.1: Plantain production trend in Nigeria: 2003 - 2012

YEAR	Area cultivated (ha)	Production (MT)
2003	354701	2263000
2004	389000	2421000
2005	426560	2591000
2006	440174	2785000
2007	443766	2991000
2008	468420	2720000
2009	481000	2700000
2010	478877	2675000
2011	482400	2736000
2012	494671	2812400

Source: FAO, 2013

While the crophave high export values, 90% of the production, in the producing countries is consumed locally where they serve as staple food for more than 300 million people (Akinyemi*et al.*,2010). The fluctuations is notreadily noticed in the traditional homestead

and intercropping field production systems andso appear to attain perennial productivity despite the low adoption of improved culturalpractices. This loss of perennial productivity is due to a combination of factors such as soil fertility decline, climate change and increasing hunger and poverty factors the farmers cope with by working the land more intensively (Akinyemi*et al.*,2010).

The yearly increases in plantain production have not been consistent over the last two decades, and average yield per hectare has remained constant. Between 1990 and 1999, for example, average yield was 7 tonnes per hectare, signifying consistency in intensity of cultivation for ten years. The land area cultivated increased by 40% between1999 and 2000. Though the production during this period increased by 0.67 million tonnes, the yield per hectare dropped from 7 to 5 tonnes per hectare, indicating that the increase came from an increase in area cultivated rather than from an increase in intensity of cultivation that was experienced ten years earlier.

2.3 Plantain Production and Utilization

The soils in Nigeria fall into four zones:(a) the northern zoneof sandy soils; (b) the interior zone of laterite soils; (c) the southern belt of forest soils; and (d) the zone of alluvial soils. Forest soils in the southern belt are naturally fertile as a result of dense vegetation cover. This zone also contains laterite soils. Forest soils are good for cocoa, palm and rubber production and are also the main soil types in the plantain and banana producing regions of Nigeria. Plantain production is mainly in the Southern states of Nigeria, which include Akwa-Ibom, Cross River, Imo, Enugu, Rivers, Edo, Delta, Lagos, Ogun, Osun and Oyo states (Ogazi, 1996). Annual rainfall in these areas is usually above 1000 mm spread over 7

to 9 months. Plantain is transported to other parts of the country from these states. Plantain plays vital roles in the feeding of both human beings and farm animals. It has a very high nutritional value in source of dietary carbohydrates, vitamins and minerals. Plantains are extremely rich in vitamin A. In spite of the consumption of plantains as a staple food, it is also used in the food industries for the manufacture of chips, flakes, cakes, thereby creating important opportunities to the populace directly or indirectly and invariably, income for small holder farmers. At the household levels, plantains are consumed raw with water, soaked withgarri, fried as dodo, boiled, roasted and can be dried and grounded into flour for feature use. Plantains, when ripe, contain a high level of sugar and can be put into various uses like the preparation of plantain custard for infants and adults, together with sick patients for convalescence (Alimi*et al*., 2007).

Benjamin *et al.* (1995) in their contribution to plantain utilization said that apart from its major uses as dessert fruit eaten raw or as starchy fruits cooked before eating, the proportion of plantain production put to other uses is relatively small and can further be stressed that plantain lack good processing qualities due to lack of acidity which make preservation difficult and the year – round availability of fresh fruits also makes preservation unnecessary. Presently, plantain peels are used in the formulation of feeds for pigs in the eastern part of the country which is said to be very palatable. Plantain is a foreign exchange earner to some countries. FAO (2008) listed some countries that earn foreign exchange from plantains as Ecuador, Costa Rica, Columbia, Philippines, Honduras and Panama.

2.4Analytical Framework

2.4.1 Farm profitability analysis

Farm profitability analysis involves estimation of costs and returns of production. Gomez (1975) and Adeleke, *et al*. (2008) developed a farm level model to evaluate alternative cropping mixtures and patterns. These includes: (i) profitability: which is measured as the differences between value of yield and cost of production, and (ii) Net return: which involves the difference between value of yield and cost of inputs, including hired labour, in choosing economic indicators on the basis of production factors affected by potentials innovation. Abedullah and Mushtaq(2007)suggested the use of the following: (i) gross margin and returns to variable cost, where only capital is affected. (ii) yield/labour ratio, where only labour is affected, and (iii) gross margin, return to variable costs and monetary return to labour, where capital and labour are affected.

The major problems associated with cost-return analysis as basis for profitability assessment are that: (i) it does not indicate the relative importance of each of the resources in production and (ii) it is location bound and specific in applicability due to use of money as the common unit of measurement and the prevailing price for estimates. Gomez (1975) said that in spite of the limitations, cost and return analysis is a useful tool for enterprises comparison and indicating a profitability pattern of aggregate input use.

As with any economic analysis, the profitability of an investment is based on a comparison of the cost and returns of the investment. Another way to add value on the production side would be to reduce processing costs by increasing the efficiency (and thus the profitability) of production (Masters *et al*., 2005). Hence, the profitability of crop production depends on

reducing the farming cost as much as possible, and at the same time maximizing the income from the sale of crop. Profitability in some farm business exists because they are managed more efficiently than others. The reward for doing the job better is usually profit. The prospect of earning and maintaining profitability serves as the incentives for creativity and efficiency among farmers. Profitability stimulates risky ventures and drives farmers to develop ways of cutting cost and improving technology always in an effort to satisfy consumer interest (Troke, 2008). Profitable agriculture is dependent on productive soil and plantain production is not an exception.

Net farm income is the difference between gross income (revenue) and total cost of production. (Olukosi and Erhabor, 2008). It is used to show the levels of costs, returns and net profit that accrue to farmers involved in production. The technique emphasizes the costs (fixed and variable cost) and returns of any production enterprise. Olukosi and Ogungbile (2006) have examined two major categories of costs involved in crop production. These are fixed and variable cost. Fixed costs (FC) refer to those costs that do not vary with the level of production or output while variable cost (VC) refers to those costs that vary with output. The total cost (TC) is the sum of total fixed cost (TFC) and total variable cost (TVC).

2.4.2 Factors affecting profitability

The characteristics of resource-poor farmers can be examined from the view point of the pattern of the use of farm resources such as land, labour, and capital (Banta *et al*, 2008).

Land: This is the most important input of small farmers, but it is generally not believed to be abundant relative to other production inputs (Banta *et al.*, 2008). It is estimated that only

less than 40% of the 71 million hectares of cultivable land is currently under cultivation and is also stressed that the apparent abundance of land in Nigeria is being limited by population pressure, livestock expansion, desertification and deforestation (Banta *et al.,* 2008). Land is a fixed resource whose area can be expanded only at slightly prohibitive costs through drainage of swamp, reclamation from water, and improvements designed to make non-cultivable land suitable for cultivation.

Labour: Labour is very important in the production process. Where labour is limited, it is expected that production of goods will be low and hence the profitability. In areas where partial mechanization is possible in form of animal traction and hired tractor, human labour is still required to about 70% of all the operations for planting, weeding and harvesting (Faturoti*et al.,* 2007).

Capital: There is very low capital investment in farming tools and equipment which consists of hoes and cutlasses. Expenditures on purchasing inputs like fertilizers, pesticides, and improved seeds and seedlings usually constitute a minor component of the total cash expenditure (Olukosi and Erhabor, 2008). Capital is considered as total investment available for use. Low capital investment on an enterprise affects its profitability.

Management: Good management practice and efficient combination of all other factors of production ensures good profit and coordinates other factors of production. Management is concerned primarily with the organization of production and other operation of farm firm so as to achieve certain objectives, one of which is profit maximisation (Olukosi and Erhabor, 2008).

Farm size: The size of the farm also influences profitability. Availability and cost of acquisition of land will determine farm size. The more the land is put into cultivation, the more the yield (other things being equal).

Time: This can also affect profitability. Early planting result in good yield. The time of marketing of the product is also of vital importance and a measure determinant of profitability. Time is the period needed to realize any goal and allows re-evaluation and adjustment of one's choice (Olukosi and Erhabor, 2008).

Fertilizer: Organic manure dropping from roaming cattle are commonly used by small farmers especially in the northern part of the country. The use of inorganic fertilizers has been on the increase as a result of the following; awareness created by Operation Feed the Nation (OFN), National Accelerated Food Production Project (NAFPP), the establishment of Agricultural Development Programmes (ADPs), large irrigation project and the heavy subsidy on fertilizer (Banta *et al*., 2008).

2.4.3 Empirical measurement of efficiency

Variations in productivity are a function of differences in scale of operation, production technology, operating environment and operating efficiency (Fried *et al*. 2008). Increases in productivity can be achieved by improvements in technology such as introduction of new machinery, pesticides, and improved seed varieties among others. Alternatively, productivity can be improved by changing factors that improve the efficiency by which

inputs are being transformed into output such that higher outputs are produced from the same level of inputs and technology (Bravo-Uretaand Pinheiro, 1997; Coelli, 1996).

To measure efficiency, the efficient production function needs to be known. In most empirical studies, the efficient frontier is unknown and has to be estimated from data on which efficiency is to be measured. The nature of the assumptions made in estimating the frontier divides the efficiency measurement into non-parametric and parametric. The parametric methods of estimating efficiency make *a priori* assumptions about the functional form of the production function and the inefficiency term. In the non- parametric methods such as Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH), the form of the production function is taken as unknown.

2.4.4 Parametric methods

The parametric methods involve econometric modeling of the production process making assumptions *a priori* on the functional form of the production function and the distribution of the inefficiency term. The common functional forms of the production function in the literature are the Cobb-Douglas (and its modifications) and the trans-log models. The estimated frontier can be deterministic or stochastic depending on the treatment of deviations of an observation from the frontier. Deterministic frontiers are regression based and attribute all deviations to inefficiency. Deterministic frontiers may be estimated using Corrected Ordinary Least Squares (COLS) or ModifiedOrdinary Least Squares (MOLS). Unbiased estimates of the slope parameters in both estimation procedures are obtained using OLS followed by a correction of the intercept. The COLS uses the largest positive observed

residual while MOLS modifies the intercept using the mean of the assumed one-sided distributed disturbance term (Kumbhakar and Lovell 2000).

Stochastic frontiers take into account stochastic error by decomposing the error term into stochastic and inefficiency components. In Stochastic Frontier Analysis (SFA), the error term is decomposed by parameterizing the distribution of the inefficiency term (Fried *et al*. 2008). This entails making assumptions on the distribution of the inefficiency term, usually half-normal or exponential, and that the stochastic error and inefficiency are independent of each other and the independent variables (see for example, Coelli, 1996; Emokaro and Ekunwe, 2009 among others). Other distributions of the inefficiency term are available. The stochastic frontier can be estimated using maximum likelihood estimation (MLE) to obtain consistent estimates of the slope parameters. The conditional distribution of the estimates can be used to obtain conditional expected values of inefficiency for each observation. Stochastic distance frontiers are also available for measuring efficiency.

2.4.5 The non-parametric methods

The non-parametric methods use mathematical programming methods to measure relative efficiency of units commonly referred to as Decision Making Units (DMUs). The most common non-parametric methods are the DEA and the more general FDH. A piecewise frontier is constructed based on data points that use the least inputs in producing a particular level of outputs. Relative efficiency is measured by comparing observed performance against best-practice performance. The non-parametric methods differ from the parametric in that, the former does not make any *a priori* assumptions about the functional form of the production function and the inefficiency term. The DEA makes general assumptions of

monotonicity and convexity, resulting in a flexible frontier that allows the production functional form to vary across DMUs. Relaxing the convexity assumption in DEA leads to FDH which has a step frontier (De Borger *et al.*, 1994). The basic DEA and FDH are deterministic, thus attributing all deviations from the frontier to inefficiency.

The most common method of estimating efficiency in DEA is a radial measure based on Farrell's (1957) concept of radial contraction of inputs to the least level necessary for production of a specific level of output. In output space, the radial measure can be thought of as radial expansion of output obtainable from a given combination of inputs. Other methods of estimating efficiency in DEA include the use of a target DMU for each DMU under study, and other non-radial measures such as the additive model, Russell measure, range-adjusted measure, slack-based measure, geometric distance function, hyperbolic and dimensional efficiency models (Fried *et al.*, 2008) for a detailed discussion of each of these methods.

The flexible functional form of the non-parametric methods has won favour in the efficiency literature. Also, other than just measuring efficiency, the non-parametric techniques of DEA and FDH also provide information on the shadow prices of inputs and outputs of the DMUs. These are obtainable from the weights which can be unrestricted or restricted within acceptable ranges (Marriotand Lancaster, 1993). DEA is also able to handle multiple outputs and multiple inputs without requiring price data (Coelli, 1996). The deterministic nature of the basic DEA is usually cited as its main weakness as it fails to account for stochastic noise in data which could potentially bias the estimated efficiency scores (Coelli, 1996; Oso*et al.*, 2014). The DEA is also argued to be less robust to outliers

and extreme values and also lacks parameters for economic interpretation (De Borger *et al.*, 1994).

2.5 Stochastic Frontier Analysis

The stochastic frontier production function is a method of economic modeling. It has its starting point in the stochastic production frontier models simultaneously introduced by Ogundari (2006), Rahman and Umar (2009), Thomas*et al.*, (2007), Emokaro and Ekunwe (2009) and others which derived from the error model of Aigner*et al*. (1977) and Meeusen and Van den Broeek (1977). The stochastic frontier production function is specified as:

$$Y_i=f(X_i.\beta)+e_i \quad \ldots\ldots 1$$

Where:

Y_i = quantity of output of the i^{th} farm

X_i = vector of the inputs used by the i^{th} farm

β = a vector of the parameters to be estimated

e_i = composite error term

v_i= random error outside farmer's control

u_i =technical inefficiency effects

$f(X_i, \beta)$ = a suitable function of the vector

This according to Ogundari (2006), it has been used by many empirical studies, particularly those relating to agriculture in developing countries and also that the functional form meets the requirement of being self-dual (allowing an examination of economic efficiency):

$$\ln Y = \beta o + \beta_1 \ln X_1 i + \beta_2 \ln X_2 i + \beta_3 \ln X_3 i + (V_i - U_i) \quad \ldots\ldots 2$$

Where:

ln = the natural logarithm

Y = output of plantain (kg/ha)

βo = constant term

β_1- β_3 = regression coefficients

X_1 = quantity of seed (kg)

X_2 =quantity of fertilizer (kg)

X_3 = total labour used (man days)

X_3 = quantity of agrochemical (litres)

V_i = random variability in the production that cannot be influenced by the farmer.

U_i = deviation from maximum potential output attributable to technically inefficiency.

The inefficiency of production, U_i was modelled in terms of the factors that are assumed to affect the efficiency of production of farmers. Such factors are related to the socio-economic and management variables of the farmers. The determinant of technical inefficiency is defined by:

$$U_i = \delta_0 + \delta_1 1nZ_1 + \delta_2 lnZ_2 + \delta_3 lnZ_3 + \delta_4 lnZ_4 + \delta_5 lnZ_5 + \delta_6 lnZ_6 \ldots\ldots\ldots\ldots\ldots\ldots 3$$

Where;

U_i = inefficiency effects of individual farmers

Z_1 = Age of farmer (years)

Z_2 = Household size (number)

Z_3= Education (years)

Z_4 = Cooperative association (Years of participation)

Z_5 = Access to extension services (number of extension contact)

Z_6 = Amount of credit obtained (Naira)

δ_0 = constant

δ_1-δ_6 = Parameters to be estimated.

These variables are assumed to influence technical efficiency of the plantain farmers. The gamma ($\gamma = \sigma^2 \mu / (\sigma 2 \mu + \sigma \nu)$ which is the ratio of the variance of U $\sigma^2 \mu$ to the sigma squared ($\sigma^{2)}$ which is a summation of variances u and v of U and V ($\sigma^2 = \sigma^2 \mu + \sigma^2 \nu$) were also determined.On the other hand, U_i is a non negative truncated half normal random variable associated with farm- specific factors which lead to the i^{th} farm not attaining maximum efficiency of production. U_i is associated with technical inefficiency of the farm and ranges between zero and one. $U_i$follows an independent and identical half-normal distributed N ($0.\delta^2 u$). N represents the number of the farms involved in the cross-sectional survey. According to Bakhsh (2007), stochastic frontier production function model is estimated using the maximum likelihood estimation procedure (MLE).

2.6 Empirical Studies Utilizing the Stochastic Frontier Approach.

The farm households are both involved in the consumption and production activities, this dual economic characters of the household has implication for economic analysis that can be made on it. According to Coelli (1996), the strict definition of economic efficiency requires a competitive market, since neither the individual production unit nor the sector can attain efficiency if some economic agents can influence the prices and return of other

economics agents. The concept of efficiency measurement begins with Farrel (1957) who define a sample measure of firm efficiency which could account for multiple inputs. Farrel (1957) proposed that efficiency measurement of a firm consist of two component, technical efficiency (TE) and allocative efficiency (AE) which reflects the ability of a firm to use the inputs in optimal proportion given their respective price.

According to Aigner*et al.* (1977) and Meeusen and VandenBroeck (1977), motivated by the idea that derivation from the production frontier may be entirely under the control of the farmer. The model allows for technical inefficiency and that random shock outside the control of the farmer can affect output. The main feature of stochastic frontier model is that the disturbance term is composed of two parts, the symmetric component $v_{i\ which}$ captures the random of error outside the control of the farmer while the one-side (non-negative) component u_i with $u_i \geq 0$ which captures the random of human error or technical inefficiency relative to the stochastic frontier. This randomness is under the control of a farmer. Its distribution is assumed to be half normal or exponential. The v_i assumed to be independently and identical distribution random variable, independent of u is and v is assumed to be independently and identically distributed as exponential (Meeusen and Van den Broeck, 1977).

Stochastic frontier approach has found wide acceptance within the agricultural economics literature because of its consistency with theory, versatility and relative ease of estimation. The measurement of efficiency (technical, allocative and economic) has remained an area of important research both in the developing and developed countries, where resources are not sufficient and opportunities for developing and adopting better technologies are

dwindling.Efficiency measures are important because it is a factor for productivity growth. Such studies benefit these economies by determining the extent to which it is possible to raise productivity by improving the neglected sources of growth i.e. efficiency, with the existing resources base and availability of technology.

2.7 Problems of Efficiency Measurement

Farrell's definitions as elegant as they are cannot be measured easily as precise measurement rests on the assumption of an efficient isoquant. Efficiency measures as the average productivity of the say land, labour, capital, water and so forth can only be a meaningful index of technical efficiency if any one of the resources is limited in the production process (Olayide and Heady, 1982). The index of efficiency measured as the weighted average of all inputs compared with the output has index number problems and is consequently not a reliable measure of technical efficiency. In addition the use of cost comparisons in the production process as an index of technical efficiency has restricted application where all farm or plants do not face same factor price (Olayide and Heady, 1982).

Olayide and Heady (1982) asserted that the theory of the concept of technical efficiency based on the assumption that all farm firms have an identical production function, that is identical technology, identical fixed factor endowment and therefore, a short run concept of efficiency seems to have a less significant impact in the area of production measures than improvement in technical efficiency. Maximum efficiency is guaranteed if single products are produced under conditions of decreasing returns (or increasing costs) and if

commodities produced in combination are never produced within the range of complementary relationships (Olayide and Heady, 1982).

Measurement of efficiency started with Farrell (1957) who proposed a division of efficiency, which represents a firm's ability to produce a maximum level of output from a given level of inputs. Technical efficiency is the extent to which the maximum possible output is achieved from a given combination of inputs or the ability of a firm to obtain maximal output from a given set of inputs. Allocative efficiency is the ability of a firm to use inputs in optimal proportions, given their respective prices and production technology. The combination of these two measures yields the level of economic efficiency.

There are several approaches to analyzing the determinants of technical efficiency from stochastic production frontier function. One is a two-step procedure, in which the frontier production function is first estimated to determine technical efficiency indicators while the indicators thus obtained are regressed against a set of explanatory variables that are usually firm specific characteristics. While this approach is very simple to handle, the major drawback is that it violates the assumption of the error term. In the stochastic frontier model, the error term is assumed to be identically independently distributed (Jondrow*et al.*, 1982). In the second step, the technical efficiency indicators obtained are assumed to depend on a certain number of factors specific to the firms, which implies that the inefficiency effects are not identically distributed. This major drawback led to the development of a more consistent approach that modeled efficiency effects as an explicit function of certain factors specific to the firm, and all the parameters are estimated in one step using maximum likelihood procedure.

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study Area

The study was carried out in Sagbama Local Government Area (SALGA) of Bayelsa State. The State covers an area of about 21,110 square kilometers with more than three quarters of this area covered by water. Sagbama Local Government (SALGA) is geographically located within latitude 04^0 15North, 05^0 23 South and longitude 05^0 22 West and 60^0 45 East. The Local Government shares boundaries with Patani Local Government in Delta State on the North, Kolokuma/Opokuma Local Governmentof Bayelsaon the East and the Atlantic Ocean on the West and South. Annual rainfall is about 2400mm with a mean temperature of about 27^0C, and lies in the heavy tropical rain forest region of Africa where such crops as yam, cassava, cocoyam, rice including plantain grow abundantly. The vegetation is characterized by mangrove forest, riparian forest and fresh water swamps.

Sagbama Local Government Area (SALGA) constitutes 248,483of the total population of Bayelsa State of 2,257,179 people projected to 2014 based on a 3.2% growth rate per annum(NPC, 2006).Sagbama Local Government Area (SALGA) is made up of six dialects which include Kabowei, Kumbowei, Tarakiri, Mien, Odoni and Tungbo clan. The main

language spoken inSagbama Local Government Area (SALGA) isIzon. The predominant occupation of the people in the Local Government Area are fishing, farming, palm oil milling, lumbering, palm wine tapping, local gin making, trading, carving and weaving. Culturally, plantain in an average Bayelsan's meal is commonly combined in the following forms: eba/soup and boiled plantain; foofoo/soup and boiled plantain; boiled plantain and palm oil; roasted plantain and palm oil; plantain/pepper soup; and plantain pottage. In some parts of the State, certain markets and market days are dedicated to this crop exclusively (Kainga, 2013).

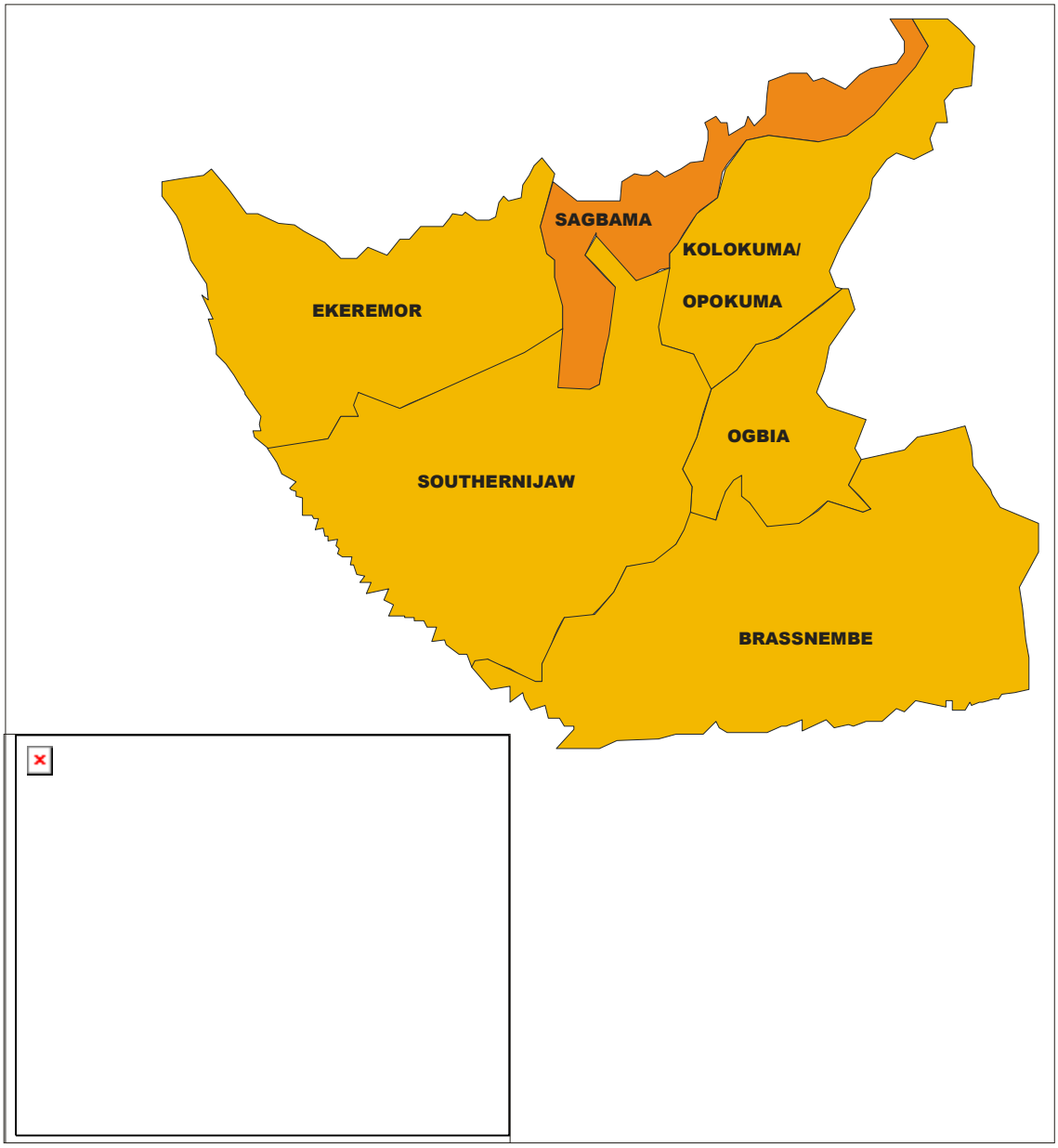


Fig. 3.1 Map of Bayelsa State showing the Study area

3.2 Sampling Procedure and Sampling Size

A multi-stage sampling technique was used to select the respondents for this study. The first stage involved a purposive selection of Sagbama Local Government Area (SALGA) based on predominance of plantain plantations in the area, and easy accessibility because of its road network. In the second stage, four villages wererandomly selected from the six villages of the Local Government Area using the lottery method. Finally, a simple random sampling was employed in selecting farmers from each of thevillages through random numbers from the list of the sample frame.Twelve percent (12%) of the sample frame (1609) was used as the sample size. In all, 195 farmers were randomly selected.

Table 3.1: Population and sample size of the farmers

Villages	Sample frame	Sample size
Kabowei	431	52
Kumbowei	426	51
Tarakiri	362	45
Mien	390	47
Total	**1609**	**195**

3.3 Data Collection

Primary data was used for this study which was collected with the aid of structured questionnaire. Information were collected on; (a) farmer's socio-economic characteristics such as age, household size, educational status, amount of credit received, numbers of extension contact andyears spent on the cooperative. (b) Production information; level of inputs used and output in plantain production. (c) Constraints faced by the farmers in plantain production.

3.4 Analytical Techniques

3.4.1 Descriptive statistics.

Descriptive statistics was used to achieve objective (i) and (v) of the study. It involves the use of measures of central tendency such as mean, frequency distribution and percentages.

3.4.2 Net farm income

The Net Farm Income (NFI) was employed to achieve objective two (ii). It was used to estimate the cost and return of plantain production. The formula for net farm income is stated as follows.

NFI= TR-TC**…….....**4

Where:

NFI= net farm income (₦)

TR= total revenue (₦)

TC= total cost of production (₦)

TC= TVC+TFC

TVC= total variable cost (₦)

TFC= total fixed cost (₦)

Thecomponents of variable costs considered include hired labour,rent on land, depreciation on purchased tools orequipment, hired cost of implements, cost of harvestingoperations, handling and transportation, purchasedmodern consumable inputs such as fertilizers, herbicides,pesticides and planting materials (suckers).

The fixed inputs (hoes, machete, spade, wheelbarrow, farm house, canoe, knife, file, paddle, rope and tape) are not normally used up in a production cycle. They were depreciated using the straight line method given by:

$$D = \frac{P-S}{N} \quad \text{..... 5}$$

Where:

D = depreciation (₦)

P = Purchase value (₦)

S = salvage value (₦)

N = life span of asset (years)

Return per naira invested (RNI) is obtained by dividing the gross income (GI) over the total cost (TC).

Therefore, RNI= $\frac{GI}{TC}$ 6

Where:

RNI = return per naira invested

GI = gross income

TC = total cost

3.4.3 Stochastic production frontieranalysis.

The stochastic production function was used to achieve objective iii. The stochastic production function is specified as:

$$Y_i = f(X_i.\beta) + e_i \quad \text{.....7}$$

Where:

Y_i = quantity of output of plantain of the i^{th} farm

X_i = vector of the inputs used by the i^{th} farm

X_1 = quantity of sucker (kilogrammes)

X_2 = farm size (hectares)

X_3 = total labour used (man days)

X_4=quantity of agrochemical (litres)

X_5 = fertilizer (kilogrammes)

β = a vector of the parameters to be estimated

e_i = composed error term

v_i= random error outside farmer's control

u_i =technical inefficiency effects

Stochastic Frontier Model used in the study is specified as:

$$\ln Y = \beta_0 + \beta_1 \ln X_1 i + \beta_2 \ln X_2 i + \beta_3 \ln X_3 i + (V_i - U_i) \quad \ldots\ldots 8$$

Where:

ln = the natural logarithm

Y = output of plantain (bunches)

β_0 = constant term

β_1- β_3 = regression coefficients

X_1 = quantity of sucker (kilogrammes)

X_2 = farm size (hectares)

X_3 = total labour used (man days)

X_4=quantity of agrochemical (litres)

X_5 = fertilizer (kilogrammes)

V_i = random variability in the production that cannot be influenced by the farmer.

U_i = deviation from maximum potential output attributable to technically inefficiency.

$U_i = \delta_0 + \delta_1 1nZ_1 + \delta_2 lnZ_2 + \delta_3 lnZ_3 + \delta_4 lnZ_4$…….....9

Where:

U_i = inefficiency effects of individual farmers

Z_1 = Age (years)

Z_2= Farming experience (years)

Z_3 = Farm size (hectares)

Z_4 = Household size (number)

Z_5= Cooperative Membership (years)

Z_6= Extension contact of farmers (number)

Z_7= Amount of credit obtained (Naira)

δ_0 = constant

δ_1-δ_7 = Parameters to be estimated.

Stochastic Frontier Cost Function Model was used to achieve objective iv. The stochastic frontier cost function, which is dual of the frontier production function, is the basis for estimating the allocative and economic efficiencies of a farm (Martin and Taylor, 2003). The model is specified as:

$C_i = f(Y_i, P_i, \alpha) + \varepsilon_i$ (i = 1,2,3, ….n) ……..……..10

Where:

C_i = Total cost of production by i^{th}farm;

Y_i= Output of plantain produced by i^{th}farm;

P_i = Cost of inputs (Fertilizers, Suckers, Agrochemicals, Labour, Farm Size) of i^{th}farm;

α_i= Parameters of the cost function to be estimated, and;

ε_i = The error term, composed of two components related as:

$e_i = v_i + u_i$…….....11

Where:

v_i and $u_i$are as defined earlier in the stochastic frontier production function. However, because inefficiencies are assumed to always increase costs, the two error components have positive signs (Coelli*et al.*, 1998).

The farm specific economic efficiency (EE) is defined as the ratio of the minimum observed total production cost (C_i*) to actual total production cost (C_i),

That is EE = $\frac{C^*}{C}$…….....12

The measure of farm specific allocative efficiency is thus obtained from economic and technical efficiencies estimated as:

AE =$\frac{EE}{TE}$……..... 13

That is 0≤AE≤1 (Martin and Taylor, 2003; Ogundari and Ojo, 2006).

The Allocative Efficiency Index (AEI) was used to determine whether the farmers are efficient or inefficient in the allocation of their productive resources in plantain production. This is expressed thus:

$$A_i = \frac{MPV_x}{P_y} \quad \text{.....14}$$

Where:

A_i= Allocative Efficiency Index

MPV_x = Marginal Value Product (MPP * P_y)

P_y = Unit price of input

MPP= Marginal Physical Product

P_y= Unit price of output

Decision rule:

- If A = 1, then the farmers are allocatively efficient
- If A ≠ 1, then the farmers are allocatively inefficient
- If A □ 1, then the resources are under utilized
- If A □ 1, then the resources are over utilized (Tiku and Eniobor, 2012).

3.5 Definition and Measurement of Variables and their *apriori* Expectations.

(i) Quantity of sucker: Sucker is the seed used for planting in plantain production. This was measured in kilogrammes. It is included in the model to examine how variability in quantity of seed used in production, affect output of plantain. The estimated coefficient of seed will be expected to have positive effect on plantain output.

(ii) Labour: This consist of family and hired labour, it was included in the model to examine how variability in labour used affect output. Following Norman (1972), children age 7-14years are accorded 0.5 of adult male equivalent, female adult of 15-46 years are accorded 0.75 and male adults of 15-64years are accorded 1.00. Labour was measured in

man-day. The estimated coefficient of labour will be expected to have positive effect on plantain output

(iii)Quantity of herbicides: It is included in the model to examine how variability in the quantity of herbicide used affect output. It will be measured in litres.The estimated coefficient of agrochemical will be expected to have positive effect on plantain output

(iv) Age: This refers to the actual age of the respondent as at the time of interview and this was measured in years. This variable is expected to be negatively related with productivity in plantain production. The reason is that older farmers seem to be somewhat less inclined to adopt innovative farm management practices than younger ones (Njoku, 1991). Younger farmers tend to be more adventurous and flexible in their decision making and adopt new ideas more readily (Obeta and Nwagbo, 1991).

(v) Farm size: farm size is the total farm land cultivated by the household measured in hectares. The larger the farm size, the higher the production level. It is thus expected that household with larger farm size are more likely to produce more output.

(vi) Household size: This means the total number of people in the house which includes the wives, children and dependents that reside within the same house. Since food requirements increases with the number of person in the household and also because land and finance to purchase agricultural inputs are limited. Increasing family size, according to Brown (2004), tends to exert more pressure on consumption than the labour it contributes to production. This was measured in numbers. The estimated coefficient of household size will be expected to have positive sign on the technical inefficiency.

(vii) Farming experience: This refers to the years the farmer has actively engaged in plantain production and was measured in years. It is expected to have an impact on the ability to seek and obtain off-farm income, which increase household income. The estimated coefficient of farming experience will be expected to have positive sign on the allocative efficiency.

(viii) Cooperative membership: Cooperatives are vehicle for development in the rural areas. Access to cooperative loans depends on membership of the society and it is expected that access to credit should increase household income. This was measured in years the farmer has actively engaged in plantain related cooperative association The estimated coefficient of cooperative membership will be expected to have a positive sign on the allocative efficiency.

(ix) Extension contact: This refers to the number of times respondents have visited or have been visited by government extension services. It was measured in number of visits. This variable is expected to have a positive effect on allocative efficiency. This is because extension contact exposes farmers to availability of information on new production practices and will therefore be expected to stimulate adoption (Polson and Spencer, 1990).

(x) Amount of credit obtained: This refers to amount of credit obtained from either formal or non formal credit sources or both. It was measured in Naira.The expected sign of this variable is positive. The reason is that with credit available, farmers can have sufficient

funds to invest in the farm business by adoption of improved technologies while managing the household needs at the same time.

CHAPTER FOUR

RESULTS AND DISCCUSSION

4.1 Socio-economic Characteristics of the Respondents

4.1.1 Age of the farmers

The age of the respondents as presented in Table 3ranged between 18-75 years. The age of the farmer affects the level of agricultural production. In other words, the older the farmer the better he is able to understand the social, climatic and economic factors affecting farming. Also, younger farmers are likely to adopt new technology faster than the older ones.A greater number of the plantain farmers' surveyed fall within the age bracket of 31-40 years. Of the 195 plantain farmers interviewed, about 8% were below 20 years, 54 representing about 28% are within the age range of 21-30 year, 85 representing 43.59% were within the age range of 31-40 years, 28 representing about 14% were within the age range of 41-50 years, 10 representing about 5% were within the age range of 51-60 years while the remaining 3, representing about 2% were above 60 years. It can be inferred from the above results that, plantain farming in the area is mostly carried out by young people with mean age of approximately 37 years, implying that the farmers involved in plantain farming were in their active age group. Age is very important in agricultural production and

livelihood activities. It presupposes active period people are expected to be responsive to developmental initiatives and food production programs.

Table 4.1: Distribution of the respondents based on their age

Age (years)	**Frequency**	**Percentage**
< 20	15	7.69
21-30	54	27.69
31-40	85	43.59
41-50	28	14.35
51-60	10	5.12
> 60	3	1.53
Total	**195**	**100**
Mean	37	
Minimum	18	
Maximum	75	

4.1.2 Educational Level of the farmers

Distribution of the farmers by educational level as shown in Table 4 indicates that about4% had adult education. About 2% of the farmers never had any form of education. About50% of the farmers had secondary education while about 22% had tertiary education. This result shows that majority of the farmers (98%) had one form of formal education or the other. The implication is that education is a social capital and could impact positively on

household ability to take good and well-informed production decisions. Some scholars have argued that spouse education could be more important in food production than household's head educational status. Najafi (2003) noted that educational attainment is very important because it could lead to awareness of the possible advantages of modern farming techniques which in turn would enhance household food production.

Table 4.2: Distribution of the respondents based on their level of education

Education	Frequency	Percentage
Adult education	8	4.10
Never attended	3	1.54
Primary	42	21.54
Secondary	98	50.26
Tertiary	44	22.56
Total	**195**	**100**

4.1.3 Household size

The distribution of the respondents by household size was shown in Table 5. The result shows that, about 67% of the respondents had 1-6 members. Those with 7-12 members constituted about 31% of the farmers. Only about2% of the farmers had household size above 12 members. The average household size was about 5 people per household. The significance of household size in agriculture hinges on the fact that the total area cultivated, the amount of farm produce retained for domestic consumption, and the marketable surplus are all determined by the size of the farm household (Amaza*et al.*, 2006). Size of the household may enhance labour availability that can be used for different farm activities.

Table 4.3: Distribution of the respondents based on their Household size

Household Size	Frequency	Percentage
1- 3	23	11.79
4 – 6	107	54.87
7 – 9	36	18.46
10 – 12	25	12.82
Greater than 12	4	2.05
Total	**195**	**100**
Mean 5		
Minimum 1		
Maximum 13		

4.1.4 Farming experience

The farming experience of the respondents was shown in Table 6. The results indicate that about 71% of the farmers produced plantain for 1–10 years, while about 24% produced plantain for 11-20 years.About 5% of the farmers had experience greater than 20 years. The mean years of farming experience is 10 years. Farming experience of a farmer determines his ability to make effective farm management decisions, not only adhering to agronomic

practices but also to input combination or resource allocation. With an average farming experience of 10 years, it could be said that they were sufficiently experienced in plantain production.

Table 4.4: Distribution of the respondents based on their farming experience

Farming Experience	**Frequency**	**Percentage**
1-5	75	38.46
6-10	64	32.82
11-15	31	15.90
16-20	16	8.21
Greater than 20	10	5.13
Total	**195**	**100**
Mean	10.41	
Minimum	1	
Maximum	39	

4.1.5 Farm size

The distribution of farmers by their farm size was shown in Table 7. The results reveal that about 75% of the farmers had farm size between 0.1-1.0 hectares, while about 16% of them had between 1.1-2.0 hectares. Only about 8% of the farmers had farm sizes greater than 2.0

hectares. The farmers had an average farm size of 0.8 hectares. This result is not implausible as most of the farmers in the study area are smallholder farmers. Small farm sizes may affect the size of plantain production. According to Najafi (2003), food production can be increased through expansion of area under cultivation. Therefore under plantain production, farm size is expected to play a significant role in influencing the output because size of the land under cultivation will determine the size of food production

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

Farm Size	**Frequency**	**Percentage**
0.1-1.0	147	75.38
1.1-2.0	32	16.41
Greater than 2.0	16	8.21
Total	**195**	**100**
Mean	0.82	
Minimum	0.5	
Maximum	6.0	

4.1.6 Number of times of extension visit

The results in Table 8 revealed that 56% of the respondents had no extension contact during the production season while about 25% of the farmers had just one contact with extension agents. 12% of the respondents had two extension contacts while only 8% had three contacts with extension agents. Thus, about 44% of the farmers had access to extension

agents, who are the main source of farmers' information on improved agricultural technologies.

Table 4.6: Distribution of the respondents based on the number of extension visits

Number of extension visit	Frequency	Percentage
No contact	109	55.90
Once	48	24.62
Twice	23	11.79
Three times	15	7.69
Total	**195**	**100**

4.1.7 Amount of credit obtained

The amount of credit obtained by the respondents is presented in Table 9. The study revealed that about 65% of the respondents had no access to credit. 4% of the farmers obtained less than N10000. The result revealed that 17% of the respondents received ₦10,000-20,000, 7% received ₦20,001-30,000, about 2% obtained ₦30,001-40,000. About 5% of the farmers obtained credit greater than ₦40,000. Credit obtained ranged between ₦5,000 and ₦60,000 with an average of ₦24,860.91. The low value of credit obtained cannot be unconnected with the fact that farmers in the area only have access to cooperatives which offer minimal amount for production purposes. The availability of credit is expected to loosen the constraints of production, facilitates timely access to inputs and improved management practices.

Table 4.7: Distribution of the respondents based on the amount of credit obtained

Amount of credit obtained (₦)	Frequency	Percentage
0	127	65.13
Less than 10000	8	4.10
10000-20000	34	17.44
20001-30000	14	7.18
30001-40000	3	1.53
Greater than 40000	9	4.62
Total	**195**	**100**
Mean 24860.91		
Minimum 5000		
Maximum60000		

4.1.8 Cooperative participation

The results in Table 10 showed the distribution of the farmers by their years of membership in cooperatives. It was found that about 69% of the farmers did not belong to any cooperative, 23% of farmers had between 1-5 years in cooperative, 5% had between 6-10 years while only 3% of the farmers had more than 10 years in cooperative. Cooperative participation can enhance the accessibility of farmers to credit facilities and other farm inputs and serve as a medium for exchange of ideas that can improve their household's income and food production.

Table 4.8: Distribution of the respondents based on years of membership of cooperative

Years of membership	Frequency	Percentage
0	134	68.72
1-5	45	23.08

6-10	10	5.13
11-15	6	3.08
Total	**195**	**100**

4.2 Profitability of Plantain Production in the Study Area

The viability of an enterprise is indicated by the amount of profit realized per period of time. Profit is the difference between the monetary value of goods produced and the cost of the resources used in their production. The amount of revenue realized and operating cost of a business venture determines how much gain or loss the enterprise can achieve within a certain period. The profitability analysis which was used to achieve objective ii is shown in Table 4.9.

Total Variable Cost is the operating costs of the respondent which are the day-to-day cost incurred for plantain production. The Total Variable Cost (TVC) incurred by the respondents averaged ₦68,395.80/ha, with a Net Farm Income (NFI) of ₦157,521.20/ha. The return per naira invested was 2.26 for the plantain farmers implying that for every one naira invested in plantain production, there is a profit of ₦2.26. This indicates that plantain production is profitable in the study area since the return per naira invested is greater than 1.

Labour was sourced from both family and hired. Family labour was evaluated using the principle of opportunity cost and it was assumed that family labour served as a substitute for hired labour. Consequently, the imputed cost of labour used for family labour equals the prevailing wage rate of hired labour. Hence, labour cost accounts for 71% of the TVC, while seed, fertilizer and agrochemicals costs account for 7%, 20% and 2% respectively for

the plantain farmers in the study. The analysis revealed that labour is the most used variable among the respondents. This conforms to the study of Bamidele*et al.* (2010) where labour cost dominates the Total Variable Cost of Cassava-Based Production Systems in the Guinea Savannah, accounting for over 80% of the TVC.Average fixed cost of the plantain farmers surveyed was estimated at ₦1443.00. This amount represents depreciation on knives, machetes, files, hoes, spades, canoes, paddles, etc.

Table 4.9: Costs and returns for plantain production

Cost/Return Items	**Value (₦/ha)**
(A) Variable Costs	
Suckers (kg)	4668.2
Labour (man-day)	48419.0
Fertilizer (kg)	13893.6
Agro-chemical (litre)	1415.00
(B) Total Variable Costs	68395.8
(C) Depreciation on Fixed items	
Sprayer	288.00
Farm tools	1155.00
(D) Total Fixed cost	1443.00
(E) Total cost (B+D)	69838.8
(F) Gross Income	
Average yield (kg)	227360.00
(G) Net Farm Income (F-E)	157521.2
(H) Return/Naira Invested (G/E)	2.26

4.3 Input – Output Relationship in Plantain Production

Cobb–Douglas Stochastic Frontier Production Function was estimated to examine thenature of input-output relationship in plantain production. The results showed that the estimated coefficients for all inputs werepositive except for agrochemical which wasinsignificant.

i. ***Farm size***

In Table 4.10, the coefficient for farm size was positive and significant at 5% level. Thisimplies that increase in farm size would result in increase in output level in plantain production in the study area. This result agrees with the finding of Muhammad–Lawal*et al.* (2009) who worked on the technical efficiency of youth participating in agricultureprogramme in Ondo State, Nigeria. They reported that farm size was positive andsignificant and that increase in the farm size would increase output level of farmers.

ii. ***Suckers***

The coefficient of seed input (suckers) was observed to be positive and significant at 5% level.This implies direct relationship between suckers and plantain output. Suckersare importantcomponents of farm input that if underutilized or over utilized could affect total output offarmers. This finding agrees with Okoruwa and Ogundele (2006) who examinedtechnical efficiency differentials in rice production technologies in Nigeria. Theyreported that the coefficient of seed was positive and significant for traditionaltechnology and that increase in seed would increase output levels of rice farmers.

iii. ***Fertilizer***

Fertilizer had a positive relationship with plantain output and significant at 1%. This impliesthat increase in the use of fertilizer would lead to increase in output of plantain farmers. This finding agrees with the result of Amaza and Maurice (2005) who reportedpositive and significant coefficient of fertilizer in rice-based production system inNigeria.

iv. Labour

The coefficientof labour was found to be positive and significant at 1% level. This implies that increasein the use of labour would increase farm output in the study area. This agrees withseveral other studies such as Muhammad-Lawal*et al.* (2009) and Amaza and Maurice(2005) who reported that coefficient of labour was positive and significant and thatincrease in labour usage would result in increase in output levels in farm production.This also agrees with findings of Oniah*et al.* (2008) who reported that the coefficient oflabour was positive and statistically significant and that increase in labour usage wouldincrease output level of farmers.

Table 4.10:Maximum likelihood estimate of stochastic frontier productionFunction

Variable	**Coefficient**	**Std Error**	**T-ratio**
Constant (β_0)	1.471	0.285	5.152***
Farm size (β_1)	0.217	0.099	2.198**
Suckers (β_2)	0.259	0.088	2.940**
Labour (β_3)	0.169	0.056	3.026***
Fertilizer (β_4)	0.063	0.019	3.325***

Agrochemicals (β_5)	0.007	0.063	0.113
Sigma squared	0.062	0.017	3.683***
Gamma	0.836	0.062	13.445***

***P<0.01

** P<0.05

* P<0.10

4.4 Resource-use Efficiency in Plantain Production

4.4.1 Technical and economic efficiencies of the farmers

Measure of resource use involves the estimation of technical and economic efficiency. Thiswas done and the results generated showing the determinants of technical and economic (in)efficiency are presented in table 13. For technical inefficiency, the coefficients of age (p<0.10), household size(p<0.10), farm size (p<0.05) and extension contacts (p<0.10) are significant, while only household size haspositive coefficient. For economic inefficiency, coefficients of farm size, credit and cooperative participation are negatively significant (p<0.05). It is only the coefficient of household size and experience that are positively related to economic inefficiency (p<0.05).

The technical inefficiency variance parameter of Sigma (δ 2) was 1.548 for the farmers and statistically significant at 1%, this indicates a good fit and correctness of the distributional form assumed for the composite error term. The gamma (γ) which is the proportion of deviation from frontier that is due to inefficiency estimate was 0.953 and was statistically significant at 1%; it shows the amount of variation resulting from the technical inefficiency of plantain farmers. This means that more than 95% of the variation in the farmer's outputs respectively is due to differences in technical efficiency.

Economic efficiency indicates the welfare and the economic status of the respondents. The positively significant value of the sigma-square of economic inefficiency conforms to the expectation of the data fitted into the model of the stochastic function. The gamma coefficient of the economic efficiency lies between 0 and 1 as expected (0.96). This implies that about 96% of the variations in the economic status of the respondents are attributable to differences in their economic efficiencies. This implies that economic inefficiency significantly contributes to the production of plantain in the study area**.**

i. ***Age***

Furthermore, the coefficient of age (year) is negatively related to technical inefficiency ($p<0.10$). The negative relationship between age and technical inefficiency conforms toDimelu, *et al.* (2009) findings. The means that technical inefficiency would reduce asfarmers' age increases. That is, as plantain farmers' advance in age, inefficiency in resource use decreases andtechnical efficiency increases.Here, output is expected to be closer to production frontier. This is contrary toprevious findings that as farmers advance in age they tend to be averse to adoption of improved technology, asthey would be less energetic to work and would tend to misallocate resources (Ogundari and Ojo, 2007; Idiong,2005; Ajibefun and Abdulkadri, 2004). Ike and Inoni (2006) also affirmed that labour productivity decreases withage because of the arduous nature of farm operations, hence aged farmers do not often show willingness to adoptnew practices which could raise their overall level of efficiency.

ii. ***Household size***

Moreover, the positive coefficients (significant)of household size for both technical and economic inefficiencies imply that the inefficiencies increase ashousehold size increases. However, according to Dimelu*et al.* (2009), large household size serves a ready sourceof labour for most farm operations. However, this may not be the case where a large proportion of householdmember are children.

iii. ***Farm size***

The coefficient of farm size was found to be negatively related ($p<0.01$) to technical and economic inefficiencies. This means that increase in farm size reduces technical inefficiency or it is a factor forincreased technical efficiency (Dimelu*et al.,* 2009). The import of this finding is that plantain farmers with larger farm sizes tend to be moretechnically efficient, presumably due to the fact that large farm size motivates adoption of innovations which can translate into higher output, thus making them moveclose to the frontier output (Amaza and Maurice, 2005).

iv. ***Membership of cooperative society***

The coefficient of cooperative participation was found to be negatively related to both technical and economic inefficiencies at ($p<0.01$) and ($p<0.05$) respectively. This means that increase in cooperative participation reduces technical and economic inefficiency or it is a factor forincreased technical and economic efficiency (Dimelu*et al.,* 2009). The import of this finding is that plantain farmers with higher cooperation participation tend to be moretechnically efficient, presumably due to the fact thatmembership of cooperative can enhance farmers' access to credit facility and serve as a medium for exchange of ideas that can improve their farm activities.

v. ***Farming experience***

Increased farming experience, according to Khai*et al.* (2008), may lead to better assessment ofimportance and complexities of good farming decision, including efficient use of inputs. The results shows thatthere is a positive relationship between farming experience and economic ($p<0.05$)inefficiency. These results are in agreement with Khai*et al.* (2008) findings, meaning that economic inefficiency increases with increased years of farming experience. This suggests that older plantainfarmers are less efficient, and that being an experienced farmer is not enough to significantly make a farmer toattain higher level of efficiency (Idiong, 2007).

vi. ***Extension contact***

Coefficient of extension contact is negatively correlated with technical ($p<0.10$inefficiency. This result conforms to earlier findings by Ajewole and Folayan (2008) and Obwona (2006). Itimplies that, farmers that had more extension contact through visitation tend to be less inefficient. Extensioncontact is known to enhance efficiency through better management and provision of up-to-date information forfarmers. The importance of this result is that, as plantain farmers embrace improved technologies it is expected thateconomic inefficiency reduces.

vii. ***Amount of credit***

Also, the coefficient of credit accessibility is negatively related to economic inefficiency ($p<0.10$). Theresult indicates that as farmers get access to more credit coupled with extension contact, the better efficient theywill be. This is because such credit accessibility will enable farmers to make timely purchase of necessary inputsto enhance their production.

Table 4.11: Determinants of technical and economic inefficiencies

Inefficiency model	**Technical inefficiency**			**Economic inefficiency**		
	Coefficient	**Std Error**	**t-value**	**Coefficient**	**Std Error**	**t-value**
Constant (δ_0)	0.13	0.20	0.64	-0.03	1.00	-0.03
Age (Z_1)	-0.66*	0.35	-1.87	0.22	0.69	0.32
Farming experience (Z_2)	0.21	0.51	0.41	0.34	0.15	2.31**
Farm size (Z_3)	-0.27**	0.10	-2.66	-0.12	0.05	-2.29**
Household size (Z_4)	0.30*	0.17	1.81	0.36	0.52	2.36**
Cooperative (Z_5)	-0.12	0.03	-4.49***	-0.73	0.33	-2.22**
Extension (Z_6)	-0.27*	0.15	-1.81	-0.12	0.12	-1.00
Credit (Z_7)	0.92	0.68	1.35	-0.34	0.18	-1.89*
Sigma squared (σ^2)	1.548	0.34	4.508***	2.191	0.36	6.063***
Gamma (γ)	0.953	0.02	58.39***	0.955	0.01	99.711***

***P<0.01

** P<0.05

* P<0.10

4.4.2 Frequency distribution of farm-specific efficiency levels

The frequency distribution of technical, and economic efficiency, as shown in table 7,revealed that the predicted farm specific efficiency range between 0.52 and 0.98 with a mean of 0.84 for technical efficiency (TE). The predictedfarm specific economic efficiency (EE) ranged between 0.63 and 0.93 with a mean of 0.72.Specifically, the result below indicates that 16.5% and 27.9% reduction in plantain production from maximum possible

(frontier) output is attributed totechnical and economic inefficiencies respectively.Moreover, 68.8% of the farmers' attained technical efficiency that ranges between 0.76 and 0.85, while 87.5% of the farmers recorded an economicefficiency of between 0.61 and 0.75. The implication of this result is that most of the farmers fairly utilized andallocate existing resources in their area for good production.

Table 4.12: Frequency distribution of farm-specific efficiency levels

Efficiency level	**Technical Efficiency**		**Economic Efficiency**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
0.50-0.55	5	2.56	-	-
0.56-0.60	4	2.05	-	-
0.61-0.65	6	3.08	21	10.77
0.66-0.70	8	4.10	35	17.95
0.71-0.75	12	6.15	109	55.90
0.76-0.80	116	59.48	17	8.72
0.81-0.85	30	15.38	6	3.08
0.86-0.90	7	3.59	5	2.56
0.91-0.95	5	2.56	2	1.03
0.96-1.00	2	1.03	-	-
Total	**195**	**100**	**195**	**100**
Minimum 0.523		0.631		
Maximum0.975		0.928		
Mean0.835		0.721		

4.4.3 Allocative efficiency estimate

The measure of farm specific allocative efficiency is thus obtained from economic and technical efficiencies estimated as:

$$\text{Allocative Efficiency} = \frac{MeanEconomicEfficiency}{MeanTechnicalEfficiency}$$

That is 0≤AE≤1 (Martin and Taylor, 2003; Ogundari and Ojo, 2006).

$$\text{Thus, Allocative Efficiency} = \frac{0.721}{0.835} = 0.863$$

The allocative inefficiency contributed more (86%) to the short fall in plantain production between maximumpossible (frontier) level of production and recorded output.Specifically, the result above indicates that 13.7% reduction in plantain production from maximum possible (frontier) output is attributed toallocative inefficiency.

4.4.4 Allocative Efficiency Index (AEI) Estimate

A given resource is allocatively used when MVP = Px, this is consideration of the acquired cost of all input in the prevailing market price per unit in the study area. It is the assumed that the opportunity cost of family labour is valued at cost of hired labour per man-day. The prevailing unit price of labour per man-day at the time of the survey was ₦700 per man-day. The price of land is the rent per hectare which was ₦5000 per annum at the time of the survey. The unit factor cost of purchased input (suckers) was ₦20. Unit of price of output was determined based on the average prevailing price of plantain output which is ₦58. Table 15 shows the result of the estimated allocative efficiency index of the production resources of plantain in the study area. The result indicated that the planting material, fertilizer, agrochemical and farm size were underutilized as their allocative efficiency index were found to be >1. This means that for the farmers to maximize output there should be an increase in the planting material, fertilizer, agrochemicals and farm size. Labour was overutilized as the allocative index was found to be <1. This means that with less labour, the farmers can produce maximum output if and only if they are able to technically allocate

their input resources using adequate planting material, fertilizer, agrochemicals and farm size.

Table 4.13: Estimation of Allocative Efficiency Index

Variables	**Mean**	**MVP (b_i $\bar{y}/\bar{x}$.Py)**	**Py**	**AEI (MVPx/Py)**
Output	3,920			
Planting material (Suckers)	233.41	252.2867	20	12.614
Farm size	0.82	60167.22	5000	12.614
Labour	69.17	555.4986	700	0.794
Fertilizer	173.67	82.47642	80	1.031
Agrochemical	2.83	562.3746	500	1.125

4.5 Constraints Faced by Farmers in Plantain Production

Table 4.13 shows the distribution of farmers based on constraints associated with plantain production and are discussed according to their ranking. These problems were affecting the profits they could realize.

4.5.1 Poor market price

About 98% of the farmers reported Poor/low plantain price at harvest. It was ranked 1st among the constraints. This was because most of the plantain farmers sold their products at harvest time when there is over supply or glut in the market.This cannot be unconnected to the unorganised nature of our rural markets. Market information flow as regards good prices is a major challenge in this aspect. Markets are located in far areas which induce the farmers to sell at give away prices. This makes farmers not to have steady pricing trend which they

can predict at any time. The inconsistent trend of prices forces farmers to sell their produce as soon as they notice a rise in price.

4.5.2 High cost of fertilizer

The farmers ranked high cost of fertilizer as their 2nd constraint. About 96% of the respondents identified this as a problem. This is because the subsidized agricultural inputs especially fertilizer are enjoyed by government officials and those who patronize the party in power. Most of the farmers are forced to buy their fertilizer from the open market. High cost of fertilizer also cannot be unconnected to the fact that farmers are made to buy these chemicals from open markets as against government provision. This increases their cost of production and subsequently reduces their profit.

4.5.3 Bad roads

Harvested farm produce are transported with great difficulties from the farms to market or points of processing. The farm products are mostly transported to the market for sale. Therefore, the farmers ranked bad roads3rd constraint among the constraints encountered by them. About 88% of the respondents had this challenge. This cannot be unconnected to the bad roads in the area which makes some roads inaccessible by vehicles rather they use motorcycle, hence, charges are high. Erratic fuel prices and its scarcity is also a factor in this case. The difficulty in getting transport to market their produce leads to these farmers being exploited by hawkers, thereby causing a decline in returns.

4.5.4 Inadequate farm land

About 78% of the plantain farmers reported they failed to secure adequate farm land for their farming purposes. It was ranked 4th among the constraints for the respondents. This could be attributed to the nature and design of their farms. Population problem and urbanization could also be a factor in this regard. Furthermore, oil exploitation has posed a serious threat to farm lands as they are rendered uncultivable due to oil spills.

4.5.5 Theft

Some of the farmers stated that theft of their produce was a major issue (68%). This was presumed to be done by the locals who have nothing to do in terms of farming and is usually carried out in large scale in some instances. It ranked fifth (5th) among the identified constraints.

4.5.6 Low extension contact

Some of the plantain farmers stated that Low extension services (65%) in terms of accessibility to information on improved farm technologies are hindering their maximum productivity. It ranked sixth (6th) among the identified constraints.

Table 4.14: Distribution of farmers based on constraints faced in plantain production

Constraints	Frequency	Percentage	Rank
Poor/low plantain price at harvest	192	98	1
High cost of fertilizer	188	96	2
Bad Roads	172	88	3
Inadequate farm land	152	78	4
Theft	133	68	5
Low extension contact	126	65	6

*Total frequency is more than 195 due to multiple responses

CHAPTER FIVE

SUMMARY, CONCLUSION, RECOMMENDATIONS AND CONTRIBUTION OF STUDY TO KNOWLEDGE

5.1 Summary

The study investigated the economics of plantain production in Sagbama Local Government Area, Bayelsa State, Nigeria. The specific objectives were to describe the socioeconomic characteristics of the respondents,analyze the cost and returns associated with plantain production, estimate the input/output relationship, determine the resource use efficiency and identify the problems associated with plantain production in the study area.A multi-stage sampling technique was used to select the plantain farming household for this study to give a sample size of 195. Datacollected with the aid of structured questionnaire was analysed using descriptive statistics, net farm income, stochastic frontier production function, and allocative efficiency index.

The result shows that age ranged between 18 - 75 years. The mean age of the farmers was 37 years, implying that the farmers involved in the plantain farming were in their active age group. The result shows that majority of the farmers (98%) had one form of formal

education or the other. The result shows that farmers had an average farm size of 0.82 hectares. This result is not implausible as most of the farmers in the study area are smallholder farmers. The average household size was about 5 people per household for the farmers with mean years of farming experience of 10. Farming experience of a farmer determines his ability to make effective farm management decisions, not only adhering to agronomic practices but also to input combination or resource allocation. The results indicate that 65% of the respondents had no access to credit with56% of them not belonging to any cooperative association.

The Total Variable Cost (TVC) incurred by the respondents averaged ₦68, 395.80/ha, with a Net Farm Income (NFI) of ₦157, 521.20/ha. The return per naira invested was 2.26 for the plantain farmers implying that for every one naira invested in plantain production, there is a profit of ₦2.26. This indicates that plantain production is profitable in the study area since the return per naira invested is greater than 1.The results showed that the estimated coefficients for all inputs werepositive except for agrochemical which wasinsignificant.

Measures of resource use involved the estimation of technical, allocative and economic efficiency.For technical inefficiency, the coefficients of age ($p<0.10$), household size($p<0.10$), farm size ($p<0.05$) and extension contacts ($p<0.10$) were significant, while only household size had positive coefficient. For economic inefficiency, coefficients of farm size, credit and cooperative participation are negatively significant ($p<0.05$). It is only the coefficient of household size and experience that are positively related to economic inefficiency ($p<0.05$). The farm specific allocative efficiency was calculated as the ratio of economic efficiency to technical efficiency to be 0.863. This indicates thatallocative inefficiency contributed more (86%) to the short fall in plantain production between

maximumpossible (frontier) level of production and recorded output.Specifically, the result above indicates that 13.7% reduction in plantain production from maximum possible (frontier) output is attributed toallocative inefficiency. Furthermore, estimation from the allocative efficiency index indicated that the planting material, fertilizer, agrochemical and farm size were underutilized as their allocative efficiency index were found to be >1 while labour was overutilized as the allocative index was found to be <1.

Problem of poor price, high cost of fertilizer, bad roads, inadequate farm land, theft and low extension contactwere the major constraints identified by the respondents. These problems were affecting the profits they could realize.

5.2 Conclusion

Plantation production is profitable venture in the study area. This profitability has positive implications for investment opportunities for individuals and corporate organizations and thus, improved household incomes. Similarly, adjustments in the production inputs such as farm size, increase and efficient utilization of fertilizers and herbicides and their cost of acquisition could lead to increased production of plantain. In the same vein, farming experience, membership of cooperative societies, accessibility to credit, extension visits and education were significant variables that influenced efficiency. Noticeable gaps in technical, allocative and economic efficiencies could be drastically improved upon if perceived constraints such as inadequate capital, poor market and lack of modern cleaning facilities were addresses thereby contributing to the well being of farmers as well as their Stochastic frontier production function was estimated for plantain production in Bayelsa State, Nigeria

with farm size, planting material, labour and fertilizer being significant factors that influence plantain output.

5.3 Recommendations

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

1. Farm size was found to be insufficient and which affect increase food production. Farming households should therefore be empowered to expand their farm production through access to soft loan that will enable them to increase farm size and inputs required for such expansion.

2. Since cooperative association is a significant determinant of technical inefficiency, farmers should be encouraged to form cooperatives/farmers organization or join existing ones as this can attract private investors, improve their access to production inputs, output markets, reduce transaction cost and enhance marketing efficiency.

3. Extension agents and farmers relationship should be encouraged and strengthened by the State Government through adequate funding of ADP's and provision of incentives and better salaries for the agents. Extension agents should be properly trained and provided with all necessary technological packages required to teach and guide farmers on improved agricultural technologies to reduce cost of production by research institute.

4. Low annual income of households the area was found to be a major constraint in farm production. Therefore, effort that could boost households' income generation in addition to farm income should be promoted.

5. Subsidy on the fertilizer input to relieve costs of plantain production is indeed necessary to enhance good plantain output. Also, group marketing of plantain by farmers via farmers cooperative can also help alleviate unstable prices and poor returns to plantain production.

6. Small scale agro-processing industries could be enlightened and encouraged to exploit the potentials of plantain.

5.4 Contribution to knowledge

1. The study established that plantain production in the study area was profitable with a net farm income of ₦157, 521.20 and return to investment of ₦2.26 per hectare.

2. The study proved that the mean economic efficiency index was 0.721, suggesting that farmers can reduce input cost by 27.9%, while maintaining same output or they can increase output by 27.9% while maintaining the same input costs and technology.

3. The study found that the planting material, fertilizer, agrochemical and farm size were underutilized while labour was however over utilized. This means that with less labour, the farmers can produce maximum outputif they are able to technically

allocate their input resources using adequate planting material, fertilizer, agrochemicals and farm size.

REFERENCES

Abedullah, S. K. and Mushtaq, K. (2007). Analysis of Technical Efficiency of Rice Production in Punjab (Pakistan): Implications for Future Investment Strategies, *Pakistan Economic and Social Review.* 45(2):231-244

Adeleke, O. A., Matanmi, H. and Ogunniyi, L. T. (2008). Application of the Normalized Profit Functions in the Estimation of the Profit Efficiency among Smallholder Farmers in Atiba Local Government Area of Oyo state, Nigeria.*Journal of Economic Theory.*2(3):71-76.

Aigner, D. J, Lovell, C. A. K, and Schmidt, P. (1977).Formulation and Estimation of Stochastic Frontier Production Function Model.*Journal of Econometrics.* 1(1):21-37.

Aina, O. S., Ajijola, S., Bappah, M. T., Ibrahim, I. and Musa, I. A. (2012). Economic Analysis of Plantain Marketing in Odigbo Local Government Area of Ondo State, Nigeria.*Global Advanced Research Journal of Agricultural Science.*1(5)104-109.

Ajewole, O. C. and Folayan, J. A. (2008): Stochastic Frontier Analysis of Technical Efficiency in Dry Season Leaf Vegetable Production among Smallholders in Ekiti State, Nigeria. *Medwell Agricultural Journal.*3(4):252 - 257.

Ajibefun, I. A. and Abdulkadri , A. O. (2004) Impact of Farm Size Operation on Resource Use Efficiency in Small Scale Farming: Evidence from south western Nigeria.*Journal of Food, Agriculture and Environment.*2(1):359-364.

Akinyemi, S. O. S., Aiyelaagbe, I. O. O. and Akyeampong, E. (2009).Plantain (Musa spp.) Cultivation in Nigeria: A Review of its Production, Marketing and Research in the Last Two Decades (eds). Dubois, T. (2010).*Nigerian Journal of Weed Science*. 12:29–33

Akinyemi, S. O. S., Aiyelaagbe, I. O. O. and Akyeampong, E. (2010).Plantain (Musa spp.) Cultivation in Nigeria: A Review of its Production, Marketing and Research in the Last Two Decades. AVRDC–The World Vegetable Centre, Sub-regional Office for West and Central Africa, BP 320, Bamako, Mali. Proc. IC on Banana & Plantain in Africa Eds.: T. Dubois et al. Acta Horticulture. 879, ISHS 2010

Akyeampong, E. (1999). Plantain Production, Marketing and Consumption in West and Central Africa.Proceedings of the International Symposium on Banana and Food Security.Douala, Cameroon 10–14, November.Picq, C., Fouré, E., Frison, E. (Eds.). pp.353–359, INIBAP, Montpellier.

Alagoa, E. J. (1999).Land and People of Bayelsa State: Central Niger Delta. Alagoa E. J. (ed) Onyoma Research Publications, Port-Harcourt, Rivers State.

Alimi, T., Baruwa, O. I.,Bifarin,J.O.,Abogan, P.O. andAjewole, O.C. (2007).Application of Marcov Chain in Forecasting Plantain Farm Size in the Rain Forest Zoneof Osun State, Nigeria.*Journal of Agricultural Rural Development*, 2:69-83.

Amaza, P. S., Umeh, J. H. and Adejobi, A. O. (2006). Determinants and Measurement of Food Security in Nigeria: Some Empirical Policy Guide. Contributed Poster prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia.

Amaza, P.S. and Maurice, D.C. (2005).Identification of Factors that Influence TechnicalEfficiency in Rice-based Production Systems in Nigeria. Paper Presented at the Workshop on Policies and Strategies for Promoting rice production and food Security in Sub-Saharan Africa. 7–9 Nov., 2005, Cotonou, Benin.

Bakhsh, K. (2007). An Analysis of Technical Efficiency and Profitability of Growing Potato, Carrot, Radish and Bitter Gourd: A Case Study of Pakistani Punjab. An unpublished Ph.D dissertation submitted to the Department of Environmental and Resource Economics. University of Agriculture, Faisalabad, Pakistan.

Bamidele, F. S.; Abayomi, O. O. and Adebiyi E.O. (2010) Economic Analysis of Rice Consumption Pattern in Nigeria, *Journal of Agricultural Technology*.12:1-11.

Banta, A. l., Ibrahim, U. W., Onaiwu, S. A. and Magaji, Y. (2008).*Economics of Maize-Cowpea Production.*Paman and Associates Ltd. Aku, Okigwe, Imo- State, Nigeria.

Bayelsa State Government Blue Print for Agricultural Development (2003).Bayelsa State Government (BYSG)Yenagoa, Bayelsa State

Benjamin, K. K., Dadzie,T. and Wainwright, H. (1995).Plantain Utilization in Ghana. *Tropical Science.* 35:405-410.

Bravo-Ureta, B. E. and Pinheiro, A. R. (1997).“Technical, Economic and Allocative Efficiency in Peasant Farming.Evidence from the Dominican Republic.*The Development Economics*. 35(1):48-07.

Brown, W. H. (2004). *Useful Plants of the Philippines,* Vol. 1 (Tech. Bui. 10). Phillipine, Department of Agriculture & Natural Resources, Manila.

Coelli, T. J., PrasadaRao D. S. and Battese, G. E. (1998).*An Introduction to Efficiencyand Productivity Analysis.*Kluwer AcademicPublishers, Boston/Dordrecht

Coelli, V. J. (1996). Guide to Frontier Version 4.1: A Computer Program for Crops in Africa. In: Akoroda, M. O. and Ngeve, J. M. (eds.). Proceedings of the 4th Triennial Symposium of the International Society for Tropical Root Crops (ISTRC).8:7 – 16

De Borger, B., Kerstens,K., Moesen, W. and Vanneste, J. (1994). A Non-Parametric Free Disposal Hull (FDH) Approach to Technical Efficiency: An Illustration of Radial and Graph Efficiency Measures and some Sensitivity Results, *Swiss Journal of Economics and Statistics.* 130(4):647-667.

Dimelu, M.U., Okoye, A.C., Okoye, B. C., Agwu, A. E., Aniedu, O. C., and Akinpelu, A. O. (2009):“Determinants of Gender Efficiency of Small-older Cocoyam Farmers in Nsukka Agricultural Zone ofEnugu State, Nigeria.” *Scientific Research and Essay.*4(1): 28-32.

Ega, L. A. (2010). Land Holding Patterns and Related Problems of Agricultural Development in Zaria Villages.*Samaru Journal of Agricultural Research. 14 (1&2)*

Emokaro, C. and Ekunwe, P. (2009).Efficiency of Resource-Use and Elasticity of Production among Catfish Farmers in Kaduna, Nigeria.*Journal of Applied Sciences Research.*5(7):776-779.

Fakayode, B. S., Rahji, M. A. Y., Ayinde, O. and Nnom, G. O. (2011).An Economic Assessment of Plantain Production in Rivers State, Nigeria.*International Journal of Agricultural Economics & Rural Development.* 4(2):28-36.

FAO (2011).FAOSTAT Database, Food and Agricultural Organization of the United Nations, Rome, Italy. pp. 28-30.

Farrell, M. J. (1957). The Measurement of Production Efficiency.*Journal of the Royal Statistical Sciences.*2(2):47-49.

Faturoti, B. O., Madukwe, M. C., Tenkouano, A. andAgwu, A. E. (2007).A Review of Policyacts and Initiatives in Plantain and Banana Innovation System in Nigeria.*African Journal of Biotechnology*. 6:2297-2302.

Federal Department of Agriculture (2000).Plantain and Banana Development Programme, (FDA) Training Workshop on Plantain and Banana Production for the South East Zone 9th March 2000.

Food and Agricultural Organization (2008).*Production Yearbook 2004.*FAO, Rome, Italy.

Food and Agriculture Organization FAOSTAT (2013).*Plantain Production Quantity in Nigeria 1961-2009.*Food and Agriculture Organization of the United Nations.FAO Rome.

Fried, H. O, Lovell, C. K. and Schmide,S. S. (2008). *Efficiency and Productivity*, In Fried,H. O.FrisonA. E. and Sharrock, S. (1999). The Economic, Social and Nutritional Importance of Banana in the World. In: Bananas and Food Security. Proceedings of an International Symposium held in Douala, Cameroon, 10-14 November 1998. Montpellier, France, International Network for the Improvement of Banana and Plantain (INIBAP), PicqC, Foure, E, Frison E. A (eds). pp. 21–35

Gomez, O. (1975). *Economic of Agricultural Production and Resource Use.* Prentice Engle Wood, New York, pp 428. In India Agriculture: A Restricted Profit Function Approach. *Review of Economics and Statistics.*74:231-39. In Punjab (Pakistan): Implications for Future Investment Strategies, *Pakistan Economic and Social Review*. 45(2):231-244

Idiong, I.C. (2007).“Estimation of Farm Level Technical Efficiency in Small-Scale Swamp Rice Production in CrossRiver State, Nigeria: A Stochastic Frontier Approach.”*World Journal of Agricultural Science.*3(5):653-658.

Ike, P.C., and Inoni, O.E. (2006).“Determinants of Yam Production and Economic Efficiency among Small-Holder Farmers in South-Eastern Nigeria.”*Journal of European Agriculture.* 7(2):337-342.

Jondrow, J., Lovell, C. A., Materov, I. and Schmidt, P. (1982).Estimation of Technical Inefficiency in the Stochastic Frontier Production Model.*Journal of Econometrics*. 19:23-38.

Kainga, P. E. (2013)**.** Resource Allocation and Utilization in Banana and Plantain Production Enterprises in Bayelsa State, Nigeria. PhD Thesis, Department of Agricultural Economics, University of Nigeria, Nsukka.

Khai, H. V., Yabe, M., Yokogawa, H. and Sato, G. (2008): "Analysis of Productive Efficiency of Soybean Production in the Mekong River Delta of Viet Nam."*J. Faculty of Agriculture Kyushu Univ*ersity. 53(1):271-279.

Kumbhakar, S. C. and Lovell, A. (2000): *Price Distortions and Resources-use Inefficiency*.Paman and Associates Ltd. Aku, Okigwe, Imo- State, Nigeria.

Marriot, J. and Lancaster, P. A. (1993).Bananas and Plantains. In: Chan, (Ed.), *Handbook of Tropical Foods.* Marcel Dekker, New York, USA, pp: 85-143.

Martin, M. and Taylor,T. G.(2003).A Comparisonof the Efficiency of Producers under Collective and Individual Modes of Organization.*Colombian Economic Journal*.1(1): 246-266.

Masters, E. T., Lovett, P. N. and Yidana, J. A. (2005). Tangible Benefits Encourage Sustainable Agro Forestry Parklands: *Management of the Shea tree, VitellariaParadoxa, in Sub-Saharan Africa's*. Forests, Trees and Livehoods (in press).

Meeusen, W. and Van den Broeck,J. (1977).Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error.*International Economics Review*. 18:435-444.

Muhammad-Lawal, A. Omotesho, O. A. and Falola, A. (2009) Technical Efficiency of Youth Participation in Agriculture Programme in Ondo State, Nigeria. *Journal of Agriculture Food and Environment.*5(1):20-26.

Najafi, B. (2003). An Overview of Current Land Utilization Systems and Their Contribution to Agricultural Productivity.Report of the APO Seminar on Impact of Land Utilization Systems on Agricultural Productivity.

National Population Commission (NPC) (2006). Population of Rivers State.National Population Commission of Nigeria.Abuja .

Ndubizu, T. O. C. (1985). Plantain Production Manual for Nigerian Growers Association. An Invited Paper presented at the First National Workshop on Fruits Production in Nigeria, Sponsored by Federal Agricultural Coordinating Unit, NIHORT, FACU Conference Hall, Ibadan. 4th-16th. Nigeria Limited.

Njoku, J. E. (1991). Factors Influencing the Adoption of Improved Oil Palm Production Technologies by Small-holders in Imo State of Nigeria. In Olukosi, J.O., Ogunbile, A.O. and Kalu, B.A. (eds.), *Appropriate Agricultural Technologies for Resource-Poor Farmers.* Proceedings of the National Farming Systems Research Network Workshop held in Calabar, Cross Rivers State, August 14-16, 1990, Nigeria.

Norman, D. W. (1972). *An Economic Survey of three villages in Zaria Province. 2 Input Output Study*. Vol.1 text.Samaru Miscellaneous paper 37.

Obeta, M.E. and Nwagbo E. C. (1991). The Adoption of Agricultural Innovations in Nigeria: A Case Study of an Improved IITA Cassava Technology Package in Anambra State. In Olukosi, J.O., Ogunbile, A.O. and Kalu, B.A. (eds.),*Appropriate Agricultural Technology for Resource-Poor Farmers.*Proceedings of the National Farming Systems Research Network Workshop held in Calabar, Cross River State, August 14-16, 1990, Nigeria.

Obwona, M. (2006): Determinants of Technical Efficiency Differentials amongst Small and Medium-scale Farmers in Uganda: A Case of Tobacco Growers. African Economic Research Consortium Research Paper152. Nairobi, Kenya.

Ogazi, P. O. (1996). *Plantains: Production, Processing and Utilization.*Paman and Associates Ltd. Aku, Okigwe, Imo- State, Nigeria.10-56.

Ogundari, K. (2006). Determinants of Profit Efficiency among Small Scale Rice Farmers in Nigeria: A Profit Function Approach. *Research Journal of Applied Science*. 1(1&4):116-122.

Ogundari, K. and Ojo S. O. (2007): "Economic Efficiency of Small Food Crop Production in Nigeria: A StochasticFrontier Approach."*Journal of Social Science*.14(2):123-130.

Ogundari, K. and Ojo, S. O. (2006). Economics of Scale and Cost Efficiency in Small Scale Maize Production: Empirical Evidence from Nigeria. *Journal of Social Sciences*. 13(2):131-136

Ojo, A. A. (2005). *Reflections on the Nigerian Cocoa Economy.*Precious Pearls Books, Akure,Nigeria. 2005;192.

Okigbo, B. N. (1983). Fruits and Vegetable Production and Extension Services in Africa. *Acta Horticulture*. 123:23-37.

Okoruwa V.O. and Ogundele O.O. (2006): "Technical Efficiency Differentials in Rice Production Technologiesin Nigeria" *Agricultural Research Paper 134, African Economic Research Consortium.*Nairobi.

Olayide, S. O. and Heady, E. O. (1982).*Introduction to Farm Management Principles and Application.*Agitab Publishers Limited, Zaria. Pp. 112

Olukosi, J. O. and Ogungbile,A. O. (2006), *Introduction to Agricultural Production Economics: Principles and Application.* Agitab Publishers Ltd, Zaria.

Olukosi, S. O and Erhabor, P. O. (2008). *Introduction to Farm Management Economics: Principles and Application.*Agitab Publishers Ltd, Zaria – Nigeria. Pp. 92.

Oniah, M.O., Kuye, O.O. and Idiong, I. C. (2008) Efficiency of Resource Use in Small Scale Swamp Rice Production in Obubra Local Government Area of Cross RiverState, Nigeria. *Middle East Journal of Scientific Research*. 3(3):145–148.

Oso, M., Olaniyi, O. and Ayodele, O. J. (2014). Plantain Production Systems of Ekiti and Ondo States, Nigeria: Farmers' Perception of Loss in Perennial Productivity and Abandonment of Orchards.*Asian Journal of Agricultural Extension, Economics & Sociology*. 3(6):630-637

Polson, R.A. and Spencer, D. S. C. (1990). The Technology Adoption Process in Subsistence Agriculture: The Case of Cassava in South-Western Nigeria. *Agricultural Systems*. 36(1):65-78.

Rahman, S. A. and Umar, H. S.(2009). Measurement of Technical Efficiency and its Determinants in Crop Production in Lafia Local Government Area of Nasarawa State, Nigeria.*Journal of Tropical Agriculture, Food, Environment and Extension.* 8(2):90-96

Thomas, W. E., Burke, I. C. and Wilout, J. W. (2007). Weed Management in Glyphosate-Resistant Maize with Glyphosate and Halosulfuron. *Weed Technology*, 18(4):1049-1057.

Tiku, N. E. and Eniobor, J. H. (2012).Analysis of Resource Use Efficiency in Yam Production in Yakurr Local Government Area of Cross River State Nigeria, *Agricultural Journal.* 7(5):297-304.

Troke, J. K. (2008). *Agribusiness Management International Student Edition*, Library of Congress Cataloging in Publication: Mc. Graw-hill,inc. pp 450

Wilson, G. F. (1986). Status of Banana and Plantain in West Africa. Proceedings of an International Symposium held in Douala, Cameroon, 10-14 November 1998.

World Bank (2011). The World Bank Participation, Washington DC: Operations Policy Department, *World Bank working paper.* 5:127-135.

APPENDIX 1

SECTION A. SOCIO- ECONOMIC CHARACTERISTICS OF THE FARMERS.

1) Name of Respondent_____

2) Age_____

3) Sex male ( ) female ( ) 4) Village _____5) Local govt. Area_____
6) Marital Status Married ( ) Single ( ) others ----------
7) Household size (people living together and eating from the same pot):
a) Number of Male adults: _____ b) Number of Male children: _____
c) Number of Female adults: _____ d) Number of Female children: _____
e) Total no in the household----------
8) How many members of the household go to the farm farm(s) ---------?
9) Educational status (No of years spent in school)
a) Adult education ( ) b) Never attended ( ) c) Primary school ( ) d) Secondaryschool ( )
e) Tertiary school ( )
10) Is crop farming your major occupation? Yes ( ) No ( )
11) If not farming, what other things do you do?
a) Trading ( ) b) Tailoring ( ) c) Civil Servant ( )
d) Livestock farming ( ) e) others (specify) ----------
12) Number of years spent in plantain farming _____
13) Do you belong to a cooperative society Yes ( ) No ( )
14) If yes to 13 above, how many years of membership……
15) Do you have access to credit Yes ( ) No ( )
16) If yes to 15 above, what is the source?
a) Commercial banks ( ) b) friends and relatives ( )
c) Traditional savings ( ) d) others (specify) ----------
17) How much credit did you use last season? _____
18) Have you been visited by an extension agent (s)? Yes ( ) No ( )
19) If yes to 18 above, how often did extension agent(s) visit your farm / you last croppingseason? ……

SECTION B: FARMING ACTIVITIES

20) How did you acquire your farmland(s)?
i. Through inheritance ( ) ii.Purchase ( ) iii. Rent ( ) iv. Gift ( )
21) How many farms do you have for plantain production? _____
i) Farm no 1 ------ (ha) ii) farm no 2 ------ (ha)
22) If the land was rented, how much did you pay per season/ha --------?
23) If the land was purchased, what was the amount paid/ha ----------
24) What was the mode of land preparation on the plantain field?
i. Animal traction ( ) ii.Tractor hiring ( )
iii. Manual implements ( ) iv. Others--------
25) If you employed any in 24 above, how much do you pay per hectare----------?
26) What is the prevailing rate for lease of land in your area? ……..
27) State the labour contribution of your family members and hired labour during the lastcropping season.
A) Family labour:

FARM	No OF WORKERS	ACTUAL HOURS	No OF DAYS

OPERATIONS	BY TYPE OF LABOUR			SPENT			WORK		
	MA	FA	C	MA	FA	C	MA	FA	C
Land clearing									
Ploughing									
Planting									
Fertilizer Application									
Weeding 1st wedding 2nd wedding									
Spraying									
Harvesting									
Transportation									
Others (Specify)									

MA = Male adult (15-64yrs), FA= Female adult (15-64yrs), C= children (7 – 14years)

B)Hiredlabour:

FARM OPERATIONS	No OF WORKERS BY TYPE OF LABOUR			ACTUAL HOURS SPENT			No OF DAYS WORK		
	MA	FA	C	MA	FA	C	MA	FA	C
Land clearing									
Ploughing									
Planting									
Fertilizer Application									
Weeding 1st wedding 2nd wedding									
Spraying									
Harvesting									
Transportation									
Others (Specify)									

MA = Male adult (15-64yrs), FA= Female adult (15-64yrs), C= children (7 – 14years)

28) FIXED COST

Item	No Owned	Estimated Life Span	Year Procured	Cost Price	Annual Depreciation
Knife					
Matchets					
Files					
Hoes					
Spades					
Wheelbarrow					
Farm house					
Rent (land)					
Canoe					
Paddle					
others					

29) FARM INPUT RECORD

INPUTS	Quantity	Unit Price(N)	Total(N)
i. Suckers (kg)			
ii. fertilizers(kg)			
iii.Agrochemicals(litres)			
iv. farm implements			
v. manure(kg)			
vi. others (specify)			

30) CROP OUTPUT DATA

Quantity harvested	Price per kg	Total revenue (N)

31) What quantity of plantain was consumed at home) _____

32) What quantity was given out as gifts? i) _____

SECTION C: MARKETING INFORMATION

33) Where do you sell your plantain? i) On the farm ( )

ii) Village market ( ) iii) Urban market ( ) iv) others (specify) _____

34) When do you sell your plantain? i) Immediately after harvest ( )

ii) 1 week after harvest ( ) iii) others (specify) ----------

35) Why do you sell your output in the specified period in question (30) above? ----------

---

---

36) Did you encounter any problems in plantain production last cropping season?

Yes ( ) No ( )

37) If yes, what were the nature of the problems in order of importance?----------
---
---
38) What can you suggest for improvement with regards to the problems mentioned above?-
---

---
39) What type of problems do you encounter in selling your plantain?----------
---

---
40) What type of cost do you incur in selling your plantain in the various farms?

