ECONOMIC ANALYSIS OF MAIZE PRODUCTION IN SOBA LOCAL GOVERNMENT AREA OF KADUNA STATE NIGERIA

BY

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

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DECLARATION

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

______________________________ ______________________

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CERTIFICATION

This dissertation titled "**Economic analysis of maize production in Soba Local Government Area of Kaduna State",** by Nansak NUHU meets the regulations governing the award of the Degree of Master of Science, Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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This dissertation is dedicated to Almighty God.

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TABLE OF CONTENTS

CONTENT PAGE

LIST OF TABLES

Tables **Page**

LIST OF FIGURES

Figure Page

LIST OF APPENDICES

Appendix **Page**

ABSTRACT

The study was conducted in Soba Local Government Area of Kaduna State. A multistage sampling technique was used for this study. The study analyze the economics of maize production in the study area; described the socio economic characteristics of the maize farmers, determined the profitability of maize production, estimate the technical, allocative and economic efficiencies of maize production and identify the constraints to maize production in the study area. First is the purposive selection of Maigana zone, given its importance in maize production. Secondly Soba Local Government Area was purposively selected based on the dominance of maize production activities among the farmers. Thirdly, two (2) districts were purposively selected from the Local Government Area due to their intensity in maize crop production. Finally, a simple random sampling was employed in selecting farmers from each of the district. Twelve point five percent (12.5%) of the sample frame (1096) was used as the sample size, given that the community is homogenous. In all, 137 farmers were randomly selected. Descriptive statistics, net farm income and stochastic frontier production functionwere used in analyzing the data. The result of the analysis shows that (36%) of the respondents fell within the age range of 28-37years, the majority of the farmers (50%) did not have formal education. the household size ranged from 1-7 persons with 50%. 65% were not members of a cooperative society. About 82% of the farmers did not have access to extension service while about 96% of the farmers did not have access to credit. The total revenue was ₦51924.41 while the total cost was ₦34644.8. The net farm income was therefore ₦17279.61.The estimated mean technical efficiency for maize farmers was 0.87. The mean allocative efficiency of the maize farmers was 0.62, while the mean economic efficiency of the maize farmers was 0.54. Finally, among the major constraints identified in maize production in the study area were high cost of inputs (24%), inadequate capital (23%) inadequate extension services (18%), poor selling market price (15%), poor climate conditions (11%) and pest and disease (6%) . High cost of farm input such as fertilizers, improved seeds and herbicides are the major constraints faced by maize farmers. Therefore the government in partnership with the private sector should make available these inputs at subsidized rates through the small and medium scale enterprises.

CHAPTER ONE
INTRODUCTION

1.1 Background to the study

Maize is a cereal crop grown in various agro-ecological zones, as a single crop or in mixed cropping. It is the third most important cereal in the world, next to rice and wheat and with highest production potential among the cereals (Prathyusha*et al*., 2013). It is the most heavily cultivated cereal crop globally, and one of the main cereals crops of West Africa and the most important cereal food in Nigeria (Onuk*et al*., 2010). Maize is high yielding, easy to process, readily digested, and cheaper than other cereals (Valencia J.A. *et al*, 1999). It is also a versatile crop; growing across a range of agro ecological zones (Valencia J.A. *et al.*, 1999). Every part of the maize plant has economic value: the grain, leaves, stalk, tassel, and cob can all be used to produce a large variety of food and non-food products (IITA,2009).

Nigerians consume maize as a starch in a wide variety of porridges, pastes, grits, and beer. Green maize (fresh on the cob) is eaten raw, baked, roasted or boiled; playing an important role in filling the hunger gap after the dry season (IITA, 2009). The crop has established itself as a very significant component of the farming system and determines the cropping pattern of the predominately peasant farmers, especially in the Northern states (Ahmed, 1996). Research shows that Nigeria is the tenth largest producer of maize in the world, and the largest maize producer in Africa, followed by South Africa. While maize is grown in the entirety of the country (both yellow and white varieties), the north central region is the main producing area. (Oyelade and Awanane, 2013). Maize in Nigeria is usually intercropped, with yam, cassava, guinea corn, rice, cowpea, groundnut, and soybeans. (Oyelade and Awanane, 2013).

1.2 Problem Statement

The importance of agriculture and cereal crop to the Nigerian economy cannot be over emphasized. Fabunmi and Agbonlahor (2012), reported that agriculture is the single largest contributor to the well-being of the rural poor in Nigeria, sustaining about 86 percent of rural households in the country and a major source of domestic food consumed, contributing about 46 percent to the gross domestic product of the economy with the main staple food produced in large quantities which include maize, sorghum, rice, millet, et cetra. Maize is one of the most important cereal crops in Nigeria where over 150 million people consume an average of 43 kilogrames per year (Oyelade and Awanane, 2013). Maize consumption is widespread across the country and among households of different wealth (Cadoni and Angelucci, 2013). Among different income generating crops, maize is an important cash crop to smallholder farmers which constitute a major source of calories for the poorer proportion of consumers, who cannot afford more expensive foods such as bread, milk or meat (Oyelade and Awanane, 2013).

Given the importance of maize to individual household, industries and the economy as a whole, research has shown that it has not been produced to meet the level of food and industrial needs of the country. Also yields have increased only marginally over the last two decades, where most of the increase in production has come from expansion in the area harvested rather than from increases in yield (FARA, 2009). This depicted a short fall in the overall production and given that maize production, apart from its role in improving food security, is a source of employment and income for farmers and other entrepreneurs, there is therefore the need to increase productivity so as to meet up with the increase in the demand for the crop. Though there are many literatures on maize production, there is also the need to update the research and findings on the crop so as to sustained growth and development of the economy.

Therefore, this study intends to provide answers to the following research questions:

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

ii. How profitable is maize production in the study area?

iii. What are the technical, allocative and economic efficiencies of maize production in the study area?

iv. What are the determinants of technical, allocative and economic efficiencies in maize production in the study area?

v. What are the constraints associated with maize production in the study area?

1.3 Objectives of the Study

The main objective of this study is to analyse the economics of maize production in Soba Local Government Area of Kaduna State of Nigeria. The specific objectives are to:

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

ii. determine the profitability of maize production in the study area;

iii.estimate the technical, allocative and economic efficiencies of maize production in the study area;

iv.estimate the determinants of technical, allocative and economic efficiencies in maize production in the study area;

v. identify and describe the constraints associated with maize production in the study area;

1.4 Justification for the Study

Research have shown that despite the economic importance of maize to the teeming population of Nigeria, it has not been produced to meet the level of food and industrial needs of the country, and given that the demand for maize in the country is estimated to increase by 3.2 percent per year due, a perspective growth of urbanization and population (Bemire *et al.,* 2010). Maize is high yielding, easy to process, readily digested, and cheaper than other cereals. It is also a versatile crop; growing across a range of agro ecological zones. Every part of the maize plant has economic value: the grain, leaves, stalk, tassel, and cob can all be used to produce a large variety of food and non-food products.

In industrialized countries, maize is largely used as livestock feed and as a raw material for industrial products, while in developing countries, it is mainly used for human consumption. In sub-Saharan Africa, maize is a staple food for an estimated 50% of the population. It is an important source of carbohydrate, protein, iron, vitamin B, and minerals. Africans consume maize as a starchy base in a wide variety of porridges, pastes, grits, and beer. Green maize (fresh on the cob) is eaten parched, baked, roasted or boiled; playing an important role in filling the hunger gap after the dry season (Tahirou*etal.*2009). Maize industries provide employment opportunities for many farmers; for example, in 1964 to 1965 cropping season, about 28% of the Nigerian famers cultivated maize, as at 1986 production of maize estimated to be 861,000 metric tonnes, and land area under maize has increased from 653,000 in 1984 to its present level of 500,000 m ha; production has also increased from 1,000,000m tonnes to 7,000,000m tonnes during the same period

(IITA, 2007).

Maize have established itself as a very significant component of the farming system and determines the cropping pattern of the predominately peasant farmers especially in the northern state (Ahmed,1996). Therefore, it is of strategic importance to improve maize production so as to meet up with the increasing demand of the grain for food security, employment and socio-economic stability of the country.

The findings of this study when completed will be useful to maize farmers and other cereal crop farmers. The study will provide information to both private and public or government sectors of the economy on maize production in Kaduna State. It will be of assistance to researchers and add to existing knowledge in maize production among smallholder farmers.

Hypotheses of the Study

The following hypotheses were tested in the study:

i There is no significant relationship between inputs and output in maize production.

iiThere is no significant relationship between the socio-economic characteristics of maize producers and economic efficiency estimates.

CHAPTER TWO

LITERATURE REVIEW

2.1 Importance of Maize in Nigeria

Maize is one of the most crucial and strategic cereal crops in Africa and developing world in general. It is produced in different parts of the continent under diverse climate and ecological conditions. Due to its increasing importance, maize has become a major staple and cash crop for small holder farmers (IITA, 2000). Maize is the preferred staple for about 900 million poor consumers and about one third of all malnourished children in africa
(FARA, 2009).

It is one of the most important commodities used for food aid to the deadly war and hunger areas of the world. Since maize is cheaper than other cereals such as rice, and wheat, it is more affordable to the vast majority of the population, and therefore occupies a prominent position in the agricultural development agenda of several countries in Africa (FARA, 2009). It is a multipurpose crop because every part of its plant has an economic value (Oladejo and Adetunji, 2012). The grain, leaves, stalk, tassel and cob can all be used to produce a large variety of food and non-food products (IITA, 2001). In industrialised countries, maize is largely used as livestock feed and as a raw materials product, while in low-income countries, it is mainly used for human consumption (IITA, 2001).

Maize also serves as food for human consumption. Pap, popcorn, thick porridge boiled grains is notable food consumed by majority of Nigerians, mostly in the southern part of the country. (Oyewo, 2011). Maize is industrially important chiefly for the production of starch and alcohol. The starch can be used as converter dextrin, syrup and sugar; oil obtained from it is used to make soup or refine for cooking and salad dressing. (Oyewo,2011).

The importance of maize have during the December 2006 Abuja summit on food security in Africa, Africa head of states and governments identified maize, among other crops, as a strategic commodity for achieving food security and poverty reduction and called on Africa union commission (AUC) and the new partnership for Africa development (NEPAD) to promote maize production, on the continent to achieve self-sufficiency by 2015 (AUC, 2006). Oyelade and Awanane (2013), also shows that among different income groups, maize is a relatively more important source of calories for the poorer proportion of consumers. With more than 50% of all households assigning over 50% of their cereal area to maize, maize production dominates the farming system in Nigeria and hence it is of strategic importance for food security and the socio-economic stability of the country (Oyelade and Awanane, 2013).

2.2 Maize Production Trend in Nigeria

Until recent years, the bulk of maize grain produced in Nigeria was from the southwest zone (Iken and Amusa, 2004). It was reported that western Nigeria generally produced about 50% of Nigeria's green maize, the remaining 50% being split between the north and the east. Although a large proportion of the green maize is still produced in the south-western part of the country, there has been a dramatic shift of dry grain production to the savanna, especially the Northern Guinea savanna, which is now regarded as the maize belt of Nigeria (Iken and Amusa, 2004).

Maize yields in Nigeria have undergone sustained growth in the last two decades and increases in both yields and cultivated area contributed to the output growth (RMRDC Report, 2004).

Production yields and areas harvested trends for the past two decades, shows an overall alignment between production and area harvested until 2000. Indeed, from 2000, the area harvested remains lower than the 90's (between 3 and 4 million from 1998 to 2010). While the production increased between 2000 and 2010. This might indicate an improvement in production technology, since yields are increasing as well. The area devoted to maize crop increased from 5.1 million hectares in 2012 which represent about 4% level of increase and the out for-cast of maize is 9.7 million tonnes in 2012 compare with 9.088 million tonnes produced in 2011 which represent a 6.74% increase (Badu-Akpraku*et al*, 2012).

Table 2.1: Maize Production Trend in Nigeria from 1998-2012

Year	Area Planted (ha)	Output (ha)	Yield
1998	15.66724	363657.00	23211.30
1999	17.175487	387441.00	22558.97
2000	16.498883	383504.00	23244.24
2001	14.832926	366153.00	24685.15
2002	4.5001733	161000.00	35776.40
2003	4.3869676	163963.00	37375.02
2004	3.4391562	150170.00	43664.78
2005	4.5242417	161500.00	35696.59
2006	4.5483541	162000.00	35617.28
2007	4.5606648	162500.00	35630.77
2008	3.7449868	159248.00	42522.98
2009	3.0480904	128112.00	42030.25
2010	4.9711340	187300.00	37677.52
2011	5.4054054	200000.00	37000.00
2012	5.2287582	200000.00	38250.00

Source: FAO, 2014.

2.3 Maize Cropping System

The term cropping system refers to the crops and crop sequences and the management used on a particular field over a period of years (Emerson Nafziger, 2010). The various types of cropping system include mono-cropping, Double-cropping, Relay intercropping, strip cropping, inter-cropping etc. (Emerson Nafziger, 2010). It refers to the crop production activity of a farm, which comprises all cropping patterns on the farm and their interaction with farm resources, other household enterprise and the physical, biological, technological and socio-economic factors or environment.

The cultivation of maize in Nigeria is performed in two major ways depending on the environment and custom of the people concerned. Sole cropping is seldom practised; the great majority of the maize crop is grown as mixed crop with yam, cassava, guinea corn, rice, cowpea, groundnut, soybeans et cetera (RMRDC, 2004). The crop is Africa's most important cereal, and also forms a basic part of the cereal-legume intercropping system common to most developing countries agriculture. Maize-legume intercropping is currently receiving global attention because of its prime importance to world agriculture
(Oyelade and Awanane, 2013).

Maize is typically inter-cropped with other food crops, with the predominant combinations varying by production zones. When grown in mixtures, the maize is usually in low density mixed with one or more associated crops including cassava, sorghum, cowpea, groundnut, yam, sweet potato, rice, vegetables et cetera. Mixed cropping lower's maize yields, but it helps farmers increase the overall productivity of the resources invested in agriculture and reduces losses if any of the crop fails. However, some farmers grow a super-impose mixture of the maize with legumes, particularly groundnut, soybeans and cow pea (RMRDC Report, 2004). Ecological zone of production includes; swamp, deepwater, irrigated lowland, rain-fed lowland, rain-fed lowland and rain-fed upland. Although the guinea savanna zones provide the best ecological condition for maize cultivation, maize is also grown in the forest zones, the derived savanna zone and the southern savanna The cropping system of maize in Nigeria is classified based on the ecological zones of Southern guinea, Northern guinea and Derived guinea savanna (Olukosi, 1991).

Southern guinea savanna is predominant with sorghum, maize and millet based cropping system, in which maize seems to be replacing gero (millet), while yam now assume an increasing role for food and cash crop. The major maize crop mixtures include millet/maize/dauro (millet), maize/sorghum and maize /cassava (Olukosi, 1991).

Northern guinea savanna is dominated by millet, sorghum and cow pea, in which maize is now becoming an important crop. The major maize crop mixtures are maize/sorghum, maize/cotton and maize/ rice. Derived guinea savanna is dominated by yam/cassava based system, and other crops include sweet potato, sesame pigeon pea, sorghum, groundnut and rice. The important maize crop mixtures are maize/rice, maize/pigeon peas, maize/groundnut (Olukosi, 1991).

2.4 Concept of Farm Productivity

Productivity denotes the efficiency with which various input are converted into product. It signifies the relationship between output and input. Agricultural productivity is the index of the ratio of the value of total farm output to the value of the total input used in farm production (Olayide and Heady, 1982).

Productivity measures are sub-divided into partial and total measures. Partial measures are the amount of output per unit of the particular input. Commonly used partial measures are yield (output per unit of land), labour productivity (output per economically active person or per agricultural person - hour). Yield is commonly used to assess the success of new production practices or technology. Labour productivity is often used as a means of comparing the productivity of sectors within or across economies. It is also used as an indicator of rural welfare or living standards since it reflect the ability to acquire income through sale of agricultural goods or agricultural production (Block, 1995). Also partial productivity includes capital and management productivity which is the ratio of total output to inputs of capital and management respectively.

The total measures of productivity, which is often the total factor productivity (TFP), is the ratio of an index of agricultural output to an index of agricultural inputs, the index of agricultural output is a value –weighted sum of conventional agricultural inputs. These generally include land, labour, physical capital, livestock, chemical fertilizer and pesticides.

2.5 The Concept of Farm Efficiency

Efficiency is concerned with the relative performance of the process used in transforming given inputs into outputs. Economic theory identifies at least three types of efficiency, these are; technical, allocative and economic efficiencies.

Technical efficiency shows the ability of these inputs to employ the best practice in an industry, so that no more than the necessary amount of a given set of inputs is used in producing the best level of outputs. Technical efficiency is a major component of productivity being used in measuring farm performance. It is used to measure the ability of a farm performance. It is used to obtain maximum output from a given set of inputs (Rahman, 2013). A technically efficient farm operates on the production frontier while a technical inefficient farm operates below the frontier and could be made efficient by increasing its output with the same input level or using fewer inputs to produce the same level of outputs.

As such, the closer a farm gets to the frontier, the more technically efficient it becomes (Rahman, 2013).

Allocative efficiency refers to the choice of an optimum combination of inputs consistent with the relative factor price. Allocative efficiency reflects the ability of the farm to use input in optimal proportion given their respective prices and the production technology. Under competitive conditions, a farm is said to be allocative efficient if the marginal returns of factor input equal the market price of output. Allocative efficiency deals with the extent to which farmers make efficient decision by using inputs up to the level at which their marginal contribution to production value is equal to the factor cost (Rahman, 2013).

Economic efficiency is derived as the product of the technical and allocative efficiencies (that is, technical efficiency multiply by allocative efficiency) (Rahman, 2013). Economic efficiency is concerned with the utilization of maximum output in monetary term with the minimum available resources. It occurs when a farm chooses resources and enterprises in such a way to attain economic optimum. A farm that is economically efficient should, by definition, be both technically and allocatively efficient. However, this is not always the case, as pointed out. It is possible for a farm to have either technical or allocative efficiency without having economic efficiency. The reason may be that the famer in this case is unable to make efficient decisions as far as the use of inputs is concerned (Rahman, 2013).

2.6 Profitability in Farm Production.

Profitability is the primary goal of all business ventures without which the business will not survive in the long run. It is the ratio of revenue to cost, which is measured with income and expenses. Income is money generated from the activities of the farm business. Expenses are the cost of resources used up or consumed by the activities of the farm business.

2.6.1 Gross margin analysis

The gross margin analysis involves evaluating the efficiency of an individual enterprise (or farm plan) so that comparison can be made between enterprises or different farm plans. It is a very useful planning tool in situations where fixed capital is a negligible portion of the farming enterprise, as is the case in subsistence agriculture.

Gross margin is the difference between the gross income (GI) and total variable cost (TVC).

Gross Margin (GM) = GI – TVC.

Where:

GM = Gross labour, capital and managerial capability is represented as: margin (Naira/hectare)

GI = Gross Income (Naira /hectare)

TVC= Total Variable Cost (Naira/hectare)

2.6.2 Net farm income

The net farm income (NFI*)* measures the return to unpaid family labour, operator's land,

Net Farm Income = Gross Receipts – Total cost of production. Although the income can be withdrawn from the business without affecting its scale of operation, it is generally advisable to plough it back into the farm business.

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 incentive for creativity and efficiency among farmers. Therefore, profitability stimulates risky ventures and drives farmers to develop ways of cutting cost and improving technology always in an effort to satisfy consumer's interest.

2.7 Empirical studies on stochastic frontiers

Udoh and Etim (2007) used the stochastic frontier production function in estimating farm level technical efficiency of fluted pumpkin production in Uyo, Nigeria. The result showed that land, labour, inorganic fertilizer and planting material were significantly related with output of fluted pumpkin at 1%, 5% and 10% levels of probability, respectively. The technical efficiencies ranged between 0.01 and 0.96 with a mean technical efficiency of 0.86. The determinants of technical inefficiency in fluted pumpkin production result showed that extension contact and farming experience were the significant determinants of technical inefficiency at 5% and 1% levels of probability respectively.

Tanko and Opara (2010) used stochastic frontier production function in the measurement of technical efficiency in maize production in Bosso Local Government Area of Niger State of Nigeria. Farm size, labour and fertilizer were found to be significantly related with maize output at 1% levels of probability. The mean technical efficiency is 0.873 which implies that on the average the respondents are able to obtain a little over 87.3% of potential output from a given mix of production inputs, suggesting a wider scope for the farmers to increase their level of technical efficiency by allocating existing resources more optimally. The summary of the results indicated that the best farm has technical efficiency of 0.983 (98.3%) while the worst farm has a technical efficiency of 0.434 (43.3%) implying that some of the farmers are operating far away from the frontier region. The results of the determinants of technical inefficiency in maize production showed that education, farming experience, and credit were significantly related with technical efficiency at 1% levels.

Rahman*et al*. (2005) used the stochastic frontier production function in estimating the technical efficiency in sorghum-based cropping systems in Soba area of Kaduna state of Nigeria. For sole sorghum production, land, fertilizer and labour were significantly related with output at 5% level of probability, with an average technical efficiency of 0.62. For sorghum-cowpea production, land and labour were reported to be statistically significant at 5% level with an average technical efficiency of 0.74. For sorghum-groundnut production, land and labour were statistically significant at 5% level with an average technical efficiency of 0.64. For sorghum-soya bean production, land and labour were statistically significant at 5% with an average technical efficiency of 0.71 (71%). For sorghum- millet production, land and labour were statistically significant at 5% level with an average technical efficiency of 0.58 (58%). The overall technical efficiencies achieved in the sorghum-based cropping system ranged between 58 to 74 percent.

Kadurumba*et al*, *(*2009) used translog stochastic frontier production function to measure the level of technical efficiency and its determinants in traditional palm oil processing in Imo State of Nigeria. From the result, oil palm fruit (kg), water used, amount of loan borrowed, petrol/diesel energy were statistically significant at 5% and 10% levels respectively and were positively related with technical efficiency. While labour, labour^2 and water used^2 were statistically significant at 1%, 5% and 10% levels respectively and negatively related with technical efficiency. Result of the determinants of technical efficiency in traditional palm oil processing showed that age, educational level and net processing income were negatively related with palm oil processing but significant at 5%, 1% and 10% level respectively. Depreciation on fixed assets, litre of petrol/diesel energy, cooperative membership, credit availability, interest on loan, mill membership and mechanization energy were statistically significant at 1%, 5% and 10% level respectively. The frequency distribution of technical efficiency indices showed the maximum technical efficiency (0.97), minimum technical efficiency (0.16) and the mean technical efficiency (0.86).

Muhammad-Lawal*et al.* (2009) used Cobb-Douglas frontier production function model to estimate technical efficiency of youths participating in agricultural programs in Ondo State, South-Western Nigeria. The estimated individual technical efficiencies ranges between 32.62% and 96.25%, with a mean technical efficiency of 85.23%.The result showed that 86% of the respondents were operating at 80% level of technical efficiency. The determinants of technical efficiency were years of participation in agricultural programme, household size, usage of extension service and education.

Chukwuji (2010) studied the technical efficiency in cassava-based food crop production systems in Delta State by using stochastic frontier function. The result showed that 71% and 67% of the variations in output is attributable to difference in technical inefficiencies. Mean technical efficiencies for mixed crop and mono-crop farmers were 80 and 71 percent respectively. The determinants of technical inefficiency are Level of formal education, contact with extension agents, farming experience and capital to labour ratio and credit to total cost ratio.

2.8 Stochastic Frontier Analysis

Stochastic frontier analysis (SFA) is a method of economic modeling which deals with efficiency measurement in production system .It has its starting point in the stochastic production frontier models simultaneously introduced by Aigner, Lovell and Schmidt (1977).

The stochastic frontier production function is specified as:

$Y_i = f(x_i.\beta) + e_i$ 1

$e_i = v_i - u_i$ 2

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.

ei = composite error term.

vi = random error outside the farmer's control.

ui = technical inefficiency effect.

f (xi, β) = suitable function of the vector.

Ogundari et al. (2006), shows that the stochastic frontier has been used by many empirical studies, especially 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):

$$\ln Y = \beta o + \beta_1 \ln X_1 i + \beta_2 \ln X_2 i + \beta_3 \ln X_3 i + \beta_4 \ln X_4 i + \beta_5 \ln X_5 i + (Vi – Ui) \text{ .... } 3$$

Where:

ln = the natural logarithm

Y = output of smaize (kg)

βo = constant term

$\beta_1 – \beta_5$ = regression coefficients

X_1 = farm size (hectares)

X_2 = quantity of seed (kg)

X_3 = quantity of fertilizer (kg)

X_4 = total labour used (man/ days)

X_5 = quantity of agro – chemicals (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 modeled in terms of the factors that are assumed to affect the efficiency of production of farmers. These factors are related to the socio – economic and institutional variables of the farmers. The determinants of technical inefficiency are defined by:

$U_i = \delta_0 + \delta_1 1nZ_1 + \delta_2 1nZ_2 + \delta_3 1nZ_3 + \delta_4 1nZ_4 + \delta_5 1nZ_5 + \delta_6 1nZ_6$ ………………… 4

Where:

U_i = inefficiency effects of individual farmers

δ_0 = constant

$\delta_1 – \delta_6$ = parameters to be obtained.

Z_1= age of farmer (years)

Z_2 = household size (number of persons)

Z_3 = education (years)

Z_4 = amount of credit obtained (naira)

Z_5 = Access to extension service (number of times of contact)

Z_6 = membership of cooperative societies (years)

These variables are assumed to influence technical efficiency of the maize farmers. Bakhsh (2007), shows that stochastic frontier production function model is estimated using the maximum likelihood estimation procedure (MLE).

The stochastic frontier cost function is defined by:

C = F (Wi, Yi, α) exp, ei, i = 1,2, 3…… …………………………………………….. 5

Where

C = the observed cost associated with maize production

W_i = vector of input prices

Y_i = maize input

α = vector of parameter and

e_i = composite error term

2.9 Constraints to Maize Production in Nigeria

The most important constraints farmers face in maize farming as pointed out by research include lack of farm tools, low soil fertility, lack of financial resources to purchase inputs and high prices of the inputs (especially fertilizers and seed, and low technical know-how. Others are pests and diseases, vagaries of weather, unavailability of inputs, lack of access to credit facilities and agricultural extension services, and poor marketing of both inputs and outputs.

Oyelade and Awanane (2013) indicated that a major limitation to maize production in Nigeria is the declining soil fertility which is exacerbated by the high cost and/or unavailability of chemical fertilizer. Low soil fertility, especially of Nitrogen and Phosphorus, is the prime factor limiting maize growth which subsequently affects grain yield. The production constraints associated with maize production include drought, shortage of rainfall, and pest and diseases (Oyelade and Awanane, 2013). Other constraints relate to crop management, the non-availability of good seed, as well as soil fertility depletion (Badu-Apraku*et al.*, 2012). Research by scholars have shown that, low capitalization, price fluctuation, diseases and pests, poor storage facilities, and inefficiency of resources utilization are the identified problems in maize production in Nigeria.

Valencia *et al.,* (1999) reported Sasakawa Global 2000, research on irrigated maize production, identified farmers majors constraints to increase maize production under irrigation to include land scarcity, fluctuations in supply of irrigation water, inadequate credit facilities, high water table, exorbitant prices of fertilizers and other inputs, lack of improve seeds and weed infestation.

Also an important limitation to maize production identified by researchers is lack or inadequate use and application of improved seeds varieties. Abdoulaye*et al.,* (2009) reported that the shortfall in seed supply over sowing requirement is attributed partly to

institutional problems related to the establishment of a seed production unit, seed production and processing, seed marketing and distribution, seed demand at the farm level and the operational environment of seed production and distribution. Another major constraint to the development of the seed sector also includes the low adoption of improved varieties in some areas (IITA, 2009).

Baffour*et al.,* (2011) reported that maize production in West and Central Africa has been greatly constrained by many biotic and abiotic stresses often too formidable for individual National Agricultural Research System to combat alone. The report reveals that, most of these constraints cut across countries with similar agro ecological zones, and the most important being drought, low soil fertility, striga infestation, stem borers and maize streak virus. The report also revealed that farmers face a variety of policy and institutional constraints, such as undeveloped markets, high cost or unavailability of farm inputs, high labour requirements for land preparation and weeding, and difficult access to credit, all of which inhibit increases in maize yields and production.

In 1998 the West and Central Africa Maize Collaborative Research Network (WECAMAN) in a workshop of national maize scientists in collaboration with farmers, identified maize production constraints, although varying in relative importance among countries and agro ecological zones, to include the need for improved crop varieties, appropriate natural resources and crop management, plant health, postharvest technologies,

socioeconomic practices and conditions, as well as the need to improve human capacity (Baffour*et al.,* 2011).

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study Area

The study was conducted in Soba Local Government Area of Kaduna State, Nigeria. The Local government covers approximately 2955sqKM and lies between Latitudes 90^{o}N and 110^{o}NE. It has 33 villages and 10 wards, with a population of 291,173 as at the 2006 census. The State lies between Latitudes 90^{o}N and 12^{o}N of the equator and between Longitudes 6^{o}E and 9^{o}E of the Prime Meridian, with an area of approximately 46,053 kilometers. It has 23 Local Government Areas, with a total population of 6.11 million (National Population Commission, 2006), and a projected population of about 7,830,293 million people in 2014, based on annual population growth rate of 3.2%. The state experiences constant rainy and dry seasons, the rainy season begins in April and the dry season starts from October, the state is divided into four agricultural zones, namely, SamaruKataf, Lere, BirninGwari and Maigana Agricultural zones respectively. Agriculture is the main occupation of the people and small scale traditional farming system predominates the area. Also trading is common in both urban and rural areas of the state, with civil servant as an occupation in some areas given the vast institutions in the state ranging from Federal and State Universities, polytechnics and Monotechnics among others. The Local Government area is blessed with vast fertile land suitable for the cultivation of both wet and dry season crop like tomatoes, pepper, sugarcane, rice, maize, corn, vegetables etc.

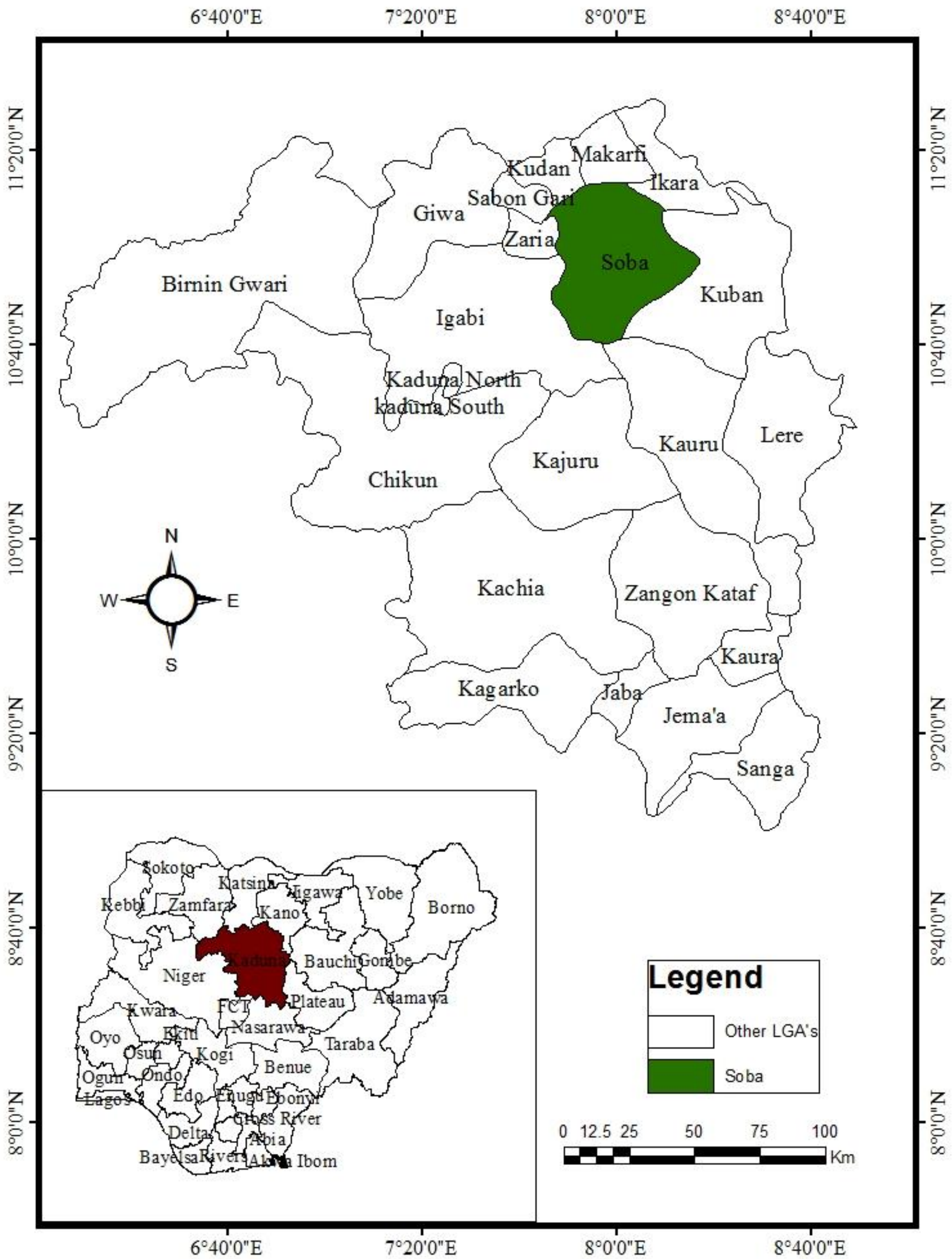

Figure 1. Map of Kaduna state showing Soba L.G.A

3.2 Sampling Size and Sample Technique

A multistage sampling technique was used in selecting respondents for this study. First is the purposive selection of Maigana zone, given its importance in maize production. Secondly Soba Local Government Area was purposively selected based on the predominance of maize production activities among the farmers. Thirdly, two (2) districts were purposively selected from the Local Government Area due to their intensity in maize crop production. Finally, a simple random sampling was employed in selecting farmers from each of the district. 12.5% of the sample frame (1096) was used as the sample size. In all, 137 farmers were randomly selected.

Table 3.1: Distribution of Maize Farmers in the Study Area.

LGA	Districts	Wards/Villages	Sample Fram	Sample Size (12.5%)
Soba	Soba	Soba	684	85
	Maigana	Maigana	412	52
Total			**1096**	**137**

Kaduna State Agricultural Development Project (KADP), 2013 and Reconnaissance Survey 2015.

3.3 Data Collection

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

3.4 Analytical Techniques

The tools used in the analysis include descriptive statistics, Net farm income and the stochastic frontier production function.

3.4.1 Descriptive statistics.

Descriptive statistics was used to achieve objectives (i) and (v) of the study. It involved the use of measures of central tendency which include means, frequency distributions and percentages to describe the socio-economic characteristics of maize farmers and the constraints to maize production in the study area.

3.4.1.1 Net farm income

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

NFI= TR-TC ………………………………………………………………............... 14

Where,

NFI= net farm income (₦);

TR= total revenue (₦);

TC= total cost of production (₦); Also,

TC= TVC+TFC ……………………………………………………………………… 15

Where,

TVC= total variable cost (₦) and

TFC= total fixed cost (₦).

The fixed inputs are not normally used up in a production cycle. They will be estimated using the straight line depreciation method given by:

$D = \frac{P-S}{N}$……………………………………………………………………………….16

Where:

D = depreciation (₦),

P = Purchase value (₦),

S = salvage value (₦) and

N = life span of asset (years).

Returns per naira invested (RNI) will be obtain by dividing the gross income (GI) by the total cost (TC).

Therefore,

$RNI = \frac{GI}{TC}$……………………………………………………………………………... 17

Where:

RNI = returns per Naira invested

GI = gross income and

TC = total cost.

Decision Rule:

RNI >1, implies that the enterprise is profitable;

RNI =1, implies that the farmer is operating at breakeven point and

RNI<1, that the farmer is at loss

3.4.1.2 Stochastic frontier production analysis.

The stochastic frontier production function was used to achieve objective iii and iv. It is specified implicitly as:

$Y_i = f(x_i.\beta) + e_i$……………………………………………..………………………..18

$e_i = v_i - u_i$…………………………………………………………………………19

Where:

Y_i = quantity of output of the ith farm,

x_i= vector of the inputs used by the ith farm,

β = a vector of the parameters to be estimated,

e_i = composite error term,

v_i= random error outside the farmer's control and

$-u_i$ =technical inefficiency effects.

Stochastic Frontier Production Function Model used in the study is specify explicitly as:

$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + (Vi\text{-}Ui)$ ……………………………………20

Where,

ln = the natural logarithm,

Y = output of maize (kg/ha),

β_0 = 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),

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

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

$-U_i = \delta_0 + \delta_1 1nZ_1 + \delta_2 \ln Z_2 + \delta_3 \ln Z_3 + \delta_4 \ln Z_4 + \delta_5 \ln Z_5 + \delta_6 \ln Z_6$ ………………………… 21

Where:

$-U_i$ = inefficiency effects,

δ_0 = constant

δ_1-δ_6 = Parameters to be estimated

Z_1 = age of farmer (years),

Z_2 = household size (number of persons),

Z_3 = formal education (years),

Z_4 = amount of credit optained (₦),

Z_5 = access to extension services (number of times of contact),

Z_6 = membership of cooperative society (years).

Stochastic Frontier Cost Function (Allocative Efficiency) Model used in the study is specified as:

$C = F\ (W, Y; \alpha)\ \exp e_i \quad i = 1,2 \ldots n$ ……………………………………………………22

Where:

C = Represents the cost associated with maize production,

W= Vector of input prices,

Y = maize output,

α = Vector of parameters and

ei = Composite error term.

The explicit form of stochastic frontier cost function is specify as:

$\ln C = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + (Vi + Ui)$ …………………………… 23

Where,

ln = the natural logarithm,

C = Total cost of output (₦),

β_0 = constant term,

β_1- β_3 = regression coefficients

X_1 = cost of seed (₦),

X_2 = cost of fertilizer (₦),

X_3 = cost of labour (₦),

X_4 = cost of Output (₦),

Vi = random variability in the production that cannot be influenced by the farmer and

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

Economic Efficiency Model to be use in the study is specify as:

The product of technical efficiency (TE) and allocative efficiency (AE) provides the index of economic efficiency (EE).

EE = TE * AE …………………………………………………………………………. 24

Where;

EE= Economic Efficiency,

TE= Technical Efficiency and

AE= Allocative Efficiency

3.5 Variable Definition and Measurement

Nine explanatory variables were measure as continuous and discrete variables were hypothesized for determinants of maize production.

3.5.1 Age

This refers to farmer's years attained from birth. It is a continuous variable which will be measured in years. The variable is expected to be negatively related with technical inefficiency, the reason is that the older a farmer is, the fewer the number of farm practices he adopts. Also older farmers seem to be somewhat less inclined to adopt new farm practices than younger ones and this will increases their technical inefficiency.

3.5.2 Household size (number per persons)

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, this tends to exert more pressure on consumption than the labour it contributes to production. The larger the family size the more favorably disposed will be the members to participate in cocoyam production operation. The estimated coefficient of household size was expected to have negative sign on the technical inefficiency model. This was measured in numbers of household size. The a priori expectation for household size was expected to be positive; this implies that the household size of the farmer is increasing technical efficiency.

3.5.3 Education level

Education is generally considered an important variable that could enhance farmer's acceptance of new technologies. The more educated farmers are, the more likely they adopt technology and also translate into production experience. Level of education is measured by number of years spent in formal schooling. The estimated coefficient of education was expected to have negative sign on the technical inefficiency model; this implies that the educational level of the farmer is reducing technical inefficiency thereby increasing technical efficiency.

3.5.5 Amount of money received

This refers to amount of money received from both formal and informal sources. It will be measured as the actual money/credit borrowed. Credit is a very strong important factor that is needed to acquire or develop farm enterprise (Ekong, 2003). Its availability could determine the extent of production capacity. This was measure as amount received in naira. The estimated coefficient of credit obtained is expected to have negative sign on the technical inefficiency model. The a priori expectation for amount of money received was expected to be negative, this implies that the amount of money received by the farmer is reducing technical inefficiency or increasing technical efficiency.

3.5.6 Extension visits

Agricultural extension service constitutes a driving force for any agricultural development. The relationship between agricultural extension agent and the farmer is an important determinant in improving yield of maize as well as in ensuring food security (Chikezie*et al*., 2012). The more number of visits of an extension agent to the farmers, the greater the chance for them to adopt innovation. It was measured in terms of number of visits made by an extension agent. The estimated coefficient of extension contact was expected to have negative sign on the technical inefficiency. This implies that the extension contact of the farmer is reducing technical inefficiency or increasing technical efficiency.

3.5.7 Co-operative membership

Co-operative groups are organized for the promotion of special interest or meet certain needs that cannot be achieved by the individual efforts. They contribute to the dissemination of new ideas, practices and products as well as in sourcing for loan and farm input (Chikezie*et al*., 2012). Farmers that belong to a co-operative society are likely to adopt new technology easily than those not in any co-operative. Thus it influences the attitude of members towards community developmental projects. This variable was used to characterize farmers based on particular involvement in maize production at the time of data collection. This was measure in years of participation. The estimated coefficient of cooperative membership was expected to have negative sign on the technical inefficiency.

3.5.8 Quantity of seed

This was measured in kilograms (kg). It was included in the model to examine the actual kilograms of the maize seed used in production cycle. The a priori expectation for quantity of seed was expected to be positive; this implies that, a unit increase in quantity of seed will bring about increase in output.

3.5.9 Quantity of fertilizer

This was measured in kilograms (kg).It was included in the model to examine the actual amount of fertilizer used in production. The a priori expectation for fertilizer was positive; this implies that, a unit increase in quantity of fertilizer will bring about increase in output.

3.5.10 Quantity of labour

This consist of family and hired labour, it was included in the model to examine how variability in labour used affect output. hildren age 7-14years are accorded 0.5 of adult male equivalent, female adult of 15-46years are accorded 0.75 and male adults of 15-64years are accorded 1.00. Labour was measured in man-days. The a priori expectation for quantity of labour was positive; this implies that, a unit increase in quantity of labour will bring about increase in output

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socioeconomic Characteristics of Maize Farmers

In this section the general socio-economic characteristics of maize farmers are provided. These include age, household size, education, amount of credit, extension visit and membership of cooperative association.

4.1.1 Age

The result in Table 4.1 revealed that most of the respondents (36%) were between the ages of 28-37 years. The mean ages of the farmers are 34 years. This implies that majority of respondents are still within a productive and active working age range, hence their ability to produce to earn some income from farming and non-farming activities. This shows that most farmers are within their active years and can make positive contribution to agricultural production.

Table 4.1: Age Distribution of maize farmers

Age(yrs)	**Frequency**	**Percentage**
18-27	42	31
28-37	50	36
38-47	23	17
48-57	15	11
58-67	7	5
Mean	34	
Total	**137**	**100**

4.1.2 Household size

The result in Table 4.2 revealed that majority about 50% of the respondents had between 1-7 household sizes. The mean household size of the respondents is 38. The implication is that the relatively large household size may likely enhance the family labour supply on the farms, hence supporting favorably, productive capacities of the farmers already enhanced by their age.

Table 4.2: Distribution of Maize farmers according to Household Size

Household size	**Frequency**	**Percentage**
1-7	68	50
8-14	46	34
15-21	17	12
22-27	6	4
Mean	38	
Total	**137**	**100**

4.1.3 Educational level

The result in Table 4.3 revealed that about 13% of the respondents had tertiary education. About 18% of the respondents had secondary education. About 19% of the respondents had primary education, and majority of about 50% of the respondents had no formal education. Muhammed-Lawal*et al.,* (2009) noted that level of education is expected to influence farmers' adoption of agricultural innovations and decision on various aspects of farming. He maintained that education is highly important for sustainable agricultural growth and development.

Table 4.3: Educational Level of maize farmers

Educational level	Frequency	Percentage
Non-Formal	69	50
Primary Education	26	19
Secondary Education	24	18
Tertiary Education	18	13
Total	**137**	**100**

4.1.4 Source of credit for maize farming

Adequate funding is required by farmers to finance their maize production activities. However, a large number of farmers face serious shortage of funds to finance their maize production activities, which in turn limits their level of production. They obtained their funds through formal and informal sources as presented in Table 4.4.

The result shows that 96% (131) of the maize farmers have no access to credit while only 4% (6) of the maize farmer had access to credit and 3% (4) could only access between ₦10,000 - ₦35,000 while 1% (2) of the farmers access between amount of ₦62,000 - ₦87,000 . The low access to credit could be attributed to the fact that government seldom grants financial credit to farmers. Ekong (2003) asserts that credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity. it also agrees with findings of Nasiru (2010) who noted that access to micro-credit could have prospects in improving the productivity of farmers and contributing to uplifting the livelihoods of disadvantaged rural farming communities.

Table 4.4: Distribution of maize farmers according to amount of credit received

Amount of Credit(~~N~~)	Frequency	Percentage
No access to credit	131	96.0
Access to credit		
10000-35000	4	3
36000- 61000	0	0
62000- 87000	2	1
Mean	33167	
Total	**137**	**100**

4.1.5 Extension contact

The main aim of extension services is to enhance farmers' ability to efficiently utilize resources through the adoption of new and improved methods used in maize production instead of using traditional methods which are inefficient, resulting to low yield. The distribution of the sampled farmers based on numbers of extension visit is presented in Table 4.5.

The result shows that (82.5%) of maize farmers in the study area had no access to extension service while (14.6%) had access to extension service. This could be attributed to low extension agent-farmers' ratio in the study area.

Table 4.5: Distribution of Maize Farmers According to Extension contact

Extension contact	Frequency	Percentage
No contact	113	82.5
1-3	20	14.6
4-6	04	2.9
Mean	1	
Total	**137**	**100**

4.1.6 Membership of cooperative association

The result in Table 4.6 revealed the number of years spent as members of Cooperative. About (65%) of maize farmers did not participate in any Cooperative Association and the reasons for this include: being small scale and unaware of any association while mean participation is 2 years. The implication of this result is that most of the maize farmers in the study area do not enjoy the assumed benefits that accrued to co-operative societies through pooling of resources together for a better expansion, efficiency and effective management of resources and for profit maximization. Ekong (2003) observed that membership of cooperative societies has advantages of accessibility to micro-credit, input subsidy and also as avenue in cross breeding ideas and information.

Table 4.6: Distribution of Maize farmers according to years of Membership of Cooperative Association

Cooperative association	**Frequency**	**Percentage**
Non members	89	65
1-5	34	24.8
6-10	8	5.8
11 and above	6	4.4
Mean	2	
Total	**137**	**100**

4.2 Costs and Returns of Maize Production in the Study Area

4.2.1 Summary of inputs utilized and output realized

The level of inputs used and output realized in the study area are reported in Table 4.7. The inputs that were used in maize production include; land, seed, fertilizer, herbicide and labour. The result revealed that the mean farm size was 2.53 hectares. The minimum and maximum land areas were 0.25 hectares and 10 hectares, respectively. The average quantity of seed used by maize farmers was 43.38 kg/ha. The minimum and maximum seed used were 10 kg/ha and 550 kg/ha, respectively. Average fertilizer used is 130.70 kg/ha while the minimum and maximum were found to be 50kg/ha and 1500kg/ha, respectively. Average herbicide used by the maize farmers is 2.09 L/ha while the minimum and maximum were found to be 0 and 28L/ha, respectively.The mean labour recorded is 27.51 man-day/ha while the minimum and maximum were observed to be 16 man/days/ha and 177 man/days/ha, respectively. This shows that agricultural production in the study area is of small scale and labour intensive.

The coefficient of variation of each variable input used and output realized are also presented in Table 4.7. The higher the coefficient of variation, the greater the dispersion in the variable while the lower the ratio of standard deviation to mean return, the better your risk-return tradeoff. The coefficient of variation (CV) for a model aims to describe the model fit in terms of the relative sizes of the squared residuals and outcome values. The lower the coefficient of variation (CV), the smaller the residuals relative to the predicted value. This shows a good model fit.

Table 4.7 shows that, the coefficient of variation of all the variable inputs such as the seed, fertilizer, herbicide and labour were 274.25, 236.49, 278.08 and 90.82 respectively. The high coefficient of variation of variable inputs implies high level of variation in the use of variable input among maize farmers in the study area. However, the coefficient of variation for labour is lower compared to other variable inputs used for maize production. The wide variation in input used by the farmers could be attributed to the fact that they differ in purchasing power and size of production.

The coefficient of variation in maize output was 244.88% which implies high variability in output level among maize farmers in the study area. The instability in output of maize could be attributed to inconsistency and inadequacy of variable inputs among farmers in the study area.

Table 4.7: Summary of input utilized and output realized in maize production

Variables	Mean	Std dev.	Min	Max	CV
Seed(kg/ha)	43.38	118.97	10	550	274.25
Fertilizer(kg/ha)	130.70	309.09	50	1500	236.49
Herbicide(L/ha)	2.095	5.83	0	28	278.08
Labour(Man-day/ha)	27.51	24.98	16	177	90.82
Yield(kg/ha)	1298.11	3178.76	270	14000	244.88

4.2.2 Cost of maize production in the study area

Maize seed used by the farmers in the study area were mainly unimproved seeds taken from the last harvest. The quantity of maize seed is 43.3801kg/ha with an average market price of ₦40 per kg was used and this constitutes 5% of the total cost of production. The quantity of fertilizer is 130.6981kg/ha with an average market price of ₦94 per kg was used and this constitutes 35% of the total cost of production. The quantity of herbicide is 2.0948L/ha with an average market price of ₦900 per L was used and this constitutes 5% of the total cost of production.

Labour costs consisted of cost of land preparation, planting, fertilizer application, weeding and harvesting. The family labour was computed on the basis of opportunity cost in man-days. The wage rate varied according to farm operation performed. An average wage rate of ₦400 per man-day was used, giving the average labour cost per hectare to be ₦27.5092 and this constitutes 32% of the total cost of production, while the total cost of fixed inputs (cost of renting land and depreciation of tools) incurred on maize production was ₦7735.03 and this constitute 23% of the total fixed cost.

4.2.3 Returns to investment in maize production

Results presented in Table 4.8 indicated that the total revenue (TR) was ₦51924.41while the total cost (TVC + TFC) is ₦34644.8. The net farm income is therefore ₦17279.61. The average rate of returns on investment (return per naira invested) is 1.50, indicating that for every ₦1 invested in maize production in the study area; a profit of 5 kobo was made. Thus, it could be concluded that maize production in the study area though on a small scale, was economically viable. This finding is related to that of Okoye*et al.*, (2009) in Determinants of labour productivity on small-holder cocoyam farms in Anambra State, Nigeria, observed that cocoyam production is profitable by returning ₦1.80 to every ₦1.00 spent.

Table 4.8: Average costs and returns per hectare of maize production

Variable	Values/ha(₦)	% Contribution
A. Variable cost		
i. Seed	1735.205	5
ii. Fertilizer	12285.62	35
iii. Herbicide	1885.287	5
iv. Labour	11003.67	32
Total variable cost (i+ii+iii+iv)	**26909.77**	
B. Fixed costs		
i. Cost of renting land	6758.39	20
ii. Depreciation of tools(hoe and cutlass	976.64	3
Total fixed cost(i+ii)	**7735.03**	
C. Total cost=(A+B)	**34644.8**	
D. Total revenue	**51924.41**	
E. Net farm income(NFI)=D-C	**17279.61**	
F. Return per naira invested(D/C)	**1.50**	**100**

4.3 Efficiency of Maize Production

4.3.1 Estimation of the technical efficiency of maize farmers

The stochastic frontier model specified was estimated by the maximum likelihood (ML) method using FRONTIER 4.1 software developed by Coelli (1995). The stochastic frontier production function estimates and the inefficiency determinants of the specified frontier are presented in Table 4.9. The study revealed that the generalized log likelihood function was 9.2544. The log likelihood function implies that inefficiency exist in the data set. The value of gamma (γ) is estimated to be 0.86 and it was highly significant at 1% level of probability.

This implies that 86% of variation in the output of the maize farmers from the frontier was due to the farmers' technical inefficiencies in their respective farms and not as a result of random variability. Since the factors responsible for the maize farmers' technical inefficiencies are under their control, reducing their effects will greatly enhance their technical efficiencies and improve their outputs. The value of sigma-squared (σ^2) was significantly different from zero level of probability. Sigma was 0.24 which represents good fit and correctness of the distributional form assume the composite error term. The study revealed that the estimated coefficients of parameters of the production function were positive except labour with a negative coefficient and seed and fertilizer are significant at 1%, herbicide at 10% level of significance while labour is not significant. The estimated coefficient of seed is 0.5648, which implies that increasing seed by 1% will amount to 0.56% increase in the output of maize. The significance of seed quantity is however, due to the fact that seed determines to a large extent the output obtained. If correct seed rates and quality seeds are used, output will be high given other inputs in abundance. This agrees with the findings of Zalkuwi*et al* (2010) who observed that the estimated coefficient of seed and labour inputs were positive as expected and significant at 1% level which implies that the more seed is applied and the more labour employed the better the output of maize.

The estimated coefficient of herbicide was 0.000194 which is positive and significant at 10% level of significance. This implies that 1% increase in herbicide output of maize will increase by 0.0002%. However, this finding is in line with the findings of Zulkawi*et al* (2010) who observed that the estimated coefficient of agrochemical input was positive as expected and significant at 1% level implies that the more agrochemical is applied and the more labour employed the better the output of rice. The elasticity of production with respect to labour was -0.06121 which is negative and not significant at 1%, 5% and 10% significance level. This implies that when 1% of labour is increased, maize output will decrease by 0.061%. This contradicts the study of Umoh (2006) which shows the importance of labour in farming, particularly in developing countries where mechanization is rare on small scale farms.

The result of the inefficiency model is contained in table 4.9. The estimated coefficients with negative signs attached indicate that they reduce technical inefficiency among the maize farmers, while positive signs indicate that the coefficients increase technical inefficiency or reduce technical efficiency. The results showed that age, household size, education, amount of credit, extension visits and membership of maize cooperative society were the determinants of technical inefficiency among the maize farmers.

Age, amount of credit and membership of maize cooperative society were negatively related with technical inefficiency, while household size, education and extension visit were positively related with technical inefficiency. The estimated coefficient of age was -0.04245 which is not significant. The negative coefficient of age implies that the older a farmer is, the lower will be the level of technical inefficiency or the higher will be his technical efficiency in maize production. This result is in line with Zulkawi et al., (2010) who in their study of small scale farmers in Nigeria found age to be negatively related to inefficiency.

The coefficient of Household size (0.139987) is positive and significant at 1% probability level. This implies that as household size increases, the technical inefficiency increases thereby reducing technical efficiency of farmers. It also implies that technical efficiency of farmers can be improved without taken into consideration the household size of the maize farmers. This finding agrees with MuhammedLawal*et al.*, (2009) who reported that as household size increases the technical efficiency decreases. They observed that this may be as a result of the fact that most of the household members who are still at a very young age may not be able to contribute to labour supply since they are likely to be in school during the period of agricultural production activities.

Level of education has an estimated coefficient of 0.071481 and significant at 1% level of significance. This implies that the more educated a farmer is, the more technical inefficient he becomes, thereby reduces his level of technical efficiency. This contradicts the apriori expectation that the coefficient of education is negative and reduces technical inefficiency. Education enhances farmer's ability to derive, decode and evaluate useful information as well as improving labour quality. This result agrees with that of Onyenweaku*et al.* (2005) that showed a positive relationship between education and technical efficiency in yam production in Nasarawa state, Nigeria.

The coefficient of the amount of credit received (-0.00005) is negative and not significant at all probability level. The implication of this is that the higher the amount of credit a maize farmer receives, the less technically inefficient he becomes. This is because Credit is an important component of agricultural production, the absence of which poses severe constraints to agricultural development in low-income countries, like Nigeria. This result does not agree with the findings of Onyenweaku and Nwaru (2005) who found a positive relationship between credit and technical inefficiency.

The coefficient of extension visit is (0.0724467) which is positive and significant at 1% level of significance. This shows that the more extension visit a maize farmer receives, the higher will be his level of technical inefficiency or the lower his level of technical efficiency. Extension visit is positively related to technical efficiency in accordance with the a priori expectation that extension contact leads to more efficient transmission of information to farmers as well as enhancing the adoption of innovation. This result contradict that of Onyenweaku*et al.*(2005) which shows that there is a positive relationship between extension contact and technical efficiency in yam production in Nasarawa state, Nigeria.

Cooperative association (-0.16691) is negative and not significant at the probability level. This shows that cooperative association contributes towards increase in the technical efficiency of the maize farmers. Cooperative association have more access to agricultural information, credit and other production inputs as well as more enhanced ability to adopt information. This finding agrees with that of Onyenweaku and Nwaru (2005) that membership of cooperative society enhances technical efficiency of farmers.

Test of Hypothesis I

The result of the null hypothesis (H_o) which stated that there is no significant relationship between inputs and output in maize production are presented in Table 4.9.Based on the result the null hypothesis is rejected because three variables (seed, fertilizer, and herbicide) were significantly related to output at 1% and 10% levels of significant.

Table 4.9: Results of maximum likelihood estimates of stochastic frontier production function of maize production

Variables	**Parameters**	**Coefficient**	**Standard-error**	**T-ratio**
Production function				
Constant	β_0	3.744252	0.247135	15.15066
Seed	β_1	0.564825***	0.044542	12.68084
Fertilizer	β_2	0.368304***	0.055029	6.692889
Herbicide	β_3	0.000194*	0.00011	1.76958
Labour	β_4	-0.06121	0.069993	-0.87453
Inefficiency model				
Constant	Z_0	0.046122	0.364772	0.126442
Age	Z_1	-0.04245	0.028424	-1.49359
Household size	Z_2	0.139987***	0.014687	9.531658
Education	Z_3	0.071481***	0.004575	15.62426
Amount of credit	Z_4	-1E-05	8.36E-06	-1.21193
Extension visits	Z_5	0.072467***	0.004593	15.77769
Cooperative societies	Z_6	-0.16691	0.114385	-1.4592
Diagnostic statistic				
Sigma-squared	(σ^2)	0.238204*	0.127539	1.867687
Gamma	(γ)	0.864649***	0.078533	11.01005
Log likelihood function	*L/f*	9.254367		
LR Test	27.006			
Number of observation	137			
Mean efficiency	**0.87**			

significance ***=1%, **=5%, and *=10%.

4.3.2 Estimation of the allocative efficiency of maize farmers

The Maximum Likelihood (ML) estimates of the stochastic frontier cost parameters for maize are presented in Table 4.10. For the cost function, the sigma σ^2 = 1.36E-01 and the gamma γ=2.83E-04 are quite high and highly significant at 1.0% level of probability. The high and significant value of the sigma square (σ^2) indicate the goodness of fit and correctness of the specified assumption of the composite error terms distribution (Idiong, 2005). The gamma (γ = 2.83E-04) shows that 83% of the variability in the output of maize farmers that are unexplained by the function, is due to allocative inefficiency.

The estimated coefficients of the parameters of the cost function are positive except that of herbicide which is negative. The cost variables of seed is significant at 5%, labour at 1% level while herbicide and fertilizer are not significantly different from zero.

The coefficient of the cost of seed (0.0651) is positive and significant at 5% level of probability. This implies that seed are important in crop production in maize farms. The implication of this is that 1% increase in the cost of seed will give rise to 0.07% increase in the cost of maize production. The cost of labour (0.4422) is positive and significant at 1% significance level. This implies that 1% increment in cost of labour will increase the cost of maize production by 0.44%. The significant influence of seed cost and labour cost is in agreement with the findings of Okoh (2009), who found seed and labour cost as determinant of allocative efficiency in the Fadama production of tomato in Benue State.

The coefficient of maize output (-0.048) is negative and not significant. This implies that as the quantity of maize produced decreases, the cost of maize production decreases accordingly. This shows that the cost of production is influenced by the quantity of maize output realized. This finding concurs with the one of Ogundari*et al.,* (2006) that reported direct effect of output on cost of production in the study on economies of scale and cost efficiency in small scale maize production in Nigeria.

The result of the inefficiency model of the stochastic frontier cost function revealed that age, household size, amount of credit received and extension visits were the determinants of allocative efficiency among the maize farmers. The coefficients of the variables of household size and amount of credit received were all significant at 1% level of significance, with exception of age and extension visits that are significant at 10 % and 5% significance level.

Household size has an estimated coefficient of 0.6709. The implication of this result is that larger maize farmer's households are more allocative inefficient than small maize farmer's household size. That is to say, the smaller a maize household, the more efficient it will be in the allocation of productive resources. This may be due to the fact that larger maize farmer's households have more mouths to feed than small maize farmer's households, as a result of this, the ability to make appropriate choices between alternative farm inputs is constrained by the shortage of financial resources

Age has an estimated coefficient of 0.031087. This implies that the more advanced in age a maize farmer is, the higher will be his allocative inefficiency. The older a farmer is, the poorer his ability as a decision maker to obtain and process information about prices and technology.

Amount of credit received has a coefficient of 0.3575. The implication of this is that the more credit a maize farmer receives, the more allocatively inefficient he becomes. This result is in line with Okike*et al.,* (2000) which shows that receiving credit contributed to farmers' economic inefficiency. They contended that this could be the result of disbursement of credit in cash rather than in kind and loan misapplication endangered by resource poverty.

The coefficient of extension visits is 0.04792. This is an indication that extension visit contributed towards increasing allocative inefficiencies among the maize farmers. This finding disagrees with the study of Ajani (2000) who observed that extension contact enhance farm productivity and efficiency in his study of resources productivity in food crop farming in Northern area of Oyo State Nigeria.

Table 4.10: Results of maximum likelihood estimates of stochastic frontier cost function of maize production

Variables	Parameter	Coefficient	Standard-error	T-ratio
Production function				
Constant	β_0	8.987901	0.36466	24.64732
Seed	β_1	0.065052**	0.030854	2.108397
Fertilizer	β_2	0.007531	0.056349	0.133656
Herbicide	β_3	-0.01378	0.028682	-0.48056
Labour	β_4	0.44219***	0.081225	5.444002
Output	β_5	-0.04792	1.00E+00	-0.04792
Inefficiency model				
Constant	Z_0	3.096072	0.096459	32.09719
Age	Z_1	0.031087*	0.016975	1.831291
Household size	Z_2	0.670891***	0.014826	45.24971
Education	Z_3	4.15E-07	3.14E-05	0.013195
Amount of credit	Z_4	0.357535***	0.018085	19.7696
Extension visits	Z_5	-0.04792**	0.021095	-2.27174
Cooperative societies	Z_6	9.19E-03	1.00E+00	9.19E-03
Sigma-squared	(σ^2)	1.36E-01***	1.43E-02	9.49E+00
Gamma	(γ)	2.83E-04***	1.42E-01	2.00E+01
Log likelihood function	*L/f*	212.1153		
LR Test	43.340			
Number of observation	137			
Mean efficiency	**0.62**			

significance ***=1%, **=5%, and *=10%.

4.3.3 Distribution of respondents according to technical efficiency of maize farmers.

The frequency distribution of the technical efficiency estimates for maize farmers in the study area as obtained from the stochastic frontier model is presented in Table 12. The study revealed that 85% of the maize farmers had technical efficiency (TE) of 0.61 and above while 15% of the farmers operate at less than 0.61 efficiency level. The maize farmers with the best and least practices had technical efficiencies of 0.97 and 0.40 respectively. This implies that on the average, maize output fall by 3% from the maximum possible level of 1.00 due to technical inefficiencies. The result also showed a mean technical efficiency of 0.87. This means that majority of the maize farmers operated closer to their production frontier. Also, this implies that on the average, maize farmers are able to obtain 87% potential output from a given mix of productive resources. In a short-run, there is scope for increasing maize output by 23% by adopting the techniques and technologies employed by the best maize farmers.

The study also revealed that for the average maize farmer in the study areas to become the most efficient maize farmer, he will need to realize about 23%[1-(0.87/0.97)*100] cost savings, while on the other hand, the least technically efficient maize farmer will need about 38% [1-(0.40/0.97)*100] cost savings to become the most technically efficient maize farmer.

4.3.4 Distribution of respondents according to allocative efficiency of maize farmers

Table 12below depicts the frequency distribution of the allocative efficiency estimates of maize farmers in the study areas. The result revealed that 8% of the maize farmers had allocative efficiency (AE) of 0.61 and above while 92% of the farmers operate at less than 0.61 allocative efficiency levels. This implies that the greater majority of maize farmers were not allocative efficient as 8% of them attained efficiency level greater than 0.61 and above. In other words, the clustering of allocative efficiencies in the region of 0.61 – 1.00 efficiency range implies that the maize farmers are not efficient. That is, the farmers are not efficient in producing maize at a given level of output using the cost minimizing input ratio as about 8% of the maize farmers have allocative efficiencies of 0.61 and above. High values of allocative efficiencies represent less efficiency or more inefficiency among the maize farmers during the course of maize production in the study area. The estimated allocative efficiencies differ substantially among the maize farmers ranging between the minimum value of 0.32 and maximum value of 0.85. This means that the most allocative inefficient maize farmers operated closer to their cost frontier or minimum cost of 1.00. The mean allocative efficiency was 0.62. The study also revealed that for the average maize farmer in the study area to become the most allocative efficient maize farmer, he will need to realize about 38% cost saving i.e. [1-(0.62/0.85)*100] while on the other hand, the least technically efficient maize farmer will need about 68% [1-(0.32/0.85) x100] cost savings to become the most allocative efficient maize farmer.

4.3.5 Frequency distribution of economic efficiency estimates of maize farmers

The frequency distribution of the economic efficiency estimates of maize farmers in the study areas is contained in Table 12. The result revealed none of the maize farmers had economic efficiency (EE) of 0.61 and above while all the maize farmers operated at less than 0.61 efficiency levels. The mean economic efficiency of the maize farmers in the study areas was 0.54. This implies that on the average, there was a fall in the maize output level by 46% from the maximum feasible level due to economic inefficiency. The maize farmer with the best and least practice had economic efficiencies of 0.77 and 0.26 respectively.

In the same vein, the study also revealed that for the average maize farmer in the study area to achieve economic efficiency of his most efficient counterpart, he will have to realize about

46% [1-(0.46/0.77)*100] cost savings while on the other hand, the least economic efficient maize farmers will have to realize about 74% [1-(0.26/0.77)*100] cost savings to become the most economic efficient maize farmer. However, the result indicates that the highest number of maize farmers have economic efficiencies between 0.21-0.40, representing about 53% of the 137 maize farmers. This is an indication that the maize farmers were not economic efficient in producing maize at a minimum cost for a given level of technology.

Table 4.11: Frequency Distribution of Technical, Allocative and Economic Estimates from the Stochastic Frontier Model

Efficiency level	**Technical Efficiency**		**Allocative Efficiency**		**Economic Efficiency**	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
<0.2	1	0.7	3	2.2	20	14.6
0.21-0.40	2	1.5	43	31.4	72	52.6
0.41-0.60	17	12.4	80	58.4	45	32.8
0.61-0.80	117	85.4	11	8.0	0	0
0.81-1.0	0	0	0	0	0	0
Total	**137**	**100**	**137**	**100**	**137**	**100**
Minimum	0.40		0.32		0.26	
Maximum	0.97		0.85		0.77	
Mean	0.87		0.62		0.54	

4.6 Constraints to Maize Production

The constraints faced by maize farmers are presented in Table 4. 12. It was found that about 24% of the respondents ranked high cost of farm inputs as the major constraints. This finding is in line with Ekong (2003), opined that most farmers have little or no access to improved seeds and continues to recycle seeds that have become exhausted after generations of cultivation.

About 23% of the respondents ranked inadequate capital as the second constraints. This agrees with the findings of Nasiru, (2010) who noted that access to micro-credit could have prospect in improving the productivity of farmers and contributing to uplifting the livelihoods of disadvantaged rural farming communities. Also, about 18% of the respondent's ranked inadequate extension contact as third constraints. Poor market selling price ranked fourth with about 15% of the respondents, while poor climatic conditions(short period of rainy season) and pest and diseases was ranked 11% and 9% respectively as fifth and sixth constraints of the respondents. This finding agrees with that of Hyun *et al.,* (2008), Tekana*et al.,* (2011) and Onuk*et al.,* (2010) who observed that high cost of farm inputs, inadequate capital and government interference, inadequate transportation facility inadequate storage/processing facilities and inadequate rainfall were among the constraints faced by farmers. This revealed that farmers in the study area are faced with constraints that can limit maize production.

Table 4.12: Constraints associated with maize production in the study area

Constraints	**Frequency**	**Percentage**	**Rank**
High cost of inputs	137	24	1st
Inadequate capital	127	23	2nd
Poor selling market price	87	15	4th
Poor climate condition	63	11	5th
Inadequate extension contact	100	18	3rd
Pest and diseases	48	9	6th
Total	**562**	**100**	

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study focused on the economics of maize production in Sabo local government area of Kaduna State, Nigeria. A combination of purposive and random selection of two districts from the LGA and 137 farmers were selected for this area. The purpose of the study was to examine the economics of maize production in Sabo local government area of Kaduna State, Nigeria and to achieve this, the study came up with five main objectives. These were to: describe the socio-economic characteristics of maize farmers, determine the profitability of maize production, estimate the technical, allocative and economic efficiencies of maize production, estimate the determinant of technical allocative and economic efficiencies of maize production and to identify and describe the constraint associated with maize production in the study Area.

Primary data were collected from 137 respondents through the use of random sampling techniques with the aid of structured questionnaire. The statistical tools used to analyze the data were descriptive statistics, stochastic production frontier function model, net farm income and profit function model. A descriptive analysis of the sample farmers was done to understand and describe the socio-economic factors influencing maize production and as well as income made from the production in the study area.

The results of the socio-economic analysis shows that (36%) of the respondents fall within the age range of 28-37years, the predominant household size ranged from 1-7 persons with 50%. the majority of the farmers (50%) had no formal education. (96%) of the respondents access credit ranged of 10000-35000, majority of the respondents (82%) have no extension visit and only (35%) were members of a cooperative society.

The average costs incurred and revenue obtained per hectare for maize were estimated to determine the profitability or otherwise of maize production in the study area. The total revenue (TR) is ₦51924.41 while the total cost is ₦34644.8. The net farm income is therefore ₦17279.61. The average rate of return on investment (return per naira invested) is 1.50, indicating that for every ₦1 invested in maize production in study area; a profit of 50 kobo was made. Therefore, it could be concluded that maize production in the study area though on a small scale, was economically viable.

The stochastic frontier production function was estimated for technical, allocative and economic efficiency. It was observed from the study that 85.4% of the farmers had technical efficiency (TE) of 0.61 and above while 14.6% of the farmers operate at less than 0.6 efficiency level. The mean technical efficiency for the 137 sampled farmers in the study area was 0.87. The farmer with the best practice has a technical efficiency of 0.97 while the least efficient farmers have 0.40. This implies that on the average, output fall by 3% from the maximum possible level due to inefficiency. The mean allocative efficiency was 0.62. The result indicates that average maize farmer in the state would enjoy cost saving of about 38% while allocative inefficient farmer will have an efficiency gain of 85% to attain the level of most efficient farmer among the respondents. The mean economic efficiency was 0.54. The farmers with the best practice have an economic efficiency of 0.77 while 0.26 was for the least efficient farmers. This implies that on the average, output fall by 46% from the maximum possible level due to inefficiency.

Multiple regression analysis showed that age, household size, amount of credit and cooperative societies are the significant factors that influenced the level of economic efficiency of the maize farmers in the study area.

High cost of input, inadequate capital, inadequate extension visits and poor selling market price were the major constraints to maize production among the identified constraints in the study area.

5.2 Conclusion

The study revealed that maize farmers in the study area did not achieve absolute efficiency in the use of variable inputs. However, the study showed that maize production among farmers was profitable.

5.3 Recommendations

1 Fertilizer is one of the major inputs that positively and significantly influence maize production in the study area. Therefore, the government in partnership with the private sector should ensure timely and adequate supply of fertilizer to the farmers through the market forces in which it will serve as a regulatory body, at affordable prices in order to enhance the production of the crop.

2Cooperative association significantly influences efficiency, and a significant proportion of the respondents do not belong to cooperative society, this call for policy that would encourage farmer’s cooperatives association. This will enable the farmers to benefit from the government and non-governmental organizations.

3High cost of farm input such as fertilizers, improved seeds and herbicides are the major constraints faced by maize farmers. Therefore cooperative societies should be encouraged among maize farmers. This will enable the farmers groups to have the advantage of economies of scale purchase, thereby reducing cost of production.

4 The positive relationship between amount of credit accessed and efficiency of the farmers implies that policies that will make micro-credit from government and non-governmental agencies accessible to these farmers will go a long way in addressing their resource use inefficiency problems.

5Government in partnership with private sector should encourage farmers to increase their technical efficiency in maize production which could be achieved through improved farmer specific efficiency factors, such as education, access to credit, access to improved extension services.

5.4 Contribution of the Study to Knowledge

The study revealed that maize production in the study area is profitable with net farm income of ₦17279.61 despite the problems identified.

The study also shows that maize farms were economically inefficient in the study area having an economic efficiency of 46%.

The study revealed that maize farmers in the study area achieved technical and allocative efficiency of 87 % and 62% respectively.

Also a significant proportion of the respondents complained of poor selling market price. Therefore the Government in conjunction with the private sector should re-establish the marketing board so as to control the selling market price.

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APENDIX 1: QUESTIONAIRE

SOCIO –ECONOMICS CHARATERISTICS

1. Name of farmer………………………………

2. Sex: Male ( ) Female ( )

3. Age (years)…………………………………………

4. Marital status: Married ( ) Single ( )

5. Highest level of Education:

(a) No Formal Education ( ) (b) Primary school Education ( ) (c) Secondary School Education ( ) (d) Tertiary Education ( )

6. Family Size (All the number of the people depending on you for living)……………

(a) No of Adult Male ( ) (b) No of Adult female ( ) (c) Children >15yrs ( ) (d) Children <15yrs ( )

7. How long have you been in maize farming? (Years of experience)……………

8. Do you belong to any co-operative/Association? Yes ( ) No ( )

9. If yes, (Years of participation) ------------------------

10. What benefit did you derive as a member?

11. Do you have access to credit (a) Yes ( ) (b) No ( )

12. What is your major source of capital for maize farming?

a .Personal savings ( ) b. credit (borrow) ( ) c. Friends and family ( )

d. Money Lenders (Borrow) ( )

13. If you borrow, what were the sources of the credit?

a. commercial bank( ) b. Bank of Agriculture ( ) c. Cooperative Society ( )

d. Money Lenders ( ) e. Friends and Family ( ) f. Others (specify)…………………………

14. How much did you borrow to finance last production? (Fill for the source you indicated inQ .12)

SOURCE OF LOAN	AMOUNT(₦)	INTERST RATE (%)
Commercial Bank		
Bank of Agriculture		
Cooperative Societies		
Money Lenders		
Friends And Family		
Others (Specify)		

15. Have you been visited by an extension agent? Yes ( ) No ( )

16. If Yes, How many times in last one year……………………..?

17. What activities did the agent teach you? ....

18. Of what benefit were the techniques learnt to you to the success of your farm? ....

19. Have you been trained on maize farming? Yes (   ) No (   )

20. If yes, which organization conducted the training?

21. Was the training beneficial to you?

a. Not beneficial (   ) b. somehow beneficial ( ) c. beneficial (   ) d .very beneficial ( )

B. INFORMATION ON INPUTS

Farm size (Ha)

How many maize farm plots do you have? .... Indicate and the size in the table below.

Plot NO	Plot Size (Ha)
1	
2	
3	

(ii). How did you acquire your land? *(Tick below)*

Plot	Mode of Acquisition				
	(a) Inheritance	(b) Lease	(c) Borrowed	(d) Gift	(e) Purchased
1					
2					
3					

(iii). what does it cost to rent one Hectare of land per season in your village?.............. Naira

23. Variable inputs (Last production Cycle)

(i)Seed (Kg)

Plot No	Quantity of Seed(Kg)	Cost (₦)
1		
2		
3		

(ii) Fertilizer.

Plot No	Fertilizer type	Quantity(Kg)	Cost(₦)
1			
2			
3			

(iii) Agrochemical.

Plot No	Agrochemical type	Quantity(litres)	Cost(₦)
1			
2			
3			

(iv) Labour input

(a) Land preparation

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(b)Planting

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(c) Fertilizer Application

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(e) First Weeding

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost(₦)
1						
2						
3						

(f) Second Weeding

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost(₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(g)Harvesting

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						

(h) Information on cowpea output

Plot No	No. of output produced(number)	Total Quantity sold (Kg)	Price/Unit
1			
2			
3			

21. Where do you sell your produce?

a. Farm gate ( ) b. Rural market ( ) c. Urban market ( )

22. When do you sell your produce?a. immediately after harvesting ( ) b. Few months after harvest ( ) c. Off season ( )

23. CONSTRAINTS TO MAIZE PRODUCTION

S/n	Constraints
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

24. What can you suggest as solutions to these constraints?

……………………………………………………………………………………….

………………………………………………………………………………………

Thanks for your Attention