ECONOMIC ANALYSIS OF PINEAPPLE PRODUCTION IN ESAN WEST AND OVIA SOUTH LOCAL GOVERNMENT AREAS OF EDO STATE, NIGERIA

BY

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DECLARATION

I hereby declare that this thesis titled **"Economic Analysis of Pineapple Production in Esan West and Ovia South Local Government Areas of Edo State, Nigeria."** has been written by me and is entirely the result of my research work. No part of this work has been presented in previous application for another degree or diploma at any institution. All borrowed information has been duly acknowledged in the text and list of references provided.

__________________________ __________________

Lilian Omon AKHILOMEN Date

CERTIFICATION

This thesis titled **"Economic Analysis of Pineapple Production in Esan West and Ovia South Local Government Areas of Edo State, Nigeria"** Written by Lilian Omon AKHILOMEN meets the regulations governing the award of the degree of Master of Science (Agricultural Economics) of the Ahmadu Bello University, Zaria, Nigeria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to the Almighty God, the Father of the fatherless, Strength and Hope of the poor, who has been my strength, helper, provider, defender and sustainer even to this present time.

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ABSTRACT

This study analyses farmers' overall efficiency in Pineapple production in Edo State, Nigeria. Data were collected through structured questionnaire administered on 175 Pineapple farmers selected using a multi-stage sampling technique and analyzed using descriptive statistics and the stochastic frontier production and cost function models The results showed that 76.0 percent of pineapple farmers in the study area were male and 24.0 percent of them were Female. Budgetary analysis revealed that pineapple farming in the study area was profitable with an average return of ₦1.27 kobo for every ₦1 invested. The result of the study also revealed that the technical, allocative and economic efficiencies of the farmers were with a mean of 0.70 percent, 0.68 percent and 0.64 percent respectively, which indicates ample opportunity for the farmers to increase their productivity through improvement in their technical efficiency. Farm size and labour were found to be statistically significant and positively related to output while educational level, marital status, membership of cooperative society, extension contact and farming experience of the respondents negatively influenced farmers' technical inefficiency. Inadequate credit facilities (44%), Weather and disease (35%), poor road network and high transportation cost (30%) were the prominent constraints to pineapple production in the study area. The study recommends the need to increase output through more intensive use of land, availability of high yielding Pineapple varieties and the effective and efficient utilization of labour and fertilizer inputs.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Nigeria is largely an agrarian country, because 70 percent of the population is engaged in agricultural production at a sustainable level despite the fact that the country depend on the oil industry for its budgeting revenues (WHO, 2006). The importance of this sector is more pronounced in the developing countries including Nigeria where it is the main thrust of national survival, employment, food and foreign exchange earnings (Adebayo *et al.* 2005).

Nigeria is a nation blessed with good climatic condition that favours agricultural production. Nigeria's wide range of climatic variation allows it to produce a wide variety of cash crops, fruits and vegetables. However, food production trend does not correspond to the population growth of Nigeria which is put at about 3.2 percent. The rate of growth of Nigeria's food production has been very low. Food growth rate has been put at 2.65 percent and population growth at 3.2 percent, leaving a food deficit of 0.55 percent (CBN, 2007). Despite the great inherent potential for farming in Nigeria, the country has not kept up with the rapid population growth due to the decline in agricultural production as a result of the discovery of oil and gas. According to Abdullahi (2001), the general lack of scientific and technological capacity will severely limit actual production in spite of the inherent potential. Also poor resource base, coupled with competing demands for other developmental needs makes public funding for agriculture grossly inadequate. Mention could also be made of poor prioritization, mismanagement of limited resources and lack of sufficient political will as additional factor limiting agricultural growth in most developing countries, Nigeria inclusive (Iken and Amusa, 2004; Oniah, 2005).

In spite of the different initiative programmes by successive Governments aimed at boosting agricultural production in Nigeria such as the River Basin Development Authority, Land Use Decree, World Bank Assisted Agricultural Development Programme, National Fadama Development Project, Root and Tuber Expansion Programme , and the Special Programme on Food Security (Panwal *et.al.* 2006), the horticultural sub-sector still remain relatively under-developed.

The horticultural sub-sector also reflects the problem in the agricultural sub-sector. These problems include inadequate knowledge of production, technology of production, insufficient planting materials, land tenure, poor extension and insufficient post harvest facilities (Babatola, 2004).Horticultural crop production in Nigeria has been hampered by the policy and fiscal constraints of the government. It has received very little attention in the national perspective plan for agricultural development (Oseni, 2004). In addition, Nigeria has only one research institute, the National Horticultural Research Institute (NIHORT) established in 1975 for all horticultural crops. Fruit crop farming in Nigeria is associated with general negative outcomes stemming from imperfect predictable biological climatic and price variables. Those variables include natural adversities such as pest and diseases, weather factors not within the control of the agricultural producer and adverse fluctuation in both input and output prices.

Fruits are of great nutritional value. Fruits have been significantly singled out in human nutrition for the supply of minerals and vitamins, hormone pre-cursors in addition to protein and energy (Taylor, 2003). Fruit production forms a substantial percentage (about 25%) of the major food crops cultivated in the tropics and so it is the source of livelihood for a considerable section of the population (Abba, 2004). In spite of their importance in the diet, per capita consumption of fruits in Nigeria is only 100g compared with 400g per head per day as recommended by the World Health Organization (WHO). In Nigeria, numerous quantities of fruits and vegetables are produced and staggering figures are given as estimated annual production level (Dauda *et al*. 2008).

Pineapple (*Ananas comosus*) belongs to the family of *bromeliaceae*. Pineapple is popularly known as "queen of fruit" because of its excellent flavour, shape and taste of fruit (Mali *et al*. 2001). It is one of the most important commercial fruits of the world and also available throughout the year. Collins (1980) and David and Adam (1991) stated that the primary areas of world production of Pineapple are the Philippine, Brazil, Mexico, Australia and part of Africa. The fruit is relatively drought resistance and can be grown in the sub tropical and dry region as well as the humid tropics (FAO, 1990). The Pineapple is the second fruit of importance after banana, contributing over 20 percent of the world production of tropical fruits (Coveca, 2002). Nearly 70 percent of the Pineapple is consumed as fresh fruit in producing countries. Its origin had been traced to Brazil and Paraguay in the Amazonic basin where the fruit was domesticated (FAO, 2008).

Until recently about 80% of Pineapple produced in Nigeria came from small scale farms managed under mixed cropping system. Recent access to international markets, enhanced value of fresh fruits, resuscitation of pineapple cultivation and local processing have encouraged the development of few large scale farms where Pineapple is produced as a mono crop (Adesope *et al.* 2009).

1.2 Problem Statement

Securing adequate food supply has been the fundamental concern of mankind over the millennia and even in today's modern world of great scientific and technological achievements. The world is faced with the problem of food shortage. Obiefunna and Lemechi (2001) reported that majority of the people in West Africa lack adequate food that are rich in nutrients needed by man for health and reproductive life.

Between 1998 and 2000, more than a quarter of the population of Africa was chronically undernourished (FAO, 2002). In sub-Saharan Africa, it is expected that the number of undernourished people will increase from 180 million in 1997 to 184 million by 2015 (Ijeoma, 2004). This stands in sharp contrast to the Millennium Development Goals (MDGs) of halving hunger and malnutrition and poverty by 2015.

Nigeria up till now is yet to achieve 5 percent total calories intake of non–starch food recommended by the Food and Agricultural Organization (FAO) and the 400g per head per day fruit as recommended by the World Health Organization (FAO, 2002). These, however, could not be achieved without using appropriate technologies. There are several production constraints that impede the full benefit of fruits as an important supplementary source of food and nutrients.

Population growth and poverty which pervade sub-Sahara Africa continues to emphasize the need to increase food production (Adinya *et al.* 2008). Predominant use of traditional system of farming is leading to declining agricultural production (Adinya, 2001). The traditional system of agricultural production still dominate with characteristically low technological base, high reliance on manual labour and hence low resource productivity. Manual farm operation imposed several limitations on farmers' capacity to increase their farm size and is technically inefficient and labour intensive (Amaza *et al.* 2002).

The transformation of agriculture from low productivity traditional inputs to high productivity modern inputs is a major problem facing agricultural development in sub-Sahara African countries (Ibrahim *et al*. 2006). Despite the nutritional and commercial value of fruits including pineapple, their production remains low in Nigeria. Excessive feeding on starchy food has been found to cause malnutrition and the resultant effect is the adverse effect on one's health; particularly the mental capability, working productivity and eventually the overall national economic growth. Malnutrition reduces the working capacity of farmers and their families. In several cases, serious physical and mental retardation and even death may occur. As a result of the reduced working capacity, income may decrease and poverty may increase (AVRDC, 2004).

Aside its nutritive and economic importance, therefore, pineapple production has encouraging potentials for foreign exchange earnings, increase national income through the expansion of local industries and higher incomes for farmers involved in its production. This study seeks to address the following research questions:

i. What are the socio-economic characteristics of pineapple farmers in the study area?
ii. What are the costs and returns associated with pineapple production?

iii. What is the technical relationship between input and output in pineapple production?

iv. What is the technical efficiency of pineapple production?

v. What is the economic efficiency of pineapple production?

vi. What are the major constraints facing pineapple production?

1.3 Objectives of the Study

The broad objective of this study is to examine the economic efficiencies of pineapple production in Esan West and Ovia South Local Government Areas of Edo State. The specific objectives are to:

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

ii. determine the profitability of pineapple production ;

iii. estimate the technical relationships between inputs and output ;

iv. determine technical efficiency of pineapple production ;

v. determine the economic efficiency of pineapple production in the study area; and

vi. identify the major constraints limiting pineapple producers in the study area with a view to proffering to policy recommendations.

1.4 Research Hypotheses

H_a: There is significant relationship between inputs and output in pineapple production;

H_o: Pineapple farmers' socio-economic characteristics have no significant influence on the technical efficiency of pineapple production.

1.5 Justification of the Study

Edo State is endowed with natural and human resources being presently unexploited. The State has the potential to be one of the large producers of pineapple in the country because of the presence of suitable ecological zone for its production, but low capacity utilization of resources or inefficient allocation of resources by pineapple farmers in the State has led to decline in pineapple production. (Adinya *et al*. 2010). In Edo State, pineapple production has been inadequate to bridge the demand–supply gap in both local and urban markets because of non-optimal use of resources. There is need to reverse this trend, hence, the resource poor farmers must learn to efficiently use resources and improved farm management techniques which is the most effective way of increasing productivity of pineapple in the short and long term. Thus, this study is expected to provide useful information for policy formulation towards increasing pineapple production in the State to bridge the gap between demand and supply in both local and world market. The identification and understanding of the factors that determine the level of output will provide valuable information useful to formulate fruit development programmes and guidelines for interventions that would improve efficiency of the fruit production system. The potential users of the results of this study would be farmers, traders and policy makers, governmental and non-governmental organizations and so on in making good policies on investment which will translate into increase output of pineapple and in turn increase income and lead to reduction in poverty. Past studies used insufficient or ill- defined variables but this study tries to explore more avenues. This study is therefore, an avenue to contribute to the debate in expanding the literature or the body of knowledge on the subject matter.

1.6 Scope and Limitation of the Study

The study mainly addressed problems during the period of survey. Records on previous activities were only guesstimates at best as no written records by these participants in the study area .Access to reliable data was, therefore, a major constraint experienced in this study. However, the concepts and analytical procedures employed in this study are those deemed adequate to handle the problem at hand within the confines of the type of data. Despite these inherent limitations, information derived from the analysis and interpretation are till indispensable.

1.7 Organisation of the study

The study is organized into five chapters, chapter two presents Literature review and Conceptual Framework that are relevance to the study. Chapter three presents Methodology, while Chapter four presents Result and Discussion and Chapter five deals with conclusion and recommendation by summarizing the findings and indicates the policy implication.

CHAPTER TWO

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Origin and Distribution of Pineapple *(Ananas comosus)*

Pineapple (*Ananas comosus)* belongs to the family *Bromeliaceae*. It is a perennial monocotyledonous herb with a terminal inflorescence and fruit. Pineapple is a native of Southern Brazil and Paraguay where wild relatives occur. The crop was spread by the Indians up through to South and Central America to the West Indies. Spanish traders introduced it into the Philippines and may have taken it to England in 1660. By 1720, the crop was grown in green house in England, from where it came to West Africa in the 18th century (Sampson, 1986; Ubi e*t al.* 2008). According to Ubi *et al.* (2006), the crop is drought tolerant and well adapted to the tropical acid sand with pH ranging from 4.5 to 6.5 and the crop is propagated by new vegetative growth. Pineapple have oval to cylindrical shape fruit and develops from many small fruits fused together. The Pineapple fruit may be dark green, orange, yellow or reddish when the fruit is ripe for harvest. The fruit is both juicy and freshly with the stem serving as fibrous core (Sampso, 1986).

Collins (1980) and David and Adam (1991) stated that the primary area of world production of pineapple are Philippine, Brazil, Mexico, Australia and parts of Africa. Pineapples are produced in many tropical region of Africa, where rainfall are adequate and are mostly consumed locally (Alika, 2005) while pineapples are produced and even exported by Kenya, South Africa, Ivory Coast and Nigeria (Rice *et al.* 1990).

It is cultivated in all tropical and sub-tropical countries. Annual world production has tripled during the last 30 years and now exceeds 12 million tonnes. Most of this production (70%) is locally consumed as fresh fruit. World trade mainly consists of processed products of which 80% canned slices (1,065,000 tonnes) and juice (215,000 tonnes) is supplied by Thailand and the Philippines. The fresh fruit market (680,000 tonnes) is dominated by the Philippines, Costa Rica and Côte d'Ivoire which supplies 60 percent of the European market, the leading importer with more than 226,000 tonnes (FAO, 1994; Loeillet, 1996). Thailand is the leading pineapple producer (16% of world production), followed by Brazil (13%) and the Philippines (13%), India (8.9%) and China (7.3%). Important American producers are Colombia (329,300 tonnes), Mexico (301,407 tonnes), Costa Rica (260,000 tonnes), and the U.S.A. (Hawaii and Puerto Rico, 301,000 tonnes). About 70% of the world production and 96% of the pineapple used by the processing industries comes from one cultivar, 'Smooth Cayenne'. The cultivar Queen has occupied small specific niches of high quality and expensive fresh fruit. Recently, the pineapple industry has responded to the increasing demand for fresh pineapple in the temperate markets with the introduction of more attractive cultivars such as 'MD2', also named 'Golden Ripe'.

Pineapple is the second fruit of importance after bananas, contributing to over 20 percent of the world production of tropical fruits (Coveca, 2002) with Thailand, Brazil, Philippines and China the main pineapple producers in the world. Other important producers include India, Nigeria, Kenya, Indonesia, Mexico and Cost Rica and these countries provide most of the remaining fruit available. Since 1960 pineapple production worldwide has risen by 400% and the world fresh/juice/canned pineapple trade has nearly doubled in the last 10 years. Pineapples dominate the world trade of tropical fruits although other fruits have gained market share. Statistics from the year

2002 indicate that the pineapple trade took 51% from a total of 2.1 million tonnes of the whole fruit market with mangoes taking second place with 21.7% (FAO, 2002).

Nigeria takes the lead as the highest producer in Africa (Wobeh, 2008). Current production figure showed that Nigeria ranked 6th on the list for world pineapple production with nearly 800,000 tonnes produced annually and if current production and marketing trends are encouraged, commercial production for export and local consumption will be enhanced (FAO/World bank, 1999). In Nigeria, total production of pineapple in 2009 and 2010 was put at 898,376 and 1,052,000 tonnes respectively (FAO, 2010).

2.2 Pineapple Varieties

According to Katerina (2006), there are about 40 different varieties of pineapples. In international trade, the numerous pineapple cultivars are grouped in four main classes: 'Smooth Cayenne', 'Red Spanish', 'Queen', and 'Abacaxi', despite much variation in the types within each class. Smooth cayenne is the most important pineapple cultivar in Africa and throughout the tropics (Rice *et al.* 2001). The smooth cayenne or cayenne is the most popular canning variety, which is extensively cultivated in Hawaii, Philippines, Australia, South Africa, Puerto Rico, Kenya, Mexico, Cuba and Formosa. The queen is an old cultivar and is grown mainly in Australia, India and South Africa, where it is cultivated for table and processing purpose. The flesh, although less juicy than cayenne is crispy, with a pleasant aroma. Acidity ranges between 0.6 and 0.8%.

Red Spanish is a semi-spineless cultivar grown primarily in West Africa and Germany and its fruits are intermediate in size between those of queen and smooth cayenne. It has some resistance to mealybug wilt disease (Rice *et al.* 2001). 'Abacaxi' (also called the 'White Abacaxi of Pernambuco', 'Pernambuco', 'Eleuthera' and 'English') is well known in Brazil, the Bahamas and Florida. The plant is spiny and disease-resistant. Leaves are bluish-green with red-purple tinge in the bud. The numerous suckers need thinning out. The fruit weighs 2.2 to 11 lbs (1-5 kg), is tall and straight-sided and sunburns even when erect and it is also very fragrant. The flesh is white or very pale yellowish, of rich, sweet flavor, succulent and juicy with only a narrow vestige of a core and this is rated by many as the most delicious pineapple. It is too tender for commercial handling and the yield is low. The fruit can be harvested without a knife; breaks off easily for marketing fresh. Other varieties include kew which is the leading commercial variety in India. It is a late maturing variety, valued particularly for its canning quality and is grown in some part of Maghalaya and Kerala in India.

Jaldhup and Lakhut, are both two local types, being named after the places of their maximum production. They fall in queen group of fruits being smaller than queen. Exotic varieties include Eleukera, Ihio, f-200 grown in U.S.A., G-25, Caynee de Guinea, Bsaronne de Rakschild, Comke de Paris grown in West Africa, Gueeustand in Australia, Sarawak in Malaysia, Yupi, Randon, Paulista in Brazil. According to EADP (2000), the Red Spanish variety is popularly grown in Edo State because of its high resistance to mealybug wilt disease.

2.3 Economic Importance of Pineapple

Pineapple is used mainly as food in the form of snacks and fruit-juice, while in most parts of the world the fermented juice is used to make vinegar and alcoholic spirit. Pineapple leaves are used to make cloth and rope, while the whole plant is used as a source of energy. Pineapple is eaten as a fresh fruit throughout the tropics and subtropics (David and Adam, 1991). The outer shells and central core are used as livestock feed.

Pineapple is a favorite desert of many health conscious individuals, its health benefits ranges from protection of simple flu to fighting off free radical that causes cancer. This inexpensive food supplement is a great way to achieve a healthy body and a cleansed internal system. Pineapple fiber helps for proper digestion of the food we eat and easier elimination of body waste and provides the necessary nutrients to our body.

The crown or leaves of pineapple is used as a raw material for wallpaper and furnishing. The leaves result to a very beautiful fabric, woven from the fiber extracted from its leaves. This fabric is a favorite material in creating the elegant “Barong Tagolog” in the Philippines, the fibers of pineapple leaf can also be extracted to produce the pine textile. It is also a good source of vitamin B1, Vitamin B6, manganese and a very essential anti-oxidant vitamin C.

Pineapple bromelain is use commercially as meat tenderizing enzyme and a nutraceutical. Bromelain has shown activity with the interference of growth of malignant cells, the inhibition of platelet aggregation, fibrinolytic action, anti-inflammatory processes and skin debridement.

2.4 Concept of Production Efficiency in Agriculture

The crucial role of efficiency in increasing agricultural output has been widely recognized by researchers and policy makers alike. It is no surprise therefore, that considerable effort has been devoted to the analysis of farm production efficiency in developing countries, Nigeria inclusive. An underlying premise behind much of this work is that if farmers were not making efficient use of existing technology, then efforts designed to improve efficiency would be more cost effective than introducing new technologies as a means of increasing agricultural out (Belbase and Grabowski, 1995). The efficiency of a farm/firm refers to its success in producing as large amount of output as possible given a set of inputs. It is the using of resources in such a way as to maximize the production of goods and services (O'Sullivan and Shefrin, 2003). One can get more output with the same inputs only when technology improves, when more resources are discovered or when the economic institutions get better at fulfilling our wants (Colander, 2004).

The concept of efficiency can be said to deal with the relative performance of the processes used in the transformation of inputs into output. Economic theory's discussion of efficiency distinguishes it into two types; allocative efficiency and technical efficiency. Farrell (1957), one of the pioneers of efficiency studies distinguished the two type of efficiency through the use of the frontier production function (Xu and Jeffrey, 1998). Technical efficiency is defined by the duo as the ability to produce a given level of output with a maximum quantity of inputs under certain technology. Allocative efficiency refers to the ability of choosing optimal input levels for given factor prices. The total efficiency otherwise called economic efficiency is the product of technical and allocative efficiency. The degree to which technical and allocative efficiency are achieved is referred to as production efficiency.

2.5 Measurement of Production Efficiency

Broadly two quantitative approaches are developed for measurement of production efficiency, parametric (stochastic frontier approach) and the non-parametric (Data envelopment analysis).

Thus all derivation from the frontier will be accounted for as inefficiencies (Jonnasson, 2005). The stochastic approach is sensitive to the choice of functional form and account for random errors. In this approach all deviation from the frontier are due to random effect and inefficiency (Coelli *et al.* 2002). The measurement of efficiency is important because it leads to substantial resource savings (Bravo-Ureta and Rieger, 1991).

2.5.1 Data envelopment analysis

Data envelopment Analysis (DEA) is a non–parametric deterministic methodology for determining relative efficient production frontier, based on the empirical data on chosen inputs and outputs of a number of entities, called Decision Making Unit (DMUs). From the set of available data, DEA identify reference points (relatively efficient DMUs) that define the efficient frontier (as the best practice production technology) and evaluate the inefficiency of others interior points (relative inefficient DMUs) that are below that frontier.

Compared to the regression analysis, Data Envelopment Analysis provides an alternative approach while regression analysis relies on central tendencies. Similarly, the DEA is based on external observations while in regression approach, a single estimated regression equation is assumed to apply to each observation vector. The DEA analyze each vector separately, producing individual efficiency measure relative to the entire set under evaluation.

The main advantage of DEA is that, unlike the regression analysis, it does not require a prior assumption about the analytical form of the production function, instead, it constructs the best practice production function solely on the basis of observed data and therefore the possibility of misspecification of the production technology is minimized.
On the other hand, the main disadvantage of DEA is that the frontier is sensitive to extreme observations and measurement errors (the basic assumption is that random errors do not exist and that all deviations from the frontier indicate inefficiency). Among the numbers of DEA models, two are most frequently used the CCR-model (after Charnes, Cooper and Rhodes, 1978) and the BCC–model (after Bankers, Charnes and Cooper, 1984).

2.5.2 Stochastic frontier approach.

The stochastic frontier production function was independently proposed by Aigner *et al*. (1977) and Meeusen and van den Broeck (1977).The stochastic production function is defined by:

$Y_i=f(X_i,\beta)E_i$---1

$E_i=V_i-U_i$--2

Where

Y_i is the observed output of the i^{th} sample farm, $f(x_i,\beta)$ is a suitable functional form, β is vector of the unknown parameters to be estimated, E_i is the error term made up of two component; V_i is the random error having zero mean which is associated with random factor outside the farmers' control such as topography, weather, measurement errors, disruptions of supplies and is assumed to be independently and identically distributed normal $(0,\delta^2 v)$ random variable and independent U_i. On the other hand, U_i is a non-negative truncated half normal random variable associated with farm specific factor, which lead to the i^{th} farm not attaining maximum efficiency of production. U_i is associated with technical inefficiency of the farm and range between zero and one. U_i follows an identical and independent half normal distribution $N(0,\delta^2 v)$. N represents the number of farms involved in the cross sectional survey. The technical efficiency of an individual farm from above can be defined in terms of ratio of the observed output to the corresponding frontier output, given the available technology. The technical efficiency is thus empirically measured by decomposing the deviation into a random component (U_i) (Ojo, 2003).

In that case Technical efficiency (TE) = Y/Y^*……………………………………………………3

$= f(X_i, \beta)\exp(V_i - U_i)/f(X_i,\beta)\exp(V_i) = \exp(-U_i)$……………………………………………4

Where Yi is the observed output and Y^* is the frontier output.

This is such that so $0 \leq TEi \leq 1$

The stochastic frontier production function model is established using the maximum likelihood estimation procedures (MLE).

The strength of the stochastic frontier approach is that it deals with the stochastic noise and permits statistical test of hypotheses pertaining to the structure and degree of inefficiencies.

Its limitation is:

- There is no a priori justification for the selection of any particular distribution for the technical inefficiencies effects U_i

- Efficiency measures may still be sensitive to distributional assumptions
- The Cobb -Douglas has constant input elasticities and return to scale for all firms.

2.6 Empirical Studies on Production Efficiency

Adinya *et al.* (2011) conducted a study on the estimation of efficiency constraints using Cobb- Douglas production function in snail production by small farmers in Cross River State, Nigeria. In their research they analyzed the data obtained using the Ordinary Least Square (OLS) multiple regression technique to determine the relationship between snail output and the input variables. They also tried to use the linear, double-log and semi-log function forms to determine which of the forms would best fit the relationship between snail output and the independent variables. The value of their co-efficient of determination (R^2) indicated that the Cobb- Douglas production function was the best compared with the Linear and Semi-log production functions. The Cobb-Douglas function had the highest R^2 value of 0.60 and meeting other econometric criteria.

Belen *et al.* (2003) made an assessment of technical efficiency of horticultural production in Navarra, Spain. They estimated that tomato producing farms were 80 percent efficient while those that raised asparagus were 90 percent efficient. They concluded that there exist a potential for improving farm incomes by improving efficiency.

Gautam and Jeffrey (2003) used a stochastic cost function to measure efficiency among small-scale tobacco farmers in Malawi. Their study revealed that large tobacco farms are less cost-efficient.

Rahji (2003) studied the technical, allocative and economic efficiencies of broiler farms in Ibadan, Oyo State of Nigeria. The result showed average technical, allocative and economic efficiencies of 80.3, 74.9 and 60.3 percent respectively. This means that the sampled broiler farms would be able to reduce their cost by 31 percent by operating at technical and allocative efficiency levels.

Keerthi (2008) studied the production and marketing of pineapple in the Shimoga District of India and examined the productivity of important resources used in the cultivation of pineapple. The Cobb-Douglas production function was used to estimate the resource productivity of pineapple cultivation. He classified the variable inputs into five major groups which included human labour, fertilizers, herbicides, growth regulators and planting materials with the dependable variable being yield of pineapple per hectare. The results of the regression analysis of pineapple production by sample cultivators did showed a range of marginal value product to marginal factor cost for various resources. The regression co-efficient for fertilizer and planting material were positive, which indicated that they will have a positive impact on the pineapple yield with further application of these two resources in the production process.

Binam *et al.* (2008) carried out an empirical study on the production efficiency of farmers in the West and Central Africa apple sector using Kirari village as a case study.

The study revealed that the average productivity per hectare of apple orchards was 1,285 standard boxes of each 18 kg.

Dhehibi *et al.* (2007) estimated farm level average technical inefficiency of 13.77 of citrus production by fitting a stochastic frontier production function in Ghana. The authors found that the coefficients of the share of productive trees, the agricultural training, irrigation operations and the experience of farmer estimated for technically efficient frontier had the positive effect on technical efficiency of farmers.

2.7 Farm Budgeting Technique

According to Olukosi and Erhabor (2006) farm budgeting technique is the report from the farmer, illustrating a farm plan or a change in the farm plan and the forecast of financial results. It tells if a desired alteration can enhance the income of a farm enterprise based on priorities or scale of preference (Olukosi and Erhabor, 2006). It ignores the complementary co-existence between enterprises and diminishing returns, but assumes a linear relationship. The Gross margin is not gross profit because it does not take into account overhead or fixed costs such as depreciation, interest payment rates, power, water, insurance or mortgage cost (Quinlan, 2004).

The gross margin analysis can be used in two ways; to diagnose the weaknesses of the existing farm business and to prescribe for reorganization of the farm business.

Gross margin analysis is very important for comparing performance of farm enterprise. If a farm enterprise records a relative low gross margin, it may be due to: unfavourable input costs relative to product prices; low output associated with low variable cost (pointing to inadequate expenditure on variable cost, example feed, fertilizer, labour, machine expenses); excessive inputs relative to value of production; and an inadequate or otherwise unsuitable type of production technology (Richards and McConnell, 2003). Tamasese (2009) conducted an analytical study of selected fruits and vegetable value chain in Samoa. In his study Gross margin analysis for pawpaw production was performed for farmers in Samoa with secondary data from the Ministry for Agriculture. In determining the total income of farmers, the number of trees per acre, the acres planted, plant spacing, growth period, land preparation cost per acre, and the number of fruits per tree harvested were considered. The average weight per fruit was also very significant in determining the total sales or income. The total direct cost was also considered. Cost like planting material, fertilizer, transport to market, hire of market stall, packaging costs and labour cost were determined. The gross margin of farmers was deduced by deducting the direct cost from the total income of farmers. The gross margin was calculated for three consecutive years before determining the total crop income over the three years.

Egyir (2007) in her work on Allanblackia, compared the net returns to Allanblackia with alternative tree crops including cocoa and evaluated the potential synergies between Allanblackia and other crops such as Cola, Cocoa, 'Abesebuo' and 'Atooto'. She calculated the gross margin per annum for each combination. The study revealed that the Gross margin for Allanblackia, Abesebuo, Atooto, Cola and Cocoa were equal to the mean revenue because the variable cost for all the crops were equal to zero.

2.8 Constraints to Pineapple Production

Hiremath (2005) expressed that the absence of processing facility, absence of cold storage facility, fluctuation in price are the major problems expressed by farmers and other problems are absence of cooperative marketing, non availability of packaging material at reasonable price and difficulty in transportation and non-availability of right inputs.

The shortage of affordable credit constraints the agricultural growth of pineapple production. It has been argued that the limited availability or affordability of credit delays, if not prevent the growth adoption of new production technologies and the use of non-labour inputs such as fertilizers. This in turn slows down output growth and the general development of the agricultural sector.

The perishable nature of pineapple is another major constraint to its production and marketing. According to Malcom (1999), the analysis of Nigeria food losses during marketing shows the percentage of post-harvest losses of pineapple of up to 70% and pawpaw (40-69%). In addition, Pineapple marketing cannot be over-emphasized considering the numbers of industries springing up which make use of pineapple as raw material for their production. However, it is characterized mainly by the problem of perishability, seasonality of production and bulkiness. Often marketers are compelled if not forced to sell their fruit at very low price to avoid huge wastage or total losses and this reduces their marketing margin and efficiency which in turn reduce the growth and production of pineapple production.

Pests and diseases are also among the major problems that affect the production or yield of pineapple. According to Eria (2009), the common disease in pineapples is “Pineapple mealybug wilt and nematode wilt”. Eria (2009) said that, the pineapple mealybug wilt is characterized by the reddening of the leaves, downward curling of the leaf margins, loss of turgidity, leaves reflex downwards, leaf tip dieback, and the plants either recover or endure further leaf tip dieback resulting in their death. In Nigeria, the pineapple mealybug wilt and nematode wilt have been reported in many part of Nigeria among them is Edo, Delta and Rivers States in the Southern part of Nigeria where this disease (Pineapple mealybug wilt) has been found to be the most problem facing pineapple farmers. Pineapple mealybug wilt and nematode wilt are quickly spreading to other regions through transportation of the pineapple planting materials.

Education is also a key factor in development. The major constraint in pineapple production according to (Masimbe *et al.* 2008) is the ineffectiveness of the extension system. The extension agents have weak links to the research service; often do not have sufficient means of moving about the countryside, and generally lack knowledge on more specialized topics. They also have a message-oriented, top-down framework for working and have not developed strong skills as facilitators of the farmers' own processes of knowledge acquisition. Also, there are too few women extension agents. The process of linking District extension agents with specialized sources of knowledge is not well developed.

Cultural research is another factor limiting the production of pineapple. This include lack of commitment by government in fruit and vegetable research as reflected in lack of credit policies that address the need of famers, low and unpredictable budget, lack of clearly defined research priorities and inadequacy of trained national researchers and technicians.

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study Area

This study was conducted in two Local Government Areas of Edo State, (Esan West and Ovia South LGAs). These Local Governments were used for the study due to two reasons: high concentration of pineapple growers in the area and representativeness of a typical pineapple growing community. The State is made up of 18 Local Government Areas and has Benin City as the State capital. Edo State is situated between Latitudes 2^0 40'S and 4^0 30'N of the Equator and Longitudes 5^0 0'W and 6^0 40'E of the Greenwich meridian. The land area is 19,035 km^2 and share boundaries with five other states of the federation, namely: Kogi to the North, Ondo to the West, Delta to the South and Enugu and Imo to the East (EADP, 2000).

Edo State climate is tropical with temperature range of 25.1°C to 27°C. The State is characterized by two distinct seasons namely; the wet and the dry seasons. The rainy season occurs between April and October, with a break in August and an average rainfall which range from 150cm in the extreme Northern part to 250cm in the South. On the other hand, the dry season last from November to April with cold harmattan spread between December and January.

As revealed by the 2006 census, Edo State has a population of 3,209,434 persons and based on the National Population Commission data, the State's population has been projected to be 3,867,105 for 2013. Rural population accounted for 2,118,226 persons representing 66.0 percent of the total population while 1,091,208 persons or 34.0 percent live in urban and semi–urban areas (NPC, 2006). The vegetation of the State varies from the swamp forest in the South – West part to the rain forest in the middle and then Savannah in the North. The soil type ranges from low productive sand in the South–East to fertile clay–like in the North–West. Agriculture dominates economic activities in the State and the common agricultural crops include cassava, rice, plantain, yam, okro, sugar-cane, cashew, groundnut, cotton and tomatoes which geared towards the local and national markets. Major export crops in the State are rubber, palm oil and palm kernel, timber and cocoa, while fruits such as citruses, pineapples, guava, coconut, mangoes, pear and cherry are also grown. These products provide the incentive for agro–based industries to spring up in the State, such as, the Bendel Feeds and Flour Mill in Ewu, Edo State.

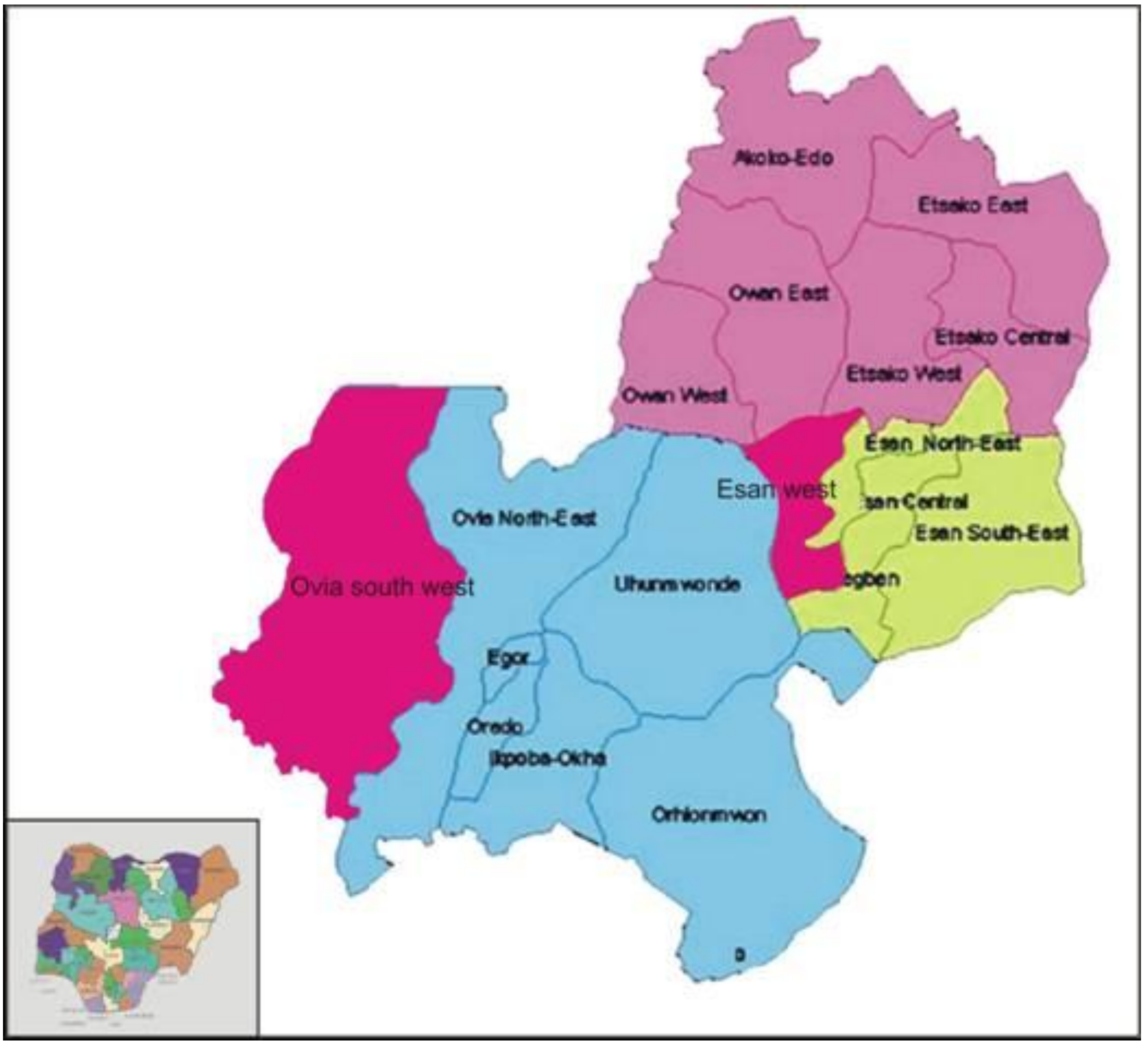

Figure 1: Map of Edo state showing the two local governments

3.2 Sampling Procedure

Two-stage sampling technique was used for this study. Two Local Government Areas (Esan West and Ovia South LGAs) were used for the study. The first stage involved the purposive selection of five (5) villages in each of the Local Government Areas based on two criteria: high concentration of pineapple growers in the area and representativeness of a typical pineapple growing community. These villages were: Emuhi, Ughiyiokho, Ujamen, Uke, and Uhi for Esan West Local Government Area and Ogubazuwa, Iguoriaki, Okoro, Udo, and Ugboqui in Ovia South Local Government Area. A reconnaissance survey conducted with village extension agents (VEA) of Edo State Agricultural Development Programme (EADP) revealed the sampling frame of pineapple farmers in the selected villages as indicated in Table 3.1. The second stage involved the technique of random sampling used to select 10% of the population of pineapple producers in each village giving a sample size of 175.

Table 3.1: Sampling frame and sample size of pineapple farmers

Local Govt Area	**Selected Villages**	**Sampling frame**	**Sample Size**
Esan West	Uhi	105	11
	Ujamen	170	17
	Ughiyiokho	200	20
	Uke	119	12
	Emuhi	206	21
Ovia South	Ogubazuwa	200	20
	Iguoriaki	202	20
	Okoro	140	14
	Udo	200	20
	Ugboqui	206	20
	Total	**1748**	**175**

3.3 Method of Data Collection

Primary data were used for this study. The primary data were collected with the aid of structured questionnaires which was administered to the selected pineapple farmers. The data generated from the information include: input and output quantities and their unit prices, and socio economic characteristics of farmers such as age, sex, marital status, household size, farm size, educational status, farming experience, extension contact, access to credit and membership of cooperative society. The input data include land size (ha), Labour (man-days), quantity of suckers (kg), and quantity of fertilizers (kg)**.** This study was conducted June, 2012.

3.4 Analytical Techniques

In order to achieve the objectives for this study, the following tools of analyses were used.

i. Descriptive Statistics

ii. The Budgetary Technique

iii. The Stochastic Frontier Model

3.4.1 Descriptive statistics

These were used to achieve objectives i and vii. These include arithmetic mean, frequency distribution and percentages.

3.4.2 Gross margin analysis

This was used to achieve objective ii. It is the evaluation of the efficiency and profitability of an individual farm enterprise or farm plan that enables one to compare different farm enterprises or farm plans. Olukosi and Erhabor (2006) referred to Gross Margin (GM) as a very useful tool in a situation where fixed capital is a negligible portion of the farm enterprise.

The formula is specified as:

GM = GI – TVC ---(5)

Where: GM = Gross Margin (₦/ha)

GI = Gross Farm Income (₦/ha)

TVC = Total Variable Cost (₦/ha)

3.4.3 The stochastic frontier model

The stochastic frontier production function was used to achieve objective iii, vi and v. The model in its general form is;

$Y_1 = f(X_i\, \beta)Ei$---6

$Ei = V_i - U_i$……………………………………………………….…………………………………………….7

Where,

Y_i = quantity of output of the ith farm

X_i = vector of the inputs used by the ith farm

β = vector of the parameters to be estimated

E_i = composed Error term

V_i = random error outside producers' control

U_i = technical inefficiency

$f(X_i\, \beta)$ = appropriate functional form of the vector.

The production technology is assumed to be characterized by Cobb-Douglas production function. The Cobb-Douglas production function has advantage over other forms of production functions like the Linear and Semi-log production functions in that a logarithmic transformation provides a model which is linear in the log of input and hence, easily used for econometric studies (Coelli, 1995). The Cob–Douglas production model is defined by:

$ln\mathrm{Y}_i = \beta_o + \beta_1 ln\mathrm{X}_{1i} + \beta_2 ln\mathrm{X}_{2i} + \beta_3 ln\mathrm{X}_{3i} + \beta_4 ln\mathrm{X}_{4i} + V_i - U_i$ -------------------8

Where,

Y_i = Output of pineapple (kg)

β_o = constant or Intercept of the model

β_1- β_5 = Regression Coefficients

X_1= Quantity of suckers (kg)

X_2= Quantity of fertilizers used (kg)

X_3= Labour used (Man-days)

$X_{4=}$ Farm size (Ha)

V_i = random error term defined earlier

U_i = Technical inefficiency effect predicted by the model and the subscript i indicate the i^{th} farmer in the sample.

3.4.4 Inefficiency effect model

In the analysis of farmer efficiency/inefficiency, it is not the average of the observed relationship between the farmers' inputs and output that is of interest but the maximum possible output that is obtained from a given combination of inputs. Not all producers are technically efficient as opposed to conventional microeconomic theory; such statement implies that not all producers are able to utilize the minimum quantity of required inputs in order to produce the desired quantity of output given the available technology. Similarly, not all producers are able to minimized necessary costs for the intended production of output.

From a theoretical point of view, producers do not always optimize their production functions. The production frontier characterizes the minimum number of necessary combinations of inputs for the production of diverse products, or the maximum output with various input combination and a given technology. Producers operating on the production frontier are considered technically efficient, while those who operate below the production frontier are denoted technically inefficient.

In line with Ray (1988) and Sharma *et al.* (1999), the determinants of technical inefficiency can be estimated as:

$U_{it} = \alpha_{0} + \alpha_{i}Z_{it}$...9

Where Ui is technical inefficiency, Z_{it} are the vectors of explanatory variables associated with technical inefficiencies, and α_{is} are vector of unknown parameters to be estimated.

An explicit equation can be expressed as:

$U_i = \alpha_0 + \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + \alpha_6 Z_6 + \alpha_7 Z_7 + \alpha_8 Z_8$--------------------10

Where,

U_i = technical inefficiency

Z_1= age of the farmer (years)

Z_2= farming experience (years).

Z_3= educational Level of the farmer (years of schooling)

Z_4= household size (Number)

Z_5 = sex of the farmer (dummy; 1=male and 0= female)

Z_6 = extension visit (Number of visit)

Z_7 = membership of cooperative society (Years of participation)

Z_8 = marital status (dummy; Married = 1 and Single = 0)

These were included in the model to indicate their possible influence on technical efficiency of the farmers and to satisfy objective (vi).

α_0= constant or intercept

α_1 - α_8 is the scalar parameters to be estimated.

The estimates for all the parameters of the stochastic frontier production function and inefficiency model was obtained using the programme FRONTIER 4.1 (Coelli, 1994)

The stochastic frontier cost functions model for estimating the farm overall economic efficiency is specified as:

$C_i = g(P_i, \alpha) \exp (V_i + U_i)$---11

Where,

C_i = represent the total input cost of the i^{th} farm

g = is the suitable functional form

P_i = represent input prices employed by the i^{th} farm

α = parameters to be estimated

V_i and U_i are the error terms

However because inefficiencies are assumed to always increase costs, error component have positive sign. The farm–specific cost efficiency is defined as the ratio of the observed total cost of production to minimum cost. But economic efficiency is the inverse of the cost efficiency (Ogundari and Ojo, 2006). Therefore, the farm specific economic efficiency (EE) is defined as the ratio of minimum production cost (C*) to actual production (C).

That is:

$EE=C^*/C$. …………………………………………………………………12

Hence a measure of farm specific allocation efficiency (AE) was obtained from technical and economic efficiencies as:

$AE=EE/TE$…………………………………………………………………13

This means that $0 \leq AE \leq 1$.

A Cobb-Douglas functional form was employed to the model of pineapple production in this study because of the following reasons:

- The functional form has been used in many empirical studies, particularly, those relating to developing country agriculture
- The functional form also meets the requirement of being self- dual.

The Cobb-Douglas functional form for pineapple farm is specified as follows:

$In\ C = \alpha_0 + \alpha_1 lnP_1 + \alpha_2 lnP_2 + \alpha_3 lnP_3 + \alpha 4lnP4 + \alpha_5 Q + V_i + V_i$------------------------14

C= total input cost of production of pineapple farm (₦)

In =logarithm to base e

P_1= cost of labour (₦)

P_2= Average cost of sucker (₦)

P_3 = Average cost of Fertilizer (₦)

P_4=Average cost of farm size (₦)

Q = Quantity of output (Kg)

3.4.5 Description of Variables and Apriori Expectation

Variable	Description	Measurement	Expectation
Y_i	The maximum attainable output for a given level of all inputs	Kilograms	+
X_1:	Quantity of planting materials (suckers)	Kilograms	+
X_2	Quantity of fertilizer used in production	Kilograms	+
X_3	Total amount of labour used	man-days	+
X_4	land under pineapple cultivation	Hectares	+

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of Pineapple Farmers

The distribution of the pineapple farmers according to their sex, marital status, household size, extension visit, level of education, age, farming experience, and membership of cooperative society are presented in Table 4.1

The study observed that 76% of the respondents were male while 24% were female. The predominance of male in the study area could be attributed to the labour intensive nature of pineapple farming which could be very tedious, hectic and time consuming especially for females who have to combine this farming activity with their domestic chores. This agrees with the findings of Adeoye *et al*. (2007) who found out in their study of economic analysis of watermelon, that 95 percent of the farmers in Oyo State were men. Another reason for male dominance could be attributed to the general belief in the study area that a woman should not inherit a farmland except in very few cases.

Furthermore, 95% were married while 8% were single. Marital status determine household size, hence married respondents tend to have larger household size and produce more output because of family labour availability. This finding is in agreement with that of Omolehin (2006) who indicated that the family is known to play a critical role in the provision of labour for farm work.

About 45.1% of the households had between 4 – 6 persons, 30.3% of the respondents had 7 - 9 persons per household, 14.9% had between 10 - 12 persons per household while 9.7% of the respondents had 1 - 3 persons. The household size ranges from 1-21 persons with an average of 7 persons per household indicating that pineapple farmers in the study area had relatively large household size. This agrees with the findings of Effiong (2005) and Idiong (2006) who reported that a relatively large household size enhances the availability of labour. Rahman *et al.* (2002) also reported that adoption index may be positively or negatively related to the household size depending on the nature of age structure and the amount of labour contributed among household's members.

The result also revealed that 41% of the respondents had contacts with extension agents while 59% of the respondents had no extension contact. This low frequency of contact with extension agents could be attributed to the limited number of extension agents (1:4000 farmers) in Nigeria, which make it impossible to reach all farmers by interpersonal means (Fawole, 2008). This is in agreement with Ovharhe and Okoedo-Okojie (2011) who reported that extension service in Nigeria is poorly organized and in some cases, non–existent.

The age of the farmers ranges from 27 - 86 years. About 41% of the respondents were between the ages of 27 – 46 years, 55% were between the ages of 47 – 66 years, 5% were between the ages of 67 - 86 years. The mean age of the farmer was 50 years implying that they are advanced in age, going by African context. Thus, output productivity will be quite low since age determines the physical strength of the farmers. This is consistent with the past studies of Idowu (2006) who reported that rural areas are populated with aged men and women who are left behind as a product of rural-urban drift. This further corroborates the finding of Ekunwe *et al.* (2008) that pineapple farmers in Delta and Kogi States are aging with mean ages of 52 and 53 years respectively.

Years of farming determine farmers' ability to make effective farm management decisions, not only in adhering to agronomic practices but also with respect to input combination or resource allocation. The result also revealed that majority of the famers (46%) had between 1 - 20 years of experience in pineapple faming while 5% had between 21 - 30 years of experience. The study revealed an average farming experience of 12 years for the pineapple farmers in the study area. It could therefore be said that the pineapple farmers in the study area were sufficiently experienced in pineapple farming with relevant skills to enhance farm management and hence productivity. This finding is in accordance with Rahman *et al.* (2003) who indicated that years of farming experience can be linked to farmers' tendency to adopt innovation and new technology.

With respect to the respondents' years of participation in cooperative societies, the result showed that (21.6%) belong to cooperative societies while 78.3% do not belong to any cooperative society. About 15% of the respondents had between 5 - 9 years of participation in cooperative societies and 6% had 10 – 16 years of membership. Membership of a cooperative society avails a farmer the opportunity of not only obtaining credit and agricultural inputs but also information on how to improve farming activities/productivity.

Education is highly important for sustainable agricultural growth and development. About 14% of the respondents had no formal education while 42% had primary education, 34% had secondary education and 10% had tertiary education. This showed that an average farmer in the study area was moderately educated and therefore can take a better decision as regards to acceptance of innovation and also applies better agronomic practices that will help to increase pineapple production. This agrees with the finding of Ewuola and Ajibefun (2000) who indicated that education enhances the capacity of individual to understand, manage and work with ideas.

Table 4.1: Socio-economic Characteristics of the Pineapple Farmers

Variables	Frequency	Percentage
Sex		
Male	133	76.0
Female	42	24.0
Marital Status		
Single	8	4.6
Married	167	95.4
Households 'size		
1-3	17	9.7
4-6	79	45.1
7-9	53	30.3
10-21	26	14.9
Extension service(Numbers)		
Visit	72	41.1
No visit	103	58.9
Level of Education		
No formal education	24	13.7
Primary education	74	42.3
Secondary education	59	33.7
Tertiary education	18	10.3
Age(years)		
25-40	40	22.9
41-56	88	50.3
57-72	45	25.7
73-88	2	1.1
Farming experience(years)		
1-10	82	46.9
11-20	82	46.9
21-30	9	5.1
31-40	2	1.1
Years of participation in a cooperative		
0-4	137	78.3
5-9	27	15.4
10-16	11	6.3

4.2 Cost and Returns Analysis of Pineapple Farmers in the Study Areas

Pineapple farming may not be for the purpose of only satisfying the household food need or subsistence. Thus the farmers, like any other entrepreneur, would be interested in the profitability of the farm enterprise. For this reason, efforts were made to determine the cost associated with pineapple farming and also revenue that accrues to the farmers' efforts. The various costs incurred on different type of inputs used and the revenues obtained from sales were estimated based on the prevailing market prices. Because the sampled farmers were small scale, their fixed cost was negligible and so only the Total Variable Cost (TVC) was considered.

The total variable costs are costs that change directly with the level of production. It is the cost of variable inputs such as labour, fertilizer and suckers used in production. It is the operating cost of the farmer which is the day-to-day cost incurred on production. Gross Margin is the difference between Total Revenue and the Total Variable Costs.

As shown in Table 4.2, of all the variable items, Labour constituted the largest (about 63%) of the total variable cost. This shows the importance of labour in pineapple farming in the study area. This is followed by cost of suckers which make up about 30% of the cost with fertilizer application having the lowest cost percentage. This implies that fertilizer is not commonly applied to pineapple farms in reasonable quantity in the study area.

On the average, it cost ₦167,121.00 to cultivate one hectare of farmland in the study area with an average of ₦772,854.00 accruing to the farmer as revenue leaving a gross margin per hectare of ₦605,733.00. The average rate of return on investment (Return per naira invested) was estimated to be 1.27 indicating that for every ₦1 invested, a profit of ₦0.27 kobo is made (27 kobo). This is a clear indication that pineapple production in the study area was profitable.

Table 4.2: Gross Margin of Pineapple Farming per Hectare in the Study Area

Variables	Unit Price(₦)	Quantity/ha	Values/ha (₦)	Percentage
1. Gross Return (GR)	60	12880.90	772854.00	
2. Inputs				
a. Sucker	25	2015.97	50399.25	30.20
b. Fertilizer	45	243.95	10977.75	6.50
c. Labour (hired)	800	132.18	105744.00	63.30
3. Total Variable Cost (TVC) = (a+b+c)			167121.00	
4. Gross Margin (GM) = (GR-TVC)			605733.00	100.00
5. Average Rate of Return (ARR) = (GR/TVC)			1.27	

4.3 Estimates of Stochastic Frontier Production Function

The maximum likelihood estimates (MLE) of the parameters of the stochastic frontier production function for pineapple farmers are presented in Table 4.3.

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The sigma squared (2.35) of the estimated model was statistically significant at 1 percent and different from zero. This indicates a good fit and the correctness of the distributional form assumed for the composite error term. The variance ratio, known as gamma (α) which is associated with the variance of technical inefficiency effects in the stochastic frontier is estimated to be 0.65 indicating that systematic influences that are unexplained by the production function are the dominant sources of random error. This means that 65 % of the variation in output among the pineapple farmers was due to disparities in technical efficiency.

Analysis of the estimated model revealed the coefficient of farm size was positive and statistically significant at 1% level. The positive relationship with output conforms to a priori expectation suggesting that a 1 unit increase in farm size will result to an 0.45 unit increase in output. This means that there is scope for increasing output by expanding farmland.

Labour was positive with a coefficient of 0.17 and significant at 10 percent level. This implies that labour is a significant factor that influences changes in output of pineapple. The positive coefficient is in agreement with the expected sign and implies that as the amount of labour increases, output also increases; this type of relationship is however expected where the available labour is efficiently managed along with other inputs to avoid redundancy and diminishing return to labour.

The coefficient of fertilizer was positive and in accordance with the expected sign meaning that quantity of fertilizer applied was directly related to the output while the statistical insignificance of its coefficient implies that fertilizer was not a significant factor in pineapple production.

The coefficient of suckers was estimated to be negatively related to output but not significant. The inverse relationship indicates that as the quantity of sucker increases, quantity of pineapple produced decreases. This can probably be attributed to improper spacing of pineapple suckers during planting since farmers in the study area used it as a means of controlling weed. Thus productivity tends to be low.

Table 4.3: Stochastic Frontier Cobb-Douglas Production Function for Pineapple

	Coefficient	Standard-error	T-ratio
Production model			
Constant	9.84	1.01	9.72
Sucker	-0.18	0.12	-1.51
Fertilizer	0.08	0.14	0.61
Labour (Hired)	0.17***	0.09	1.85
Farm size	0.45*	0.13	3.48
Inefficiency model			
Constant	-1.26	2.52	-0.50
Age	-0.004	0.03	-0.16
Experience	-0.21**	0.09	-2.44
Education	-0.04	0.05	-0.84
Household size	0.02	0.08	0.21
Gender	5.14***	2.84	1.81
Extension	-2.13**	0.98	-2.17
Cooperative	0.12***	0.07	1.71
Credit	-0.000001	0.000002	-0.61
Marital status	-1.61***	0.97	-1.66
Sigma-squared	2.35*	0.61	3.87
Gamma	0.65*	0.12	5.45

*P<0.01; **P<0.05 and ***P<0.10

4.3.1 Technical efficiency of pineapple farmers in the selected two Local Government Areas of Edo State

The technical efficiency of the pineapple farmers in the two selected Local Government Areas is presented in Table 4.4. The technical efficiency of farmers in Esan West Local Government Area ranged from 0.98 to 0.04 with a mean TE of 0.31. This implies that on the average the respondents are able to obtain about 31 percent of potential output from a given mix of production inputs. Thus, in the short-run, there is scope for increasing pineapple production by 69 percent by adopting the technologies or techniques used by the most technical efficient farmers in pineapple production.

The technical efficiency of pineapple farmers in Ovia South LGA ranged from 0.88 to 0.33, with a mean TE 0.60. This implies that on the average the respondents are able to obtain about 60 percent of potential output from a given mix of production inputs. Thus, in the short-run, there is scope for increasing pineapple production by 40 percent by adopting the technologies or techniques used by the most technical efficient farmers in pineapple production.

The results of the technical efficiency showed that farmers in Ovia South Local Government Area were relatively more technically efficient than farmers in Esan West Local Government Area.

Table 4.4: Technical Efficiency in the selected two Local Government Areas of Edo State

Technical Efficiency Estimate	**Local Government Area**		**Both LGA**
	Esan West	**Ovia South**	
Maximum	0.98	0.88	0.91
Mean	0.31	0.60	0.70
Standard deviation	0.21	0.20	0.19
Coefficient of variance	1.48	0.33	0.27

4.3.2 Determinants of technical inefficiency

The variables influencing inefficiency were specified as those relating to farmers' socio-economic characteristics. The results of the analysis of the determinants of technical inefficiency are presented in Table 4.5. Analysis of the estimated coefficient of the inefficiency variables of the efficiency model tells us the contribution of the variables to technical efficiency. Since the dependent variable of the function represents inefficiency, a positive sign of an estimated parameter implies that the associated variable has a negative effect on efficiency and a negative sign indicates the reverse. That is, a negative sign on parameter inefficiencies means that the variable reduces technical inefficiency while a positive sign increases technical inefficiency.

Farming experience is negative and significantly related to technical inefficiency at 5 percent level. This implies that farmer with more years of farming experience are expected to have less level of inefficiencies. This result is in line with that of Oluwatusin (2011) who reported that with increased years of experience, farmers become more specialized which means that they must have acquired more skill and good experience in production. This finding also agrees with those of Onu *et al*. (2000) who reported a negative relationship with respect to faming experience thus suggesting that older farmers are relatively more efficient and vice versa. It is possible that such farmers gained more years of farming experience through "learning by doing" and thereby becoming more efficient.

The coefficient of gender was estimated to be positive and significantly related to efficiency at 10% level of probability, suggesting that inefficiency is less among female than male. This is contrary to the a priori, because men are usually more endowed with resource inputs than women. However, women generally control smaller farmlands than men and appear keener in planting vegetables and fruits for family consumption than their male counterparts who normally devote their time to the production of cash crops for income (Agyare, 2010). Another plausible reason can be attributed to the older age of the male farmers involved in pineapple production in the study areas compare to women as this tends to make them less efficient than the women. However, previous studies as reported by Tchale and Sauer (2007) had found gender to have no significant impact on efficiency.

The coefficient of contact with extension agents (-2.13) was negative and statistically significant at 5% level. This agrees with a priori expectations. This implies that farmers that had more contact with extension agents tend to be less inefficient than their counterpart with less/no contact with extension agents. The implication is that farmers having more contact with extension agents are able to get information about the state of latest agricultural technology, pest management and proper and timely use of agricultural inputs. Similar result was indicated by Hassan (2004) and Yaseen (2006).

The coefficient of membership of cooperative association (0.12) was reported positive and significantly related to technical inefficiency at 10 % level of probability. This is contrary to a priori expectation implying that farmers who are members of association are less efficient. Membership of association can be very valuable for small-scale operation farmers because it facilitate access to market, secure market for their crops as well as provide some technical assistance. However as compared to the result of descriptive statistics in Table 4.5, the study showed only few farmers were members of cooperative societies and were mostly new entrants irrespective of their years of farming and as such most of the benefits of being a member eluded them. This finding was consistent with the finding of Onyenweaku and Ohajiannya (2005) and Bernard *et al*. (2008) who reported that farmers with wealthy households, sufficient experience in farming and with excess labour tend not to be involved in collective action which is consistent with theoretical predication. In addition another possible explanation could probably be that pineapple farmers in the study area regard membership of cooperative as a “public good” and not as a “social good” where they fraternize not necessarily for farming or production motives.

In accordance with a priori expectation, the coefficient of access to credit was negative but not significantly related to inefficiency. This implies that farmers having access to credit are technically more efficient than farmers with less/no access to credit. The finding of this study conformed to the finding of Idiong (2007). The obvious reason for this relationship may be that credit availability improves farmers’ liquidity and facilitate the purchase of inputs like fertilizers, herbicide and other farm implement during peak season.

The coefficient of marital status (-1.61) was negative and statistically significant at 10% level of probability, implying that the variable had the effect of reducing the farmers’ technical inefficiency. Married respondents were more efficient than the single ones who are into pineapple farming. Since marital status is correlated with household size, large household size is a source of labour for most farm operations (Dimelu *et al*. 2009). More adult persons in the household meant more quality labour would be available for carrying out farm activities.

4.3.3 Elasticity of production and return to scale

The elasticity of production measures the responsiveness of output to a change (increase or decrease) in input. Table 4.5 showed results of the production elasticities for the inputs in the Cobb-Douglas frontier function. The estimated elasticity of production of farmers in Esan West LGA showed increasing return to scale. Quantity of suckers, fertilizer, labour and farm size showed increasing positive return to scale implying efficient allocation of the variables in the production process in the study area.

For Ovia South LGA, the elasticity of quantity of suckers, labour and fertilizer showed positive decreasing return to scale except for farm size whose elasticity showed negative return to scale, implying inefficient allocation. As observed in the below result, all the inputs elasticities are inelastic; a one percent increase in each input results in less than one percent increase in yield.

The RTS parameter (0.52) is obtained from the summation of the coefficient of estimated inputs (Elasticities) which indicate that pineapple production in the study area is in the stage II of the production surface. Stage II is the economic relevance stage of production function (rational Stage), where inputs and production are believe to be efficient. Hence, it is advisable that the production units should maintain the level of input utilization at this stage as well as ensure maximum output from given level of inputs. However, they can do well by increasing their level of fertilizer, labour and farm size.

Table 4.5: Elasticity of Production and Return to Scale

Variable	**Esan West**	**Ovia South**	**Elasticity**
Sucker	0.73	0.09	-0.18
Fertilizer	0.01	0.44	0.08
Labour	0.32	0.43	0.17
Farm size	0.45	- 0.4	0.45
RTS	1.51	0.66	0.52

4.3.4 The estimate of stochastic frontier cost function

The estimated parameters for the stochastic cost function are presented in Table 4.6. The result revealed that the variance parameter estimates for sigma squared (δ^2) was positive (22) and was statistically significant at 1% level of probability. Gamma (γ) coefficient was 0.78 and was statistically significant at 1% level of probability. The estimated gamma (γ) parameter of 0.78 implies that about 78 percent of variations in the total cost of production of pineapple production were due to differences in the cost efficiencies. This means that the cost inefficiency effect do make significant contributions to the cost of producing pineapple in the study area.

Apart from cost of fertilizer which has a negative coefficient, all other explanatory variables included in the model had positive coefficients and were significant at different level of probability, indicating that as the cost of these variable increases, total cost of production increase and vice visa.

The positive relationship between the level of output and the total cost of production implies that as the total output increases by one unit, total cost of production will also increase by 0.15 percent. The cost of labour, farm size and suckers had direct relationship also with total cost of production and are significant at different probability level. This implies that a unit increase in any of these variables will increase their total cost of production by 0.32, 0.06 and 1.71 percent respectively, ceteris paribus.

Table 4.6: Estimates of the stochastic frontier cost function for the pineapple production

Variables	Coefficient	Standard-Error	T-Ratio
Cost model			
Constant	10.80	0.23	46.10
Average cost of labour	0.06***	0.03	1.72
Average cost of sucker	0.32*	0.04	9.08
Average cost of fertilizer	-0.03	0.07	-0.51
Average cost of farm size	1.71*	0.16	10.51
Output	0.15*	0.03	4.92
Inefficiency model			
Constant	1.49	0.15	9.87
Age	0.001	0.00	0.24
Experience	-0.331**	0.147	-2.25
Education	0.002	0.01	0.31
Household size	0.02***	0.01	1.78
Gender	-0.21**	0.10	-2.07
Extension	0.11	0.08	1.44
Cooperative	-0.03**	0.01	-2.37
Credit	-0.23*	0.07	-3.11
Marital status	-0.31	0.21	-1.48
Diagnostic statistics			
sigma-squared	0.22	0.03	8.05
Gamma	0.78	0.21	3.71

*P<0.01, **P<0.05 and *** P<0.10

4.3.5 Determinants of allocative inefficiency

It is evidence from Table 4.6 that farming experience, household size, gender, membership of cooperative society and credit variables are significantly related to allocative inefficiency at different level of probability, while age, education, extension and marital Status variables had no significant effect on allocative inefficiency on pineapple production in the study.

The coefficient of farming experience (-0.331) is negative and statistically significant at 5 percent, this implies more years of farming help reduce allocative inefficiency. The household variable has a positive and significant effect on allocative inefficiency at 10% level of probability which implies that increase in the household size will increase total production thereby increasing allocative inefficiency.

The coefficient of gender is negative (-0.21) and significant at 5% level, which shows that women who are involved in pineapple production are more allocative efficient than their male counterparts. Finding from some studies revealed that women produce and process food, using diverse coping strategies for ensuring food security for their household than their male counterparts.

The coefficient of access to credit had negative (-0.23) and significant effect on allocative inefficiency at 1% level. The result of the study indicates that farmers having good access to credit are allocatively less inefficient than their counterparts having poor access to credit. The possible reason for this relationship may be that better access to credit improves farmer's liquidity and ensures timely and proper application of inputs, helping them to produce at minimum cost.

The coefficient of membership of cooperative was negative (-0.03) and significantly related to allocative inefficiency at the 5% level. Result of the study indicates that farmers who belong to cooperative scieties were more allocative efficient than those who are not members. This implies that farmers that belong to cooperative societies are more able to get information from extension agents about pest management, spacing, quantity of inputs, proper and timely application of inputs and better access to market.

4.3.6 Distribution of efficiencies among the pineapple farmers

The result of the general distribution of pineapple farmers' efficiencies presented in Table 4.7 indicates that the Technical efficiency (TE) ranges between 0.03 and 0.91 with the mean technical efficiency of 0.704. The average technical efficiency index of 0.70 suggests that an average pineapple farmer in the study area still has the capacity to increase technical efficiency in pineapple production by 30% to achieve the maximum possible level.

It therefore, shows that there is efficiency gap but with scope for improvement in pineapple production among pineapple farmers in the study area. These results compare favourably with the findings of Ekunwe and Orewa (2007), Ekunwe *et al.* (2008), Ojo *et al.* (2009) and Shehu *et al.* (2010). The sample frequency distribution indicated a clustering of technical efficiency in the region 0.71 - 0.8 efficiency ranges representing 14% of the respondents.

The estimated economic efficiencies (EE) differs substantially among the farmers and ranged from 0.42 to 0.87 with an average of 64% (Table 8).This mean that if the average farmer in the sample area were to reach EE level of its counterpart, then the average farmer could experience a cost saving of 26% while the most inefficient farmer suggests a gain in economic efficiency of 51%.The frequency distribution indicate that about 43% of farmers had economic efficiencies between 0.71-0.80 while 87 % of the respondents had EE of 0.70 and above. That is, majority of the farmers were efficient in producing at a high economic efficiency.

The allocative efficiency of the sample farmers ranged from 0.02 to 0.99 with the mean value of 0.684. This implies that if the average farmer in the sample area were to reach AE level of its counterpart, then the average farmer could experience a cost saving of 31% (i.e 1-(68.4/99.0)*100) while the most inefficient farmer suggests a gain in Allocative efficiency of 98% (i.e 1-(42.0/87.0)*100). The frequency distribution indicated that about 24% of farmers had allocative efficiencies of 0.91-1.00 while 67% of the respondents had AE of 0.70 and above. That is, the farmers are efficient in producing pre-determined quantity of pineapple at the minimum cost for a given level of technology.

Table 4.7: Technical, Allocative and Economic Efficiencies of Pineapple production

Efficiency level	**Technical efficiency**		**Economic efficiency**		**Allocative efficiency**	
	Freq	**%**	**Freq**	**%**	**Freq**	**%**
0-0.3	12	3.6	-	-	20	11.4
0.31-0.4	8	2.4	-	-	8	4.6
0.41-0.5	16	4.8	8	4.6	17	9.7
0.51-0.6	20	6.1	13	7.4	13	7.4
0.61-0.7	41	12.4	57	32.6	19	10.9
0.71-0.8	46	13.9	76	43.4	19	10.9
0.81-0.9	32	9.7	21	12.0	37	21.1
0.91-1	-	-	-	-	42	24.0
Total	**175**	**100.0**	**175**	**100.0**	**175**	**100.0**
Mean		0.704		0.643		0.684
Std. deviation		0.188		0.093		0.263
Minimum		0.03		0.42		0.02
Maximum		0.91		0.87		0.99

4.3.7 Hypotheses testing

The result of the stochastic frontier production function showed that farm size and labour inputs were positive and significantly related to output which implies that as the level of these inputs increase, output also increases, thus the hypothesis (H_a)that there is significant relationship between input and output is accepted.

The second hypothesis (H_o), which states that pineapple farmers' socio-economic characteristics have no significant influence on technical efficiency of pineapple production, is rejected. Hence, five explanatory variables (Farming experience, Gender, Extension services, membership of cooperative societies and credit) in the inefficiency model for the farmers made significant contribution to the explanation of the technical inefficiency effects associated with the output of the farmers involved.

4.4 Constraints Encountered by Pineapple Farmers in the Study Area

Constraints could be seen as hindrances or difficulties faced by farmers in production. The major constraints to the effective production of pineapple in the study area were ranked according to their severity as presented in Table 4.8.

Lack of credit facility was the major constraint to pineapple production in the study area 44% as reported by the respondent. Access to agricultural credit has been positively linked to agricultural productivity in several studies (Nwaru *et al.* 2004). Yet this vital input has eluded smallholder farmers in Nigeria. Banks with large loan funds are generally difficult to access as issues of collateral and high interest rates screen out most rural smallholders. Cooperatives, friends and family members dominate the sources of farm credit among the farmers in the study area.

Weather and Disease 35% as indicated by the farmer ranked the second most serious constraints faced by farmers in the study area. Weather condition at the time of pineapple production is very important as the crop requires humid weather to thrive and produce optimally, so adverse changes in weather affect pineapple production.

Lack of road and high cost of transportation (30%) was ranked as the next most severe constraint. Transportation costs were considered very high and road conditions were very poor, and these limit access to purchased inputs, credit, and output markets, and reduce the transmission of market signals. High transport costs are significant constraints to agricultural productivity, reflecting the poor state of rural transport infrastructure in the study area.

About 17% of the farmers complained of the problem of low price and poor market outlet. Marketing of horticultural crops such as pineapple is quite complex and risky due to the perishable nature of the fruit, post-harvest food losses; seasonality of production and bulkiness. Low output price and poor marketing among other things can be attributed to how the fruit was harvested, handled and stored. Improper handling of harvested pineapple reduces the quality thereby leaving farmers at the mercy of the merchants in determining the price of the output.

About 16% complained of the problem of high post harvest loss of pineapple. This is because of the perishable nature of pineapple which accounts for the acute post harvest losses.

About 12% complained of lack of herbicides and a further 9.7% complained of the problem of lack of land. Communal systems of land ownership prevailed among famers in the study area, in which individual ownership of land is embedded in group or kinship ownership. Communal ownership of land in Nigeria has been associated with such problems as limited tenure security, restrictions on farmers' mobility and the inevitable fragmentation of land holding among rural famers.

The lack of storage facility ranked second to the last of the constraints faced by 3.4% of the farmer and high cost of labour was considered the least among all the constraints faced by the pineapple farmers in the study area. This could be linked to the large family size of the farmers in the study area which constitute large percentage of family labour in pineapple production in the study area.

Table 4.8: Constraints associated with Pineapple Farmers in the Study Area

Constraints	**Freq**	**%**	**Rank order**
Lack of credit facility	77	44	1
Weather and disease	62	35	2
Lack of road and high cost of transport	54	30	3
Low price and lack of market outlet	31	17	4
High post harvest loss	29	16	5
Lack of herbicide	21	12	6
Lack of land	17	9.7	7
Lack of storage facility	6	3.4	8
High cost of labour	5	2.9	9
Total	302*		

*Multiple responses existed. Hence, total frequency exceeded the total sample size of 175

CHAPTER FIVE

SUMMARY, CONCLUSION, CONTRIBUTION TO KNOWLEDGE AND RECOMMENDATIONS

5.1 Summary of the Findings

The results indicated that 50.3% of the respondents were within the age bracket of 41 – 56 with mean age of 56 years implying that the farmers in the study area were relative old. About 45.1% of the respondents had 4 – 6 persons in their household. The average household size was 7 persons. The study revealed that about 46.9% of the farmers have been producing pineapples for between 11 – 20 years and that 13.3% of the total respondents had no formal education while 66.3% had formal education. Also, about 41.1% of the respondents had access to extension services, 76% of the respondents were male and only about 24% of the respondents were female, while 15.4 % of the respondents who are in cooperatives had spend 5-6 years in the cooperative.

The results of farm budgeting analysis showed that total revenue of pineapple was ₦772,854.00 per hectare while total variable cost of production was ₦167,121.00 per hectare. Cost of labour and cost of suckers and output were the only variables that affected total cost of production positively meaning that an increase in the cost of any of these variables would lead to increase in the total cost of production, which implies that the cost of pineapple production is significantly affected by these variables.

The analysis revealed an average level of technical, allocative and economic efficiency of 70, 68 and 64 percent respectively. Years of farming experience, extension contact, credit and marital status were significant variables that influenced technical efficiency while gender, household size and membership of cooperative were observed to increase technical inefficiency. The return to scale was 0.52 suggesting that the production function was characterized by decreasing returns to scale, hence pineapple producers operated in stage II of the production surface.

The constraints faced by the pineapple farmers in the study area includes lack of credit facilities, changes in weather and diseases, lack of road and high cost of transportation, low price and poor market outlet, high post harvest loss of pineapple, high cost of labour and lack of farming land.

5.2 Conclusion

Result from the study indicated that adjustment in the production inputs such as farmland, increased use of fertilizer and labour could lead to increased production of pineapple. Farming experience, extension contact, and marital status were the socio economic characteristics that had significant and negative effect on the farmers' technical inefficiency. None of the sampled respondents operated at the efficient level indicating that the output realized was below attainable maximum, hence there is still scope for improvement in pineapple production in Edo State. Increase productivity and improvement in technical efficiency can be achieved by addressing the factors responsible for the inefficiency.

5.3 Contribution of the study to knowledge

1. The study revealed that pineapple farmers in the study area achieved technical efficiency of 70 percent which indicate that there is ample opportunity for the farmers to increase their productivity.

2. The study also revealed that pineapple farming in the study area was profitable with an average return of ₦1.27 kobo for every ₦ 1 invested .
3. Farming experience, household size, gender, membership of cooperative society and credit variables had no significant effect on allocative inefficiency on pineapple in the study area.

5.4 Recommendations

- Policies that would focus on ways of attracting and encouraging the youths who are agile and stronger to embark on pineapple production should be pursued. Such as setting up of fruit processing factories or industries in the rural areas where they are produced.
- Farmers in the study area should be empowered in the area of land and capital acquisition and other inputs for increase level of production.
- Government agencies in the State should implement capacity building programmes to train the extension agents and farmers on farm production techniques and farm management of available resources as efficient as possible to achieve optimum production.
- Farmers should be encouraged to setup cooperatives as well as taught the importance of being members of cooperatives as this will strengthen their role in inputs acquisition and marketing of their produce.
- Agricultural development programmes and policies should respect and encourage gender equity to improve accessibility to resources and transform productivity among pineapple women farmers in the study area.

- More research on pineapple production should be encouraged especially in the areas of disease control. This will solve the problem of disease infestation during the growing period.

5.5 Suggestion for Further Studies

This analysis overtime would have enabled one forecast the trend. In order to make effective use of such a model, however, ordered data that reflect the movements of these particular sampled respondents overtime are required.

For this study, data involving these time-ordered detailed changes for the particular sampled respondents were not available. More evaluative studies should be made on the selected respondents to determine the qualitative as well as the quantitative responses to variables under investigation overtime. Further studies could be more mindful of the methodology of capturing the environment, quantifying the level of impact as well as the policy options and strategies needed to obviate the real and perceived challenges.

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APPENDIX

ECONOMIC ANALYSIS OF PINEAPPLE PRODUCTION IN ESAN WEST AND OVIA SOUTH GOVERNMENT AREAS OF EDO STATE

Dear Respondent,

This questionnaire will be used by a student of the Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria. Please, fill as appropriate. All information will be treated with confidentiality and strictly for the purpose of research. Thanks for your co-operation.

Village/Community …………………………………………………. L.G.A …………………………………………………..

A. SOCIAL –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)…………….

7. How long have you been in pineapple 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. What is your major source of capital for pineapple farming?

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

d. Money Lenders (Borrow) ( )

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

a. commercial bank( ) b. Nigeria Agricultural Cooperative And Rural Development banks( )

c. Cooperative Society ( ) d. Money Lenders ( ) e. Friends and Family ( )

g. Others (specify)…………………………………………………………………

13. How much did you borrow to finance last production? (Fill for the source you indicated in Q .12)

SOURCE OF LOAN	AMOUNT(#)	INTERST RATE (%)
Commercial Bank		
Nigeria agricultural Cooperative And Rural Development Bank		
Cooperative Societies		
Money Lenders		
Friends And Family		
Others (Specify)		

14. Have you been visited by an extension agent? Yes ( ) No ( )
15. If Yes, How many times in last one year?
16. What activities did the agent teach you? ....
17. Of what benefit were the techniques learnt to you to the success of your farm? ....

B.INFORMATION ON INPUTS

(1) Farm size (Ha)

(1) How many pineapple farm plot 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

(II) Variable inputs (Last production Cycle)

(ii)Sucker(Kg)

Plot No	Quantity of Sucker(Kg)	Cost #
1		
2		
3		

(iii).Fertilizer.

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

(vi) 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						

(d) 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						

(e) 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).Replacement

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost #	No of people	No of Hours	Cost#
1						
2						
3						

(h)Harvesting

Plot No	Hire Labour			Family Labour		
	No of people	No of Hours	Cost #	No of people	No of Hours	Cost#
1						
2						
3						

C.INFORMATION ON INPUT(Last production cycle)

No of plot	No of quty produced	Kg
1		
2		
3		

CONSTRAINTS OF PINEAPPLE PRODUCTION

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

Suggest possible solution to the constraints in pineapple production.

1……………………………………………………………………………………………

……………………………………………………………………………………………

2……………………………………………………………………………………………

……………………………………………………………………………………………

3……………………………………………………………………………………………

……………………………………………………………………………………………

4……………………………………………………………………………………………

……………………………………………………………………………………………

5……………………………………………………………………………………………

……………………………………………………………………………………………

6……………………………………………………………………………………………

……………………………………………………………………………………………

7……………………………………………………………………………………………

……………………………………………………………………………………………

Thanks for your Attention