ANALYSIS OF GENDER DIFFERENTIAL IN RESOURCE UTILISATION AND EFFICIENCY OF STRAWBERRY PRODUCTION IN PLATEAU STATE NIGERIA

BY

Washan Jamok ELISHA
(P16AGAE8010)

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

DEPARTMENT OF AGRICULTURAL ECONOMICS,

FACULTY OF AGRICULTURE,

AHMADU BELLO UNIVERSITY,

ZARIA, NIGERIA

FEBRUARY, 2021

DECLARATION

I declare that this work in this Dissertation entitled '**Analysis of Gender Differential in Resource Utilisation and Efficiency of Strawberry Production in Plateau State Nigeria'** has been performed by me in the Department of Agricultural Economics. The information derived from the literature has been duly acknowledged and a list of references provided. No part of this Dissertation was previously presented for another degree or diploma at any other institution.

Washan Jamok ELISHA

_____	_____	_____
Student	Signature	Date

CERTIFICATION

This Dissertation entitled '**ANALYSIS OF GENDER DIFFERENTIAL IN RESOURCE UTILISATION AND EFFICIENCY OF STRAWBERRY PRODUCTION IN PLATEAU STATE NIGERIA'** by ELISHA Washan Jamok meets the regulations governing the award of Degree of Master of Science in Agricultural Economics of the Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literacy presentation.

_____ _____

Dr. Y. U. Oladimeji Date
Chairman, Supervisory Committee

_____ _____

Dr. O. O. Ugbabe **Date**
Member, Supervisory Committee

_____ _____

Dr. A. A. Hassan **Date**
Head of Department

_____ _____

Prof. S. Abdullahi **Date**
Dean, School of postgraduate Studies
Ahmadu Bello University, Zaria

DEDICATION

This Dissertation is dedicated to my parents.

ACKNOWLEDGEMENTS

I thank God Almighty, the source of all knowledge who granted me the enablement to complete this study. He saw me through thick and thin. Without him nothing would have been possible." I specially wish to express my deep appreciation and sincere gratitude to my supervisors, namely Dr. Y. U. Oladimeji, and Dr. O. O. Ugbabe for their invaluable assistance, suggestions and pieces of advice that facilitated the completion of this research work. I am grateful for their tireless readings, editing and constructive criticisms of this work which served as a stimuli to this study. May God bless you all and your respective families.

I am thankful to the lecturers of both the Department of Agricultural Economics and that of Agricultural Extension and Rural Development, Ahmadu Bello University, Zaria for giving me excellent background knowledge in Agricultural Economics and Agricultural Extension and Rural Development, which I found very relevant and useful especially in the course of this study. I am indebted to Dr S. Abdulrahman of the Department of Agricultural Economics for his profound support which facilitated the speedy completion of the analysis of this work. The contributions of Professor Z. Abdulsalam, Dr O Yusuf, and Prof M. W. Musa must be acknowledged.

I also wish to express my sincere gratitude and appreciations to my parents, Mr. and Mrs. Jacob Jamok Elisha whose parental care, encouragement and advice have been a source of inspiration all through my life. My sincere gratitude and appreciation also goes to my awesome husband (Solomon pam Dauda) for his love and earnest support I love you and appreciate your patience, words of encouragement and prayers. My sweet children Zarah Dauda and Abba-salim Dauda thank you for your understanding and patience and for being there all the time and to my sister Mbwehfuk I love you loads. May the Almighty God bless you all and keep us together.

To my P16 class, I appreciate you all especially Nonso Chidera Offokansi you were there when I needed someone all the time I really appreciate you. My appreciation also goes to Naomi, Munirat, Yemi, Aisha, Tolu and my friend Tolu Owolabi just to mention a few. I wish to also express my sincere gratitude to Mr Weng Paul Fom, Mr Ande, Mr Chris and Godiya for allowing me access their farms and also by connecting me to some of their farmers who assisted me with information I appreciate your guidance, materials provided and your service of love.

Finally may the peace and blessings of God be upon us now and forever.

ABSTRACT

The study evaluates gender differential in resource utilization and efficiency of strawberry production in Plateau State Nigeria. Primary data for the study were collected using structured questionnaire, administered to 182 female and 116 male strawberry farmers. Data collected were analyzed using descriptive statistics, cost-benefit analysis and stochastic frontier production function. Results of the study indicated that the average age were 37 and 34 years for female and male farmers respectively. About 76% of female farmers and 85.3% of male strawberry farmers were married. The average household size for the two groups was 4 members per household. More than half of both groups of strawberry farmers had between 1 and 10 years of farming. The result revealed that 83.2% of female farmers and 87% of male farmers had formal education in the study area. The average score on land areas ($\bar{x}$ =4.04) obtained for male is an indication of supporting the statement of male and female having equal access to land, while female farmers strongly disagreed ($\bar{x}$ =1.37) to the statement. Land ownership increase social status had a score of ($\bar{x}$ =4.18) and ($\bar{x}$ =4.22) for both male and female respectively. In terms of access to fertilizer, seed and agrochemical was agreed by both male and female having equal access to these productive resources. The result shows that female farmers disagreed that male and female had equal access to labour ($\bar{x}$ =1.88). The female farmers mentioned labour to be expensive to hire and lack of funds to hire adequate labour. Among the male farmers, the mean score of ($\bar{x}$ =3.51) signifies agreement to the statement; of male and female having equal access to labour. The mean score of ($\bar{x}$ =1.91) and ($\bar{x}$ =1.87) obtained from the scale indicate that both male and female farmers do not agree to men and female had access to credit. Determinants of technical inefficiency in female and male strawberry production in Plateau State revealed that age

of the farmer was positive and significant at 10% for male farmers. Year of education showed a negative relation with technical inefficiency and is significant at 5% level for female and 10% for male. Household size showed a negative relation with predicted technical inefficiency and is significant at 5% level for male strawberry farmers. It is evident here that, the two strawberry producers did not reach the frontier of production with a technical efficiency of 0.68 for female and 0.51 for male. Age, education and household size are major socio-economic determinant of technical efficiency for both female and male strawberry producers. The most severe problems encountered in strawberry production are excess rainfall, insect, bird and disease. This constraint constitutes serious impediments to strawberry production and need to be addressed adequately before strawberry production can be improved in the study area. It is recommended that agro-based industries and non-governmental organization should be encouraged by the local government to support research and production of strawberry products for commercial purposes.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The importance of agriculture in Nigeria cannot be over-emphasized as productive agriculture offers quality food for domestic consumption, raw materials for agro-allied industries, employment that generates income, which in turn encourages other industrial, commercial service and export markets for foreign exchange earnings (Yusuf, 2015). The contribution of agriculture to Nigeria's Gross Domestic Product (GDP) with crop production accounting for an estimated 85% of this total which stood at an average of 56% in 1960-1964 decreased to 47% in 1965-1969, decrease to 35% in 2002-2004 and a further decline to 21.2% in 2017 (World Bank, 2017). The agricultural sector provides a livelihood for the bulk of the rural population up to 70% active labour force supplies raw materials required by the industrial sector and generate foreign exchange through export (Umaru, 2015). In spite of this, agricultural production has failed to meet the food needs of the country's rapid growing population (Gyimah-Brempong *et al*. 2016).Yet, Nigeria is endowed with flowing rivers and a vast rich forest belt, fertile and cultivable arable land with about 98.3 million hectares across different regions for crop cultivations (Oladimeji and Abdulsalam, 2014; Yusuf, 2015).

Strawberry (*Fragarin chiloensis*) is an important small fruit among the berries particularly in Plateau State, Nigeria with various strawberry species growing wild all over the world (Afridi, Ishaq and Ahmad, 2009). Nutritionally, strawberry is superior to citrus, guava and apple in the possession of higher protein, mineral and vitamin contents in addition to having more digestible starch. The great dietetic compositionin strawberry

includes 100g of vitamin C, edible portion contain 89g of water, 0.07g of protein, 0.5g fats, 8.4g of carbohydrates and 59g of ascorbic acid (Afridi*et al*., 2009).

Strawberry is grown in many countries of the world but is also cultivated in Nigeria. the world production in 2016 is 4, 895, 459 metric tonnes (MT) and USA was the largest producer with an annual production of 1,452,000 metric tonnes. This constitutes 26% strawberries of the entire world. The average production figure for Nigeria was 21,780 mt which accounts for about 0.45% of total world output (Food and Agricultural Organization, 2017).

Plateau State accounts for the bulk of strawberry production in Nigeria. Small scale farmers, especially women who operate within the subsistence economy grow most of the Strawberry in Nigeria. The surplus of the product is supplied to the market in the rapidly growing urban centers. The bulk of the production of strawberry in Nigeria is inPlateau State (Enyinnia, 2001). The strawberry fruit is commercially consumed both in fresh form and can be preserved as Jellies, and squashes that can be used in off-season (Galletta and Bringhurst, 2005), and of recent in powder form through dehydration.

Genderdifferential issues in relation to farm productivity in subsistence farming has been of special interest from the standpoint of public policy in developing countries (Mabundza *et al*., 2014; Kabeer, 2016; Morgan *et al*., 2016; Rola-Rubzen *et al*., 2016). The difference is usually viewed from the angle of human capital theory and measurement of discrimination. Gender has proven to be an essential variable for analyzing the roles, responsibilities, constraints, opportunities, incentives, costs and benefits in agriculture (Koyenikan, 2011;Adejoh *et al*., 2017).

Like many other countries in Africa, women in Nigeria have broadened and deepened their involvement in agricultural production in recent decades (World Development Report (WDR), 2015). Although men dominate the sector in Nigeria, a large share of women also participates across the agriculture value chain; as they are involved in production, processing, and sales. Overall 48 percent of female headed households participate in the agriculture sector and, in the rural areas; almost 70 percent of female headed households are involved in the sector (Damisa and Yohanna, 2007; Abdulrahman *et al.*, 2018).

However, thereis debate in the general literature on gender and agricultural productivity as to the contribution of the differential use of inputs in explaining productivity gaps.Itis certainly true across a range of countries that women tend to have lower levels of usage of various productive assets (Croppenstedt *et al*., 2013). This is also true in the case of Nigeria. Despite their significant role in agricultural production, women in Nigeria have relatively limited access to agriculture land and lower levels of inputs and use of extension services compared with men (Phillip *et al.*, 2009). In Nigeria, men are five times more likely than women to own land and this varies across regions, with lower ownership by women and higher gender gaps in land ownership in the North compared to the South (British Council Nigeria, 2012). Theseconstraints could limit women's productivity relative to men.

1.2 Statement of the Problem

Gender relations are influenced by ethnic origin, age, religion, traditions, ideologies, societal perceptions as well as cultural and economic conditions (Yusuf, 2015). Gender

gap is manifest in various facets of life. In agriculture, this include among others, access to and control of resources, as well as division of labour at the household level and among farming activities (Danso *et al*., 2014). Lower access to credit is thought to impact women's ability to engage in more productive irrigation farming, as this requires more expensive equipment and labor (Porter and Philips-Howard, 1997). Further, women's lower levels of agency and decision-making power may negatively impact their inability to benefit from their activities in the agriculture sector, as well as in other areas of their lives (Croppenstedt *et al*., 2013). Thus, there is gap in decision making between male and female and this often turns out that in many cases, women use their land primarily for subsistence crops to feed their families while men cultivate cash crops and keep the income.Access to productive resources is an obstacle to agricultural growth in Africa, thus access to productive resources such as land, modern inputs, technology, education and financial services is a critical determinant of agricultural productivity (Food and Agriculture Organization, 2011).

Access to resources is one of the elements of women's empowerment and a base for the attainment of the Sustainable Development Goals (SDGs). Many international conferences have been held to improve rural women's equitable access to and control of land in recent years. The 4thWorld Congress of Rural Women, held in South Africa in 2007, reiterated the need to provide full and equal access for rural women to productive resources, including the right to inheritance and ownership of land and other property, credit/capital, appropriate technologies, markets and information (Shahnaj, 2008). However, women across all developing regions and Plateau State in specific are consistently less likely to own or operate land; they are less likely to have access to rented land, loans, extension services credit and other financial services and the land

they do have access to, are often of poorer quality and in smaller plots. In addition to being more likely to hold land, men also typically control larger land holdings than women (FAO, 2010).In terms of labour female farmers may receive help from male relatives, but only after the men have taken care of their own plots. The fact that female farmers typically farm smaller plots may not compensate for the lower availability of family labour, consequently women cultivate smaller plots and achieve lower yields (Gilbert *et al.*, 2002).

There is dearth of gender disaggregated research and documentation data in strawberry production especially in Plateau State. It is, therefore necessary to assess gender accessibility to resources among strawberry farmers in the study area; to establish benchmark for developing strategy for promoting gender equity in the accessibility to resources, involving strawberry farmers in the area. This becomes imperative to conduct this research which raises the following research questions:

i. What are the socio- economic characteristics of the male and female strawberry farmers in the study area?

ii. What are the levels of gender accessibility and resources utilization in strawberryproduction?

iii. What are the gender differential on profitability of strawberry farmers?

iv. What are the gender differential in production efficiency of strawberryfarmers?

v. What are the constraints confronting strawberry farmers in the study area?

1.3 Objectives of the Study

The broad objective was to analyze gender differential in resource utilization and efficiency of strawberry production in Plateau State Nigeria.The specific objectives were to:

i. describe the socio economic characteristics of the male and female strawberry farmers in the study area;

ii. assess the levels of gender accessibility and resources utilization in strawberry production;

iii. determine the gender differential on profitability of strawberry farmers;

iv. examine the gender differential in production efficiency of strawberry farmers and

v. identifythe constraints confronting strawberry farmers in the study area.

1.4 Justification of the Study

Thefuture of strawberry production and processing might be very much bright in our country in general and in Plateau State in particular because this fruit fetches maximum economic returns for the farmer. Moreover, low chilling temperature, technically skilled labour force, improved and high yielding varieties, capacity to rapidly disseminate the latest technology and good market access further brighten the future of this crop. Developmental research experiences have shown the importance of considering the gender of farm people in efforts to understand their behavior and improve their welfare (Ahearn, 2010).

The central focus of this research is on gender on resource utilization and efficiency of strawberry production; to this end, this study contributes to the existing data on gender-based information. Thus, this study provides valuable information that helps to examine

gender-based differences in access to resources and utilization that aids male and female achieve sustainable agricultural production. Subsequently, this research provides information that enlightens policy makers about the obstacles to farmer's productivity in the study areas. Result obtained from this study helps in the formulation of appropriate gender responsive policies and projects which addresses the needs of rural male and female with a view of improving their welfare.

1.5 Hypotheses of the Study

i. There is no significant difference on productive resources between male and female strawberry farmer.

ii. There is no significant differencein profitability of male and female strawberry farmer.

iii. There is no significant differencein technical efficiency between male and female strawberry farmer.

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual Framework

2.1.1 Concept of Gender

'Gender' is a term used to explain how society constructs the differences between women and men, whereas 'sex' identifies the biological differences between women and men. Therefore, looking at gender does not focus primarily on women or men, but rather on the relationships between their different roles, responsibilities, opportunities and needs. In sub-Saharan Africa, women, men and youth are key players in rice production, processing and trading; we refer to them as 'gender actors' (Agboh-Noameshie *et al*, 2013). Gender differences in productivity have been shown to be due to differences in the intensity of use of productive inputs (such as labour, land, fertilizer, manure, credit, extension training and education) rather than in differences in the efficiency or management styles of men and women (Quisumbing, 1996). Because women processors lack access to cash and/or credit to acquire modern processing techniques, they tend to produce less, and more of their crops are consumed within the family (Gladwin, 2002).

Gender inequalities and lack of attention to gender in agricultural development contribute to lower productivity, and higher levels of poverty as well as under-nutrition (IFAD, 2009; FAO 2011; World Bank, 2012). The 2012 World Development report

dedicated to Gender Equality and Developmentwarns that the failure to recognize the roles, differences and inequities between men and women poses a serious threat to the effectiveness of the agricultural development (World Bank, 2012).

Over the past years there have been major shifts in conceptual language which have led to a growing practice of using the term gender as a substitution for the word woman. Gender does not refer to women or men as is usually misconceived. On the contrary, the concept of gender refers to the relationship between men and women, the ways in which the roles of men and women are socially constructed and to the cultural interpretations of the biological differences between men and women (Suda, 2002). Gender roles are shaped by ideological, religious, ethnic, economic and cultural factors and these are key determinant of the distribution of responsibilities and resources between men and women. Being socially determined, this distribution can be changed through conscious social action, including public policy (FAO, 2011).

The subject of gender is an increasingly important component of rural development policies all over the world. Gender enhancement requires policy measures to improve the conditions of both female and male farmers. At the same time, raising social awareness of people about the symptoms, causes and consequences of oppressive economic, cultural, religious and legal practices is necessary for changing traditional gender roles and mindsets (Acharya, 2003). Governments in developing countries have shown increasing commitment to address gender concerns in their agricultural development programmes. It is also of utmost importance to have gender relevant information on access to productive resources. Gender specific information is necessary

especially in societies where majority of the population depends on agriculture and poverty may be a critical issue (Ahearn, 2010).

The recognition and promotion of women's contribution in agricultural production requires tireless effort. Given women's crucial role in food production and provision, any set of strategies for sustainable food security must address their limited access to productive resources. Women's limited access to resources and their insufficient purchasing power are products of a series of inter-related social, economic and cultural factors that force them into a subordinate role, to the detriment of their own development and that of society as a whole.

2.1.2 Gender Differences in Agricultural Productivity

Across Sub-Saharan Africa, a range of empirical studies have found that female farmers have lower yields than male farmers. Several reports have documented this pattern and sought to explain it (WDR 2012). Taken together, these studies suggest constraints in every step of the production process. First, women are likely to have less land to cultivate than men, and when they do, tenure security may be weaker. Second, their access to technology, information, and agricultural extension tends to be more limited compared to men. In growing crops, women are more prone to be constrained in their access to inputs, resulting in lower levels of fertilizer, labor, and other inputs than is optimal. And management of the fields may reveal constraints as well – ranging from lower levels of education to trying to juggle dual roles as farm manager and household manager.

Although this is the general perception, the reality is more nuanced with some studies finding females to have lower productivity than males on average while others finding no significant differences between the two groups (Croppenstedt *et al.*, 2013). In many

instances, back of the envelope calculations show that if you normalize inputs (taking into account access to land and productive inputs), the gender gap almost always disappears (WDR 2012). These findings indicate that women are not worse farmer but just face certain constraints that limit their productivity. However, these types of calculations do not take into consideration that returns to productive inputs also matter. Men and women could have access to the same quantity of inputs, but with different returns.

Empirical issues complicate our understanding of the link between gender and agricultural productivity. A large proportion of the studies use the gender of the household head as the gender identifier while fewer studies have been able to examine the differences in productivity at the plot level. The latter approach allows researchers to match the characteristics of the individual in the household managing plot activities to the input use and productivity of the plot. Defaulting to the household head when plot level information is not available may masks some gender differences in productivity as it is possible for other members of the household to be responsible for the day-to-day decision making on the plot other than the household head. In a study of Ugandan households, Peterman *et al.* (2011) conducted a sensitivity analysis comparing plot level with household head level data and found that significant gender differences at the plot level disappear at the household head level. The authors speculate that this suggests gender differences in agricultural productivity may not be revealed at higher levels of aggregation that do not correspond to the basic decision-making unit in specific farming systems. Kilic *et al*. (2013) is one of the few studies that have used nationally representative data to examine gender differences in agricultural productivity at the plot

level. In their analysis on Malawi, they find that female managed plots are 25 percent less productive compared to male managed plots.

There is strong evidence to suggest that women have significantly less access to productive assets, such as land, credit, extension services, fertilizer, and agricultural machinery. However, the evidence on the significance of this differential access in accounting for gender productivity gaps is mixed, and further research is needed to examine the extent to which the differential quantity of inputs/outputs used/produced by female and male farmers (such as land) and gender differences in input prices may impact productivity gaps. Also, it seems likely that the choice of unit of analysis (gender of household head or gender of plot farmer/owner) has significant impact on study results, with plot level analysis appearing to capture more of the gender productivity gap.

2.1.3 Gender Inequality

Gender inequality is a major cause and effect of hunger and poverty: it is estimated that 60 percent of chronically hungry people are women and girls. (WFP Gender Policy and Strategy, United Nations, 2012). When more women work, economies grow. An increase in female labour force participation—or a reduction in the gap between women's and men's labour force participation—results in faster economic growth (OECD, 2002). On average, women make up about 43 percent of the agricultural labour force in developing countries. Evidence indicates that if these women had the same access to productive resources as men, they could increase yields on their farms by 20 to 30 percent, raising total agricultural output in these countries by 2.5 to 4 percent. This would reduce the number of hungry people in the world by around 12 to 17 percent (United Nations,2012). Women are generally responsible for food selection and

preparation and for the care and feeding of children. Women play many roles in land use, production, distribution, processing, marketing accessing, trading and food availability. They often work as unpaid and self-employed workers on and off farm employees, entrepreneurs, traders, providers of services and caretakers of children and elderly, women farmers represent more than a quarter of the world population (Otaha, 2013).

Reducing gender inequality and recognizing the contribution of women to agriculture is critical to achieving global food security, there is consistent and compelling evidence that when the status of women is improved, agricultural productivity increases, poverty is reduced and nutrition improves.

2.1.4 Gender Accessibility to Productive Resources

Access is the right or opportunity to use, manage or control a particular resource. Resources may be economic (e.g. land and credit), political (e.g. participation in local government and community decision-making) and social (e.g. education and training). Productive resources are key factor in eradicating hunger and rural poverty. This has been restated in the framework of international commitments at World Food Summit (FAO, 2011). Access to resources is essential to improving agricultural productivity of both men and women farmers. Improving productivity will depend to a great extent on ensuring that women farmers, as well as men farmers have sufficient access to production inputs and support services. While both men and women smallholders lack sufficient access to agricultural resources, women generally have less access to resources than men.

Globally, women have title to only 1% of the world's land; yet paradoxically, women produce over half of the world's food and provide significant unpaid agricultural labour. In developing countries, women are represented in agriculture, producing up to 80% of

all foodstuffs in Sub-Saharan Africa, 50-60% in Asia, 46% in the Caribbean and 31% in the Middle East (Daniel, 2009). While, historically, women have been neglected as subjects and objects of development, there is an increased realization by government, donors and communities that, particularly in agriculture no meaningful development can take place unless women are granted access to all resources. Resources are the key considerations for rural livelihoods. Rural households negotiate their livelihoods by obtaining access to land, labour, capital, knowledge and market, which leads to enhanced and sustained family well-being (Valdivia and Gilles, 2001). Access to resources is one of the elements of women's empowerment and a base for the attainment of the Millennium Development Goals (MDGs). Many international conferences have been held to improve rural women's equitable access to and control of land in recent years. The 4th World Congress of Rural Women, held in South Africa in 2007, reiterated the need to provide full and equal access for rural women to productive resources, including the right to inheritance and ownership of land and other property, credit/capital, appropriate technologies, markets and information (Shahnaj, 2008).

The study ofShahnaj (2008), showed women's access to extension services and training, technologies, formal or informal institutions, land and inputs for production was limited. For instance, the respondents (87%) received a limited amount of credit from NGOs, co-operatives, money lenders and relatives, with a high rate of interest. The women were almost always excluded from loans from commercial banks because of lack of land ownership. The respondents reported that their access to institutional loans was further restricted by their lack of education, confinement to household activities, lack of familiarity with loan providers and restrictions on their mobility.Almost half of the respondents (44%) had no opportunity to receive services from different extension agencies. As a result, they lack modern avenues of knowledge and information, new

technologies and opportunities for training to increase their farm productivity and income (Shahnaj, 2008).

2.1.6 Economic Importance of Strawberry

Strawberries are of great importance in the society in areas of nutrition and medicine. It has a substantial measure of Calories, Protein and Vitamins. These Calories might be substantial of a typical man yet insufficient for a competitor, which needs such a great amount of Calories to finish his body necessities. Protein is additionally very sufficient in Strawberries, a human body require much Proteins to set up body, muscles and different tissues of human body. In any case, Strawberries have much Vitamin C yet there is absence of different Vitamins which are the prerequisite of a body. Surprisingly, China is not available in the list of largest strawberry producer in the world (Basseto *et al.*, 2015; Alagumani, 2015).

It is critical for the heart issues, blood expanding, and pulse stay ordinary. strawberry producing countries have large markets for people to buy. The skin issue which happen because of sun warmth are not affected on the human body. It cleans the skin, make best tone of face, has against maturing capacities and battles against pimple inflammation. It is likewise utilized for fat issues, age controlling, weight, eyes and makes solid bones. Makes solid and long hair, expand silk & sparkle and battles against dandruff (Alagumani, 2015; Basseto *et al*., 2015).

Battles against numerous sicknesses like malignancy, diabetes and Stroke which is extremely perilous disease in USA. Because of cancer prevention agents, numerous ailments like malignancy are reduced from human body. Constipation is a malady in which entrails are squeezed together however the fruit products which have high water

in it like Strawberry production is best for that issue. Strawberries are good for a pregnant lady and misery issues (Alagumani, 2015; Basseto *et al.*, 2015).

2.2 Theoretical Framework

2.2.1 Agricultural Productivity and Profitability

Productivity and profitability persist to be the two most important indicators in assessing the success or failure of crop production. Productivity and profitability are some of the basic concepts in economics of agricultural production (Itam *et al*., 2014). Agricultural productivity is measured as the ratio of agricultural outputs to agricultural inputs. Its measures can be subdivided into partial, multifactor and total. Partial factor productivity is the amount of output per unit of a particular input. It only considers a single input in the ratio. For example, it uses yields of crops to determine the productivity of field crops. In this study partial factor productivity was employed in production function. Both Multifactor productivity (MFP) and Total factor productivity (TFP) are defined as the ratio of total agricultural output to a subset of agricultural inputs. They utilize more than a single factor (Mapula *et al*., 2011).

In other words, Ellis (1993) pointed out that the farmer is an individual decision maker concerned with choices like how much labor to use to cultivate a certain type of crop, whether to use purchased inputs or not, which kind of crops to grow in a certain field, etc. Thus, the author identified three kinds of relationships between farm inputs and outputs that determine the decision-making capacity of the farmer. One is input-output relationship which indicates the physical relationship between inputs and outputs. This deals with the varying level of outputs corresponding to the varying level of inputs. For example, the variation in potato output resulting from the different levels of fertilizer. Secondly, factor–factor relationship which refers to the different combination of two or more inputs required to produce a specified output. For example, the different amount

of land and labour that can give the same quantity of potatoes. Thirdly, product-product relationship that refers to the varying outputs that can result from a given set of farm inputs. For instance, the different quantities of potatoes and onions that can be obtained from the same area of land.

Output is usually measured as the market value of final output. The production function consists of different functional forms. These include the Cobb Douglas, linear, quadratic polynomials and square root polynomials. Others are semi-log and exponential functional forms (World Bank, 2008). The use of production functions to determine farm productivity is restrictive, as it does not account for disparities in input and output prices across farms. An analysis of farm profits addresses this shortcoming by including the effect of price of agricultural inputs and outputs (Elodie *et al*., 2015).

Profitability is a measure of the relationship between the levels of profits earned during an accounting period and the level of resources committed to earn those profits. Profitability measures the ability of farmers to recover from their costs and is an important concept, because it provides incentives for entry into and longevity in the farming business.Cooke *et al*. (2013) ranked profit, risk minimization and crop complexity respectively as the three most important objectives by farmers. The profit objective was defined in farm as the sum of gross margin of each crop less the costs. The risk minimization objective was based on the principle of minimization of total absolute deviation. The risk values are linked to farmer satisfaction and represent the best or worst possible farm income deviation a farmer would expect over a 5-year period. The number of crop types grown measured the crop complexity. The number of

crop types grown is associated with a number of different operations and a level of difficulty.

2.2.2 Theory of Profit Maximization

Common theories of smallholder production generally fall under profit and utility maximization (Ellis, 1988). According to Ellis (1988), these theories are not mutually exclusive. They have much in common in the starting point, approach, logical method, and sharing of certain key assumptions meaning that they are variations on a single theme. For instance, where income is the only variable in the utility function, then profit maximization and utility maximization coincide. The theory of profit maximization was described in this section.

Economic theory considers a firm as a transformation unit which converts input into output (Parkin, 1998). In the process of such conversion, the firm tries to create a surplus value, called a profit. According to Parkin (1998) the major objective of the firm is profit maximization. He argues that while individual firms and entrepreneurs that run them can have many different objectives such as quality product, growth, market share, and employee job satisfaction, all such objectives are only a means to a fundamental and perhaps a deeper objective of profit maximization.

Profit maximization is considered as a rational behaviour of equilibrium assumption where marginal revenue is equated to marginal cost (Baumol and Blinder, 1991; Parkin, 1998; Anderson and Ross, 2005). A firm which aims to maximize profit will go on increasing its output till it reaches a maximum profit. The bigger the difference between total revenue and total cost the bigger the profit. Therefore, profit is maximized when there is maximum difference between total revenue and total cost (Penson et al., 2006). This strong assumption that makes up the theory of the firm that business firms

automatically maximize (economic) profit (and minimize costs) has been widely discussed, tested, and in many incidences criticized (Baumol and Blinder, 1991; Anderson and Ross, 2005).

Immediate criticism is the fact that profit maximization is possible for an ideal market, where the decision-maker has full or perfection information. According to Anderson and Ross (2005), this means that all market participants have full and relevant information that they are always aware of their particular demand curves that they are fully aware of all their costs at all times so that they would consistently set output where marginal revenue equals to marginal cost. Baumol and Blinder (1991) argue that while it would seem that firms choose the price and the quantity to be sold, in fact, they choose only one. Once they have selected the price, the quantity they will sell is up to the consumers. This is to say that if firms cannot predict with certainty the quantity they will sell then they cannot consistently maximize profit. Thus, Anderson and Ross (2005) argue that time factor, uncertainties, and other factors pertinent to the decision-maker should be considered.

According to Ellis (1988) the theory of profit maximization treats the smallholder farmer as a farm firm, operating in fully formed and competitive input and output markets. Profit maximization predicts a positive response by the farmer to market price changes, i.e. an increase in the real price of output results in higher input use, higher output, and higher net income. But According to Ellis (1993) small scales are characterized by partial engagement in input and output markets which are often imperfect or incomplete markets. With complete markets, the production decisions of households are separable from its consumption decisions. In this case, the household

maximizes profit and then maximizes utility subject to budget constraint. However, with incomplete markets, the separation property no longer holds, households fail to maximize profit and production decisions depend on the preferences and endowments of the household (Bezawit, 2011).

2.3 Analytical Framework

2.3.1 Measurement of Farmers' Efficiency and Productivity in Agricultural Production

Efficiency of a farm refers to the performance of the farm in the utilization of resources at its disposal (Kalirajan and Shand 1994) as cited by Maurice (2012). This performance is either compared with the normative desired level or with that of any other farm. The analysis of efficiency is generally associated with the possibility of farms producing a certain optimal level of output from a given bundle of resources or certain level of output at least cost.

Measurement of efficiency according to Ogunjobi (1999) as cited by Maurice (2012) is important for the following reasons: Firstly, it is a success indicator, performance measure by which productive units are evaluated. Secondly, only by measuring efficiency and separating its effects from the effects of the production environment can one explore hypotheses concerning the sources of efficiency differentials. Identification of source of inefficiency is important to institution of public and private agencies designed to improve performance. Thirdly, the ability to quantify efficiency provides decision makers with mechanism with which to monitor the performance of production system or units under their control. In some cases, theory provides no guidance or provides conflicting signals concerning the impact of some phenomena on performance. In such situation empirical measurement provides qualitative as well as quantitative evidence (Coelli, 1994).

The Centre for Efficiency and Productivity Analysis (CEPA, 2003), recommended the use of either Data Envelopment Analysis or Stochastic Frontier Production (DEA or SFPF) in measuring the efficiency of production due to the inadequacies associated with the use of the Least Squares Econometric Production Models and Total Factor Productivity Indices (LSEPM and TFPI). The Data Envelopment Analysis (DEA) is non-parametric requiring the use of linear programming while SFPF is parametric and involves the use of econometric methods. The assumption that the production function of a fully efficiency firm is known is not true in practice. So Farrell (1957) suggested that it can be estimated from sample data using either parametric or non-parametric function such as Cobb-Douglas form. The parametric form resulted in the development of the stochastic frontier approach (CEPA, 2003), the advantage of Stochastic Frontier Production Function (SFPF) is that it accounts for the noise‖ or disturbance problem often encountered in data collection. The stochastic frontier production function model used for this study because of its parametric nature is reviewed below.

2.3.2 Stochastic frontier production function model

The stochastic frontier production model represents an improvement over the traditional average production function and over the deterministic functions, which use mathematical programming to construct production frontiers. The notion of a deterministic frontier shared by all firms ignores the possibility that a firm‘s performance may be affected by factors entirely outside its control such as bad weather and input supply breakdowns as well as by factors under its control (i.e. technical inefficiency). To lump up the effects of exogenous shocks, both favourable and unfavourable, together with the effects of measurement errors and inefficiency into a single one-sided error term, and to label the mixture inefficiency is a problem with the deterministic frontiers.

To solve this problem associated with the deterministic frontiers, stochastic production frontier was developed. Aigner *et al.* (1977) and Meeusen and Broeck (1977) simultaneously introduced stochastic production frontier models. The econometric approach to estimate frontier models uses a parametric representation of technology along with a two-part composite error term. Under the assumption that f(Xi;β) is of Cobb-Douglas type, the stochastic frontier model can be written in logs as**:**

$$lnY_i = \beta_0 + \ln\beta_1 X_1 + \ln\beta_2 X_2 + \ln\beta_3 X_3 + \cdots \ln\beta_n X_n + V - U$$

2.3.3 Production Efficiency and its Components

In every country, enhancing productivity and efficiency in agricultural sector remains a vital key to improving the standard and quality of life, especially in developing countries where a preponderant majority of the poor are employed. One strategy to improving farm productivity is the adoption of new technologies. The adoption of new technologies, as a means of accelerating economic development, has been the focus of a number of researchers and policymakers. Awotide*et al*. (2010), Kudi*et al*. (2011) and Dontsop*et al*. (2011) focused particularly on the role of new technologies in fostering productivity and development. But technological progress is not the only parameter that determines output growth, enhancement in efficiency can also affect growth in output.

Perhaps the most important work in the production efficiency literature is that of Farrell (1957) who drew upon the work of Debreu (1951) and Koopmans (1951). This research laid the foundation for the development of a number of related efficiency models, collectively known as frontier models. There are two main benefits that result from estimating frontier functions, as compared to estimating average functions using ordinary least squares (OLS) technique. First, when a frontier function is estimated, the result is strongly influenced by the best performing firm, and therefore the frontier reflects the technology set that the most efficient firm uses. Compare this to the

estimation of an average function, which only shows the technology set employed by an average firm. Second, frontier functions provide a useful performance benchmark. These functions normally represent best practice technology, against which the efficiency of other firms within the industry can be measured. It is for this reason that frontier estimation continues to attract attention in the empirical production economics literature.

In microeconomic theory of the firm, production (or economic) efficiency is decomposed into technical and allocative efficiency. A producer is said to be technically efficient if production occurs on the boundary of the producer‘s possibilities set, and technically inefficient if production occurs on the interior of the production possibilities set. That is, technical efficiency is the extent to which maximum possible output is achieved from a given combination of inputs (Haghiri, 2003). On the other hand, a producer is said to be allocatively efficient if production occurs in a region of the production possibilities set that satisfies the producer‘s behavioural objective.

Farell (1957) distinguished between technical and allocative efficiency in production through the use of a frontier production function. Technical efficiency is the ability to produce a given level of output with a minimum quantity of inputs under certain technology. Allocative efficiency refers to the ability of using inputs in optimal proportions for given factor prices (i.e. where the ratio of marginal products for each pair of inputs is equal to the ratio of market prices). The product of technical and allocative efficiency is the Economic efficiency. An economically efficient input-output combination would be on both the frontier function and expansion path. Alternatively, economic efficiency can be defined as the ability of a production organization or any other entity to produce a given output at minimum cost. If a firm has achieved both

technically and allocatively efficient levels of production, it is economically efficient and new investment streams may be critical for any new development.

2.3.4 Technical efficiency

One of the important measures of overall resource use efficiency is technical efficiency. Farrell (1957) defined technical efficiency, as the ability of the firm to produce on the isoquant frontier. Also, technical efficiency of an individual farm is defined in terms of the ratio of the farm‘s actual output to its maximum frontier output for a given level of inputs and chosen technology (Kalirajan and Shand, 1994). They advanced that technical efficiency is attained when the best available technology is used. It therefore implies that the frontier output varies with the level of technology employed by the farm. On the other hand, technical inefficiency arises when less than maximum output is obtained from a given bundle of factors (Russell and Young, 1983). Technical efficient farms are those that operate on the production frontier, and the level by which a farm lies below its production frontier is regarded as the measure of technical inefficiency. However, when farms fail to operate on their frontiers but somewhere below them, they are said to be technically inefficient. Amaza and Olayemi (2002) also used the stochastic frontier production function in their study of Gombe State farmers. They concluded that 98% of the variation in output among farmers was due to differences in technical efficiencies. Thus, the result of the diagnostic statistics confirmed the relevance of stochastic frontier production function using maximum likelihood estimator (MLE).

Tiamiyu *et al*. (2008) showed that the mean technical efficiency of rain-fed upland rice farmers in the Guinea Savanna Zone of Nigeria to be 65%. He concluded that, farmers’

technical efficiency is significantly influenced by educational level, rice farming experience, extension contact and credit use among the sample farmers. Omotesho *et al*. (2008), in their study of technical efficiency of youth participation in agriculture in Ondo State showed that, efficiency differential exists among the youths in the programme furthermore, land, labour, herbicides and number of cassava cuttings were found to be the major factors that influence output of the youths. The mean technical efficiency was found to be 85%.

The stochastic frontier production function was also used by Shehu *et al*. (2007) in their investigation of productivity and technical efficiency of small-scale rice farmers in Adamawa State. The technical efficiencies of the farmers range from 74%- 98% with a mean technical efficiency of 95.7%. The farmers were found to be operating in an irrational stage of production as shown by return to scale of 1.06. in another study (Shehu*et al*., 2007) of technical efficiency of small-scale rain-fed upland rice farmers in North-West Agricultural Zone of Adamawa State, the empirical result indicates that more than 88% of the farmers were more than 80% technically efficient. Farming experience, household size and level of education were found to reduce technical inefficiency while farmers' age increases technical efficiency. Giroh (2007), analysed the technical efficiency of rubber tapping in Rubber Research Institute of Nigeria (RRIN), Benin City and concluded that opportunity exist for non-permanent and permanent rubber farmers to increase their efficiency by 5% and 50% respectively.

Maurice *et al*. (2005) evaluated the technical inefficiency in rice based cropping patterns among dry season *fadama* farmers in Adamawa State using the stochastic frontier production approach. The empirical evidence from the inefficiency model shows that level of education and farming experience increase the technical efficiency

of the farmers. Ojo and Imoudu (2000) in their study of productivity and technical efficiency, they found out that training of farm settlers increase their technical efficiency than those not trained and concluded that productivity is positively correlated with training.

Asogwa*et al*. (2007) studied the relationship of technical efficiency and socio-economic variables of cassava farmers in Nigeria. The findings indicate that a significant relationship exist between technical efficiency and output of cassava (0.542), farm income (0.612), processing cost (-0.414), gari yield (0.608), gross margin (0.483), education (0.699), farming experience (0.278), and extension contact (0.585), of the sampled cassava farmers in Nigeria.

2.3.5 Allocative efficiency

Allocative efficiency relates to the degree to which a farmer utilizes inputs in optimal proportions, given the observed input prices (Coelli*et al*.,2002; Ogundari*et al*., 2006). According to Farrell (1957), allocative efficiency refers to the ability of a firm to produce at a given level of output using cost-minimizing inputs prices. That is, resources are used so that the value of an additional unit of output (the value of the marginal product) is equal to the cost of an additional unit of output. Thus, a profit maximizing entrepreneur will not use a resource beyond the point where the resource adds just as much to his revenue as it adds to his cost.

Russell and Young (1983) looked at Allocative Efficiency (AE) as a condition that exists when resources are allocated within the firm according to market prices. In a materialistic society according to them, this will represent a desirable characteristic when market prices are a true measure of relative scarcity. This will be the case when prices are determined in perfectly competitive markets, but when prices are distorted by monopolistic influences or where some goods remain outside the market system the role

of prices in resources allocation is greatly impaired. By comparing the value of marginal product with the price of the resource tests the efficiency of resource allocation (Gittinger, 1982). The test gives an indication of the direction and magnitude of resource adjustment needed to achieve optimum resource allocation. Ogundari and Ojo (2006) described allocative efficiency as the ability to choose optimum input levels for a given factor price i.e. when production occurs at a point where the marginal value product equals marginal factor cost.

2.3.6 Economic efficiency

Economic efficiency as defined by Bravo-Ureta*et al*.(1997) is the capacity of a firm to produce a predetermined quantity of output at a minimum cost for a given level of technology. It is an overall performance measure and is equal to the product of Technical Efficiency (TE) and Allocative Efficiency (AE) i.e EE = TE x AE. The simultaneous achievement of both efficient conditions according to Heady (1952) occurs when price relationship are employed to denote maximum profits for the firm or when the choice indicators are employed to denote the maximization of other economic objectives.

Abdourahamane *et al*. (2001) defined economic efficiency as the ability to produce a given level of output using a cost minimizing input ratios. Farrell (1957) defined economic or total efficiency as the product of technical and allocative efficiencies. An economically efficient input-output combination would be on both the frontier function and expansion path.

Economic efficiency also defined as the ratio of minimum observed total production cost (C*) to actual total production cost (C). Economic efficiency is the inverse of cost efficiency, thus EE = 1/CE. Ogundari and Ojo, (2006) studied the production efficiency of cassava farmers in Osun State using farm level data. The stochastic frontier

production and cost functions were used to predict the technical and economic efficiency respectively. They predicted that, TE and AE are basis for calculating economic efficiency. The TE, EE and AE were found to be 0.903, 0.890 and 0.807 respectively.

2.4 The Empirical Framework

2.4.1 The empirical findings related to productivity of agricultural farm

Empirical studies on the factors which contribute to low yield of potato and profitability of farmers are very few and limited in geographical coverage (Ayalew *et al*., 2014). Several studies have been carried out in the world on the determinants and profitability of agricultural production. Most of these studies concentrated on cereals and very few on tuber crops. The study of Mohammed (2011) on rain fed and irrigated rice production found that labour, farm size, family size, fertilizer use, education level, and market variables were determinants of production. Fertilizers, seeds, pest control, extension services, credit availability, reliability and market storage affect productivity of small scale (Christopher, 2013). This shows that by increasing the quantity use of each input individually or collectively the productivity of small scale can be increased.

Fantu *et al*. (2014) analyses indicate that household head age has no effect on productivity. But the study of Steve et al. (2014) revealed that age of household head influence productivity of small-scale rural female maize farmers. Older farmers tend to possess larger pieces of land, larger family labour force and more experience in growing and selling potato which enable them to grow and sell more (Sebatta *et al.*, 2012).

Odoemelam *et al*. (2014) revealed in their study evaluation of wome's access and rights to land and its implications on rural household food security in selectged rural communities in Abia State, Nigeria. The study showed that there are differences in yield between male and female farmers, not because the female farmers are less skilled than their male counterpart but because they are constrained by lack of access to agricultural inputs and resources. Emerging evidence suggests that women farmers have lower returns to inputs than men farmers, further contributing to the gap in agricultural productivity (Aguilar *et al*., 2015; Kilic *et al*., 2015; Oseni *et al*., 2015). According to Fantu *et al*. (2014) result indicate that male headed households have higher output and the households with better educated heads perform better in productivity.

Education enhances the acquisition and utilization of information on improved technology by farmers which tend to positively influence productivity (Osondu *et al*., 2014). Educational attainment had a direct relationship with cassava output (Itam *et al*., 2014). Farming experience, access to credit, farm income and pond size were significant determinants of output of fish production (Osondu and Ijioma, 2014). Okoli *et al*. (2015) examined factors influencing agricultural production among cooperative farmers. Their result indicated that several variables such as age, education, farm experience, credit, soil fertility, amount of fertilizer and amount seed affect farmers output.

Farmers who are nearer markets tend to participate more in the market because they have access to most of the market information (Sebatta *et al*., 2012). Rios *et al*. (2008) results indicated that regardless of market access factors, households with high productivity tend to participate in agricultural markets. In contrast being accessible to

better markets does not actually lead to productivity. Their finding implies that investment in markets access and infrastructure provides less advancement in agricultural productivity, whereas programmes targeted on enhancements in farm structure and capital have the potential to increase both productivity and market participation.

Tolno *et al*. (2016) studied factors affecting the quantity of potato produced. Their result showed that potato area, the use of improved seeds and production losses significantly influenced potato output. The low productivity of smallholder farming is due to use of traditional farming tools and the heavy reliance on traditional rain-fed cropping methods hamper productivity (Mpogole, 2013).

Abdullahi (2012) found that farm size use was determinants of output. Farm size, value of land and farming experience had a direct relationship with cassava output (Itam *et al*., 2014). But the study of Sheng *et al*. (2014) did not showed the impact of farm size and household size on productivity of small scale rural female maize farmers. Sabasi and Kompaniyets (2015) revealed that both farm size and public research investment affect productivity but not profitability.

Beaman *et al*. (2013) found that increase in fertilizer use had a large average impact on production. Changes in fertilizer amounts have been found to affect crop yield, which is a significant determinant of farm profit (Jannoura *et al*., 2014). However, the effect of fertilizer on crop yields has a diminishing effect with increasing use. From an economic viewpoint, in order to maximize profit, marginal revenue obtained for applying fertilizer on a crop must equal the marginal cost of applying the fertilizer (Farquharson, 2006).

But in the study of Supaporn (2015) fertilizer did not affect production rather cultivated area, hired labour and capital affect sugarcane production among smallholder farmers.

According to Azam and Khan (2010), agricultural productivity is greatly affected by a number of inputs such as land, labour, capital, seed, fertilizer, irrigation and soil. According to the authors, all the inputs are categorized into three main variables such as land, labour and capital, where land includes the rental value of land for 12 months and labour consists of the hired labour and family labour.

Institutional factors like land ownership, presence of extension service and relation with the local municipality influence vegetable production amongst small-scale farmers (Raleting and Obi, 2015). Contract farming has been very important and fruitful concept in potato cultivation both for farmers and for the industry partners (Pandit *et al*., 2015; Rais *et al*., 2013). There are ample opportunities for contract farming in potato where the output is well accepted in the market and potato could be supplied in a short period of time. Similarly, in Ethiopia, Bezabih and Hadera (2007) examined the utilization of low level agricultural technologies, risks related to natural occurrences such as storms and disease outbreak to be the major sources of the decline in productivity. Furthermore, rapid population growth, the size of land allocated to each household has reduced resulting to a decrease in production. The most important factors responsible for the low productivity of potato is Late Blight and managements of potato (Amin *et al*., 2013).

2.4.2 The empirical findings related to profitability of agricultural farm

Oyinbo *et al*. (2011) in their study of assessment of the profitability of small scale cassava production found that labour, farm size, family size, fertilizer use, education level, and market variables were determinants of profitability. The authors employed the

use of gross margin in their analysis. Mohammed (2011) found that farm size and market variables determine profitability of rain fed and irrigated rice production.

Beaman *et al*. (2013) found that increase in fertilizer use had a large average impact on production but no significant impact on profit. However, the study of Mohammed (2011) and Oyinbo *et al*. (2011) on rain fed and irrigated rice production and assessment of the profitability of small scale cassava production respectively showed that fertilizer use determines profitability. The finding of Behjat and Ostry (2013) indicated that the average farm size, farm area, soil conservation and operation expense had positive impact on Gross Margin. Irrigation, fertilizer applied, education, credit accessed and farming experience determine profitability of rice (Onoja and Herbert, 2012).

Nonfarm employment, education, extension service, age, farm experience, credit status degree of specialization and frequency of weeding determine profit inefficiency of Irish potato among smallholder farmers (Assa *et al*., 2012). By using Gross Margin as the measure of farm profitability. Zulu (2011) analyzed the profitability of cowpea farmers in Zambia and concluded that yields, land tenure and farm gate price had a positive influence on profitability whereas production costs and area had a negative influence on profitability. Seed variety affects the profitability of round potato (Mpogole and Kadigi, 2012). Selling price and amount of seed affects profitability of rice, onion and tomato. Warm season and cold season affects profitability but not productivity of onion (Elodie et al., 2015).

Gender of household head, fertilizer, manure, hired labour and tools influence profitability while age of household head, education, family size, contract farming and soil conservation did not influence profitability of diversified cash crop farming among smallholder tea farmers (Mwangi *et al*., 2015). There evidences were men spend most of their time working on cash crops while women on food crops so as to feed their

families. With the work burden being high on women than men and farming objectives varying between these two types of households, male headed households were able to produce more and also make more profits. In addition, fertilizer and manure application is especially important in their study since most crops are perennial and the farms are too small such that fallowing is not a feasible solution to soil infertility.

Rahman (2003) found that experience in modern rice farming plays an important role in raising profitability and reducing inefficiency among rice farmers reasoning as farmers with more experience in growing modern varieties earn significantly higher profit, incur less profit loss and operate at significantly higher level of profit efficiency.

The farm tools variable represents the value of all tools and implements used for the agricultural production process. The farmers with higher value of farm assets are in a better position to grow crops which may require different specialized tools and make more profits compared to farmers with very few assets (Masuku, 2011; Rahman, 2003). The principal argument for household asset holding as a determining factor in smallholder economic excellence can be viewed from the production side perspective which asserts that farm tools are essential for the production of a marketable surplus at a smallholder level.

Jirgi *et al.* (2010) investigated the profitability of millet/cowpea mixed farmers production by farm budgeting technique and exponential production function. Their results of the regression with NFI indicated that although these enterprises are profitable, farmers should use more seed, family labour, agrochemicals, less of hired labour and land in order to gain more profits.

Contrary to other findings, Bahta and Baker (2015) inferred that profit could not be determined by age and gender of head household but distance to market, education level of head household and access to credit determine profit among smallholder beef

producers. Lighton *et al*. (2014) examined the profitability of smallholder out-grower tea farming and its determinants. Their study found that smallholder out-grower tea farming is on average marginally profitable. Their findings also revealed that access to extension services, the extent of farm specialization, communal farming, farmer's level of education, amount of labour used influence out-grower tea farming profitability.

The recent studies, in Ethiopia, of Ayalew *et al*. (2014) explained that unavailability of storage facilities, low price of produce and entire dependency of farmers on pre-planting treatment affects profitability of potato. Almaz *et al*. (2014) results also indicated that family labour, quantity produced and selling price determine household's profitability of tomato for male household. Access to price information, achievement motivation, fertilizer cost, selling price and quantity produced determined household's tomato profitability in female household. Abraham et al. (2015) stated irrigation plays dominant role in increasing agricultural productivity. Their OLS revealed that land size and irrigation participation have positive effect on household income. Farmers align harvest time to meet off-season higher market demand, when farm-gate prices are much higher to get good return from their vegetable production (Bezabih *et al*., 2015).

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

This study was conducted in Plateau State, Nigeria. The State is located between Latitude 8^0 2″ and 10^0 24″ North and Longitude 8^0 32″ and 10^0 38″ East. Plateau State is primarily an agrarian community. The State has a landmass of 30, 913 square kilometres or 6,678,162 acres (National Bureau of Statistics, 2006). About two thirds of the land area is arable. The major food crops include Irish potatoes, sweet potatoes, chilli pepper tomatoes and strawberry. Others includesleafy vegetables, cereals, legumes and roots and tuber crops and tree crops. Vegetables include carrots, lettuce, radish, cucumber, sweet pepper, hot pepper, green beans, parsley and fruits include strawberries. However, cereal production on the Plateau represents about 34% of all agricultural produce; root and tubers production represent about 32% while horticultural crops stand out at about 21%. The least is forest products which represent 13% (Employment-oriented Private Sector Development Programme(E_oPSD), (2010).

The State is bordered in the Northwest by Kaduna State, in the Northeast by Bauchi and in the Southwest by Nasarawa State, while in the Southeast is Taraba State. Population density varies among the Local Government Areas (LGAs) of the State. Jos North, Jos South and Jos East have a combined population density of 391 persons per square kilometers to become the most densely populated parts of Plateau State. The rest of the

State has a fairly low population ranging between 40 and 125 persons per square kilometres (EoPSD, 2010)

The total population of the State is 3,178,712 million (NBS, 2006). Based on annual population growth rate of 3.2%, the projected population of the State is about 4,469,232million people in 2019. Within the State, there are a number of establishments ranging from companies, Research Institutes, Higher Institutions and Colleges.The strawberry predominantly cultivated in three LGAs because of the near temperate climate of these areas.

3.2 Sampling Technique and Sample Size

A multi-stage sampling procedure was used to select respondents for this study. Three LGAs namely: Barkin Ladi, Jos East and Jos South were purposively selected for field survey. These LGAs were chosen due to climatic and ecological features that are suitable for the production of strawberry in Plateau State. The list of villages involved in strawberry production were listed in the Table 3.1. The second stage involved a random selection of 20% of the villages from each of the selected LGA and the selection of these villages were proportionate to the size. The villages selected are: Ropp, Kasa, Sho and Gashisha from Barkin Ladi (LGA); Lamingo, Kyerkyer and Rizek from Jos East (LGA); and Chigwi, Vwang, Chaha, Chwel, Sot, Kugwon and Kuru from Jos South (LGA). The last stage involves using a Taro and Yammane (1967) formula (adopted by Abdulrahman *et al.,* 2016; Oladimeji *et al.,* 2017) for calculating sample size based on the assumption of 5% expected margins of error, 95% confidence interval and applying the finite population correction factor. The formula is expressed as follows:

$$n_0 = \frac{N}{1+N(e^2)}$$

Where: n_0 is the sample size without considering the finite population correction factor; e = 0.05; N = total number of observation. Therefore, a total of two hundred and ninety-eight (298) strawberry farmers for both male and female farmers were randomly selected using the card method.

Table 3.1: Population and sample size of strawberry farmers in Plateau State

Selected LGAs	Villages	No of male farmers	Sample size for male farmers (24%)	No of female farmers	Sample size for female farmers (24%)	Pooled sample size
Barkin Ladi	Ropp	23	6	45	11	17
	Kasa	18	4	61	15	19
	Sho	43	10	23	6	16
	Gashisha	18	4	64	15	19
Jos East	Lamingo	49	12	87	21	33
	Kyerkyer	35	8	44	11	19
	Rizek	17	4	34	8	12
Jos South	Chigwi	29	7	63	15	22
	Vwang	51	12	85	20	32
	Chaha	30	7	59	14	21
	Chwel	35	8	39	9	17
	Sot	46	11	25	6	17
	Kugwon	54	13	85	20	33
	Kuru	34	8	46	11	19
Total	**14**	**482**	**116**	**760**	**182**	**298**

Reconnaissance survey, 2018

3.3 Method of Data Collection

Primary data was used in this study. The primary data was obtained by the use of structured questionnaire. This was administered to the strawberry farmers randomly selected to generate information on socio-economic and demographic characteristics of

households such as age, marital status, household size, educational status, strawberry experience, cooperative membership. Production information; level of inputs used and output in strawberry production. (c) Constraints faced by the farmers in strawberry production.

3.4 Analytical Techniques

The following tools of analyses was employed to achieve the objectives of this study:

3.4.1. Descriptive Statistics

Descriptive statistics such as percentages, frequency distribution, standard deviation, coefficient of variation and mean was used to analyze the data to achieve objectives (i), (ii) and (v) of the study.

3.4.2 Likert-type scale

To assess the levels of gender accessibility and resources utilization in strawberry production, Likert-type scale was used to achieve objective (ii). This measures the degree or intensity of agreement by the respondents to a statement. The respondents were asked to indicate the extent of their agreement on statements using a 5-point Likert scale of Strongly Agree (SA), Agree (AG), Undecided (U), Disagree (DA) and Strongly Disagree (SD). Weight of 5, 4, 3, 2 and 1 was assigned. For each indicator a weighted mean was obtained as follows:

$$WM = \frac{[(fSA * 5) + (fAG * 4) + (fU * 3) + (fDA * 2) + (fSD * 1)]}{N}$$

Where;

*W*M= Weighted mean

f = Frequency

Values 5, 4, 3, 2, 1 = Attached weights

*S*A, AG, *U*, *D*A &*S*D = Perceptions of strongly agree, agree, undecided/ neutral, disagree and strongly disagree

N = Sample size

Adopting Bagheri (2010) perception analysis, the mean(s) for all indicators were then categorized as follows;

The mean(s) 1.00-1.49 = Strongly Disagree (SD),

1.50-2.49 = Disagree (DA),

2.50-3.49 = Undecided/Neutral (U/N),

3.50-4.49 = Agree (AG) and

4.50-5.00 = Strongly Agree (SA).

3.4.3 Costs and Benefits Analysis

The Costs and benefit ratio was employed to achieve objective (iii). It was used to estimate the costs and returns of strawberry production. The formula for the costs and benefit ratio model is stated as follows.

BCR = VNR/TC …….. 1

Where,

BCR = Cost and benefit ratio

VNR = Variety Net Revenue (₦)

TC = Total cost (₦)

NFI= TR-TC **……..** 1

Where,

NFI= net farm income (₦);

TR= total revenue (₦);

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

TC= TVC+TFC **…… 2**

Where,

TVC= total variable cost (₦) and

TFC= total fixed cost (₦).

Total Cost (TC) = Total Variable Cost (TVC) + Total Fixed Cost (TFC)

TVC = (seed, fertilizer, agrochemical and labour)

TFC = (cost of renting land and depreciation of tools (hoe, cutlass and knap sac))

The fixed inputs are not normally used up at short run in a production cycle. They were depreciated using the straight line method given by:

$$\boldsymbol{D = \frac{(P - S)}{N}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (\mathbf{3})$$

Where:

D = depreciation (₦),

P = Purchase value (₦),

S = salvage value (₦) and

N = life span of asset (years).

Returns per naira invested (RNI) was obtained by dividing the gross income (GI) by the total cost (TC).

Therefore,

$$\boldsymbol{RNI = \frac{(GI)}{TC}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (\mathbf{4})$$

Where,

RNI = returns per Naira invested

GI = gross income and

TC = total cost.

Decision Rule:

RNI > 1, it implies the enterprise is profitable;

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

RNI< 1, the farmer is at loss

Straight line depreciation was used because is a common method of depreciation where the value of a fixed asset is reduced gradually over its useful life. The default method used to gradually reduce the carrying amount of a fixed asset over it's useful life is called straight line depreciation. Each full accounting year will be allocated the same amount of the percentage of asset's cost when you are using the straight –line method of depreciation. This method was created to reflect the consumption pattern of the underlying asset. It is used when there is no pattern to the manner in which the asset is being used over time.

Since strawberry production does not follow any specific pattern of production and it produces an output of over 3-4 times annually, straight line method of depreciation is more appropriate than the discounting budget method. It is also the easiest depreciation method to calculate and results to the fewest calculation error's using straight line depreciation to calculate asset depreciation is highly recommended

3.4.4 Stochastic frontier production analysis.

The Cobb-Douglas stochastic frontier production function was used to achieve objective iv. It was specified explicitly as:

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + (Vi-Ui) \quad \ldots\ldots\ldots\ldots\ldots\ldots 5$$

Where,

ln = the natural logarithm,

Y = output of strawberry (kg),

β_0 = constant term,

β_1- β_4 = regression coefficients,

X_1 = quantity of seed (kg),

X_2 =quantity of fertilizer (kg),

X_3 = total labour used (man days),

X_4 = quantity of agrochemical (litres),

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

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

$-U_i = \delta_0 + \delta_1 1nZ_1 + \delta_2 lnZ_2 + \delta_3 lnZ_3 + \delta_4 lnZ_4 + \delta_5 lnZ_5 + \delta_6 lnZ_6$ 6

Where:

$-U_i$ = inefficiency effects,

Z_1 = age of farmer (years),

Z_2 = household size (number),

Z_3 = formal education (years),

Z_4 = amount of credit (₦),

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

Z_6 = membership of cooperative society (years),

Z_7 = farming experience (years),

δ_0 = constant and

δ_1-δ_6 = Parameters to be estimated.

Stochastic Frontier Cost Function (Allocative Efficiency) Model is specified as:

$lnC = \beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 + \beta_5 lnX_5 (Vi + Ui)$ 7

Where,

ln = the natural logarithm,

C = Total cost of output (₦),

X_1 = cost of seed (₦),

X_2 = cost of fertilizer (₦),

X_3 = cost of labour (₦),

X_4 = cost of Output (₦),

X_5 = cost of agrochemical (₦),

β_0 = constant term,

β_1- β_5= regression coefficients

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

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

Economic Efficiency Model used in the study is specified as:

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

EE = TE * AE **…….. 8**

Where;

EE= Economic Efficiency,

TE= Technical Efficiency and

AE= Allocative Efficiency

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of Strawberry Farmers in the Study Area

This chapter contains the presentation and discussion of the findings of the study. The findings consist of result of the analyses of both the descriptive and inferential statistics.The study results are presented,and the findings discussed. Findingsare on the socioeconomic characteristics of the respondents, levels of gender accessibility and resources utilization in strawberry production, gender differential on profitability of strawberry farmers, gender differential in production efficiency of strawberry farmers and the constraints confronting strawberry farmers in the study area.

4.1.1 Age distribution of strawberry farmers

The results presented in Table 4.1 show the age distribution of female and male strawberry farmers in the study area. The results showed that about 50% and 67% of female and male strawberry famers respectively were within 15-34 years. The average age was 37 and 34 years for female and male farmers respectively. These results imply that strawberry farmers in the study area were young farmers still in their active productive age group in strawberry production. Age is very important in agricultural production activities because age has a significant influence on the decision making process of farmers with respect to adoption of improved farming technologies and other production-related decisions. Asongwa, Ihemeje and Ezihe (2011) argued that age of farmers has a positive effect on technical inefficiency effects. This is because old people

are considered to be less energetic and less receptive to agricultural innovations and hence develops inefficient production routines and practices.

The coefficients of variation for female (30.1%) and male (31.8%) shows some level of consistency in term of their ages. This low coefficient of variation of age for both groups implies low level of variation in age among the farmers in the study area. This implies that strawberry production in the study area is embraced predominantly by the middle-aged farmers. According to Abdulrahman*et al.* (2015), the low coefficient of variation within the permissible upper fiducial limit (33%) of coefficient of variation reflects reliability (precision) of the result.

Table 4.1: Distribution of the respondents based on their age

Age (years)	**Female**		**Male**		**Pooled**	**Pooled**
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
15-24	30	16.5	22	19.0	52	17.44
25-34	61	33.5	56	48.3	117	39.26
35-44	32	17.6	15	12.9	47	15.77
45-54	42	23.1	17	14.7	59	19.79
>54	17	9.3	6	5.1	23	7.71
Total	182	100.0	116	100.0	298	100
Min	18		18		18	
Max	60		60		60	
Mean	37.0		33.7		35	
Std. Dev	11.1		10.7		10.8	
CV	30.1		31.8		30.2	

4.1.2 Marital status of the farmers

The result in figure 1, revealed that 75.8% of female farmers and 85.3% of male strawberry farmers were married. The significance of marital status on agricultural

production is associated with the supply of agricultural family labour. Based on these findings it is expected that family labour would be more available for strawberry production in the study area since majority of female and male strawberry farmers were married*ceteris paribus*. This also implies that labour maybe readily available for strawberry production and hectare maybe increased for marketable output.

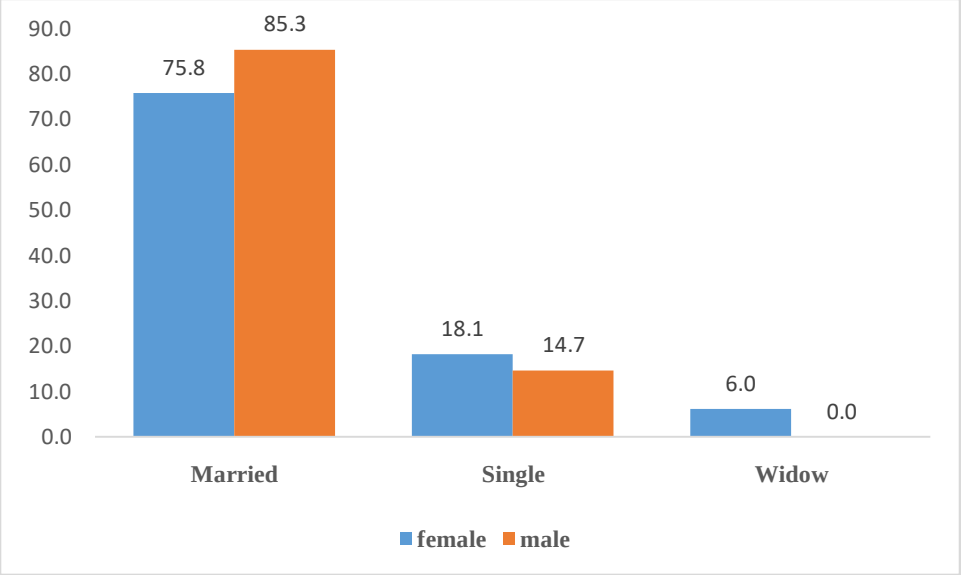

Figure 1: Distribution of the respondents based on marital status

4.1.3 Household size of the farmers

The results in Table 4.2 show that majority (63.7%) of female and (57.8%) of male strawberry farmers had household size between 1-3 members. The average household size for the two groups was 4 members per household. These results imply that household sizes among strawberry farmers is subsistence in nature, this is in line with what is obtained under subsistence agriculture. Size of the household may enhance labour availability that can be used for different agricultural activities (Oyewole, 2012). The significance of household size in agriculture hinges on the fact that the availability of labour for farm production, the total area cultivated to different crop enterprises, the amount of farm produce retained for domestic consumption, and the marketable surplus

are all determined by the size of the farm household (Abdulazeez *et al*. 2018). The coefficients of variation for female (30.1%) and male (31.8%) shows some level of consistency in term of their household size. This low coefficient of variation of household size for both groups implies low level of variation in household size among the farmers in the study area. According to Abdulrahman (2015), the low coefficient of variation within the permissible upper fiducial limit (33%) of coefficient of variation reflects reliability (precision) of the result and it implies high level of consistency in their housesize.

Table 4.2: Distribution of the respondents based on household size

Household size	**Female**		**Male**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
1-3	116	63.7	67	57.8
4-6	35	19.3	37	31.9
7-9	19	10.4	12	10.3
10-12	10	5.5	2	1.7
>12	2	1.1	0	0
Total	182	100.0	116	100.0
Min	1		1	
Max	12		14	
Mean	4		5	
Std. Dev	0.111		0.107	
CV	30.1		31.8	

4.1.4 Farming experience among strawberry farmers

Farmers' distribution by their farming experience as presented in Table 4.3.The Tableshows that 43% of female strawberry respondents had at least 10 years of experience. In contrast, only 42% of the male respondents. The average farming experience for female and male farmers were 10 and 15 years respectively.These results

implied that sizeable farmers in the study area have sufficient experience in strawberry production. Farming experience of farmer determines his ability to make effective farm management decisions, not only adhering to agronomic practices but also with respect to input combination or resource allocation. Farming experience is expected to influence farm production efficiencies because of accumulation of skills. This finding is in line with Umaru, (2015) who revealed that years of farming experience increased agricultural productivity among farming households in Nigeria.

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

Experience (years)	**Female**		**Male**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
1-5	88	48.4	49	42.2
6-10	15	8.2	31	26.7
11-28	79	43.4	36	31.1
Total	182	100.0	116	100.0
Min	1		1	
Max	28		38	
Mean	9.5		15.1	
Std. Dev	7.6		10.6	
CV	80		70.2	

4.1.5 Educational level of the respondents

Figure 2 shows the distribution of the farmers by their educational level. The result revealed that 83.2% of female farmers and 87% of male farmers are litrate. These results showed that strawberry farmers in the study area had one form of formal education or the other. These results implied that level of awareness and adoption of agricultural innovations among strawberry farmers could be high. Literate farmers are

expected to be more innovative because of their ability to get information more quickly and their ability to take more risk. Oluwatayo, Sekumade and Adesoji (2008) observed that the more educated a farmer is, the more the chances that the farmer will adopt innovations than the uneducated ones. Mohammed, Omotosho and Falola (2009) noted that level of education is expected to influence farmers' adoption of agricultural innovations and decision on various aspects of farming. They also maintained that education is highly important for sustainable agricultural growth and development. The result implied that extension packages on new technological innovations can impact positively on strawberry farmers if proper awareness is given to them.

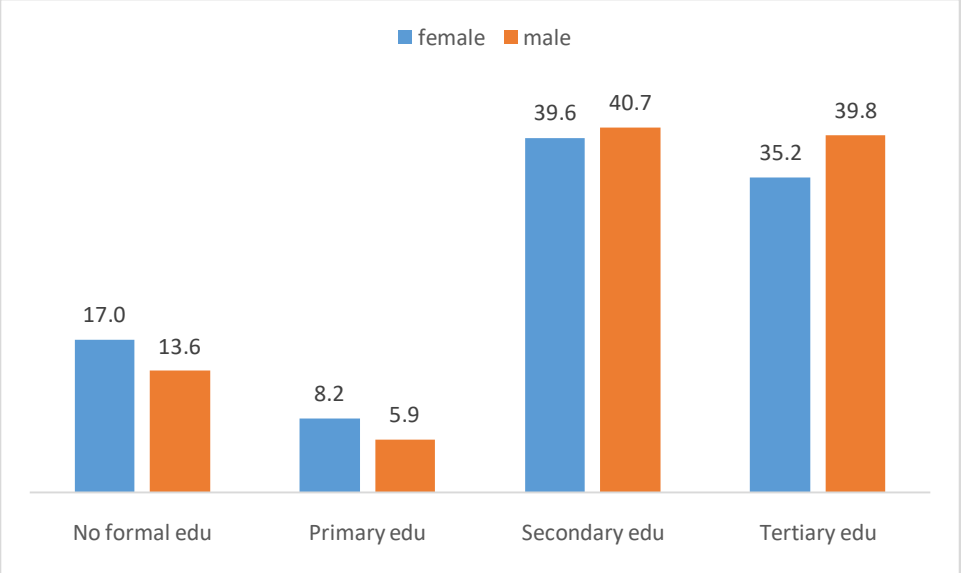

Figure 2: Distribution of the respondents based on their level of education

4.2 Level of Gender Accessibility to Resources for Strawberry Production

This section analyzes level of gender accessibility to resources for strawberry production and this was achieved through the use of descriptive statistics. The mean obtained were summarize and analyzed, farmer's perception on accessibility to productive resources such as: land, labour, credit, fertilizer, seeds and agro-chemicals

for their farming activities. The results presented in Table 4.4 showed that there were disparities in the level of accessibility to resources between male and female who engaged in strawberry production in the study area.

Table 4.4: Level of gender accessibility to productive resources

	Male					Female				
Perception constraint	**N**	**W S**	**MS**	**SD**	**CV**	**N**	**WS**	**MS**	**SD**	**CV**
Male and female have equal access to land	85	343	4.04	1.25	30.9	122	167	1.37	0.43	31.4
Land ownership increase your social status	90	376	4.18	0.77	18.5	133	561	4.22	0.88	20.9
Male and female have equal access to fertilizer	92	349	3.79	0.87	23.0	136	496	3.65	0.96	26.4
Male and female have equal access to seed	92	357	3.88	0.85	21.9	136	532	3.91	0.92	23.6
Male and female have equal access to agro chemical	89	337	3.79	0.86	22.7	133	499	3.75	0.92	24.6
Male and female have equal access to labour	86	302	3.51	1.11	31.6	126	237	1.88	0.26	13.8
Male and female have equal access to credit	83	159	1.91	0.26	13.6	124	232	1.87	0.59	31.6

N= Number of responses, WS= Weighted score, MS= Mean score, SD= Standard deviation and CV = Coefficient of variation

The average score of ($\bar{x}$ =4.04) obtained for perceived statement that male and female have equal access to land, while female farmers strongly disagreed ($\bar{x}$ =1.37) to the statement. Majority of the female agreed that female do not have access to land as male due to financial and mode of land acquisition. Female rarely own land in Nigeria, despite their heavy involvement in agriculture. Ogunlela *et al.* (2009) and Yusuf (2015) reported that lack of access to land remains a major constraint for female farmers in Africa and land reform programmes have led almost exclusively to the transfer of land rights to men heads of households. Even in countries where ownership and inheritance laws have been reformed in favour of female, in practice female do not necessarily have equal access to land as local customs act as barrier. Since majority of female disagree with this statement and the score of 1.37 implied that female farmers do not have equal access to land compare to men farmers who engaged in strawberry production. According to Kajoba (2002) in countries where ownership and inheritance laws have been reformed in favour of female, in practice female do not necessarily have more rights to land, as local customs act as barriers. Land is a basic source of livelihood; providing employment, the key factor in agricultural activities, and a major determinant of a farmer's access to other productive resources and services. Famer's right to land is a critical factor in social status, economic well-being and empowerment. Limited access to land by female could be attributed to land tenure system which is strictly by inheritance. This finding is in line with Phillip *et al.* (2009) who revealed that despite the significant role female played in agricultural production, female in Nigeria have relatively limited access to agriculture land and lower levels of inputs and use of extension services compared with men. In Nigeria, men are five times more likely than female to own land and this varies across regions, with lower ownership by female and

higher gender gaps in land ownership in the North compared to the South (British Council Nigeria, 2012).

The perceived statement that land ownership increases your social status had a score of $\bar{x}$ =4.18 and $\bar{x}$ =4.22 for both male and female respectively. This implies that both male and female strawberry farmers agree that land ownership increases their status. This result showed that property rights to land affect economic condition of the household which translate to poverty reduction. According to World Bank (2003) secured land property rights will increase the incentives of households and individuals to invest, and it will also provide farmers with better credit access.

In terms of access to fertilizer, seed and agrochemical was agreed by both male and female strawberry farmers having equal access to these productive resources. The perception obtained from the male farmers was similar to that of the female farmers. The men farmers agreed that there are no disparities in terms of accessibility to these productive resources (seed, fertilizer and agro-chemicals) used for strawberry production between male and female farmers who engaged in strawberry production. The mean scores obtained from both farmers is an indication that farmers had access to these inputs for strawberry production.

Labour is very important in small scale agricultural production; this is because farm operations are mostly labour intensive. The responses obtained from the female farmers showed they disagreed to the statement; male and female had equal access to labour ($\bar{x}$ =1.88). The female farmers mentioned labour to be expensive to hire and lack of funds to hire adequate labour. Among the male farmers, the mean score of ($\bar{x}$ =3.51) signifies agreement to the statement; of male and female having equal access to labour. In

traditional settings men is the head of households and this would enhance their easy access to family labour which made the male farmers to agree to the statement men and female had access to labour.

In terms of accessibility to credit resources used in strawberry production, both the male and female farmers disagree with this statement. The mean score of $\bar{x}$ =1.91 and $\bar{x}$ =1.87 obtained from the scale indicate that both male and female farmers do not agree to having access to credit. This suggests that the farmerscredit and availability of credit is an important factor in production. Yusuf (2015) asserts that credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity. Therefore, lack of credit will have a negative effect on productivity.

The coefficient of variations of all the statement for both men and female were adjudged to be consistent with one another having low coefficient of variation that is within the 33 percent permissible upper fiducial limit of coefficient of variation. According to Johnson and Welch, (1939) adopted by Abdulazeez *et al*. (2018).The low coefficient of variation is a reflection of reliability (precision) of the result. Johnson and Welch (1939) reported that for a normal distribution, the ratio of mean to standard deviation should be of order of three or more.

4.3 Gender Differential on Profitability of Strawberry Farmers

4.3.1 Cost of strawberry production

The net farm income model was used to determine the profitability of the strawberry production. Table 4.5 gives the summary of inputs and revenue generated from the enterprise. Strawberry seed was planted once throughout the lifecycle. The quantity of

strawberry seed used by male farmers was 0.4 kg/ha with an average market price of ₦ 1000 per kg and this constitutes 1.14% of the total cost of production. While female farmers 0.5 kg/ha with an average market price of ₦ 1000 per kg was used and this constitutes 2.24% of the total cost of production.

Table 4.5: Gender differential on Profitability of Strawberry Farmers

	2016				2017				2018			
Variable	**Male**	**%**	**Female**	**%**	**Male**	**%**	**Female**	**%**	**Male**	**%**	**Female**	
Seed	411.4	0.91	500	1.36	-	-	-	-	-	-	-	-
Labour	10,395.7	22.94	7,380	20.05	6750	42.7	6800	42.3	3500	40.9	3500	38.6
Fertilizer	20,760	45.80	15,750	42.81	5500	34.8	5500	34.2	1500	17.5	1800	19.9
Agrochemical	2,811.1	6.20	2,300	6.25	2600	16.5	2900	18.1	2600	30.3	2900	32.0
Farm size	10,000	22.06	10,000	27.18	-	-	-	-	-	-	-	-
Total variable cost	44,378.2		21,430	97.65	14850	94.0	15200	94.6	7600	88.8	8200	90.5
Fixed cost (Depreciation on Hoe, Cutlasses, knap sac sprayer)	954	2.10	864	2.35	954	6.0	864	5.4	954	11.2	864	9.5
Total cost (TC)	**45,332.2**	**100**	**36,794**	**100**	**15,804**	**100**	**16,064**		**8,554**		**9,064**	**100**
Revenue	**95,152.72**		**106,320**		**117, 600**		**112, 790**		**128,600**		**122,900**	
Net farm income	**49, 787.8**		**69,526**		**101,796**		**96726**		**120,046**		**113,836**	
BCR = VNR / TC	**2.1**		**2.9**		**7.4**		**7.0**		**15.0**		**13.6**	
t Stat		**1.64**				**1.57**				**2.01***		

Note: BCR = Benefit cost ratio, VNR = Variable net return, TC = Total cost, ***** = significant at 5%

NB: the figures were not discounted because the crop is a biannual crop not a perennial crop

Labour costs consisted of cost of land preparation, planting, fertilizer application, weeding, replacement of seedlings and harvesting. The family labour was computed on the basis of opportunity cost in man-days. The wage rate varied according to farm operation performed. An average wage rate of ₦450 per man-day was used, giving the average labour cost per hectare to be ₦10,395.7 for male and ₦7,380 for female and these constitutes 22.9% 12.9% and of the total cost of production for male and female respectively for the first year of production. In the second and third years, the average labour cost per hectare to be ₦6750 for men and ₦6,800 for female and 3500 at the third year for both parties. Furthermore, the labour cost at second and third year constitutes more than one-third of the total cost of production for male and female respectively

The quantity of fertilizer used was 207.1 and 150 kg/ha for male and female with an average market price of ₦105 per kg and this constitutes 45.80% and 70.7% of the total cost of production for male and female respectively. At second year of production only 50 kg of fertilizer was used by both farmers with an average cost of ₦5500 while ₦1500 and ₦1800 was spent by male and female strawberry farmers on fertilizer.

The farmers make use of one litre of agrochemical each on average of half a hectare in the first year and one litre for second and third year. while the total cost of fixed inputs (depreciation of tools such as hoe, cutlasses and knap sac) incurred on strawberry production was ₦954 and ₦864 for male and female throughout the production cycle these constitute 2.1% and 3.88%, 6% and 5.4%, 11.2% and 9.5% for both male and female at first, second and third year respectively of the total fixed cost.

4.3.2 Returns in strawberry production

Results presented in Table 4.5 indicated the total revenue realized by male respondents were ₦95,152.72/ha and ₦106,320/ha**,** ₦117,600 across 2016, 2017 and 2018 cropping season while the total cost was ₦45,332.2/ha and ₦36,794, ₦15,804 for the 1st, 2nd and 3rd years respectively. The net farm income was therefore ₦49, 787.8 and ₦119,526, ₦101,796.Thebenefit-cost ratio was 2.1 and 2.9, 7.4 for the 1st, 2ndand 3rd years respectively indicating that for every ₦1 invested in strawberry production, a profit of ₦1.10, ₦1.90 and ₦6.4 kobo was made. Thus, it could be concluded that strawberry production in the study area though on a small scale, was economically viable for male farmers.

Similarly, the total revenue realized by female respondents were ₦112,790, ₦128,600 and ₦122,900 across 2016, 2017 and 2018 cropping season while the total cost for female₦16,064, ₦8,554 and ₦9,064 for the 1st, 2nd and 3rd years respectively.

The net farm income was therefore ₦96, 726, ₦120,046 and ₦120,046.The benefit-cost ratio was 7.0, 15.0 and 13.6 for the 1st, 2ndand 3rd years respectively indicating that for every ₦1 invested in strawberry production, a profit of ₦6, ₦14 and ₦12.60 kobo was made. Thus, it could be concluded that strawberry production in the study area though on a small scale, was economically viable for female farmers. Thus, it could be concluded that strawberry production in the study area though on a small scale, was economically viable for both group. The difference in the strawberry production between male and female is probably attributable to exogenous factor, cultural factors and management practices.

4.3.3 Summary statistics in strawberry production

Table 4.5.1 gives the statistics of materials used and revenue generated from the enterprise. The recommend strawberry varieties are mostly improved opened pollinated (OPV) varieties but most of the seed available are wild. The expected outputs from OPV is 1.4-2 tons/ha while wild is 500 kg - 1 tons/ha (Food and Agriculture Organization (FAO) of the United Nations, 2011 and Wu *et al*., 2012). The female farmers had an average output of 0.503 tons/ha and as compared to the 0.451 tons/ha for the male farmers. The seed rate recommended for strawberry is 2Kg/ha or 68452 seedling/ha. The female farmers on the average use 0.5 Kg/ha while the male farmers used 0.4kg/ha (University of California and the United States Department of Agriculture cooperating (1999)). Strawberry has a high demand for Nitrogen. Strawberry should be fertilized adequately especially hybrids to reach its fullest expression. The fertilizer recommendation for strawberry is 10bags (500Kg/ha) when using NPK 15:15:15 and 8 bags (400Kg) when using NPK 20:10:10 for 1st and 2nd year application (EoPSD, 2010). Both categories of farmers on the average do not use the recommended fertilizer dosage. The use of herbicides for weed control requires about 3-4 litres/ha which both categories of farmers do not adhere to.

Table 4.5.1: Summary statistics for strawberry production per hectare

	Female				Male			
Variable	**Mean**	**Min**	**Max**	**SD**	**Mean**	**Min**	**Max**	**SD**
Seed	0.5	0.01	0.9	1.995	0.4	0.1	2	2.348
Labour	16.4	4	21.0	6.692	23.1	8.00	36.0	7,991
Fertilizer	207.1	50	280.0	309.78	150	112	500	480.45
Agrochemical	1.5	0.2	2.0	5.597	1.5	0.5	2.5	10.761
Output	504	200	1200.0	858.229	451.00	120	497	969.54

4.4 Gender Differential in Production Efficiency of Strawberry farmers

The result of Maximum Likelihood Estimates (MLE) for the production frontier is presented in Table 4.6. The estimated parameters of sigma-squared were 0.425 and 0.359 for female and male production systems respectively. These values were significantly different from zero at 1% and 5% level of probability, indicating a good fit and the correctness of the specified distributional assumption of the composite error term. The generalized likelihood ratio statistics were -156.41 and -117.13 for female and man respectively. This ratio exceeds the critical chi-square values at 1% level of significance. The log likelihood ratio value represents the value that maximizes the joint densities in the estimated model. Thus, the functional form that is, Cobb-Douglas used in this estimation is an adequate representation of the data. The values of the gamma statistics 0.460 and 0.598 for female and male respectively are attributable to farmers' inefficiency factors. The result revealed that technical inefficiency effects were present in strawberry production in the study area.

Table 4.6: MLE Results of Stochastic Frontier Production Function

Variable	Female			Male		
	Coeff.	Std. error	t-value	Coeff.	Std. error	t-value
Production efficiency						
Constant	4.845***	0.947	5.113	2.424***	0.719	3.371
Farm size	0.740***	0.260	2.846	0.005***	0.001	6.444
Labour	0.389***	0.108	3.608	0.083***	0.014	5.739
Seed	0.568**	0.242	2.346	0.118 NS	0.196	0.602
Fertilizer	0.517***	0.201	-2.579	0.204	0.139	1.459
Agro chemicals	0.376**	0.186	2.021	0.502*	0.268	1.875
Inefficiency						
Constant	2.257NS	2.111	1.069	1.922 NS	2.030	0.946
Age	0.098 NS	0.060	1.630	0.269**	0.112	2.409
Education	-0.152**	0.073	-2.088	-0.376*	0.201	-1.872
Experience	-0.216*	0.113	-1.910	2.352 NS	1.507	1.561
Household size	-0.062 NS	0.103	-0.602	-1.018**	0.475	-2.142
Extension contact	0.671 NS	0.509	1.319	1.195 NS	1.127	1.061
Cooperative	-0.638 NS	0.401	-1.594	-0.261 NS	0.183	-1.429
Credit	-0.193 NS	0.202	-0.955	0.214 NS	0.208	1.029
Diagnostic statistics						
Sigma squared (σ2)	0.425***	0.131	3.237	0.359*	0.183	1.967
Gamma (γ)	0.460***	0.211	2.185	0.598**	0.258	2.317
LR test	54.645			77.551 NS		
log likelihood function	-156.41			-117.13		
Mean efficiency	0.68			0.51		

*** P< 0.01, ** P<0.05, * P<0.1 and NS = not significant

The estimated coefficient for farm size for female (0.740) and male (0.005) were positive and statistically significant at 1% level of probability. This implies that as more land is being put to strawberry production the output level will increase. Strawberry production in the area is subsistent and traditional in nature, therefore access to land would determine the level of strawberry output. The results also implied that a unit increase in land size would increase strawberry output by 74% for female and 0.5% for male. This further implied that there is the possibility of increasing strawberry yield when more land is put into its production. The result further implies than male

strawberry farmers have more access to land by 74% while female farmers has 0.5% chances of increasing their farm.

The estimated coefficient of labour for female (0.389) and male (0.083) was positive and significant at 1% level of probability. These show that labour exerts positive and significant influence on strawberry output. The implication of this is that strawberry output would increase if strawberry farmers in the study area increase the use of labour. The results also implied that a unit increase in the amount of labour would increase female and male strawberry output by 0.38and 0.083 units respectively. The result further implies than male strawberry farmers have more access to labour by 38% while female farmers have 8.3% chances of accessing labour.

The estimated coefficient for seed was 0.568 for female is positive and statistically significant at 5% level. The estimated 0.568 elasticity of seed implies that increasing seed by one unit will increase strawberry output of the female farmers by less than 1% which means, all things being equal the output is inelastic to changes in the quantity of seed used. The significance of seed quantity is however, due to the fact that seed determines to a large extent the output obtained. If correct seed rates and quality seeds are not used, output will be low even if other inputs are in abundance. This is in line with the findings of Shehu *et al* (2010) who observed that the estimated coefficient of seed and labour inputs were positive as expected and significant at 1% level which implies that the more seed is applied and the more labour employed the better the output of strawberry. While the estimated coefficient 0.118 of seed for male was positive and not significant. The result further implies than female strawberry farmers utilize their seeds by 56.8% than their male counterpart which is 11.8%.

The coefficients of fertilizer (-0.517) was negatively related to the output of the female farmers and statistically significant at 1% probability level. This implies that a unit increase in the quantity of fertilizer will decrease the output of the farmers by 0.52 units and this could be attributed to over utilization of these resources. While the estimated coefficient of fertilizer 0.204 for male was positive and not significant.Fertilizer is a major land augmenting input because it improves the quality of land by raising yields per hectare. This study is in agreement with the finding of Sani and Oladimeji (2017) who observed that the estimated coefficient of fertilizer was positive as expected and significant at 1% level which implies that the more fertilizer is applied the better the output of strawberry.In spite, of the over utilization of fertilizer resources by both farmers. Female farmers utilize their fertilizer more than their male counterpart.

The results further showed that agrochemical was positively related to strawberry yield under female at 5% level of significant, while under male it was negative at 1% level. The reason for the ineffectiveness of agro-chemical on male strawberry could be non-adherence to specification on mixing formula and wrong time of application. The chemical could be washed away by rain immediately after its application, making it ineffective. The implication of this is high incidence of pest and disease infestation which invariably leads to low yield in strawberry production by the male farmers.

The results in Table 4.6 also show the determinants of technical inefficiency in female and male strawberry production in Plateau State. It was revealed that the ages of the male farmers were positive and significant at 5% level of probability and not significant for female farmers. These imply that as the age of the farmer increases technical inefficiency also increases. This may be due to the fact that the older the farmer, the less

the willingness to take risk and adopt innovation that may increase strawberry output. Also older farmers are less receptive to innovation unlike younger farmers.

Years of education showed a negative relation with technical inefficiency and significant at 5% level for female and 10% for male strawberry farmers. The negative coefficient of education reveals that a high level of education results in a reduction in technical inefficiency of strawberry farmers. Furthermore, such farmers respond fast to new technologies and adopt the use of correct management practices like timely sowing and weeding, the recommended amount, time and method of fertilizer application, recommended seed rate and other improved farm management practices. Abdulrahman *et al.* (2018) opined that education sharpens managerial input and leads to a better assessment of the importance and complexities of good decisions in farming. It also implied that education widens the scope of a farmer's horizon towards adoption of new technological innovation, thereby moving him away from traditional practices to adopt technological concepts.

Experience in strawberry production was negative and significant at 5%forfemale farmers. This shows that increase in experience of female strawberry producers would reduce technical inefficiency. Farmers' experience could be associated with skill accumulation which could enhance productivity and resource allocations thereby reduce technical inefficiency. It is also positive and not significant for male strawberry farmers, this implies that experience has no significant effect on technical inefficiency, that is increase in experience would not reduce their technical inefficiency. Farming experience for both categories of farmers was positive and was not significant. This result is at variance with the *a priori* expectation and several findings (Abdulai and

Huffman, 2010) who all argued that farmers with many years of experience were more technically efficient than those with few years and that increase in farming experience provides better knowledge about the production environment in which decisions are made.

Household size showed a negative relation with predicted technical inefficiency and is significant at 5% level for male strawberry farmers and not significant for female. A large household size may lead to a decrease in technical efficiency because families with more dependents are likely to be more financially constrained and hence unable to spare resources for the purchase of fertilizer and certified hybrid seed for strawberry production*ceteris paribus*. The implication of this is that male strawberry farmers whose household size is more than female strawberry farmers are technically efficient. This may be due to farmer's access to family labour because as the number of people in a household increases, a pool of family labour becomes available and this could lead to specialization.

4.4.1 Elasticities of production of variable inputs in strawberry production

The results in Table 4.7 show the elasticities of production and returns to scale in strawberry production in the study area. The estimated input elasticities of production for male on farm size, labour, fertilizer and agro-chemicals are less than 1, indicating that strawberry output increased less than proportionately with any increase in farm size, labour, fertilizer, seed and agro-chemicals for female strawberry producer. The elasticity of production for agro-chemical was negative for male (less than zero) indicating that output decreases as farmer uses more of agro-chemical for male. The estimated elasticities of production for farm size, labour were also less than a unit for

male while agro-chemicals for male was negative indicating that output would decrease with increase in the use of agro- chemicals for male. This implied that both groups of strawberry production are in stage one, hence the need for continuous use of additional variable inputs. This is important because in addition to knowing the number of efficient enterprise, degree inefficiency and optimal scale of operation, it is also vital to know how many farms are operating under increasing returns to scale (IRS), decreasing returns to scale (DRS) or operating at optimal scale

Table 4.7: Elasticity of Production and Return to Scale in Strawberry Production for Female and Male enterprise

Elasticity of Production	**Female**	**Male**
Farm size	0.740	0.005
Labour	0.389	0.083
Seed	0.568	0.118
Fertilizer	-0.517	0.204
Agrochemicals	0.376	0.502
Return to scale (RTS)	**1.556**	**0.912**

The sum of the elasticities of production of the five variable inputs was 1.556 for female indicating increasing returns to scale. This means that with a percentage increase, all the inputs that showed positive relationship results in a greater percentage increase in output. About 56% of strawberry female farms were found operating with increasing return to scale (IRS) or sub-optimal scale. This implies that production scale of these farms could be increased by decreasing costs, given that they were performing below optimum. Also, the sum of the elasticities of production obtained for male was 0.912 indicating decreasing returns to scale. This revealed that about 91% male's farms were operating with decreasing return to scale (DRS) or supra-optimal scale, that is the farms

were operating above the optimum scale, suggesting that these farms could increase their technical efficiency by reducing their production levels.

Critical issues and limitations of strawberry production

Strawberry life circle is averagely between the lifespan of 3 to 5 years. However, for this study, only 3 years of production records (inputs and outputs) were considered. This is because, after a period of 3 years, most of the farmers clear the strawberry farm to cultivate a fresh farm due to the fact that production declined drastically.

4.5 Constraints Confronting Farmers in Strawberry Production

The result presented in Table 4.8 assess the challenges facing strawberry farmers in the area.

4.5.1 Excessive Rainfall:strawberry production is hydrophobic plant. About 96.2% female and 91.3% of male strawberry farmers complain that excess rainfall and flooding makes the farms inaccessible and prevents maximum use of the land for strawberry production. These results are similar with the findings by (Mardaneh and Keshtkar, 2013) that natural calamities (flooding) damaged the infrastructure in Iran.

4.5.2 Pest and disease infestation: 85.6% of female and 81% of strawberry farmers had problem of pest and disease infestation and this problem was ranked second among the constraints facing the farmers. This problem could be associated with poor varieties of strawberry seed that are being used by 85.5% and 81% of the farmers which is susceptible to pest and disease infestation. Also poor cultural practice could also be the reason why farmers faced this problem in the study area. The preponderance of this constraint is more during rainy season hence, the effect is greater on man.

Table 4.8 Constraints Confronting Strawberry Farmers

	Female(N=182)			Male (N=116)		
Constraints	**Frequency**	**%**	**Rank**	**Frequency**	**%**	**Rank**
Excessive rainfall	175	96.2	1st	106	91.3	1st
Insect, birds and disease	156	85.6	2nd	94	81.0	2nd
Lack of output market	148	81.5	3rd	90	77.6	3rd
Storage problem	147	80.8	4th	89	76.7	4th
Poor price	135	74.0	5th	81	69.8	5th
High cost of inputs	110	60.3	6th	66	56.9	6th
Adulterated seed	87	47.9	7th	53	45.7	7th
Germination failure	19	10.3	8th	11	9.5	8th

Multiple responses were allowed

4.5.3 Lack of output market:about 81.5% of female and 77.6% of male farmers complained about lack of market for strawberry output. Markets for agricultural inputs and outputs are often missing and unreliable for smallholder farmers, which makes the acquisition of agricultural resources difficult and the supply of market services also becomes limited. The consequent effect of poor storage and bad road conditions which are often impassable during the rainy season also does not help matters. This situation confirms the farmers' heavy reliance on middlemen who come and procure the commodity from the farm, albeit at a lower price than what the market is offering. This finding is in line with Makoni *et al*. (2014) where theyopined that lack of infrastructural facilities prompt farmers to rely heavily on middlemen is typically poor, markets for agricultural inputs and outputs are often missing and unreliable for smallholder farmers

4.5.4 Problem of storage:about 81% of female and 77% of male farmers had problem of storage and this problem was ranked third among the constraints faced by the farmers. Poor storage could increase post-harvest losses, it could also reduce quality and quantity of strawberry which result to low market value as well as low income to the

farmers. Local method of storage adopted by the farmers are not effective, hence the tendency is to sell their produce immediately after harvest at a low price.

4.5.5 Poor price: This is also a major problem confronting female and male strawberry farmers in the study area. 74% of female and 69.8% of male farmers had this problem. This was ranked second among the constraints faced by male farmers while it was first constraint among the problem faced by female farmers. This problem mostly occurs at harvest time due to glut that reduces market price. The problem could also be due to poor market as a result of imperfect nature of most rural market in the study area. Local strawberry dealers buy directly from the farmers at farm site with low price, and later sell to consumers at high price.

4.5.6 High cost of inputs like seed, fertilizer and labour: were constraint of strawberry producers with about 60.3%.for female and 56.9% for male. According to the respondents, due to high cost of improved seed they make use of seeds from their previous harvest which is not reliable and can jeopardize improved and sustainable productivity. This finding is in line with Ekong, (2003), opined that most farmers have little or no access to improved seeds and continues to recycle seeds that have become exhausted after generations of cultivation. Also, Farmers perceived that high cost of fertilizer constraints, according to the respondent fertilizer is made available when farmers are far into the production period, sometimes at the middle of the raining season and family labour was predominant in the study area and that is why there was acute shortage of labour. According to the farmers, during active period of production-every household would have been engaged in his family farm work. The demand for labour is normally very high and expensive during the peak period of land clearing, ridging, harvesting, processing and weeding.

Other constraints: Other constraints faced by female and male farmers are adulterated seed and germination failure. About 48% of female and 46% of male farmers are faced with the problem of adulterated strawberry seed. This problem could be linked to the source of seeds. Most farmers procure their seed from fake agro-input dealers that sell adulterated strawberry seed. Problem of germination failure could also be due to poor seed varieties that are being used by the farmers. The high cost of fertilizer in the open market couple with abuse of government subsidy programme on fertilizer by government officials make it not accessible to strawberry farmers. In addition, farmers could not access fertilizer at the right time of need, and where it is available, the price is too high for them to purchase.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The study evaluates gender differential in resource utilization and efficiency of strawberry production in Plateau State Nigeria. The specific objectives were to describe the socio economic characteristics of the male and female strawberry farmers in the study area, assess the levels of gender accessibility and resources utilization in strawberry production, determine the gender differential on profitability of strawberry farmers, examine the gender differential in production efficiency of strawberry farmers and identify the constraints confronting strawberry farmers in the study area. Primary data for the study were collected using structured questionnaire, administered to 182female and 116 male strawberry farmers. Data collected were analyzed using descriptive statistics, farm budgeting analysis and stochastic frontier production function.

Results of the study indicated that the average age were 37 and 34 years for female and male farmers, respectively.About 76% of female farmers and 85.3% of male strawberry farmers were married. The average household size for the two groups was 4 members per household. More than half of both groups of strawberry farmers had between 1-10 years of farming. The result revealed that 83.2% of female farmers and 87% of male farmers had formal education in the study area. The meanperception score of ($\bar{x}$ =4.04) obtained for male is an indication of supporting the statement of male and female having equal access to land, while female farmers strongly disagreed ($\bar{x}$ =1.37) to the statement. Land ownership increase your social status had a score of ($\bar{x}$ =4.18) and ($\bar{x}$ =4.22) for both male and female, respectively. In terms of access to fertilizer, seed and

agrochemical was agreed by both male and female having equal access to these productive resources. The responses obtained from the female farmers showed they disagreed to the statement; male and female had equal access to labour ($\bar{x}$ =1.88). The female farmers mentioned labour to be expensive to hire and lack of funds to hire adequate labour. Among the male farmers, the mean score of ($\bar{x}$ =3.51) signifies agreement to the statement; of male and female having equal access to labour. The mean score of ($\bar{x}$ =1.91) and ($\bar{x}$ =1.87) obtained from the scale indicate that both male and female farmers do not agree to men and female had access to credit.

On profitability of the enterprise, the total revenue (TR) was ₦95,152.72/ha for male and ₦156,320 for female while the total cost was ₦45,332.2/ha for male and ₦22,294. The net farm income was therefore ₦49, 787.8/ha for male and ₦134,026 for female. the average rate of returns on investment was 2.1 for male and 7.0 for female, indicating that for every ₦1 invested in strawberry production for male, a profit of ₦1.10 kobo was made while for a female indicating that for every ₦1 invested in strawberry production for female, a profit of ₦6 was made. Thus, it could be concluded that strawberry production in the study area though on a small scale, was economically viable for both group.

The result of Maximum Likelihood Estimates (MLE) for the production frontier revealed that the sigma-squared were 0.425 and 0.359 for female and male production systems, respectively. These values were significantly different from zero at 1% and 5% level of probability, indicating a good fit and the correctness of the specified distributional assumption of the composite error term. The generalized likelihood ratio statistics were -156.41 and -117.13 for female and man respectively. This ratio exceeds

the critical chi-square values at 1% level of significance. The values of the gamma statistics 0.460 and 0.598 for female and male respectively are attributable to farmers' inefficiency factors. The result revealed that technical inefficiency effects were present in strawberry production in the study area. Determinants of technical inefficiency in female and male strawberry production in Jos State revealed that age of the farmer was positive and significant at 10% for male farmers. Year of education showed a negative relation with technical inefficiency and is significant at 5% level for female and 10% for male. Household size showed a negative relation with predicted technical inefficiency and is significant at 5% level for male strawberry farmers.

The constraints faced by strawberry farmers in the study area were ranked in order of priority and these include excessive rainfall, insect, bird and disease infestation, lack of output market, problem of storage, poor harvest and high cost of inputs were the major problems encountered by strawberry farmers.

5.2 Conclusion

Based on the findings of this study.it could be concluded that strawberry production in the study area though on a small scale, was economically viable for both group. The average rate of returns on investment was 2.1 for male and 7.0 for female, indicating that for every ₦1 invested in strawberry production for male, a profit of ₦1.10 kobo was made while for a female indicating that for every ₦1 invested in strawberry production for female, a profit of ₦6 was made.

Gender accessibility to resources is important to realizing the poverty reduction strategies of African countries and the achievement of the Sustainable Development Goals (SDGs). Farmers in the study area have limited access to major productive resources, but the females were more constrained. Providing resources in an efficient

and equitable manner appears to have potential for greatly improving the scope for future poverty reduction in Nigeria. Given the necessary resources and the same enabling environment as their male counterpart in farming activities, female farmers are equally efficient in the utilization of these resources to achieve higher productivity.

It is evident here that, the two strawberry producers did not reach the frontier of production with a technical efficiency of 0.68 for female and 0.51 for male. Age, education and household size are major socio-economic determinant of technical efficiency for both female and male strawberry producers. These factors tend to reduce inefficiencies as we improve on them. However, the major constraints faced by strawberry farmers in the area excessive rainfall, insect, bird and disease infestation, lack of output market, problem of storage, poor harvest and high cost of inputs.

5.3 Contribution of the Study to Knowledge

1. The study revealed that strawberry production in the study area is profitable with net return of ₦49,787.8/ha for male and ₦134,026 for femaledespite the problems identified.

2. The study revealed that, both the male and the female strawberry producers did not reach the frontier of production with a technical efficiency of 0.68 for female and 0.51 for male.

3. Resources needed for strawberry production are not efficiently accessed by farmers especially the female. the average score of ($\bar{x}$ =4.04) obtained for male and ($\bar{x}$ =1.37) for female on land access, The average score ($\bar{x}$ =1.88) for male and ($\bar{x}$ =3.51) for female had equal access to labour. The mean score of

($\bar{x}$=1.91) and ($\bar{x}$ =1.87) obtained from the scale indicates that male and female farmers do not agree to the fact that they both have equal access to credit

5.4 Recommendations

From the findings of this study, the following recommendations are made:

i. The most severe problems encountered in strawberry production are excess rainfall, insect, bird and disease. This constraint constitutes serious impediments to strawberry production and need to be addressed adequately before strawberry production can be improved in the study area. It is recommended that agro based industries and non-governmental organization should be encouraged by the local government to support research and production of strawberry products for commercial purposes.

ii. It was observed from the result that no single strawberry farm is able to attain the frontier of strawberry production, hence there is the presence of inefficiency. In other to raise efficiency level, there is need for the commitment of non-governmental organization and government in the provision of inputs such as fertilizer, agrochemicals, seeds and farm implements at affordable rates.

iii. In view of the fact that, female strawberry producer is not only more profitable with higher rate of return on investment when compared with male strawberry producers. It is therefore, recommended that all resources must be channeled towards female strawberry producers for higher yield, profit, income and efficiency by farmers

iv. Fertilizer is one of the inputs that positively and significantly influence strawberry production in the study area. Therefore, government should ensure

timely and adequate supply of fertilizer to farmers through its e-wallet programme at affordable prices in order to enhance the production of this crop.

REFERENCES

Abdulazeez, R.O., Musa, M. W., Saddiq, N. M., Abdulrahman, S. and Oladimeji, Y. U. (2018) Food Security Situations among Smallholder Farmers under Kogi Accelerated Rice Production Programme: A USDA Approach, *Journal of Agricultural Economics, Extension & Social Sciences*. 1(1), 123 – 130.

Abdullahi, A. (2012). Comparative economic analysis of rice production by adopters and nonadopters of improved varieties among farmers in Paikoro Local Government Area of Niger State. Nigerian Journal of Basic and Applied Science, 20(2):146–151.

Abdullai, A. and Huffman, W (1998): An Examination of Profit inefficiency of Rice

Abdulrahman, S. Yusuf, O. and Suleiman, A.D. (2015). Profit Efficiency of Cocoyam Production in Kaduna State, Nigeria. *American Journal of Experimental Agriculture*. 7 (4):231 -241

Abdulrahman, S., David, A.I, Yusuf, O. Abdulazeez, R.O. Binuyo, G. (2016).Analysis of Livelihood Diversification by Farming Households in Kaduna State, Nigeria.2nd International conference on Dryland Agriculture, Centre for Dryland Agriculture, Bayero University, Kano. 12th -16th December, 2016. Pp45-49

Abdulrahman, S., Gomina, A., Abdullahi, M. M., Saddiq, N. M., and Magaji, B. D. (2016). Assessment of factors Affecting Quantity of Rice Supplied to Output Market Outlets in Kano State: Market Supply Model Approach, *Dutse Journal of Economic and Development Studies*, 1 (1): 21-27.

Abdulrahman, S., Mani, J. R., Oladimeji, Y. U., Abdulazeez, R. O. and Ibrahim L. A. (2018), Analysis of entrepreneural management and food security strategies of small ruminant women farmers in Kiri-kassamma Local Government Area of Jigawa State. *Journal of Animal Production Research*, 29(1), 419 - 429

Abedullah, K. B and Ahmad, B. (2006). Technical Efficiency and Its Determinants In Abraham Gebrehiwot, Addis Adera and Mesfin Tilahun. 2015. The impact of small scale irrigation on income of rural farm households: evidence from Ahferom Woreda in Tigray, Ethiopia. *International Journal of Business and Economics Research*, 4(4):217-228

Abraham Gebrehiwot, Addis Adera, and Mesfin Tilahun., (2015). The Impact of Small – Scale Irrigation on Income of Rural Farm Households: Evidence from Ahferom Woreda in Tigray, *Ethiopia. International Journal of Business and Economics Research*. 4(4): 217-228.

Abu O. (2011). Fertilizer Usage and Technical Efficiency of Rice Farms under Tropical Conditions: A Data Envelopment Analysis (DEA). Journal of Agricultural Science, 2(2): 83-87

Acharya, M. (2003).*Efforts at Promotion of Women in Nepal*. Kathmandu: Tanka Prasad Memorial Foundation, Friedrich-Ebert-Stiftung (FES), Kathmandu.: 23

Adejoh, O. S., Onwuaroh, A. S., Abdulrahman, S. Binuyo, G. and Magaji, B. D. (2017), Factors influencing gender accessibility to productive resources for rice production in Niger State, Nigeria. *Journal of Scientific Research & Reports*, 16(6), 1-10

Adewuyi, B.A., Folawole, O.O., Phillip, B. and Fakoya, E.O. (2013). Production Efficiency of Credit and Non-Credit Users of Poultry Egg Farming in Ogun State, Nigeria: A Data Envelopment Analysis (DEA) Approach. *Journal of Agriculture and Veterinary Science*, 3(4): 73-78.

Afridi, G. S., Ishaq, M. and Ahmad, S (2009), Cost and revenue analysis of strawberry production in the sub-tropical areas of NWFP, Pakistan. *Pakistan journal of life and social science*, 7(1), 59 - 65

Agboh-Noameshie, A.R.,Schroeder, C., Zeller, M.(2013). Women, Social Capital, and Collective Action – The Case of NERICA Rice Technology in Benin.

Aguilar, A., Carranza, E., Goldstein, M. And Kilic, G. (2014).Decomposition of gender differentials in agricultural productivity in Ethiopia. Policy Research Working World Bank: Washington.

Ahearn, M.C. (2010). Gender Issues in Agricultural and Rural Household Well-being. Paper Presented at the third Global Conference on Agricultural and Rural House Hold Statistics. 24-25 May 2010, Washington D.C. : 1-18.

Aigner, D.I.C., Lovell, A.K. and Schmidt, P., (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics*, 6(1), 21 - 37.

Alagumani, T., Arivelarasan, A., Chinnadurai, M. and Swaminathan, B. (2015).Developing food security index for vulnerable sections of rural households in the Perambalur District of Tamil Nadu.*Trends in Biosciences*, 8(1), 48 – 53.

Almaz, G., Workneh, N., Edilegnaw, W. and Gezahegn, A. (2014). Determinants of profit shares to vegetable value chain actors in Ethiopia: A Gender Perspective. International Research Journal of Marketing and Economics,1(9):1-19

Amaza, P.S. and Olayemi, J.K. (2002).Analysis of technical inefficiency in food crop production in Gombe State, Nigeria.Applied Economics letter.**9**(1): 51-54.

Amin Mohammed, Mulugeta Negeri and Selvaraj Thangavel. (2013). Field Evaluation of New Fungicide, Victory 72 WP for Management of Potato and Tomato Late Blight (Phytophthora infestans (Mont) de Bary) in West Shewa Highland, Oromia, Ethiopia. Journal of Plant Pathology and Microbiology, 4(8):1-4.

Anderson, W. L. and Ross, R. L. (2005). The methodology of profit maximisation: An Austrian Alternative. The Quarterly Journal of Austrian Economics, 8(4): 31-44.

Ani, A.O. (2003).Taking farm decisions and socioeconomic characteristics of rural women farmers in Southern Ebonyi State, Nigeria.*International Journal of Agriculture and Biology*, 5(4), 645 - 649.

Asogwa, B. C., Okwoche, V. A. and Umeh, J. O. (2007). Analyzing the Determinants of Poverty Severity among Rural Farmers in Nigeria: A Censored Regression Model Approach: *American International Journal of Contemporary Research.* 2(5):166-176.

Asogwa, B.C., Ihemeje, J.C. and Ezihe, J.A.C. (2011). Technical and Allocative Efficiency Analysis of Nigerian Rural Farmers: Implication for Poverty Reduction, *Agricultural Journal,* 6(5): 243-251.

Assa, M. M,.Edriss, A.K. and Matchaya, G.C. (2012).unexploited profit among smallholder farmers in Central Malawi: What are the Sources? *International Journal of Applied Economics*, 9(2): 83-95

Awotide O. D., Kehinde A. L. & Agbola P. O. (2010).Poverty and rural livelihood diversification among farming households in southwest Nigeria.*Journal of Food, Agriculture and Environment*, (1): 367 – 371.

Awotide, B. A., Diagne, A. Awoyemi, T. T., and Ojehomon, V. T. (2010).Farm level constraint and adoption of improved rice varieties in Nigeria. Journal of Agricultural and Environmental Studies,1 (2), 12-29.

Ayalew, T., Paul, C. S.And Hirpa, A. (2014).Characterization of Seed Potato (*Solanum Tuberosum L.*) storage, pre-planting treatment and marketing systems.The case of West Arsi.African.*Journal of Agricultural Research,* 9(15), 1218 - 1226.

Azam, M. and Khan, M. (2010). Significance of the sugarcane crops with special reference to NWFP. Sarhad Journal of Agriculture, 26(2):289-295.

Bahta, S. and Baker, D. (2015). Determinants of profit efficiency among smallholder beef producers in Botswana. International Food and Agribusiness Management Review, 18(3):107-130.

Basseto B. (2015), Optimizing a patient-focused approach to primary care, American Medical Group Association. 2, 5 – 6.

Baumol, W. J. and Blinder, A. S. (1991). Economics: Principles and Policy, 5th Edition. Harcourt Brace Javanovich, San Diego and New York.

Beaman, L., Karlan, D., Thuysbaert, B. and Udry, C. (2013)."Profitability of fertilizer: experimental evidence from female rice farmers in Mali," American Economic Review, American Economic Association, 103(3), 381-86.

Beaman, L., Karlan, D., Thuysbaert, B. and Udry, C. (2013)."Profitability of fertilizer: experimental evidence from female rice farmers in Mali," American Economic Review, American Economic Association, 103(3), 381-86.

Behjat, A. and Ostry, A. (2013).Investigating regional farms profitability in British Colombia Local Health Areas. Discourse Journal of Agriculture and Food Sciences,1(8):135- 139.

Bezabih and Hadera.(2007). Constraints and opportunities of horticulture production and marketing in Eastern Ethiopia. Dry Lands Coordination Group Report No 46. Grensen9b. Norway.

Bezabih Emana, Mengistu Ketema, Jeffreyson K.Mutimba and Jemal Yousuf.(2015). Factors affecting market outlet choice of potato producers in Eastern Hararghe Zone, Ethiopia. Journal of Economics and Sustainable Development, 6(15):159-172.

Bezawit, T. (2011).Analysis of socio-economic factors influencing potato production at household level.The case of Shashemene, Shalla and Siraro Counties in West Arsi Zone Ethiopia. MSc Thesis, Wageningen University, Wageningen, Netherlands

Bravo-Ureta, Boris E., and Laszlo Rieger.(1997). "Alternative Production Frontier Method1ologies and Dairy Farm Efficiency."Journal of Agricultural Economics 41, no. 2: 215– 26.

British Council (2012). Gender in Nigeria Report 2012: Improving the lives of girls and women in Nigeria" British Council, Nigeria

Carletto, C. & Savastano, S. & Zezza, A., (2011). "Fact or Artefact: the Impact of Measurement Errors on the Farm Size - Productivity Relationship." Policy Research Working Paper Series 5908, The World Bank.

CEPA (2003).Short Course on Production Economics, Productivity and Efficiency Measurement.Center for Efficiency and Productivity Analysis (CEPA).New England.p. 634.

Christopher, G. (2013). The potential for irrigated rice production to enhance small-holder livelihoods in Tanzania.Exploring the profitability, productivity and sustainability of the Dakawa rice farm.

Coelli, T. J. (1994). A Guide to Frontier Version 4.1: A computer programme for stochastic frontier production and cost function estimation. Department of Econometrics, University of New England, Armidale, NSW 2351. Australia.

Cooke, I. R., Mattison, E. H. A., Audsley, E., Bailey, A. P., Freckleton, R. P., Graves, A. R., Morris, J., Queenborough, S. A., Sandars, D. L., Siriwardena, G. M., Trawick, P., Watkinson, A. R., and Sutherland, W. J. (2013). 'Empirical Test of

an Agricultural Landscape Model: The Importance of farmer preference for risk aversion and crop complexity', SAGE Open, 3(2013):1-16.

Croppenstedt, A., Goldstein, M., & Rosas, N. (2013). Gender and agriculture: inefficiencies, segregation and low productivity traps. World Bank Research Observer, first published online January 20, 2013 doi:10.1093/wbro/lks024

Damisa, M. A., & Yohanna, M. (2007). Role of Rural Women in Farm Management Decision Making Process: Ordered Probit Analysis. Trends in Applied Science Research, 2 (3), 241-145.

Daniel, S. U. (2009).Socio-economic impact of Hiv/Aids on farm women in Nigeria: evidence from Enugu state world applied sciences journal 6 (12): 1617-1624, IDOSI Publications

Danso G, Cofie O, Annang L, Obuobie E, Keraita B. (2014), Gender and urban agriculture: The case of Accra, Ghana. Paper presented at the RUAF/IWMI/ Urban Harvest Woman Feeding Cities Workshop on Gender Main streaming in Urban Food Production and Food Security. 20-23 September, 2014. Accra, Ghana; 2014

Debreu, G. (1951) The Coefficient of Resource Utilization. Econometrica, 19, 273-292. http://dx.doi.org/10.2307/1906814

Dontsop-Nguezet, P. M., Diagne, A., Okuruwa, V. O., and Ojehomon, V. (2011). Impact of improved rice technology on income and poverty among rice farming household in Nigeria: A local Average treatment effect (LATE) approach. Contributed paper prepared for the 25th conference of the centre for the studies of African economies (CASAE) 20-22nd March, 2011.St Catherine College, University of Oxford, UK

Ekong, E.E. (2003) Rural Sociology: *An Introduction and Analysis of Rural Nigeria*. Dove Educational Publishers, Uyo. Pp 203

Ellis, A., Manuel, C. and Blackden, C.M. (2006).Gender and economic growth in Uganda: unleashing the power of women. World Bank, Washington, DC.

Ellis, F. (1988). Peasant Economics: Farm Households and Agrarian Development. Cambridge, Cambridge University Press. 257pp.

Ellis, F. (1993). Peasant Economics: Farm Households and Agrarian Development. Cambridge, Cambridge University Press.

Elodie, B., Aurelia, L. and Strobl, E. (2015). Determinants of crop yield and profit of family farms: Evidence from the Senegal River Valley IPAG.Working Paper Series 2014- 596: 23-27

Employment-Oriented Private Sector Development Programme (2010).A Profile of the Plateau State Economy.Baseline Survey Report.Business Development Services/Value Chain Development.Conducted by Gopa Consultants Gmbh. Hindenburgring 18, D-61348 Bad Homburg.

Enyinnia CN (2001). Cocoyam, food self-sufficiency and policy in East and Southern Africa. Food Policy, 15: 383-394

Etuah, S., Gyiele, N. and Akwasi,Y. 2013. Constraints of Broiler Production: Empirical Evidence from Ashanti Region of Ghana. *Journal of Business and Economics*, 5(2):228-243.

Etuah, S., Gyiele, N. and Akwasi,Y. 2013. Constraints of Broiler Production: Empirical Evidence from Ashanti Region of Ghana. Journal of Business and Economics, 5(2):228-243

Fantu Nisrane, Bethelihem Koru, and Alemayehu Seyoum. (2014). Smallholder Teff Productivity and Efficiency: Evidence from High-Potential Districts of Ethiopia.

Farell, M.J. (1957): The measurement of production efficiency. *Journal of theRoyal Statistical society service A (general)* 25: 3-81

Farquharson, R. J. (2006). 'Production Response and Input Demand in Decision Making: Nitrogen Fertilizer and Wheat Growers', Australasian Agribusiness Review, Vol. 14, (2006)

Food and Agricultural Organization (2010f). Crop and food supply assessment mission to Ethiopia. FAO Global Information and Early Warning System on Food and Agriculture, World Food Programme, Rome, Italy. Pp3-7

Food and Agricultural Organization of United Nationss (2010).Gender and Land Rights Database; 2010. Available:http://www.fao.org/gender/landrig hts

Food and Agriculture Organization (2011).The state of food and agriculture.FAO Publication. Rome. 160pp

Food and Agriculture Organization (2013).Statistical year book.Food and Agriculture Organization, Rome 2013.

Food and Agriculture Organization (FAO), (2011).The State of Food and Agriculture. Women in Agriculture: Closing the Gender Gap for Development. FAO, Rome.

Food and Agriculture Organization of the United Nations Statistics Division (FAOSTAT).(2014). Crop production and trade. Rice production, importation harvested area. http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor accessed 19/may/2014.

Food and Agriculture Organization.**(**2017). Promoting gender equality and women's empowerment. In: *Global Monitoring Report 2007: Millennium Development Goals: Confronting the challenges of gender equality and fragile states*. : 105–148, Washington, DC.

Galletta, G.J., and Bringhurst, R.S.*(2005) in Small fruit crop management, Strawberry management, eds Galletta G.J., Himelrick D.G. (Prentice Hall, Englewood Cliffs, NJ), pp 83–156*

Gilbert RA, Sakala WD, Benson TD. (2002). Gender analysis of a nationwide cropping system trial survey in Malawi. African Studies Quarterly. 2002;6(1-2):223–243.

Gladwin, C.H. (2002). Gender and Soil Fertility in Africa: Introduction. *African Studies Quarterly* 6(1&2): 213-238.

Gyimah-Brempong, K., Johnson, M. and Takeshima, H. (2016). The nigerian rice economy: policy options for transforming production, marketing and trade. Philadelphia: University of Pennsylvania Press. Pp 42

Haghiri, M (2003), Stochastic Non-Parametric Frontier Analysis in Measuring Technical Efficiency: A Case Study ofthe North American Dairy Industry. Ph.D. University of Saskatchewan, Saskatoon, Spring Pp 142.

International Fund for Agricultural Development (2009).*The Challenge of Ending Rural Poverty*.*Rural Poverty Report 2001,* Rome.

Itam, K. O., Ajah, E. A. and Agbachom, E. E. (2014).Analysis of determinants of cassava production and profitability in Akpabuyo Local Government Area of Cross River State, Nigeria. International Business Research, 7(12):112-135.

Jannoura, R., Joergensen, R. G. and Bruns, C. (2014). Organic fertilizer effects on growth, crop yield, and soil microbial biomass indices in sole and intercropped peas and oats under organic farming conditions. European Journal of Agronomy,52(2014): 259- 270.

Jirgi, A. J., Ogundeji, A. A., Viljoen, G. and Adiele, M. A. (2010). Resource use efficiency of millet/ cowpea intercropping in Niger State, Nigeria. 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa

Johnson, N. L and Welch, B. L. (1939).On the calculation of cumulants of the K1distribution Biometrika. 31:362-38

Kabeer, N. (2016) Gender equality, economic growth, and women's agency: the "Endless Variety" and "Monotonous Similarity" of patriarchal constraints. *Feminist Economics*, 22(1), 295-321.

Kalirajan, R.J. and Shand, R.T. (1994).Economics in Disequilibrium.An Approach from the Frontier.Macmillan Ltd. India.In Maurice, D.C. (2011). Mathematical Models Used in Agricultural Production, Efficiency Studies-A Review. Unpublished Ph.D Non-Thesis Seminar Submitted to the Department of Agricultural Economics and Extension, School of Agricultural and Agricultural Technology, ModdiboAdamu University of Technology, Yola, Nigeria. Pp. 2-3

Kilic, T., Palacios-López, A, And Goldstein, M. (2015).Caught in a productivity trap: a distributional perspective on gender differences in Malawian Agriculture. World Development, (70):416–463.

Koopmans, T. C. (1951), "An Analysis ofProduction as an Efficient Combination of Activities," in T. C. Koopmans, (Ed.) Activity Analysis of Production and Allocation, Cowles Commission for Research in Economics, Monograph No.13, New York: John Wiley & Sons.

Koyenikan M. J. (2011), Genders Analysis of Participatory needs assessment of Emeroke community of Akwa-Ibom State, Nigeria. Implications for Agricultural Extension; 2010. Org>>Articles>>downloaded 2011

Kudi T.M., Bolaji M, Akintola M.O. and Nasa'I D.H. (2011).Analysis of adoption of improved maize varieties among farmers in Kwara state in Nigeria.*International Journal of Peace and Development Studies*, 1(3), 8-12

Kumar, P.,Joergensen, R. G. and Bruns, C. (2011). Aquacult.Nutr., 17 (3): 313-326

Lighton D., Guveya, E., Bandason, W. and Mashapa, C. (2014).Socioeconomic determinants of smallholder out-grower tea (Camellia Sinensis) Farming Profitability in Chipinge District, Zimbabwe.Journal of Agriculture Economics and Rural Development. 1(X):X-X.

Mabundza, R., Dlamini, C. S., & Nkambule, B. (2014) Gender mainstreaming in smallholder agriculture development: a global and African overview with emerging issues from Swaziland. *African Journal of Agricultural Research*, 9(42), 3164 - 3170.

Makoni, N; Mwai, Redda, R., Zijpp, T., van-der, A., Lee, and van-der J. (2014).White Gold; Opportunities for Dairy Sector Development Collaboration in East Africa. Centre for Development Innovation, Wageningen UR (University & Research Centre). CDI report CDI-14-006. Wageningen.

Mapula Ramaila, Sandile Mahlangu and Daan du Toit (2011). Agricultural Productivity in South Africa: Literature Review.

Masuku, M. (2011). Determinants of sugarcane profitability: The case of smallholder cane growers in Swaziland. Asian Journal of Agricultural Sciences, 3, 210:214.

Maurice, D.C. (2004). Resource productivity in cereal crops production among fadama

Maurice, D.C. (2012). Resource productivity in cereal crops production among fadama farmers in Adamawa state, Nigeria. Unpublished M.sc. Thesis submitted to the department of agricultural economic and extension, University of Maiduguri, Nigeria.

Maurice, D.C. and Yusuf, S.A, (2005).Assessment of Poverty among Urban Farmers in Ibadan Metropolis, Nigeria.*Journal of human ecology*, 22(2):24-32.

Meesusen, W., and Broeck, V. D., (1977). Efficiency estimation for Cobb-Douglass production function with composed error. *International Economic Review* 18: 435-444.

Mohammed, S. (2011). Economics of Rain Fed and Irrigated Rice Production Under Upper Benue River Basin Development Authority Scheme, Dadinkowa, Gombe State, Nigeria. Continental Journal of Agricultural Economics,5(1):14–22

Morgan, C. J., N. O. Widmar, E. A. Yeager, W. S. Downey, and C. C. Croney. (2016). "Perceptions of Social Responsibility of Prominent Fast Food Restaurants." Modern Economy 7: 704–714.

Morgan, M., Terry, G., Rajaratnam, S. and Pant, J. (2016) Socio-cultural dynamics shaping the potential of aquaculture to deliver development outcomes.*Reviews in Aquaculture,* 1-9.

Mpogole, H. (2013). Round potato production in Southern Highlands of Tanzania: Market preferences, farmers‟ variety selection and profitability. Doctoral Dissertation, University of Sokoine, Morogoro, Tanzania.

Muhammed-lawal, A.; Omotesho, O. A. and Falola, A. (2009).Technical Efficiency of Youth Participation in Agriculture.A Case Study of Youth-in-Agriculture Programme in Ondo State; South-West Nigeria.*Nigeria Journal of Agriculture, Food and Environment:* 5 (1), 20 – 26.

Mwangi, J. K., Gicuru, K. I., Sibiko, K. W. and Wanjiru, R.W. (2015).Factors Influencing profitability of diversified cash crop farming among smallholder tea farmers in Gatanga District, Kenya. Journal of Economics and Sustainable Development, 6(3):87-95.

National Bureau of Statistics (2006).National Abstract of Statistics.www.nigerianstat.gov.ng

National Bureau of Statistics (2007).*Facts and Figures about Nigeria*.National Bureau of Statistics . Abuja, Nigeria.

Odedokun, V. O., Ahmed, B., & Atala, T. K. (2015) Evaluation of parametric technique of technical efficiency measurement: application to smallholder cotton farmers in Zamfara State, Nigeria. *International Journal of Current Research and Review*, 7(11), 65-69.

Odoemelam, L. E., Alamba, C. And Lekan-Akomolate, C. N. (2014).Evaluation of Women Access and Rights to Land and Its Implications on Rural Household Food Security in Selected Rural Communities, Abia State, Nigeria.

OECD (2002). Labour Force Participation of Women: Empirical Evidence on The Role of Policy and Other Determinants in OECD Countries. *Oecd Economic Studies, No. 37.*

Ogundari, K., Ojo, S.O. and Ajibefun, I.A. (2006). Economies of Scale and Cost-efficiency in Small Scale Maize Production: empirical evidence from Nigeria. *Journal of social science.* 13(2): 131-136

Ogunjobi O.P. (1999). *Efficiency of Smallholder Cocoa Farmers in Ondo State:A Stochastic Frontier Analysis.*MSc Thesis, Unpublished, Federal University of Technology, Akure. 78pp.

Ogunlela,Y.I. and Mukhtar, A. A. (2009). Gender Issues in Agriculture and Rural Development in Nigeria: The Role of Women. *Humanity & Social Sciences Journal* 4 (1): 19-30.

Ojo, S.O. and Imoudu I.A. (2000). Economies of scale and cost efficiency in small scale maize production: empirical evidence from Nigeria. *Journal of social science.* 13(2): 131-136.

Okoli, I. M., Anigbogu, T. U. and Agbasi, O. E. (2015). Socioeconomic factors influencing agricultural production among cooperative farmers in Anambra State, Nigeria. International Journal of Academic Research in Economics and Management Sciences,4(3):43-58

Oladimeji, Y. U. and Abdulsalam, Z. (2014). An Economic analysis of dry season irrigated farming in asa river, Kwara State, Nigeria: implications for poverty reduction. *Journal of Sustainable Development in Africa*, 16(7), 1 - 15.

Oladimeji, Y. U., Ajao, A. M., Abdullahi, A. N., Abdulsalam, Z. and Damisa, M. A. (2017).Adoption of improved technologies and management practices among bee farmers in north central and north western Nigeria towards sustainable development goals.*Ethiopia Journal Applied Science Technology,* 8(1), 1 - 13

Oluwatayo, I. B., Sekumade A. B. and S. A. Adesoji (2008). Resource Use Efficiency of Maize Farmers in Rural Nigeria: Evidence from Ekiti State. *World Journal of Agricultural Sciences*, 4(1) 91-99.

Onoja, A. O. and Herbert, B. C. (2012).Econometric evaluation of rice profitability determinants in Kogi State, Nigeria. Journal of Agricultural Extension and Rural Development,4(5):107-114

Organization for Economic Corporation and Development (OECD) (2002), Managing Risk in Agriculture: Policy Assessment and Design, OECD Publishing, Paris

Oseni, G, Paul C, Markus G, & Paul W. (2015).Explaining gender differentials in agricultural production in Nigeria.*Agricultural Economics*, 46(3), 285 - 310

Osondu, C.K., Ezeh, C.I., Emerole, C.O. and Anyiro, C.O. (2014).Comparative analysis of technical efficiency of small holder Fadama II and Fadama III Cassava Farmers in Imo State, Nigeria.Nig. Journal of Rural Extension and Development. (8) : 26-37.

Oyewole OE (2012). Nutrition education in medical training: the need to reconsider the sacrosanctity of medical education in Nigeria. Afr. J. Med. Med. Sci. 37: 219-224

Oyinbo, O., Damisa, M.A. and Ugbabe, O.O. (2011). An assessment of the profitability of small scale cassava production in Edo State: A guide to policy.

Pandit A., Lal, B., and Rana, R. K (2015). An assessment of potato contract farming in West Bengal state, India. Potato Research, 58: 1-14.

Parkin, M. (1998).Economics, 4th Edition.Addison-Wesley, Reading and Massachusetts. 840pp.

Penson, J. B., Capps, O., Rosson, C. P. and Woodward, R. T. (2006).Introduction to Agricultural Economics, 4th edition.Pearson education, Upper Saddle River, New Jersey, Columbus, and Ohio. 494pp.

Peterman, A., Quisumbing, A., Behrman, J., & Nkonya, E. (2011).“Understanding the complexities surrounding gender differences in agricultural productivity in Nigeria and Uganda.” Journal of Development Studies, 47 (10), 1482-1509

Phillip, D., Nkonya, E., Pender, J., & Oni, O. (2009). Constraints to Increasing Agricultural Productivity in Nigeria: A Review. NSSP Background Paper 6, International Food Policy Research Institute, Washington, DC.

Porter, G & Phillips-Howard, K. (1997). Contract Farming in South Africa: A Case Study from Kwazulu-Natal. Geography, *Journal of the Geographical Association*, 82 (3&4), 1 – 38.

Quisumbing, A. R (1994).*Gender Differences in Agricultural Productivity: A Survey of Empirical Evidence*. Discussion Paper Series No. 36.The World Bank, Washington, DC.

Quisumbing, A.R (1996). “Gender Differences in Agricultural Productivity: A Survey of Empirical Evidence.” Discussion Paper Series No. 36, The World Bank, Washington, DC.

Rahman, S. (2003).Profit efficiency among Bangladeshi rice farmers.Food Policy, 28, 487– 503.

Rais, M., Acharya S., and Sharma N. (2013). Food processing industry in India: S & T capability, skills and employment opportunities. Journal of Food Processing Technology, 4(9):1-13.

Raleting, P. M. and Obi, A. (2015).An analysis of institutional factors influencing vegetable production amongst small-scale farmers in six vegetable projects of the Nkonkobe Local Municipality. Journal of Agricultural Science, 7(6):184-196.

Rios, A. N., William, A. M. and Gerald, E. S. (2008).Linkages between market participation and Productivity on multi-county farm households. Paper presented at an annual meeting, July 27-29, 2008, from American Agricultural Economics Association, Orlando, Florida.

Rola-Rubzen, M. F., Paris, T. R., Luis, J. and Farivar, F. (2016) Enhancing women's capacities in agricultural research and development in Asia and Africa. Human Development and Capacity Building: Asia Pacific Trends, Challenges and Prospects for the Future, 15-33.

Russell, N. P. and T. Young (1983), "Frontier Production Functions and the Measurement of Technical Efficiency," Journal of Agricultural Economics, Vol.34, pp.139- 150.

Sani. A. A. and Oladimeji, Y. U. (2017). Determinants of technical efficiency among sorghum farmers under agricultural transformation agenda in Gombe state, Nigeria. *Nigerian Journal of Agriculture, Food and Environment*, 13(3), 122 - 129

Sebatta, C., Mugisha, J., Katungi, E. And Kasharu, A. (2012). Determinants of Smallholder Farmers" Participation in the Potato Market in Kabale and Mbale Research Application Summary, Uganda.

Shahnaj P. (2008), Access of rural women to productive resources in Bangladesh: A pillar for promoting their empowerment. *International Journal of Rural Studies*, 15(1), 1 - 8.

Shehu, J.F., Iyortyer, J.I., Mshelia, S.I. and Jongur, A.A.U. (2010).Determinants of yam production and Technical efficiency among yam farmers in Benue State, Nigeria.*Journal of social science*. 24(2):143-148.

Sheng, Y., S. Zhao, K. Nossal, and D. Zhang. (2014). "Productivity and Farm Size in Australian Agriculture: Reinvestigating the Returns to Scale." The Australian Journal of Agricultural and Resource Economics, 59 (1): 16-38.

Shimelles Tenaw, Zahidul, I. K.M. and Parviainen, T. 2009. Effects of land tenure and property rights on agricultural productivity in Ethiopia, Namibia and

Bangladesh.University of Helsinki, Department of Economics and Management. Discussion Papers no 33.

Singh, B. N., Fagade, S., Ukwungwu, M. N., William, C., Jagtap, S. S., Oladimeji, O., Effisue, A. and Okhidievbie, O. (1997). Rice-Growing Environments and Biophysical Constraints in Different Agro-ecological Zones of Nigeria.*Meteorology Journal.* 2 (1): 35-44

Singh, J. (2016). The Relationship between farm size, productivity and profitability: A case study of districts Mansa and Jalandhar. Journal of Environmental Science, Computer Science and Engineering and Technology, 5(1):103-115.

Steve, O. A., Godwin, O.O. And Kate, O. I. (2014). The Impact of Education On Agricultural Productivity of Small Scale Rural Female Maize Farmers in Potiskum Local Government, Yobe State: A Panacea for Rural Economic Development in Nigeria. *International Journal of Research in Agriculture and Food Sciences*, 2(4), 26 - 33.

Suda, C. (2002). Gender disparities in the Kenyan labour market: implications for Poverty reduction. *Nordic journal of African studies,* 11(3), 301 - 321.

Supaporn, P. (2015). Determinants of technical efficiency of sugarcane production among small holder farmers in Lao PDR. American Journal of Applied Sciences, 12 (9): 644.649.

Tolno, E., Kobayashi, H., Ichizen, M., Esham, M. and Balde, B.S. (2016). Potato production and supply by smallholder farmers in Guinea: An Economic Analysis. Asian Journal of Agricultural Extension, Economics and Sociology, 8(3):1-16

Umaru, M. A. (2015). *Impact of USAID/MARKETS Programmme on Sorghum Farmers' Livelihood in Three Local Government Areas Of Kaduna State Nigeria*. A Dissertation Submitted to the School Of Postgraduate Studies, Ahmadu Bello University Zaria, 102pp.

United Nations Development Fund for Women (2012).Securing The Peace Guiding the International Community towards Women's Effective Participation throughout Peace Processes.Newyork. : 1-13

University of California and the United States Department of Agriculture cooperating (1999), Strawberry Production: Sample Costs and Profitability Analysis Based on 1999 Data Collected in Ventura County, California, Pp 20

Welch, B. L., (1939). Note on discriminant functions. *British journal of medical sciences*, 31:218-220.

World Bank (2003).Development indicators. New York: World Bank

World Bank (2008). World Development Report 2008: Agriculture for Development. Washington, DC: The World Bank.

World Bank, (2012). World Development Report: Gender Equality and Development. Washington, DC: The World Bank.

World Bank.**(**2017). Promoting gender equality and women's empowerment. In: *Global Monitoring Report 2007: Millennium Development Goals: Confronting the challenges of gender equality and fragile states*. : 105– 148, Washington, DC.

World Bank.World Bank, (2012). World Development Report 2012: Gender Equality and Development. Washington, DC: The World Bank.

World Development Report (2015). The World Development Report. New York: World Bank

World Food Programme (2011). Gender policy: Corporate action plan (2010–2011); 2009. Available:http://home.wfp.org/resources/wfp205173.pd

World Food Programme (2012).Gender policy and strategy United Nations. *No. 89*

Wu, F., Guan, Z. and Whidden, A. (2012), Strawberry Industry Overview and Outlook. "Florida Strawberry Farmers Face Increasing Competition from Mexico." The Ledger, Aug 25, 2012. http://www.theledger.com/article/20120825/NEWS/120829590?p=1&tc=pg

Yamane, T. (1967). Statistics: An Introductory Analysis, 2nd Editions., New York: Harper and Row

Yusuf, H.O. (2015), *Comparative Analysis of Gender Accessibility to Productive Resources in Ginger Production for Poverty Alleviation in Kaduna State, Nigeria.* A PhD thesis presented to Department of Agricultural Economics and rural Sociology, Ahmadu Bello University, Zaria. 121pp.

Zulu, E.T, (2011). Profitability Analysis of Smallholder *Cowpea* Production in Zambia.The University of Zambia. Pp 215

ANALYSIS OF GENDER DIFFERENTIAL IN RESOURCE UTILISATION AND EFFICIENCY OF STRAWBERRY PRODUCTION IN PLATEAU STATE, NIGERIA

Dear Sir/Madam,

I am a postgraduate student of Ahmadu Bello University, Zaria conducting an Msc research on the **Analysis of Gender Differential in Resource Utilization and Efficiency of Strawberry Production in Plateau State, Nigeria.** Kindly answer the under listed questions with utmost sincerity. You are assured of absolute confidentiality with regards to the information given, as this exercise is carried out purely for research purpose.

Thank you.

Background Information

1. Name of farmer: …….....…….
2. Phone Number ……
3. Village: ……....……..
4. LGA: …….…….
5. State: ……....…….

Section A: Socioeconomic Characteristics of the Strawberry Farmer

6. Age: ……years,
7. Sex: Male ( ) Female ( )
8. Occupation: Major …….. Minor …… …..
9. Marital status: a) Married ( ) b) Single ( ) c) Divorced ( ) d) Widow or Widower ( )
10. Highest level of Education: (a) No Formal Education ( ) (b) Primary school Education ( ) (c) Secondary School Education ( ) (d) Tertiary Education ( )
11. Are you the head of your household? Yes ( ) No ( )
12. Number of wives…….……..
13. Provide the information on your children and other dependents in the following table:

S/no	Children/Dependents	Number less than 18 years old	Number 18-59 years	60 years and above
i.	Male children			
ii.	Female children			
iii.	Male dependents			
iv.	Female dependents			
	Total			

14. Years of farming experience: ……years
15. Do you belong to any cooperative society/farmers' associations? Yes ( ) No ( )

16. If yes, for how long? .....years

17. Do you have access to loan? Yes ( ) No ( )

18. If yes, what is/are your source(s) of loan (money)?

    a) Informal sources (e.g. friends, neighbours, family members) ( )
    b) Private Commercial Banks ( )
    c) Government Loan scheme ( )
    d) Non-Governmental organizations ( )
    e) Others (Please specify)
    …….....

19. How much did you obtain from your source(s) of loan in the last strawberry production period (2017)? ₦ .....……

20. Do you have access to credit? Yes ( ) No ( )

21. If yes, what is/are your source(s) of credit (farm inputs)?
    a) Informal sources (e.g. friends, neighbours, family members) ( )
    b) Private Commercial Banks ( )
    c) Government Loan scheme ( )
    d) Non-Governmental organizations ( )
    e) Others (Please specify):
    ……

22. Do you have any off - farm employment? Yes ( ) No ( )
23. If yes, mention it:
    ……..…….
24. How much do you earn in a year, from the off-farm employment …….₦
25. Do you have extension contacts? Yes ( ) No ( )
26. If yes, how many times did you receive extension contacts last season (2017)?
    …….....
27. How many times did you visit extension agent(s)/agency last season?
    …….....
    .
28. Did you obtain any intervention or aid to improve your level of production? Yes ( ) No ( )
29. If yes, from who?
    a) Federal government ( )
    b) State government ( )
    c) Local government ( )
    d) Others (please specify): …….....

What is the nature of the intervention or aid?

a) Loan (money) ( )
b) Credit (farm inputs) ( )
c) Capacity building ( )
d) Others (please specify): .....

30. If loan, how much? ₦ …….....

31. If credit (farm inputs), name them: .....……

Section B: Information on Inputs

32. Indicates your level of agreement on the following perception statements

Perception statement	SA	A	U	D	SD
Men and women have equal access to land					
Land ownership increase your social status					
Men and women have equal access to fertilizer					
Men and women have equal access to seeds					
Men and women have equal access to agro chemical					
Men and women have equal access to labour					
Men and women have equal access to credit					

Section C: Information on Inputs

33. Farm size (Ha)

(1) How many strawberry farm plots do you have? ..... Indicate and the size in the table below.

Plot NO	Plot Size (Ha)
1	
2	
3	

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

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

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

(II) Variable inputs (Last production Cycle)

(ii)Seed (Kg)

Year	Quantity of Seed(Kg)	Cost (₦)
1		
2		
3		
4		
5		

(iii). Fertilizer.

Year	Fertilizer type	Quantity(Kg)	Cost(₦)
1			
2			
3			
4			
5			

(iv).Agrochemical

Plot No	Agrochemical type	Quantity(litres)	Cost(₦)
1			
2			
3			
4			
5			

(v) Labour input

(a) Land preparation

Year	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						
4						
5						

(b)Planting

Year	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						
4						
5						

(c) Fertilizer Application

Year	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						
4						
5						

(e) First Weeding

Year	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost(₦)
1						
2						
3						
4						
5						

(f)Harvesting

Year	Hire Labour			Family Labour		
	No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
1						
2						
3						
4						
5						

(i) Information on strawberry output

Year	No. of output produced at 1st harvest (Kg)	No. of output produced at 2nd harvest (Kg)	Total Qty sold from 1st harvest	Total Qty sold from 2nd harvest	Price of strawberry/kg
1					
2					
3					
4					
5					

Section D: Constraints of Strawberry Production

1. What other serious constraints did you encounter in strawberry production?
   ……
   ……
   ……
   ……
   ……
2. Suggest ways to overcome the constraints listed above
   ……
   ……
   ……
   ……
   ……

Thanks for your Attention

MALE PERCEPTION

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
male and women have equal access to land	85	1.00	5.00	2.6235	1.45550
land ownership increase your social status	90	1.00	5.00	4.1778	.77282
men and women have equal access to fertilizer	92	1.00	5.00	3.7935	.87125
men and women have equal access to seed	92	1.00	5.00	3.8804	.84959
men and women have equal access to agro chemical	89	1.00	5.00	3.7865	.85907
men and women have equal access to labour	86	1.00	5.00	3.5116	1.20532
men and women have equal access to credit	83	1.00	5.00	3.5542	1.26156
Valid N (listwise)	81				

male and women have equal access to land

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	26	22.4	30.6	30.6
	D	22	19.0	25.9	56.5
	U	6	5.2	7.1	63.5
	A	20	17.2	23.5	87.1
	SA	11	9.5	12.9	100.0
	Total	85	73.3	100.0	
Missing	System	31	26.7		
Total		116	100.0		

land ownership increase your social status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	2	1.7	2.2	2.2
	D	2	1.7	2.2	4.4
	U	2	1.7	2.2	6.7
	A	56	48.3	62.2	68.9
	SA	28	24.1	31.1	100.0
	Total	90	77.6	100.0	
Missing	System	26	22.4		
Total		116	100.0		

men and women have equal access to fertilizer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	4	3.4	4.3	4.3
	D	4	3.4	4.3	8.7
	U	10	8.6	10.9	19.6
	A	63	54.3	68.5	88.0
	SA	11	9.5	12.0	100.0
	Total	92	79.3	100.0	
Missing	System	24	20.7		
Total		116	100.0		

men and women have equal access to seed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	4	3.4	4.3	4.3
	D	2	1.7	2.2	6.5
	U	9	7.8	9.8	16.3
	A	63	54.3	68.5	84.8
	SA	14	12.1	15.2	100.0
	Total	92	79.3	100.0	
Missing	System	24	20.7		
Total		116	100.0		

men and women have equal access to agro chemica

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	2	1.7	2.2	2.2
	D	8	6.9	9.0	11.2
	U	8	6.9	9.0	20.2
	A	60	51.7	67.4	87.6
	SA	11	9.5	12.4	100.0
	Total	89	76.7	100.0	
Missing	System	27	23.3		
Total		116	100.0		

men and women have equal access to labour

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	10	8.6	11.6	11.6
	D	8	6.9	9.3	20.9
	U	9	7.8	10.5	31.4
	A	46	39.7	53.5	84.9
	SA	13	11.2	15.1	100.0
	Total	86	74.1	100.0	
Missing	System	30	25.9		
Total		116	100.0		

men and women have equal access to credit

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	7	6.0	8.4	8.4
	D	15	12.9	18.1	26.5
	U	5	4.3	6.0	32.5
	A	37	31.9	44.6	77.1
	SA	19	16.4	22.9	100.0
	Total	83	71.6	100.0	
Missing	System	33	28.4		
Total		116	100.0		

FEMALE PERCEPTION

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
male and women have equal access to land	122	1.00	5.00	3.0082	1.42872
land ownership increase your social status	133	1.00	5.00	4.2180	.88196
men and women have equal access to fertilizer	136	1.00	5.00	3.6471	.96248
men and women have equal access to seed	136	1.00	5.00	3.9118	.92272
men and women have equal access to agro chemica	133	1.00	5.00	3.7519	.92447
men and women have equal access to labour	126	1.00	5.00	3.4683	1.26293
men and women have equal access to credit	124	1.00	5.00	3.4839	1.29089
Valid N (listwise)	115				

male and women have equal access to land

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	24	13.2	19.7	19.7
	D	31	17.0	25.4	45.1
	U	7	3.8	5.7	50.8
	A	40	22.0	32.8	83.6
	SA	20	11.0	16.4	100.0
	Total	122	67.0	100.0	
Missing	System	60	33.0		
Total		182	100.0		

land ownership increase your social status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	4	2.2	3.0	3.0
	D	4	2.2	3.0	6.0
	U	4	2.2	3.0	9.0
	A	68	37.4	51.1	60.2
	SA	53	29.1	39.8	100.0
	Total	133	73.1	100.0	
Missing	System	49	26.9		
Total		182	100.0		

men and women have equal access to fertilizer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	7	3.8	5.1	5.1
	D	13	7.1	9.6	14.7
	U	14	7.7	10.3	25.0
	A	89	48.9	65.4	90.4
	SA	13	7.1	9.6	100.0
	Total	136	74.7	100.0	
Missing	System	46	25.3		
Total		182	100.0		

men and women have equal access to seed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	7	3.8	5.1	5.1
	D	4	2.2	2.9	8.1
	U	10	5.5	7.4	15.4
	A	88	48.4	64.7	80.1
	SA	27	14.8	19.9	100.0
	Total	136	74.7	100.0	
Missing	System	46	25.3		
Total		182	100.0		

men and women have equal access to agro chemica

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	4	2.2	3.0	3.0
	D	14	7.7	10.5	13.5
	U	11	6.0	8.3	21.8
	A	86	47.3	64.7	86.5
	SA	18	9.9	13.5	100.0
	Total	133	73.1	100.0	
Missing	System	49	26.9		
Total		182	100.0		

men and women have equal access to labour

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	13	7.1	10.3	10.3
	D	21	11.5	16.7	27.0
	U	10	5.5	7.9	34.9
	A	58	31.9	46.0	81.0
	SA	24	13.2	19.0	100.0
	Total	126	69.2	100.0	
Missing	System	56	30.8		
Total		182	100.0		

men and women have equal access to credit

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	10	5.5	8.1	8.1
	D	28	15.4	22.6	30.6
	U	7	3.8	5.6	36.3
	A	50	27.5	40.3	76.6
	SA	29	15.9	23.4	100.0
	Total	124	68.1	100.0	
Missing	System	58	31.9		
Total		182	100.0		