IMPACT ASSESSMENT OF USAID-MARKETS II ON PRODUCTIVITY AND POVERTY STATUS OF RICE FARMING HOUSEHOLDS IN EBONYI STATE NIGERIA

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Febuary, 2021

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY (PhD) DEGREE IN AGRICULTURAL ECONOMICS

DEPARTMENT OF AGRICULTURAL ECONOMICS, FACULTY OF AGRICULTURE, AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA

Febuary, 2021

DECLARATION

I hereby declare that this thesis titled **"Impact Assessment of USAID-MARKETS II on Productivity and Poverty Status of Rice Farming Households in Ebonyi State, Nigeria"** was written by me and it is a record of my research work. No part of this work has been presented in any previous application for another degree or diploma at any institution. All citations and sources of information are duly acknowledged by means of references.

_____ _____

Ogechi Cordelia, NWAHIA **Date**

CERTIFICATION

This thesis titled **"Impact Assessment of USAID-MARKETS II on Productivity and Poverty Status of Rice Farming Households in Ebonyi State, Nigeria"** by Ogechi Cordelia NWAHIA meets the regulations governing the award of the Degree of Doctor of Philosophy (PhD) in Agricultural Economics of the Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to Almighty God, the creator of all things, my life and my world.

ACKNOWLEDGEMENTS

My unalloyed gratitude goes to God for His love, guidance, care, favour and blessings upon my life and for making life meaningful to me. I sincerely thank my supervisors; Prof. Z. Abdulsalam, Prof. S. A. Sanni and Prof. M.W. Musa for their fatherly and motherly love showered on me and for the privilege to tap from their wealth of knowledge. I truly appreciate the contributions of Prof. Ben Ahmed, Prof. M. G. Maiangwa, Dr. A. A. Hassan, Dr. Y. U. Oladimeji, Dr. H. Egwuma, Dr. O. O. Ugbabe, Dr. O. A. Ojeleye, Dr. O. Yusuf, Dr. Emmanuel Dodo and all my lecturers and staff members of the Department of Agricultural Economics, Ahmadu Bello University, Zaria, which space did not permit me to mention all their names. You all are instrumental in my academic progress and process of my making. May God bless you all for me.

Am deeply grateful to my parents, Mr and Mrs Odidika Geoffrey Nwahia, my siblings, friends and well-wishers for their love, financial provision and encouragement. Many thanks go to Rev. Fr. Ikechukwu Ogbunkwu, Rev. Fr. Vincent Alabi, Rev. Fr. Anthony Onyekwe, Rev. Fr. Ejike Mbaka, Rev. Fr. Chidi Ezeanya, Prof. B.T. Omonona, Prof. P.O. Erhabor, Dr. E.N. Onyeabor, Dr. S.O. Balogun, Yemi Johnson, Kehinde Felix, Abisola, Emma and François for their moral support during the course of this study. Many thanks go to all those people with whom interviews were held and all the respondents. Finally, my thanks go to all men of scholarly disposition from whose works I benefited immensely and to the external examiner of this research work.

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ABSTRACT

Poverty and low productivity of most staple food crops have continued to be a great challenge in Nigeria. Over the years, Nigerian government has come up with various plans and programmes aimed at reducing the level of poverty and increasing agricultural productivity. There is an increasing concerns by the government, international and local aid donors for concrete evidence to be supplied on the impact of such public programmes that aims at increasing productivity and reducing poverty. Therefore, this study assessed the impact of United States Agency for International Development (USAID) -Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites (MARKETS) II project on the productivity and poverty status of rice faming households in Ebonyi State, Nigeria with a view to showcase the contribution of USAID-MARKETS II project to poverty reduction and rice productivity. Multi-stage sampling technique was employed to select 239 participants and 252 non-participants of the project for the study. Structured questionnaire and field observation were used in collecting data for 2018 cropping season. Data collected were analysed using descriptive (frequency, mean and standard deviation) and inferential (Net Farm Income (NFI), Return Per Naira Invested (RNI), Logit model, Total Factor Productivity (TFP), Foster, Greer and Thorbeecke) statistics. The USAID-MARKETS II project employed several empowerment strategies towards improving the well-being and productivity of farming households in the project sites. These include, supply of improved rice seeds, fertilisers, training and extension support. The results that emanated from the study showed that age, household size, extension visit, years in cooperative society, education and years of rice farming experience were the significant factors that influenced participation in USAID-MARKETS II in Ebonyi State. Results further showed that rice production is profitable in the study area and there was no significant difference between the mean technical, allocative and

economic efficiency of participants and non-participants of the project. The result of Total Factor Analysis shows an increase in total factor productivity by 38% for participants of USAID-MARKETS II. Using Propensity Score Matching (PSM), the average impact estimation shows that USAID-MARKETS II had a positive and significant impact on productivity of the participants by 1.075 (38.1%). The Average Treatment Effect (ATE) on the treated for rice farming households from the overall population is larger with a value of 1.178 (41.7%) compared to the untreated category. The LATE estimates revealed a significant mean difference of 0.406 (7.75%) in rice productivity between participants and non-participants of the project. The analysis also reveal that the average increase in total productivity brought about by participation in USAID-MARKETS II was 0.396 (14%). Also, the study revealed that participation in USAID-MARKETS II project increases the participants' monthly per capita income by N5,336.9 (45.5% increment) as showed by PSM. LATE estimates showed that USAID-MARKETS II project increases participants' monthly per capita income by ₦1,193.86 (5.4% increment). Household size, sex, and farm size were the significant factors that influenced poverty status of participants and non-participants of USAID-MARKETS II. Major constraints faced by the rice farming households in rice production are; inadequate fund for rice production, high cost/inadequate labour, birds, pests and disease incidences, Fulani herdsmen grazers (clash with pastoralist) and inadequate land for rice production. Despite the significant impact of the project on productivity and poverty reduction, there is the need for the project to be extended to other states and areas in Ebonyi that were not involved in the project. In addition, government at the federal, state and local government levels should consider establishing grazing reserves or commercial ranches across various area in Ebonyi state to reduce the issue of farmers and herdsmen clashes.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Rice (*Oryza Sativa*) has always been an important staple in many African countries. For some decades, it has been the most rapidly growing food source across the continent (Norman and Kebe, 2010; Aliou, Didier, Marco and Kazuki, 2012, International Food Policy Research Institute (IFPRI), 2016a). However, the local production is largely insufficient to meet the consumer needs. (Aliou *et al*., 2012). In 2016, Africa produced an average of 30.8 million tonnes of rice and Africa also consumed a total of 45.2 million tonnes of milled rice (Food and Agricultural Organization (FAO), 2017). In order to meet up with the consumers' demand, Africa imported 14.4 million tonnes of milled rice in 2017 (FAO, 2017). With high food and fuel prices predicted to last long into the coming decade, relying on rice imports is no longer a sustainable strategy for Africa. The development of rice sector in Africa could be an engine for economic growth, which can be of help in eliminating extreme poverty and food insecurity, and raising the standard of living of millions of Africa poor. Rice production will create jobs along its value chain and lead to improvement of the well-being of the rural agricultural poor (Africa Rice, 2011, Aliou *et al*., 2012).

Nigeria is blessed with climatic, vegetation and soil conditions suitable for rice production. Between 2001 and 2003, rice production was estimated at 2.03 million tonnes while consumption was 3.90 million tonnes. The balance of 1.90 million tonnes was obtained by importation (Food and Agricultural Organization Statistics Division (FAOSTAT), 2007). The country was currently producing 3.2 million tonnes of paddy annually (Osanyinlusi and Adenegan, 2016; United states

Department of Agriculture (USDA), 2018; FAO, 2019). However, compared to the annual consumption level of 5.2 million tonnes, the above estimate is far below the national requirement since the average Nigerian consumes 40 kg of rice per year as reported by (Federal University Ndufu-Alike, Ikwo (FUNAI), 2016). In Nigeria, out of 4.6 million hectares available for rice production, only 1.7 million hectares are put to rice cultivation in 2008 while 2.7 million hectares were put to rice cultivation in 2014, despite that its production is labour intensive and labour constituted major production costs (Nwachukwu, Agwu and Ezeh, 2008; Tijjani and Bakari, 2014).

Efforts made by Nigerian government to improve rice production led to the implementation of different rice policies and establishment of the following: Abakaliki Rice Project of 1978; Presidential Rice Initiative of 1999; New Rice for Africa (NERICA), Multinational Rice Dissemination Project (MNRDP) of 2000, and FADAMA project initiated in 1996 and 2001 and Ibom Rice Project of 2001 among others. Recently, programmes like the National Rice Development Strategy (NRDS) 0f 2008, the United States Agency for International Development (USAID) Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites (MARKETS) initiated in 2005 were carried out.

USAID is an international agency that provides foreign aids to needy countries. The agency's intervention in agricultural production is known as Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites (MARKETS). MARKETS are working along the rice value chain in order to improve productivity, income, sales and jobs at firm and farm levels (USAID, 2013). USAID MARKETS was initiated in 2005 and designed to expand economic opportunities in Nigeria's agricultural sector, the project started by encouraging competitiveness along the value

chains for rice, sorghum, and cowpea through encouraging the use of commercial-led technologies to meet demand requirement, improved productivity and value addition. Over time, USAID-MARKETS have grown to provide farmers with assistance such as fertilizer supply and technology development; seed development, training farmers and including additional crops like sesame and cassava (USAID-MARKETS, 2010). USAID MARKETS operated in 23 states of Nigeria which includes Anambra, Nasarawa, Niger, Ogun, Ondo, Osun, Oyo, Plateau, Bauchi, Benue, Cross River, Kastina, Kwara, Taraba, Ekiti, Imo, Zamfara Rivers, Ebonyi, Jigawa, Kaduna, Kano and FCT inclusive. However, the rice project covered only twelve states which include Anambra, Benue, Ebonyi, Sokoto, Kebbi, Jigawa, Taraba, Niger, Benue, Nassarawa, Kano and Kwara and FCT inclusive. For rice producers, USAID MARKETS designed a package called Package of Practices (POP). POP was designed in such a way that it will be useful to the extension agents, trainers and other interested users. The purpose of POP is to assist producers with adequate knowledge and skills to enhance rice productivity, supply identified market outlets with high quality paddy and also to enhance income and well-being of rice producers (USAID -MARKETS, 2010).

1.2 Statement of the Problem

Nigeria, with a population of over 175 million, is the most populous nation in Africa and the seventh most populous in the world (United Nation, 2017). Her population is projected to be 200 million by 2019 and over 400 million by 2050, becoming one of the top five populous countries in the world (UN, 2017). Nigeria is one of the poorest countries in the world, with over 80 million or over 64% of her population living below poverty line and poverty and hunger have remained high in rural areas, remote communities where agriculture is the main stay (UN, 2017). Poverty in all

its forms has affected the Nigerian society for generations. Although there have been many programmes and projects with poverty reduction mandates implemented over the years, it appears they have not addressed the root causes of poverty (Mbanasor, Nwachukwu, Agwu, Njoku and Onwumere, 2013). Ekong and Onye (2014) reported that in 2013, the Department for International Development (DFID) report shows that 63% of Nigerians are living below the poverty line of $1 daily even with plenty of natural resources such as oil and fertile land for agricultural production. About 69 million Nigerians were poor in 2004 (Omonona, 2009; Diao, Nwafor and Alpuerto, 2009) and it increased to 112.5 million in 2010 (National Bureau of Statistics (NBS), 2012) and currently, 119.5 million Nigerians are poor (World Bank, 2017). About 83 million people in Nigeria lived below the country's poverty line of 137,430 naira ($381.75) in 2019 (NBS, 2019). Past research works in Nigeria (Abur, 2014; Adetayo, 2014) attest to the growing incidence of poverty in Nigeria. Recent report has it that Nigeria has overtaken India in extreme poverty ranking despite being six times smaller in population than India (Khara, Hamel and Hofer, 2018). Therefore, It is clear from existing literatures (NBS, 2012; Abur, 2014; Adetayo, 2014; World Bank, 2017: UN, 2017; NBS, 2017; 2019) that there is a growing incidence and depth of poverty in Nigeria.

Ebonyi State being one of the states in Nigeria, was reported as having the least Human Development Index (HDI) compared to other states in the Southeast (United Nations Development Programme (UNDP), 2013). Within southern part of the country, Ebonyi is the only state with poverty rate above the national average of 46%, the poverty rate in the state is 56% which is higher than the national average of 46% and twice as high as the average of 27% for the South East (UNDP, 2013). Recently, the poverty rate in Ebonyi State increased to 58.9% (Eze, Odoh, Igwe, and Mgbanya, 2019). About 80% of Ebonyi citizens are classified as falling below the

poverty line; that is, living below the $1.9 per day benchmark with life expectancy of 47 years (UNDP, 2013; UNDP, 2016). NBS (2013; 2017) statistics included Ebonyi among the 10 poorest states in the federation while Varrella (2020) reported that Ebonyi State was ranked as the fourth most poorest States in Nigeria despite being reported by FUNAI (2016) as the 5^{th} highest producer of paddy rice in Nigeria with over 405,000 metric tonnes/annum, and highest rice processor in Nigeria with capacity to process over 2,080,000 metric tonnes/annum.

Generally, rice production in Nigeria has traditionally been characterized by low yields and slow growth (Ilu, 2015; IFPRI, 2016a; Onyekwena, 2016; Nwahia, Balogun, Balogun, Emeghara, Onwegbunam and Bala, 2020). Rice yield in Nigeria reached its peak in the mid-1980s, and has since been stagnant or even declining (IFPRI, 2016a). While progress has been made in increasing the hectares of land under rice cultivation, apparent declines in rice productivity has off set the gain in the cultivated areas (Onyekwena, 2016; IFPRI, 2016b). Low rice productivity have continued to be a major challenge facing rice producers in Nigeria (Ilu, 2015; Onyekwena, 2016; IFPRI, 2016b). It is clear from the available literatures that Nigeria rice productivity is among the lowest when compared with countries like Ghana, Chad, Niger, and Benin, with an average yield of 1.51t ha^{-1} (Cadoni and Angelucci, 2013; Ilu, 2015). Low rice productivity in Nigeria has been attributed to the prevalence of rainfed rice growing systems, among others such as low inputs use and farmers not using high yielding varieties, which has consequently resulted in a low yield. About 77 percent of rice production in Nigeria is rain-fed while 23 percent of the rice land cultivated is irrigated (Onyekwena, 2016). The average yield in rain-fed was estimated at between 1 to 3 tonnes/ha (IFPRI, 2016b). United States Department of Agriculture reported that Nigeria local rice production, and productivity dropped in 2016 and 2018 compared with 2015 production and productivity (USDA, 2018).

Recently, USAID MARKETS II was initiated to assist rice producers with adequate knowledge and skills to enhance rice productivity, income and their well-being (USAID-MARKETS, 2010; USAID-MARKETS, 2014). Given the fact that a lot of programme such as FADAMA III, IFAD rice programme among others have been implemented in Ebonyi State for rice farmers to increase productivity and reduce poverty, yet these seem not to be yielding the needed results as poverty has continued to increase in Ebonyi state (UNDP, 2013; 2016; Eze *et al,* 2019). Also, there have been an increasing number of recent requests by government, intervention partners/donors agencies and the development community for hard evidence to be supplied on the impact of such public programmes that aim at reducing poverty (Nguezet, Diagne Okoruwa, Ojehomon, 2011). Till date, research works conducted in Ebonyi state failed to capture the impact of USAID-MARKETS II on the productivity and poverty status of rice farming households. Ume and Ochiaka (2018) and Eze *et al* (2019) looked at factors influencing poverty among rural households but limited their work to only one local government area but it was not specifically on USAID-MARKETS II program.

Some other works (Ekpe and Alimba, 2013; Nwaobiala and Ume, 2013; Nwinya, Obienusi, and Onuoha, 2014; Nwalieji, 2015) looked at the rice farming households in Ebonyi State but concentrated on economics of their rice production, and disregarded their productivity and poverty status. Also, it was not specifically on USAID-MARKETS II program. Mkpuma, Adeoye, Yusuf, Balogun, and Akinlade (2013) studied competitiveness of rice processing and marketing in Ebonyi State while Chidiebere-Mark (2017) studied the analysis of value chain in rice production systems in Ebonyi State, Nigeria, but none of the studies were specifically on USAID-MARKETS II. Therefore, there seem to be inadequate independent information about the impact of USAID-MARKETS II on the productivity and poverty status of rice farming households. It is in this

respect, that this research work has been designed to empirically establish the impact of USAID-MARKETS II on the productivity and poverty status of rice farming households in Ebonyi state. The study attempted to find answers to the following research questions:-

i. What are the socio-economic profiles of participants and non-participants rice farming households in USAID-MARKETS II in Ebonyi State?
ii. What factors determine participation in USAID-MARKETS II?
iii. Is rice farming in Ebonyi state profitable?
iv. Are rice farming households technically, allocatively and economically efficient?
v. What is the impact of USAID-MARKETS II on the productivity of rice farming households?
vi. What is the impact of USAID-MARKETS II on the poverty status of rice farming households?
vii. Which factors influence poverty status among rice farming households?
viii. What are the constraints faced by the rice farming households in the study area?

1.3 Objectives of the Study

The broad objective of this study is to assess the impact of USAID-MARKETS II on the productivity and poverty status of rice farming households in Ebonyi State, Nigeria. The specific objectives are to;

i. describe the socio-economics characteristics of USAID-MARKETS II participants and non-participants rice farming households in Ebonyi State,
ii. identify the factors influencing participation in USAID-MARKETS II,

iii. estimate the profitability of rice production among participants and non-participants rice farming households,

iv. analyze the technical, allocative and economic efficiency of participants and non-participants rice farming households,

v. determine the impact of USAID-MARKETS II on the productivity of rice farming households,

vi. determine the impact of USAID-MARKETS II on the poverty status of the rice farming households,

vii. determine the factors influencing poverty status of participants and non-participants and

viii. identify the constraints faced by participants and non-participants rice farming households in Ebonyi state.

1.4 Research Hypotheses

The following null hypotheses were tested.

(i) Ho : There is no significant difference between the profit of participants and non-participants rice farming households,

(ii) Ho: There is no significant difference between technical, allocative and economic efficiencies of participants and non-participants rice farming households.

(iii) Ho: USAID-MARKETS II has no significant impact on productivity of rice farming households in the study area.

(iv) Ho: USAID-MARKETS II has no significant impact on poverty status of rice farming households.

1.5 Justification

Decreasing agricultural productivity and poverty are major problems in the developing countries in general and reducing poverty in Nigeria will reposition it to where she belongs (Jhingan, 2007) as cited in Folorunso (2015). This study will provide an understanding of the impact of USAID-MARKETS II project on the productivity and poverty status of Ebonyi rice farming households in Nigeria, and the information derived will be used by researchers, donor agencies, consultants and academicians as a reference for further research work. The study will be of help to the advocates and policy makers of the agricultural sector who will use it for advocacy and sensitization of the government (both local and central), development partners and donor agencies; for more resources to help eliminate constraints within the sector. This will also help to come up with capacity building mechanisms to help rice farmers overcome the barriers that impede high productivity.

The research work will contribute to the literature in several aspects. First, there is limited evidence on the impact of Agricultural programmes on productivity and poverty status of Ebonyi rice farming households, this study will provide evidence on impact of USAID-MARKETS II project on productivity and poverty status of smallholder rice farming households with important policy implications in designing policies for rice farming households. Second, the research work will produce evidence on USAID-MARKETS II program performance for the use of government officials, program managers, development partners, donor agencies, civil society, and other stakeholders.

This study will improve the database of USAID for further studies and provide the necessary information on impact of USAID-MARKETS II project on productivity and poverty of rice farming households with a view to improving the project design, planning and implementation

strategies, thereby accelerating the achievement of their set objectives. Resources have been utilized by USAID, Federal and State Governments to ensure that farmers are trained in different production practices to efficiently utilize their resources in order to improve their income, productivity and profit. The result of this study will showcase whether the huge resources expended on this project are justifiable. It will therefore serve as a feedback mechanism that lends credence to the interventionist roles the USAID-MARKETS II has played in reducing widespread poverty, increasing rice productivity, and raising farm incomes of rice farmers who are benefiting from the programme in the State.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Framework

The major concepts used in this research work were discussed as follows:-

2.1.1 USAID-MARKETS

USAID is an international agency that provides foreign aids to needy countries. The agency's intervention in agricultural production is known as Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites (MARKETS). MARKETS is working along the rice value chain in order to improve productivity, income, sales and jobs at firm and farm levels (USAID-MARKETS, 2010; USAID, 2013). USAID MARKETS was initiated in June 2005 and designed in such a way to expand economic opportunities in Nigeria's agricultural sector. The project started by encouraging competitiveness along the value chains for rice, sorghum, and cowpea through encouraging the use of commercial-led technologies to meet demand requirements, improved productivity and value addition.

USAID MARKETS is operated in the FCT and 23 states of Nigeria which include Anambra, Nasarawa, Niger, Ogun, Ondo, Osun, Oyo, Plateau, Bauchi, Benue, Cross River, Kastina, Kwara, Taraba, Ekiti, Imo, Zamfara Rivers, Ebonyi, Jigawa, Kaduna and Kano. However, the rice project

covered only twelve states, namely, Anambra, Benue, Ebonyi, Sokoto, Kebbi, Jigawa, Taraba, Niger, Benue, Nassarawa, Kano and Kwara. The first phase of USAID-MARKETS lasted from 2005 to 2010 and there was a bridge to MARKETS II from 2010 and MARKETS II ended in 2017. For rice producers, USAID MARKETS designed a package called Package of Practices (POP). POP was designed in such a way that it will be useful to the extension agents, trainers and other interested users. The purpose of POP is to assist producers with adequate knowledge and skills to enhance rice productivity, supply identified market outlets with high quality paddy and also to enhanced income and well-being of producers (USAID-MARKETS, 2010).

The Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites II (MARKETS II) project is designed to strengthen agricultural competitiveness and food security in Nigeria by improving livelihoods in selected areas through improved productivity, increased value-addition, increased commercialization of selected commodities and processed products, and an improved policy environment (USAID 2013, USAID-MARKETS, 2014). The objective of the MARKETS II program is to promote agricultural development through increased private sector participation and investment in the sector, raising income, increasing employment, improving food security, and reducing poverty. MARKETS II focused on seven commodities– rice, sorghum, soya bean, maize, cassava, cocoa, and aquaculture. MARKETS II not only stimulated production, but also linked producers to processors, suppliers and financial institutions. MARKETS II also engaged extension agents to educate lead farmers in improved methods and techniques, these lead farmers then served as role models and trainers for the surrounding community. Finally, the project engaged international and local partners to improve fertilizer and soil fertility; developed agronomic and agricultural small business approaches; and provided technical support for aquaculture and agronomic training (US Mission Nigeria, 2017).

MARKETS II's activities were guided by five pillars which include:

• Maximizing the MARKETS approach to unleash the potential of Nigerian agriculture, including the Niger Delta Region

• expanding the fertilizer voucher program and out-grower activities with a range of Nigerian and international processors, continuing to work through others, building new partnerships to develop sustainable buyer-farmer linkages

• Prioritizing agricultural inputs, finance and markets

• Entering every activity with an exit strategy by defining who takes on what from day one with our role to demonstrate, scale up, and exit when milestones are met.

• Empowering Nigerian agriculture – by forming Nigerian workforce that understands agriculture as a commercial business, including women, youth and the vulnerable, and puts their skills and knowledge to work to bring success to their households, the sector, and Nigeria (USAID, 2013).

USAID spent $65 million for Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites II (MARKETS II) Project in Nigeria. Support and activities were transmitted to local, state and federal partners in the feed the future initiatives. This Feed the Future initiative brought together farmers, processors, local service providers, the Ministry of Agriculture and Rural Development, and private and public sector entities to enhance Nigeria's agricultural sector. MARKETS II supported the Government of Nigeria's Agricultural Transformation Agenda by addressing critical issues hindering the agricultural sector in addition to strengthening agricultural competitiveness and food security, because of MARKETS II interventions, the private sector has invested more than 4.9 billion Naira ($27.2 M) into the agricultural sector since 2012 (US Mission Nigeria, 2017).

2.1.2 Linkages in USAID-MARKETS II Project

Nigeria's rice sector is dominated by weak and inefficient producer-market linkages due to poor infrastructure, low productivity, poor post-harvest handling and storage, expensive and poor access to inputs (high quality seeds, fertilizer and crop protection products), inadequate market information, and lack of trust amongst players. These constraints have led to low productivity and low income for the farmers (USAID-MARKETS, 2014). The USAID MARKETS II project addresses some of these problems by encouraging farmers to produce what they can sell and increase the income of farmers by linking them directly to buyers, and providing guaranteed markets for their products. They conduct training for the farmers using demo farms and facilitate the transfer of management and technology packages using extension agents who monitor and follow up farmers activities, encourage formation of organization to pull their resources together (Fig 2.1). Improved technologies introduced by MARKETS II to the rice farmers includes, good site selection/land preparation, use of crop protection products (pre emergence and post emergence), use of new improved rice seeds and quality seed tests, use of row planting, early transplanting of carefully managed seedlings, transplanting single per hole with minimal root disturbance, fertilizer application immediately after planting and quantity of application depending on soil type, use of bonds to control water in the field, frequent weeding, timely harvesting to avoid wastage, drying, and threshing using bags.

USAID-MARKETS secure commitment of credit institutions (micro-finance banks) who give loan to the farmers to finance their production and small, medium and large processors to expand their businesses through increasing their paddy requirement, USAID-MARKETS also secure the commitment of the small, medium and large businesses (e.g, Ebony Agro industries, Ebonyi Rice

World, Small Scale Processors, Abakaliki rice millers etc.) by buying more paddy directly from the farmers (Fig 2.1). There is vertical integration between small, medium and large processors and the farmers. While the farmers supply paddy to the small, medium and large processors, they in turn pay money with which the farmer finances their production. Increases in their purchase means increases in production by the farmer and increase in income of the farmer. Income indicates the ability of the farmer to purchase their basic needs of life (Fig 2.1). USAID-MARKETS also identified final markets where small, medium and large processors sell their processed rice to get money to finance their businesses

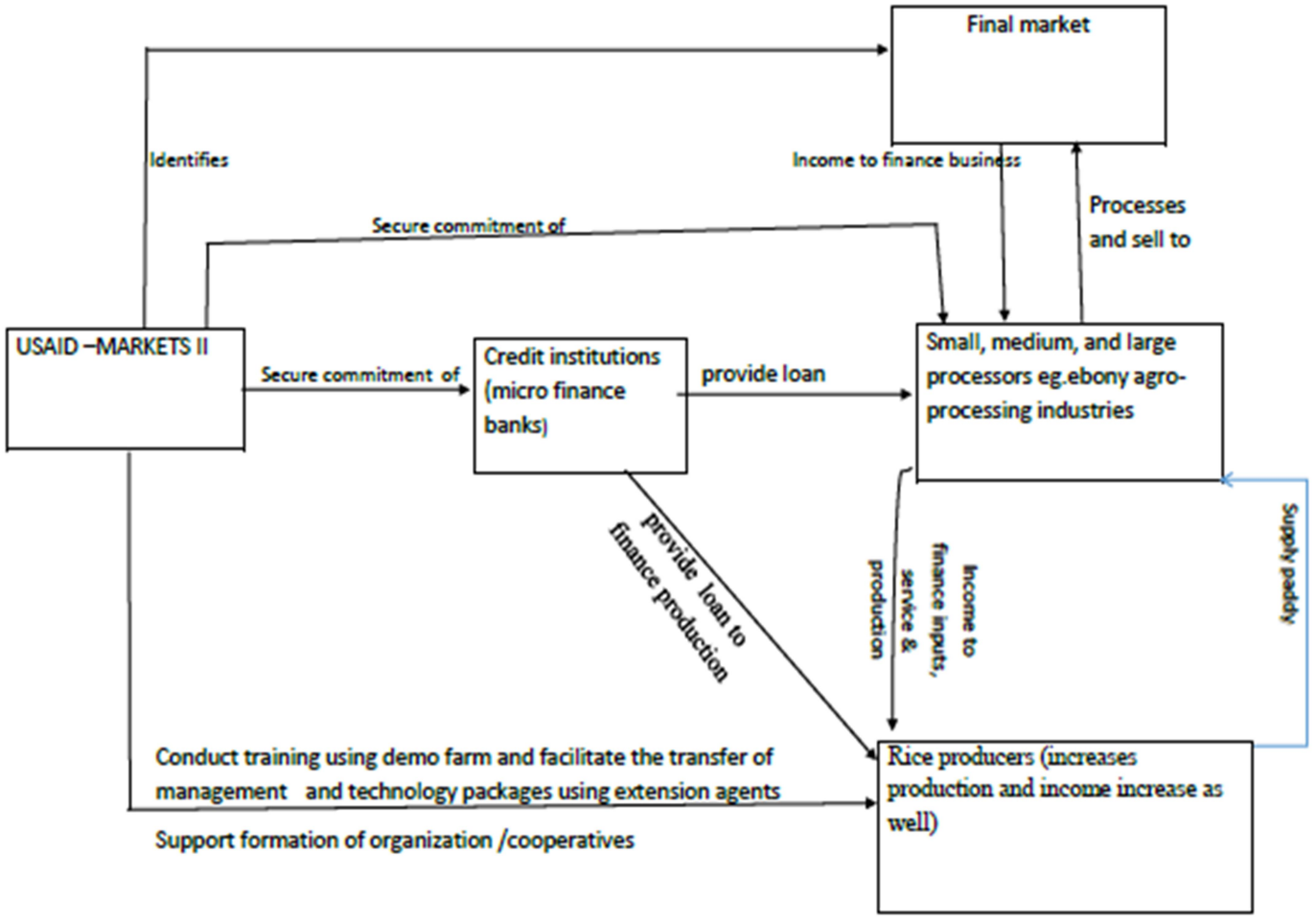


Fig 2.1: Linkages in USAID-MARKETS II

Source: USAID-MARKETS, 2014

2.1.3 The concept of productivity

Productivity is defined as a ratio of output to input (Ramaila, Mahlangu and Daan, 2011). It can be defined as the production value (or quantity) divided by the number of factors consumed in the production process (Pepitone, 2000). Productivity is the relationship between the quantity of output and the quantity of input used to generate that output. It is a ratio of output to input. The output used for productivity calculation could be of different forms. It can be in form of produced goods or provided services. Outputs may be expressed in physical (quantities) or financial (value) terms. Inputs are resources used to produce outputs, most common forms of inputs are labor, capital, and intermediate inputs. Agricultural productivity measures the performance and provides a guide to the efficiency of the sector (Thirtle, Piesse and Gousse, 2005; Kirsten and Vink, 2003 and Conradie, Piesse and Thirtle, 2009). According to Oyaide (1994), productivity is generally defined as the level of output in relation to levels of resources employed in a given period of time. It is the rates of flow of output when compared with rate of flow of resources such as land inputs used in production. Murry (2016) affirmed that the ratio of the firm's output to its input is a definition of its productivity. A firm that produces more output per unit of input is more productive.

Productivity has so many effects on economies and sectoral growth. Higher productivity results in performances enhancement (production increases) and higher profits (minimal factors costs, better selling prices and marketing capacities). Enhanced skills in transforming inputs to outputs play critical role in enhancing productivity. With the same amount of inputs, some farmers can produce more than others, depending on their skills, knowledge level, and cognitive capacities. Productivity in agriculture can be increased through one of the listed processes; an increase in output and input with output increasing proportionately more than inputs; an increase in output while inputs remain the same; a decrease in both output and input with input decreasing more; or decreasing input while output remains the same (Adewuyi, 2006). Productivity is of two major types; partial and total factor productivity.

2.1.3.1 partial factor productivity

A partial productivity measure relates output to a single input. Examples include labour productivity (output per hour worked), capital productivity (output per unit of capital), and energy productivity (output per joule of energy used). According to Murry (2016), partial productivity shows the impact key inputs have on productivity. It measures total outputs against a part of the inputs (Murry, 2016), in this case, the output per unit of input is a measure of the productivity level. Partial productivity measure provides an incomplete picture of the productivity with which the firm uses its inputs and to keep track of the firm's partial productivity growth for all inputs may be cumbersome.

This measure can be used in comparing performances between firms or sectors but in reality, at least labor and capital are needed for any simple investment. When multiple outputs are produced using multiple inputs, productivity can often be assessed using partial productivity measures or

total factor productivity. Partial productivity can be seen as produced output per unit of each input used. This is calculated for each input separately. Eamples are output per worker or per hour worked, or output per hectare of land. Though commonly used, partial productivity measures are of limited use and can potentially mislead and misrepresent the performance of a firm (Coelli; Prasada; O'Donnell and Battese, 2005). In fact, when the proportion in which the factors of production are combined (e.g., labor and capital) undergoes a change, partial measures of productivity provide a distorted view of the contribution made by these factors in changing the level of production (Kathuria, Raj and Sen, 2013).

Ramaila, Mahlangu and Daan (2011) observed that partial factor productivity only considers a single input in the ratio. For example, it uses yields of crops to determine the productivity of field crops. Literature indicates that it is easy to compute as it requires limited data, but it can be hard to identify factors that cause productivity of field crops to change.

2.1.3.2 total factor productivity (TFP)

Total factor productivity (TFP) can be defined as a ratio of aggregate output produced relative to aggregate input used. It takes into account the use of a number of factor inputs in production and, therefore, are more suitable for performance measurement and comparisons across firms and for a given firm over time (Coelli; Prasada; O'Donnell and Battese, 2005). There are different views on what TFP means (Lipsey and Carlaw 2002). The first view sees TFP as a measure of the rate of technical change (Krugman, 1996; Law, 2000) while others (Ramaila, Mahlangu and Daan, 2011) view TFP as measures of free lunches of technical change, which are mainly associated with externalities and scale effects. According to UK National statistics (2018), TFP is a key measure of the economic performance of agriculture and an important driver of farm incomes. It represents

how efficiently the agriculture industry uses the resources that are available to turn inputs into outputs.

In the word of Ramaila, Mahlangu and Daan (2011), total factor productivity is defined as the ratio of total agricultural output to a subset of agricultural inputs, TFP utilizes more than a single factor. The measures reflect the joint effects of many factors including new technologies, economies of scale, managerial skill, and changes in the organization of production. TFP is preferred due to the fact that it captures the full extent of input use and output production.

Coelli (1996) measured total factor productivity as the ratio of total revenue (product of the quantity produced and the unit price) to the total input cost (gross value of the inputs) which is given by the formula

$$TFP = \frac{\text{Gross value of output}}{\text{Gross value of inputs used}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The higher the ratio, the more productive the farmer is.

Also, Key and Mcbride (2003) as cited in Achu (2017) measured total factor productivity as the inverse of unit variable cost. According to them, total factor productivity is the ratio of the output to the total variable cost. The formula for their total factor productivity was given as:-

$$TFP = \frac{Y}{\Sigma PiXi + TFC} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where TFP = total factor productivity,

Y = quantity of agricultural product (in Kg),

Pi = Unit price of i^{th} variable input,

Xi = quantity of i^{th} variable input and

TFC = total fixed cost.

2.1.4 The concept of poverty

Poverty captures a wide range of dimensions which include social, economic, political, health and access to resources. Poverty therefore has different meaning to different people depending on the type of definition used. According to Goulden and D'Arcy (2014), poverty is the inability to meet a wide range of needs which includes education, health, and basic needs. Tersoo (2013) viewed poverty as a state where an individual is not able to cater adequately for his or her basic needs of food, clothing and shelter. Poverty was seen by Sen (2009) as the lack of necessities of life such as basic food, shelter, medical care, and safety which are generally thought necessary based on shared values of human dignity. For Sumitra and Dukhabandhu (2008) as cited in Eze (2014), poverty actually requires no definition, since everyone knows or recognizes who is actually poor. The authors were of the view that poverty reflects on the face of the poor which is a constant companion of the poor and its presence or the symbols of it serve a number of purposes. For economists, poverty is defined in relation to a specific income level ($1 or $2 USD a day), or measured in terms of per capita income (total population divided by gross domestic product). However, critics argue that measuring poverty in terms of income does not fully capture the phenomenon of poverty. A broader definition by the World Bank sees poverty as multidimensional, including variables like (i) low income, (ii) low levels of education and health, (iii) vulnerability (to health or income loss, natural disaster, crime and violence, and education curtailment), and (iv) voicelessness and powerlessness (feeling discrimination, lacking income-earning possibilities, mistreatment by state institutions, and lacking status under the law).

Poverty is characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information and depends not only on income but also access to services (Olaitan, Ali, Onyemaechi and Nwackukwu, 2000). Hildebrand (2009) described poverty as being of two types (a) relative poverty which he said is measured against the average standard of a particular society which can change overtime and (b) absolute poverty which is measured against the minimum necessary to maintain physical efficiency to the extent of being incapable of protecting human dignity. He maintained that relative poverty is seen as the difference in economic well-being between industrialized countries and the developing countries and within the developing countries between the region and social classes. Absolute poverty was seen here as inability to satisfy basic needs such as adequate housing, hygiene, food, educational opportunities, protection from and treatment of illness.

Poverty was defined by Beck (2004) as cited in Ezeh (2014) as a situation when the resources of individuals or families are inadequate to provide a socially acceptable standard of living. Apart from being the absence of daily necessities of water, food, shelter or clothing, it is the absence of the capabilities and opportunities to change those conditions. As stated by Simanga (2010), poverty is relative and its measurement according to him encompasses technical, social and political problem and could be defined by the number of people living below the international poverty line. He noted that the standards and costs of living vary from country to country but the major criterion which could be used to determine the level of poverty in any country is the standard of living, the level of basic needs and the standard of household consumption. Ekundayo (2002) defined poverty as inability of the people to provide basic material goods and infrastructure, sufficient medical services and adequate educational facilities. It is multi-dimensional and manifested in such form as social exclusion, shortage of income, deprivation in

knowledge, low life expectancy, poor quality of life and lack of material means (Eze *et al*., 2019). In support of this view, Johnson (2004), as cited in Ezeh (2014) indicated that the poor are often the ones who face extreme uncertainty and vulnerability to ill-health, and are also the ones to bear the brunt of economic and geographical dislocation. Moreover, the poor are often exposed to ill-treatment by institutions of the state and society and are powerless to influence decisions affecting their lives. Stromquist (2009) refers to poverty as "what the poor lack", but said that this lack may be as a result of a condition created or at best uncorrected by the upper and middle classes. He said that extreme poverty comprises of starvation, malnutrition and visible hardship and he believed that education can be crucial in reducing poverty.

In the word of Gordon (2008), as cited in Ezeh (2014), poverty is a denial of choices and opportunity and a violation of human Dignity. According to him, Poverty means lack of basic capacity to participate effectively in society. Gordon also saw poverty as not having enough to feed and clothe a family; not having school or clinic to go to; not having the land on which to grow one's food or a job to earn a living; and not having access to credit. Ezeh (2014) sees poverty as a problem with many faces. He stated that one face of poverty shows the material conditions which involve the absence or lack of goods and services for the people. Another face depicts the economic position of the people which involve certain situations where a person or a group of persons have low income with limited resources. The other face of poverty for him is social, which offers the poor exclusion, lack of entitlement and being too dependent on others in order to live.

2.1.5 The concept of impact evaluation

Impacts are the longer-term results produced by a programme, project or policy, usually in conjunction with other factors and activities by other agencies. They include intended and

unintended results, positive and negative, direct and indirect impacts (Rogers, Hawkins, McDonald, Macfarlan and Milne, 2015). The Commonwealth of Australia's Resource Management Guide (2015) defines impact as the ultimate difference made by fulfilling a purpose defined in an entity's corporate plan. Compared to the combined outcome of activities contributing to a purpose, impacts are measured over the longer term and in a broader societal context. Impact will have different meanings depending on the ultimate objective of an intervention or programme. Impact is defined as including, but not limited to an effect on, change or benefit to the activity, attitude, awareness, behaviour, capacity, opportunity, performance policy, practice, process or understanding of an audience, beneficiary, community, constituency, organisation or individuals in any geographic location whether locally, regionally, nationally or internationally (Commonwealth Scientific and Industrial Research Organisation (CSIRO, 2014). For the purposes of accountability, learning, value-for-money and ethical conduct, it is important that impact includes unintended impacts, positive or negative impacts (Rogers *et al.,* 2015).

Unintended impacts in an industry context might take the form of an externality, a case where a third party that is not the direct user or adopter receives a direct impact, which is often unintended (CSIRO, 2014).

Impact Evaluation

An impact evaluation provides evidence about the impacts that have been produced or the impacts that are expected to be produced (Rogers *et al.,* 2015). Impact evaluation assesses the changes in the individuals' well-being that can be attributed to a particular program, policy or project. Therefore, impact evaluations estimate the average impacts of a program, program modalities, or a design innovation (Gertler, Martinez, Premand, Rawlings and Vermeersch, 2016). It has to not only

provide credible evidence that changes have occurred but also undertake credible causal inference that these changes have been at least partly due to a project, programme or policy (Rogers *et al.,* 2015).

An impact evaluation is a form of programme evaluation and it is usually planned using the classic steps of an evaluation as listed by Rogers *et al.,* (2015).

- Identify primary intended users of the evaluation and their primary intended uses and involve them in the planning of the evaluation as much as possible.
- Identify relevant impacts and how they might be produced. Drawing on previous research and evaluation, key informants, and programme documentation, develop a programme theory of the intervention showing how its activities (or planned activities) are likely to generate the intended impacts, and a negative programme theory showing how it could generate negative impacts.
- Develop a short list of key evaluation questions.
- Answer these key evaluation questions, using an appropriate combination of methods and designs.
- Report findings to primary intended users and support them to use the findings.

Impact evaluations are divided into prospective and retrospective evaluation (Gertler *et al*., 2016). Prospective evaluations are usually developed when the program is being designed. Therefore, they are built into the program implementation. Here, baseline data are collected before the program began for both participants (those that will receive the intervention) and non-participants (those that will not receive the intervention) while Retrospective evaluations assesses program impact after its implementation. Therefore, in retrospective evaluations, there is limited information to showcase whether the program was successfully implemented and whether its

participants truly benefited from it. Retrospective evaluations uses quasi-experimental methods and usually rely on strong assumptions but they can produce evidence of an impact that is more debatable (Gertler *et al*., 2016).

Different types of impact evaluation are used before and after as well as during programme implementation. These are: -

- *Ex post* impact evaluation gathers evidence about actual impacts.
- *Ex ante* impact evaluation forecasts likely impacts.
- During implementation gathers evidence about whether the program is on track to deliver intended impacts.

Types of Impact evaluations based on intended use (Rogers *et al*., 2015).

- Formative impact evaluation is used to inform improvements to a programme or policy, particularly when there is an ongoing policy commitment.
- Summative impact evaluation is done to help make decisions about beginning, continuing or expanding a programme or policy.

Impact evaluation can provide data on impacts for economic evaluation. Therefore, Impact evaluation can be complemented by economic analysis.

Economic evaluations combine evidence from an impact evaluation and the analysis of data about costs, primarily

- Cost-benefit analysis which transforms all the benefits (positive impacts) and costs (resources consumed and negative impacts) into monetary terms, taking into account discount factors over time, and produces a single figure of the ratio of benefits to costs

- Cost-effectiveness analysis which calculates a ratio between the costs and a standardised unit of positive impacts (Rogers *et al*., 2015).

2.2 Economic Importance of Rice in Nigeria

2.2.1 Rice production in Nigeria

Rice production in Nigeria dates back 2,000 to 3,000 years ago. The production was mostly in the flood plains of the Niger River and involved one of only two species of cultivated rice in the world, Oryza glaberrima, or African rice. The introduction of the second species, Oryza sativa, or Asian rice, occurred after the arrival of the Portuguese in the 17th century (Linares, 2002). However, it was only during the last few decades that rice production in Nigeria began to emerge as an important food security issue, as demand outstripped supply with ever-increasing gaps.

Rice is cultivated in all the agro-ecological zones in Nigeria. Despite this, the area cultivated to rice is still small (IFPRI, 2016a). In 2000, out of about 25 million hectares of land cultivated to various food crops, only about 6.37% was cultivated to rice. During this period, the average national yield was 1.47 tonnes per hectare. Significant improvement in rice production in Nigeria occurred in 1980 when output increased to 1 million tonnes while area cultivated and yield rose to 550 thousand hectares and 1.98 tonnes per hectare respectively. Throughout the 1980s, rice output and yield increased. But in the 1990s, while rice output increased, the yield of rice declined, suggesting extensive rice cultivation (IFPRI, 2016b). Rice production in Nigeria has traditionally been characterized by low yields and slow growth. Yield reached a peak in the mid-1980s and has since been stagnant or even declining (IFPRI, 2016a). Though rice production in Nigeria has increased in the last four decades, this has been driven mostly by area expansion (IFPRI, 2016b).

The land area that could be cultivated in rice is roughly 4.7 million hectares, but only 2.7 million hectares were harvested to rice (Tijjani and Bakari, 2014; IFPRI, 2016b). The current rice area in Nigeria is the largest within sub-Sahara Africa (SSA) and almost twice as large as that of the second largest producer, Madagascar (IFPRI, 2016b).

Rice production in different rice ecologies in Nigeria comprising lowland, upland, and irrigated rice is as follows: - the rainfed lowland system covers about 64 percent of the area under rice and it contributes the most (67%) to national production. In contrast to the rainfed lowland system, irrigated lowlands account for only 4 percent of the national area and contribute only 7 percent to the total volume of rice produced in the country. Upland systems covers about 22 percent of the area under rice and contribute about 26 percent to the national production. Notwithstanding, yields are highest from the irrigated systems (more than 2 tonnes/ha), followed by rainfed lowland systems (between 1 and 3 tonnes/ha) and finally upland systems. The North Central zone produces the most rice, accounting for 30 to 50 percent of national production. The North West and North East zones each produce about 15 to 30 percent, respectively. Production from the South East, South South, and South West zones combined accounts for only 10 to 20 percent of total production in Nigeria. The majority of the rice is produced by small-scale farmers on less than 1 hectare of land. Only about 20 percent and 5 percent of rice producers cultivate plots of more than 1 ha and 3 ha, respectively (IFPRI, 2016b). The average yield in the country is 1.8 MT per hectare, which is significantly lower than best practice yields of 9.2 MT per hectare generated in Egypt.

Although rice grows well across Nigeria, the main areas of cultivation are the middle belt and northern states of Benue, Kaduna, Niger and Taraba, as well as the south eastern states of Enugu, Cross River and Ebonyi. In 2014, the annual rice demand in Nigeria was estimated at 5.9 million

MT. However, only an estimated 2.7 million MT of milled rice was produced locally (Sahel Capital Partners & Advisory Limited, 2015). The demand increased to 6.3 million MT in 2016 (Grow Africa, 2017). The need to bridge the gap between rice demand and supply has led to increases in rice imports. Nationally, about 13 million individuals reported producing the rice they consumed in 2011. About 82 percent of these own-production consumers are in the northern zones, with the North East and the North West having the largest share of individuals who produce the rice they consume (IFPRI, 2016b).

2.2.2 Rice consumption in Nigeria

Rice consumption in Nigeria began to increase in 1970s as a result of increase in world prices of crude oil at that time, which gave Nigeria large amounts of foreign currency reserves (IFPRI, 2016a). This in turn led to the appreciation of the naira, making it cheaper to import rice rather than to produce it at home. Per capita rice consumption in Nigeria has yet to catch up with the average for West Africa, mainly because of the large gap between Nigeria and major rice-consuming countries such as Liberia, Sierra Leone, and Senegal (IFPRI, 2016a). In Nigeria, statistics has showed that per capita consumption of rice exceeds that of cassava, indicating how dominant rice has become in the Nigerian food budget (IFPRI, 2016a). Rice not only dominates other cereals, it also dominates the average Nigerian budget. Statistics shows that 5.2 million tonnes of rice was consumed in Nigeria in 2011. Of this amount, only 2.85 million tons were produced locally, while 2.35 million tonnes were imported (IFPRI, 2016a). The average Nigerian household spent over 6 percent of its total income on rice consumption in 2011. This budget share was the highest among food staples in this time period, and the pattern is similar for both urban

and rural households. Compared to other staples, rice is also widely consumed across the population, 84 percent of Nigerian households reported consuming rice at home (IFPRI, 2016a).

There are differences in the pattern of rice consumption: while 91 percent of urban households in Nigeria consume rice, 80 percent-of rural households do so. Consumption of imported and domestic rice also differs by location. While 72 percent of rice consumed by urban households is imported, only 33 percent of that consumed by rural households is imported (IFPRI, 2016a).

2.2.3 Rice ecology

The rice ecology is a major factor determining the rice production system. There are three main rice ecologies:

-Rainfed upland

-Rainfed lowland

-Irrigated

(i) Rainfed Upland

The upland rainfed rice-based systems cover the largest area (44% of the total West Africa rice cultivated area), mainly in coastal areas in the humid and sub-humid agro-ecological zone of West Africa (Defoer, Wopereis, Jones, Lancon, and Erenstein, 2002). Rice yields in upland systems average about 1tonne/ ha, weed competition is the most important yield reducing factor (Johnson, Dingkuhn, Jones and Moussa, 1998), followed by drought, blast, soil acidity and general soil infertility. Population growth has forced farmers to reduce the fallow periods and concentrate their farming activities towards the fragile upper parts of the upland slopes (Lamin, 2010). The

slash and burn method of land clearing has aggravated the weed pressure and also a decline in soil fertility due to erosion (Lamin, 2010). Farmers also face high risks of crop failure and generally lower productivity levels. In upland areas where the growing season is short, very early maturing varieties with tolerance to drought and blast are those required. Traditionally, farmers use long-duration rice cultivars which further undermine the fragility of the system and limit the cropping intensity (Lamin, 2010).

(ii) Rainfed Lowland

The rainfed lowland systems (flood plains and valley bottoms) constitute 31% of the rice cultivation area in West Africa. The rice yields in rainfed lowlands are substantially higher than those in rainfed uplands, but still low, averaging 2 tonnes/ha (Defoer *et al*., 2002). The rice yields in these systems are highly dependent on the level of water control. The lowland systems have a potential yield of 3 tonnes/ha at low input levels. At high input level with good water control, the potential yield can go up to 5 or 6 t/ha (Defoer *et a*l., 2002). Biophysical factors affecting rice yield in rain fed lowlands systems include weed, drought, flooding, iron toxicity, soil nutrient supply, blast, rice yellow mottle virus and African rice gall midge. The major socio-economic constraints include resource availability, production risk, knowledge on best-bet crop management practices, and human health problems (Lamin, 2010).

(iii) Irrigated Ecology

Irrigation implies the ability to water and drain the field when the farmer wants to, only 12–14% (0.5 million ha) of the total rice area in West and Central Africa is irrigated (Defoer *et al*., 2002). This includes substantial areas in Cameroon (80%), Niger (55%), Mali (30%) and Burkina Faso

(20%). Irrigated rice in these countries (except Cameroon) is mainly in the Sudan Savannah and Sahel, which account for nearly 60% of the irrigated rice area in West and Central Africa. Irrigation systems include dam-based irrigation, water diversion from rivers and pump irrigation from surface water or tube-wells (Defoer *et al*., 2002). Irrigated rice farm has high yield potential, the average yield has been estimated to be between 6 to 11 tonnes/ha. Very high yield potential are found in drier zones than in others, because of high solar radiation and low disease stress problems (Lamin, 2010).

2.2.4 Factors affecting rice demand in Nigeria

Several factors have been identified as the determinants of rice demand in Nigeria and these, include rapid urbanization , accelerated population growth, increased per capita income, and changes in family occupational structures and lifestyles (Akpokodje, Larncon, and Erenstein 2001; Akande 2002; United Nations Environmental Program (UNEP) 2005; Demont., Pucsaert, Ndour and Verbeke, 2013). Urbanization is a major factor in rice demand because of the lifestyle changes it engenders, requiring foods that are convenient and quicker to prepare, and rice meets these conditions very satisfactorily. It is clean and easier and less time consuming to prepare than traditional Nigerian staples such as cassava or yam. Also, population increase has been attributed as one of the factors that contributed to the increase in demand for rice in Nigeria (IFPRI, 2016a**)**.

Most rice consumers in Nigeria combine imported and local rice in their diets; urban households generally have a preference for imported rice. The characteristics that attracted many of these consumers to imported rice include higher quality-defined as a higher swelling capacity, better taste, and preferred grain shape-as well as cleanliness, as imported rice tends to be polished, nonbroken, and free from stones and other debris (Bamidele, Abayomi, and Esther 2010). As with

imported rice, local rice is consumed for several reasons: it is cheaper, and it possesses organoleptic attributes that make it a vital component in certain local delicacies (Bamidele *et al*. 2010). These delicacies include tuwo in the north, where local rice is preferred for its ability to absorb water and to be pounded into paste, and ofada rice in the south west, which is preferred for its unique aroma. The problem with local rice is that it is often not properly processed, has a high percentage of broken grain, and usually includes foreign matter like stones. Most varieties of local rice produced in Nigeria are of short-grain types. These are usually viewed as inferior rice, and most consumers of local rice (particularly in urban areas) aspire to be able to afford imported rice, which is cleaner, requires less processing time, and can be utilized to prepare a wide variety of foreign dishes like fried rice as well as local dishes (IFPRI 2016a**)**.

2.3 Contribution of Rice in Alleviating Poverty

Rice production is a major source of employment, income generation and nutrition in many poor food-insecure countries in Africa. The numerous activities in rice production provide employment to millions of people who work either directly or indirectly (like service providers) (Norman and Kebe, 2010). After harvesting rice, farm activities shift to post-production operations, namely harvesting, threshing, drying, milling, storage and trade. The preparation of milled rice for consumption, the transformation of milled rice to other products, and the utilization of broken rice, rice bran, rice hulls and husks, and rice straw provide additional employment opportunities for a large number of people (Norman and Kebe, 2010). In Nigeria, rice is usually parboiled before hulling. These operations are typically done using small scale equipment, generating substantial post-harvest activity in rural and secondary urban areas (Misari, 2002) as cited in (Norman and Kebe, 2010). The income generated from rice cultivation and postharvest activities provides cash

to cover the expenses of clothing, housing, education and other social activities of the majority of people in rural areas. In general, sustainable rice production is the key to the improvement of rural livelihoods, not only of small rice farmers but also of poor families in urban centres (Norman and Kebe, 2010). Rice production is helpful in the area of food security and poverty reduction, rice provides about 80th percent employment along its value chain to the local community members in the producing areas. Therefore, rice is a tool for poverty reduction (Ogundele and Okoruwa, 2006; Awotide, Awoyemi, Diagne, Ojehomond, 2011). Also, rice is considered to be important for food security in many nations more especially Nigeria (Chidiebere-Mark, 2017). Amaza and Maurice (2006) noted that rice contributed greatly in the food security, poverty alleviation and human developments while Mkpuma, Adeoye, Yusuf, Balogun, and Akinlade (2013) noted that rice is a source of livelihood for farmers, traders and processors. Rice therefore possess the capacity of reducing widespread poverty among them. Rice production creates jobs along its value chain and lead to improvement of the well-being of the rural agricultural poor (Africa Rice, 2011, Aliou *et al*., 2012).

2.4 Agricultural Productivity

According to estimates from Conradie, Piesse and Thirtle (2009), agricultural productivity growth in Africa are generally low compared with those for other countries in the world, within Africa, the level of agricultural productivity differs. Ajao (2008) examined changes in agricultural productivity in Sub-Sahara Africa (SSA) countries for the period of 1961-2003. Results indicated that Burkina Faso, Cote d'Ivoire, Kenya and Djibouti were the four countries with the highest total factor productivity growth; the findings further revealed that Lesotho, Sierra-Leone and Swaziland

had negative TFP growth, which was due to decline in the technical efficiency. The average TFP growth over the whole period was 1.8% per annum. The observed increase in the TFP growth was due to technological change. Kibaara, Ariga, Olwande, and Jayne (2008) analyzed trends in agricultural productivity using a nationwide household panel survey in Kenya. Results showed an impressive growth in agricultural productivity, due to increased percentage of smallholder households using fertilizer, adoption of improved seeds and the availability of fertilizer retail outlets. In general, Kenyan agricultural productivity appears to be rising. It has been found that in order to sustain productivity growth and encourage farmers to increase production and productivity of major enterprises, farmers will require an improvement in innovative financial services.

Wiebe, Soule, and Schimmelpfennig (2001) in their study on agricultural productivity in Sub-Sahara Africa (SSA), identified constraints to agricultural productivity in sub-Sahara Africa to icnlude poor quality and availability of education, poor research and extension services, as well as institutional uncertainties that weaken incentives to invest in the maintenance or improvement of land quality. The study concluded that education of rural labour force and agricultural research is needed to improve the future prospects for productivity growth in SSA. That being the case, agricultural production has been increasing in SSA at over 2% per year in recent years. Land productivity increased by an average of 1.9% while labour productivity declined by an average annual rate. Levels of physical capital, livestock, fertilizer, and non-conventional inputs have also changed, contributing to an estimated 11.3% annual increase in total factor productivity. Further analysis projects that food production in SSA would have to grow at a rate of 3.3% to 4.5% annually to maintain per capita consumption levels or meet nutritional requirements over the next decade.

2.5 Agricultural Production and Productivity in Nigeria

Nigeria has the 27th biggest economy in the world, with a gross domestic product (GDP) of US$523 billion in 2013 (World Bank, 2014). The agricultural sector of Nigeria employs 60% of the working population and poverty incidence is still higher among households who depend on agriculture as their primary source of income (World Bank, 2014). Agricultural sector in Nigeria grew by about 5.9 % annually from 2002 to 2012, but it is believed that the growth in the agricultural sector is as a result of population growth and the farming of larger expanses of land by commercial farmers (Oseni, McGee and Dabalen, 2014). Nigerian agriculture is primarily rain-fed, which is characterized by low productivity, low technology, and high labor intensity. This low agricultural productivity has been attributed to the low use of fertilizer, the loss of soil fertility, low technology, rain-fed farming systems (Amare, Jense, and Bekele, 2017). Available literature has documented that Nigerian farmers across all regions are below their production frontiers, indicating there is room to increase agricultural productivity above existing levels, even without a change in their current levels of input use (Oseni and Winters, 2009). Low input use and farm technology, such as improved seed and fertilizer, are among the many reasons for low agricultural productivity in Nigeria.

Moreover, the Federal Ministry of Agriculture and Rural Development estimated fertilizer application by a typical Nigerian farmer at 10-15 kg/ha which is lower than the 200 kg/ha recommended by the United Nations Food and Agriculture Organization (FAO). The huge gap in fertilizer use compared to recommended fertilizer levels is often given as one of the main reasons for low agricultural productivity in Nigeria. It has long been argued that limited access of farmers to extension service, an outdated land tenure system, climatic factors, imperfect credit and capital

market, spatial inequality in the distribution of fertilizer, the high prices of other non-fertilizer inputs and an inadequate fertilizer supply are among other constraints limiting fertilizer use in Nigeria (Oseni *et al*., 2014).

2.6 Difference between Productivity and Efficiency

Productivity (rate of production) and efficiency (level of production in comparison with resources and costs) are too close but different concepts. Efficiency is determined by the amount of resources which are necessary to obtain certain results. It is comparing our current level of production with a potentially target level. In order to meet our production target, we commit a specific combination of factors and skills. For example, if we are able to meet our targeted production with fewer resources; then we have operated more efficiently. Efficiency is a measure of waste in a system while productivity is a measure of the output produced by unit of input. A firm or sector is considered efficient if it can produce more with the available inputs; this means that the enterprise is not located on the curve of production possibilities, but below it. Productivity reports the output production volume to an input quantity, independently from their efficiency use level (Aymen et al., 2015).

In the words of Thath (2015), efficiency refers to the comparison of observed and optimal values of outputs and inputs. The comparison can be output-oriented or input-oriented or the combination. The output-oriented efficiency compares the observed output to the maximum output obtainable from the input while the input-oriented efficiency compares the observed input to the minimum potential input required to produce the output (Thath, 2015). There are different types of efficiency depending on the behaviour of a producer such as cost efficiency, revenue efficiency, profit efficiency, technical efficiency and allocative efficiency. Each type of efficiency follows the

standard procedure, that is, the ratio of the observed to the optimal values (Thath, 2015). Changes in productivity are due to differences in production technology, differences in the efficiency of the production process, and differences in the environment in which production takes place (Grosskopf, 1993) as cited in (Walter, Hezron and Nyangito, 2003). Efficiency is therefore an important determinant of productivity and should be incorporated in productivity analyses. (Walter, Hezron and Nyangito, 2003).

Over the last few decades, efficiency and productivity analysis in agriculture has attracted attention of the economic researchers as well as policy makers in both developed and developing countries (Van Beveren, 2012; O'Donnell, 2012). It is not easy for a country to move forward towards economic prosperity without attaining a considerable growth in agricultural productivity (O'Donnell, 2012). According to International Food Policy Research Institute (IFPRI) (2016b), the stagnation in agricultural productivity in Nigeria was as a result of loss of efficiency in agricultural production.

Technical efficiency refers to the ability of a producing unit to obtain maximum (optimal) output from a given amount of inputs. Formally, the level of technical efficiency is measured by the distance of farm production from the optimal production frontier. Allocative (or price) efficiency, on the other hand, refers to the ability of the firm to choose its inputs in a cost-minimizing manner. For allocative efficiency to hold, farmers must equalize their marginal returns with true factor market prices. Economic efficiency refers to ―the capacity of a firm to produce a predetermined quantity of output at minimum cost for a given level of technology, and it is derived by multiplying the technical and allocative components of efficiency. All three measures are bounded between zero and one.

2.7 Poverty Incidence in Nigeria

Poverty is still a major problem in Nigeria despite the introduction of several poverty reduction programmes by successive governments. Over 100 million Nigerians live on under $1.25 a day, and the proportion of Nigerians living in poverty is increasing every year (USAID/Nigeria, 2015). Recently, 83 million Nierians are living below the country's poverty line of 137,430 naira (NBS, 2019). NBS statistics showed that the incidence of poverty has significantly increased in Nigeria since 1980. The percentages of the Nigerian population that were classified as 'extremely poor' over the last three decades are as follows: 6.2% (1980); 12.1% (1985); 13.9% (1992); 29.3% (1996); 22.0% (2004) and 38.7% (2010) (NBS, 2012) and the report has it that poverty crisis in Nigeria varied by region, sector and gender, and impacted Nigerian youth, children and mothers more than the adult male population.

Poverty levels also vary widely across the country's geo-political zones. The proportions of the population in these zones that were 'food poor' in 2010 were 38.1% in North-Central; 51.5% in North-East (51.5%); 51.8% in North-West; 41.0% in South-East; 35.5% in South-South; and 25.4% in South-West (NBS, 2012). Poverty in Nigeria is a difficult challenge to the citizens and policy makers. It manifests in Nigeria in different forms which include; lack of food, money and shelter, and indebtedness. The poor in Nigeria live in insecure environments with limited access to medical facilities, electricity, water and other basic services (NBS, 2012).

2.8 Causes of Poverty in Nigeria

There are several factors which have been identified in literatures as the causes of poverty, these include unemployment, corruption, crime and violence, Non-Diversification of the economy, ill-health and among other which are elaborated below:-

(i) Unemployment

A viable economy is essential for provision of employment thus reducing poverty levels in the nation. There is inadequate generation of employment to the teaming youth in the country. Unemployment is a major factor contributing to poverty in Nigeria. There is a strong correlation between unemployment and poverty. When people are unemployed, their source of livelihood depletes over time. The cost of living becomes high and the standard of living decreases. A diversification of the economy will provide more employment and contribute to a reduction in poverty levels (Ucha, 2010).

(ii) Crime and Violence

Olatomide (2012) observed that incessant unrest and attacks by the insurgency has created a gaping hole in the society. This has translated to an increase in the poverty levels in the country. With violence, people tend to embrace migration and are faced with the challenge of resettlement. Adequate security and proper reintegration of internally displaced persons will go a long way in reducing poverty.

(iii) Corruption

According to Ucha (2010), corruption, poor programme implementation and monitoring among others has contributed immensely to poverty in Nigeria. Also, poor accountability and lack of transparency in resource allocation have become the order of the day and this has created a dwindling pattern in the lives of the people. The abuse of entrusted power for private gain has become a common act in Nigeria and it has destabilized the political and economic system drastically, Government funds are being misappropriated on a daily basis by the leaders, who only

put the interest of their family and friends at heart while ignoring the masses. The corruption has eaten so deeply into the government and economy that everyone seems to be blinded by it. Corruption has almost become an accepted way of life in Nigeria. Good governance can generate a viable society with the basic needs of the people being taken care of and adequate provision of resources and infrastructure that will raise the standard of living and reduce poverty.

(iv) **Ill Health and Disease**

Ill health tends to suck up productivity and limits entrepreneurial activities, thus reducing the viable contribution to the economy. This means that poverty can lead to ill health or disease and vice versa. With cases of Malaria, HIV/AIDS and other infectious diseases ravaging the society, it is not surprising that poverty has the will to thrive in Nigeria. Basic health amenities if made accessible by the Government will however go a long way in poverty reduction (Olatomide, 2012).

(v) Non-diversification of the Economy

Nigeria's non diversification of the economy can be seen as a major factor contributing to poverty. Before 1970, the Nigerian economy was driven by the agricultural sector. The oil sector which only constituted 1 percent of the country's export revenue in 1958 rose to 97 percent by 1984 and has since then not gone below 90 percent. In 2008, the oil and gas sector constituted about 97.5 percent of their export revenues, 81 percent of government revenues and about 17 percent of GDP (Ucha, 2010).

In Nigeria, those in power have practically ignored other sources of income, and today, Nigeria depends heavily on exporting oil. This dependency on oil has cause so much poverty in the

country, excluding the few working in the oil sector, the majority of the people have been impoverished as their products have become irrelevant. The agricultural sector, which was their major means of income before the discovery of oil, is considered almost useless (Ucha, 2010; Olatomide, 2012).

(vi) Income Inequalities

There was an increase in income disparity after the economic growth which Nigeria experienced between1965-1975, and this income inequality has increased the dimension of poverty in the country (Oluwatayo, 2008) as cited in (Ucha, 2010). The income inequality between the people in rural and urban areas in Nigeria is remarkably high, as those who live in the rural areas base all their income on agriculture which is today not a thriving sector in Nigeria as oil has taken over the economy. They do not invest their money to acquire skills as people in the urban areas would and this makes them more vulnerable to poverty and leads to some social and economic problems such as violence, corruption and so on (Oluwatayo, 2008) as cited in (Ucha, 2010).

(vii) Poor Education System

Education can play a major role in reducing poverty. According to the World Bank, education is central to development. It promotes economic growth, national productivity and innovation, and values of democracy and social cohesion. In Nigeria, the population with no education account for most of the poor. The education system in Nigeria can be regarded as a failure compared to other countries in the world (Ucha, 2010; Olatomide, 2012).

2.9 Dimensions of Poverty in Nigeria

The scourge of poverty goes beyond mere measurement of a household's expenditure or welfare. Poverty has many dimensions and may include inadequate access to government utilities and services, environmental issues, poor infrastructure, illiteracy and ignorance, poor health, insecurity, social and political exclusion (NBS, 2010). Poverty manifests itself more in the rural areas than the urban area due to their over dependency on agriculture. For any meaningful economic growth and poverty reduction, there is the need to enhance and improve access to social services, including health and education to the rural people and women. Some of the dimension of poverty in Nigeria as identified in literature are discussed below.

(i) Rural dimension

Poverty is widespread in both rural and urban areas in Nigeria. The rural areas, however, record a higher incidence, depth and severity of poverty than the urban areas. NBS (2012) records shows that more than half of rural households are 'absolutely poor' (defined as those who have minimal standards of food, clothing, healthcare and shelter), while the proportion is much lower in the urban areas. The National Bureau of Statistics attributed the high incidence of poverty in the rural areas to their dependence on low-productivity agriculture, lack of access to opportunities and poor social and economic infrastructure.

(ii) Regional dimension

Poverty in Nigeria also has a regional dimension. Statistics show that poverty incidence is more in the northern part of the country than those living in the rest of the country. More specifically, NBS, 2012 reports show that in 2004 the poverty incidence was highest in the North-East zone (67.3%) and lowest in the South-East zone (34.2%), with similar figures for 2010.

(iii) State dimension

Poverty in Nigeria also exhibits disparities by states. NBS, (2012) reports shows that the eleven states with the highest incidences of poverty are in the northern part of Nigeria, with Jigawa topping the list with a poverty incidence of 90.9 per cent while Oyo State has the lowest poverty incidence (20.9 per cent).The NBS has it that the cost of living, low productivity, poor infrastructure, and unemployment are responsible for the disparity.

(iv) Gender dimension

Lastly, poverty in the country has a gender dimension. The incidence of poverty is higher among females than males. This disparity is attributed to the women's relative lack of access to education and technical skills as well as lack of access to capital and other means of production including land (NBS, 2012).

2.10 Characteristics of Poverty

Poverty is usually associated with different features which are listed below

(i) Low level of productivity: It is a known fact that high productivity reduces poverty (Ravallion and Chen, 2004**)** and vice versa**,** Germano (2016) noted that food poverty cannot be eradicated without a substantial increase in agricultural productivity. Productivity connotes efficiency and where there is shortage of complementary factors like infrastructure, management and efficient administration poverty becomes imminent (Olaitan, Ali, Onyemachi and Nwachukwu, 2003).

(ii) Low income: Usually when the income per individual is low, the individual is considered to be below poverty line and the same applies to a country. Nigeria is poor because the standard of

living by the citizens is low Olaitan (2004), as cited in (Folorunso, 2015). This shows that the greater percentage of Nigerians have low standard of living below the benchmark of U.S $1.9 per day. Hence, the degree of poverty is enormous.

(iii) Large family size: Some studies (Omonona, 2009; Nwahia, Omonona, Onyeabor and Balogun, 2012) has demonstrated that most of the poor households are characterized with large family size. The decision to have many children can lead to poverty because large family size is an attribute of low income per capita in a population. Large family size facilitates ill health, malnutrition, illiteracy, high dropout rate as a result of low level of education Olaitan (2004), as cited in (Folorunso 2015).

(iv) High dependence: High dependency ratio has been attributed as one of the characteristics of poverty (Omonona, 2009; Nwahia, *et al.* 2012). There is inability to generate a commensurate income for the poor because of many people that depended on the income within the households. Therefore, it takes the benevolence of the rich to assist through aids in order to eradicate poverty (Olaitan, 2004), as cited in (Folorunso 2015).

2.11 Policy Responses towards Poverty Reduction in Nigeria

Successive Nigerian governments have sought to address the challenge posed by poverty by focusing on rural development, such as improving the access of farmers and rural producers to credit, and encouraging the development of small and medium-scale enterprise (Action Aid Nigeria, 2015).

During the 1970s and 1980s, most of the measures adopted includes as follows: National Accelerated Food Production Programme and the Nigeria Agricultural and Cooperative Bank (NACB) delivered in 1972 and 1973, respectively, Operation Feed the Nation (OFN) in 1976, The

Agricultural Credit Guarantee Scheme (ACGS) established in 1977, The Green Revolution Programme in 1979, The Directorate of Food, Roads and Rural Infrastructure (DFRRI) in 1986 and the Structural Adjustment Programme (SAP) in 1986 but all these programmes failed to have significant impact on poverty levels (Action Aid Nigeria, 2015).

During 1990s upwards, lots of measures were also adopted by the Nigerian government to address poverty in the country and such measure includes:- The National Agricultural Land Development Authority (NALDA) in 1992, The Family Economic Advancement Programme (FEAP) - established in 1997 to empower locally based producers of goods and services among others, these interventions were intended to reduce poverty in the country, but their designs and implementations were faulty. Some of the programmes lacked targets; others had ambitious targets which failed to consider technical capacities and budgetary limitations, also, the targeted beneficiaries had either very limited or no participation in the planning and implementation of these interventions (Action Aid Nigeria, 2015).

In a further attempt to reduce poverty, the Federal Government also introduced the Poverty Alleviation Programme, for which it committed the sum of N10 billion which was supposed to create 200,000 jobs in the year 2000. The failure of the programme can be attributed to its method of operation; the programme believed that the high level of poverty and rising unemployment could be reduced merely by paying stipends to selected beneficiaries without giving them any meaningful or actual work (Action Aid Nigeria, 2015). Along the same line, the National Poverty Eradication Programme (NAPEP) was created in January 2001 with the goal of eradicating absolute poverty in the country by the year 2010 and the National Economic Empowerment and Development Strategy (NEEDS). These efforts hardly impacted the problem of poverty due to a combination of factors, including poor policy formulation and coordination, policy discontinuities,

weak institutional framework and lack of effective coordination among the various tiers of government, and corruption (Action Aid Nigeria, 2015).

2.12 Theoretical Framework

This research work is backed by different economic theories which include the theory of production, the theory of risk-averse small scale farmer and the profit-maximizing small scale farmer theory which are explained as follows:-

2.12.1 The theory of production

Production is general seen as the process of transforming production factors or inputs into outputs. It represents a particular process, techniques or technology adopted in the transformation of production inputs into outputs Olayemi (2004). However, there is nothing in the definition of production which suggests that a particular process, techniques or technology used is efficient, therefore it may be efficient or inefficient. A firm is usually the primary unit of production much like the household is the unit of consumption Olayemi (2004).

Usually, a farming household is faced with problems of what to produce and how much to produce, what production inputs to use for production and how to combine inputs to maximize profit. In considering the numbers of ways to use to produce output, the varying combination of inputs, as defined by a particular technology used and which give rise to varying quantities of output constitute the input-output relationship described by a production function. Production function is a technical relationship between inputs and outputs Debertin (2012). It is generally written in the form $Y = f(Xi)$, where Y is an output and Xi are the inputs. It has different stages and functional forms but Cobb Douglas was used in this study.

Debertin (2012) identified three staes of production**.** They include Stage I, II, and III

Stage I: This is the Stage of Increasing Returns. At this stage Average Product (AP) and Marginal product (MP) are increasing but MP is increasing at greater rate than the AP. MP became maximum at the inflection point then decreases to where it intercepted with AP (this is where stage I ends). AP is at its maximum at this point of interception and AP = MP. At this stage, a given increase in variable factor leads to a more than proportionate increase in the output. The producer is not making the best possible use of the fixed factor; a particular portion of fixed factor remains unutilized.

Stage II: This is the Stage of Decreasing Returns**.** Both AP and MP are decreasing at this stage but MP is decreasing at a greater rate than AP but still positive and became zero when Total product (TP) is at its maximum (this is where stage II ends). At this stage, a given increase in variable factor leads to a less than proportionate change in the output, hence, the producer will employ the variable factor in such a manner that the utilization of fixed factor is most efficient. This is the best stage to produce.

Stage III: This is Stage of Negative Returns. MP of variable factor is negative and the TP and AP are diminishing. It is not advisable to produce at this stage.

A summary of the stages of production function, show that at first, as the use of input Xi increases, the productivity of the input also increases. The function turns upward, or increases at an increasing rate, therefore both AP and MP are increasing. Then a point called the inflection point occurs. This is where the function changes from increasing at an increasing rate to increasing at a decreasing rate. Another way of saying this is that the function is convex to the horizontal axis

prior to the inflection point, but concave to the horizontal axis after the inflection point. The inflection point marks the end of increasing marginal returns and the start of diminishing marginal returns. Therefore, inflection point marks the maximum MP. It is here that the productivity of the incremental unit of the input xi is at its greatest, after the inflection point, the MP of Xi declines and intercepted with AP at the end of stage I. AP is never negative. AP is the ratio of output to input. AP reaches a maximum at a point after the inflection point but before the point in which output is maximized. Finally, the function reaches a maximum at the end of Stage II. The MP of Xi is zero at the point of output maximization, and negative thereafter and begins to turn downward at stage III where TP and AP are decreasing and MP is negative. Beyond the maximum, increases in the use of the variable input xi result in a decrease in TP.

Production function's general preposition is that, provided technologies and managerial decision making skills are the same, farmers who have identical access to identical factors in both quantity and quality may produce identical outputs of a given crop which will have overall effect on their income and subsequent poverty status within the economic society, that is, their productivity will be identical. If they use different technologies, or different quantities of these factors, or there is difference in quality of these factors and decision making on productive inputs and other household activities, their productivity will differ because, such factors affect households engaged in agricultural production differently.

Therefore, following presentations by Aigner, Lovell and Schmidt (1977), we assume that farmers utilize a vector of conventional inputs, Xi to produce a single output Y. The household incurs production risk because crop yield is affected by uncertain climatic conditions. This risk is captured by a random variable, vi, whose distribution is exogenous to the household's actions and

other risks that might occur as a result of the farmers inefficiency, which is captured by ui and its distribution is endogenous to the household's action.

Let β be the corresponding parameter of the conventional inputs and ei be the composite error term i.e, Vi + ui , then the stochastic production function is given by

$Y = f(Xi: \beta) + \varepsilon i$ ……. (3)

where Y is output, Xi are standard inputs and β are the parameters. Therefore the technical efficiency of production is given as

$TEi = \exp(-ui) = \frac{Y}{Y*}$ …… (4)

Where Y is the observed output and Y* is the maximum fessible output.

Allocative efficient implies that the firm was able to equate the Marginal Value Product (MVPx) of each resources employed to its unit cost (Px). MVPx is obtained, when slope of production function (marginal product (MPx)) is equal to the slope of the Iso-Profit line which is the ratio of the price of the factor inputs to the price of output (Px/Py) as derived below:

$MPx = \frac{Px}{Py}$ …….. (5)

$MPx \times Py = Px$ ……. (6)

$MVPX = Px.$ …… (7)

Where: MPx × Py is the MVPX (Marginal Value Product of the input)

$MPx = \frac{\delta Q}{\delta X}$ …….. (8)

based on the double log functional form, MPx is given by

$$MPP = b\left(\frac{Yi}{Xi}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

Where b is the coefficient of the variable, Yi is the geometric mean of output and Xi is the geometric mean of the inputs. Hence, for an optimum input utilization MVPx equals Px. Then, if MVPx > (<) Px, there is disequilibrium in the use of inputs that is under utilization (over utilization), hence the use of such input must be increased (decreased) in order to improve the allocative efficiency of the input by the farmer. Economic efficiency is concerned with maximum profit and it is the product of technical efficiency and allocative efficiency.

2.12.2 The theory of risk-averse small scale farmer

Most farmers operate on small-scale. Hunt (1991) identifies small-scale farms as both production and consumption units in which a proportion of produce is sold to meet their cash requirements and financial obligations, and a part is consumed by them. Farm holdings across Nigeria are generally small with less than 5 hectares on average and are often inherited rather than purchased (Adeyemo, Oke and Akinola 2010; Akintayo 2011). Also, in Nigeria, majority of small scale, resource poor farmers, engaged in subsistence or near subsistence farming, produce the majority of aggregate agricultural output via rudimentary farming systems (Ajibolade, 2005). Agricultural productivity is significantly dependent on the performance of the small-scale farmers and, at the same time, poverty is disproportionately concentrated among them. Therefore, understanding the determinants of their modes of production is a primary concern in any poverty alleviation strategy (Mendola, 2007).

Small-scale farming households are farm households, with access to a piece of land and utilizing mainly household labour in farm production and they are within economic and political system that could affect their production behaviour. Farm household behaviour is typically influenced by several natural, market and social uncertainties. Therefore, any intervention or new technology introduced to them is usually taken with caution in order to self-protect its members against hunger in the case of eventuality. This explains why vulnerable small-scale farming household are often observed to sacrifice expected profits for greater self-protection. This is because risk management is costly, and differs across households at different points in the wealth distribution, with subsequent implications in terms of efficiency losses and poverty traps (Morduch, 1994).

According to Ellis (1992), as cited in Mendola (2007), small-scale farming households produce under very high levels of uncertainty induced by natural hazards (weather, pests, diseases, natural disasters); market fluctuations; and social uncertainty (insecurity associated with control over resources, such as land tenure and state interventions, and war). These conditions pose risks to small-scale farming household production and make farmers very cautious in their decision making. It is not surprising, therefore, that farmers (in common with most other decision makers) are generally assumed to exhibit *risk aversion* in their decision making because they have to secure their household needs from their current production or face starvation. There is no room for aiming at higher income levels by taking risky decisions. It is assumed that farming households when choosing to participate in a programme that poses risk to their income first opt for safety. Decision made must ensure the survival of his households and therefore they would want to avoid the risk of their income or return falling below a certain minimum level. This safety-first criterion can lead households into participating in a programme or not. Hence, from their realm of experience, farming households do not participate in any programme they are not sure of, because

of uninsured risks. This is why rice production in Nigeria is characterized by low levels of improved technology adoption, especially for the superior-quality and high-yield seed varieties and irrigation.

2.12.3 Profit-maximizing small-scale farmer theory

This theory believed that farm households are poor but efficient. Referring explicitly to allocative efficiency, and implicitly to technical efficiency, small scale farmer production mode is described as profit-maximization behaviour; high efficiency is needed because inefficient farmers tend to go out of the business. Technical, economic and allocative efficiency criterion is usually adopted to test whether small- scale farmers were or were not efficient (whether they were profit maximizers or not). Profit maximization has both a behavioral content (motivation of the household) and a technical-economic content (economic performance of the farm as a business enterprise). Profit maximizing theory concerned less with the way a farm household reaches its decisions but with the outcome of those decisions for the efficiency of the farm as a firm. A farmer is more inclined to accept (and participate in) a recommended practice/programme if the practice/programme is profitable, compatible with existing farming system, divisible, simple to use, has relevance for his labour use, farm inputs, marketing, credit, community values and crop situation (Agwu, 2004; Ekong, 2008) as cited in bassey (2016).

2.13 Analytical Framework

2.13.1 Double difference or difference-in-difference (DD) Estimator

Double Difference is a statistical technique used in econometrics and quantitative research. It attempts to mimic an experimental research design using observational study data, by studying the

differential effect of a treatment on a ‘treatment group’ versus a ‘control group’ in an experiment. It calculates the effect of a treatment (that is, an explanatory variable or an independent variable) on an outcome (that is, a response variable or dependent variable) by comparing the average change over time in the outcome variable for the treatment group and the control group (Verner and Verner, 2005), as cited in (Folorunso, 2015). It is used to estimate and compare change in outcome or any other means of measurement determined pre and post programme for participants and non-participants (Chen, Ren and Martin, 2006). Although it is intended to mitigate the effects of extraneous factors and selectiom bias, depending on how the treatment group is chosen, this method still have certain biases (e.g., mean regression, reverse causality and omitted variable bias).

Double differences require data measured from a treatment group and a control group at two or more different time periods, specifically at least one-time period before "treatment" and at least one-time period after "treatment (Verner and Verner, 2005). Difference-in-difference method assumed that the participants and non-participants of a project may have had different characteristics that explain the difference in outcomes between the two groups rather than the program (Gertler, Martinez, Premand, Rawlings and Vermeersch, 2016). The difference-in-differences method helps resolve the problem of not including unobserved characteristics in the impact analysis. Therefore, it assumed that many unobserved characteristics of individuals are constant over time since their observed characteristics, such as location, year of birth, climate of the location, level of education among others that are directly related to their outcomes do not change within the evaluation time frame (Gertler *et al*., 2016).

The difference-in-differences method compares the difference in outcome for the programme participants and non-participants before and after the program. It does this, by subtracting the before outcome situation from the after situation. Thereby canceling out the effect of observed and unobserved time-invariant characteristics (Gertler *et al*., 2016). The difference-in-differences major limitation is that it fails to take into account the differences between the treatment and comparison groups that change over time. Therefore, in using difference-in-differences method, we must *assume* that, before the program, the outcome in the treatment group moved in tandem with the outcome in the comparison group. In a situation where their outcome trend are different, then the results from the difference-in-differences methods is invalid, or biased (Gertler *et al*., 2016).

Verner and Verner (2005), as cited in Folorunso (2015) measured the double difference from a regression model and included other personal characteristics taking observable heterogeneity of individuals into account.

The model is specified thus: $Y_{i\alpha} = \alpha + \beta_{Pi} + yX_{i\alpha} + \varepsilon_{i\alpha}$ ……(10)

Where α= common error term,

Pi= indicator for participants in the programme,

β= estimable effect of participants in the programme,

$X_{i\alpha}$ = vector of observable characteristic of the individual,

$\varepsilon_{i\alpha}$ = error term,

$Y_{i\alpha}$ = outcome of a program.

2.13.2 Chow test

The Chow test is a statistical and econometric test of whether the coefficients in two linear regressions on different data sets are equal. The Chow test was invented by an economist; Gregory Chow in 1960. In econometrics, the Chow test is most commonly used in time series analysis to test for the presence of a structural break. In program evaluation, the Chow test is often used to determine whether the independent variables have different impacts on different subgroups of the population (Doughery, 2007).

The Chow test is an application of the F- distribution test; it requires the sum of squared errors from three regressions, one from each sample group and one from the pooled data. If F-Chow is greater than the F-table, then there is project impact on the beneficiaries otherwise, there is no impact. The chow model is generally specified thus:-

$$F^{*}\text{-chow} = \frac{Rss(Rss1+Rss2)/K}{Rss1+Rss\ /(N-2K)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(11)}$$

Where RSS = Sum of squared residual from pooled data,

RSS_1 = Sum of squared residual from the first group (participants),

RSS_2 = sum of squared residual from the second group (non-participants),

N = total number of observation,

K = Total number of parameter.

2.13.3 Propensity score matching (PSM)

The concept of propensity score matching was first introduced by Rosenbaum and Rubin (1983). Also, Heckman (1997) played a role in the development of propensity score matching methods. He focused on selection bias, with a primary emphasis on making casual inferences when there is non-random assignment. PSM is based on the idea of comparing the outcomes of program participants with the outcomes of "equivalent" non-participants. Since the two groups are

comparable on all observed characteristics with the exception of program participation, the differences in the outcomes are attributed to the program. Diaz and Handa (2004) said that PSM usually works well as long as the survey instrument used for measuring outcomes is identical for treatment and control group.

The success of PSM depended on the data available, as well as the variables used for matching. In propensity score matching, we compute the probability that an individual will participate in the program based on the observed values of its characteristics (the explanatory variables). The propensity score ranges between 0 and 1 (Heinrich, Carolyn, Oli, and Vásque, 2010). The common norm is to use only observed baseline characteristics to compute the propensity score. Once the propensity score has been computed for all units, then the matching of the treated units with the untreated units that have the closet propensity score can be done. These closest units become the comparison group which produces the estimate of the counterfactual. The propensity score–matching method belong to quasi-experimental methods category. The average difference in outcomes between the treated units and their matched untreated units produces the estimated impact of the program (Gertler *et al*., 2016).

Matching methods major limitation is that, it uses only observed characteristics to construct a comparison group, if there are any unobserved characteristics that affects both the probability of participating in the program and the outcome, then the impact estimates obtained with the matched comparison group are biased (Heinrich, Carolyn, oli, and Vásque, 2010). Matching is only carried out by using characteristics that are not affected by the program and its estimation results are only as good as the characteristics that are used for matching. Matching method require large sets of

data and when the data are available, there may be a lack of common support between the program participants and nonparticipants (Gertler *et al*., 2016).

The estimated propensity score, for subject $p(xi)$, $(i = 1..., N)$ is the conditional probability of being assigned to a particular treatment given a vector of observed covariates *xi* (Rosenbaum and Rubin, 1983; Adebayo and Olagunju, 2015):

$p(x_i) = \Pr(d = 1 \mid x_i)$ ……. (12)

Where

d= 1 for treatment

d= 0 for control

xi= the vector of observed covariates for the ith subject.

Usually, some observed and unobserved characteristics (household or farm characteristics) may affect both selection (participation in programme) and outcome (productivity). Therefore, estimation of the effects of participation on poverty and productivity with ordinary least squares (OLS), which assumes random selection, is biased. There is need to use appropriate tool, as a result, the study used propensity score matching as was used by Diagne and Demot (2007). Based on this, every farmer in the population has two potential participation outcomes: an outcome when participating in programme that we denote by y_1 and an outcome when not participating in programme that we denote by y_0. If we let the binary outcome variable *d* stand for participation status, with $d = 1$ meaning participated and $d = 0$ not participated, we can write the observed outcome *Y* of any rice farmer as a function of the two potential outcomes, that is, *Y* is equal to $y_0 + d_1(y_1 - y_0)$, the causal effect of the participation on its observed outcome *y* is simply the difference between its two potential outcomes $(y_1 - y_0)$. But, because the two potential outcomes are mutually

exclusive for any household (i.e. only one of the two can be observed *ex-post*), it is impossible to measure the individual effect of participation on any given farmer. However, one can estimate the mean effect of participation on a population of farmers; such a population parameter is called the average treatment effect (ATE) in the literature (Imbens and Wooldridge, 2009). One can also estimate the mean effect of participation on the sub-population of participants ($E(y_1 - y_0/d=1)$ which is called the average treatment effect on the treated and is usually denoted by ATT. The average treatment effect on the untreated denoted by ATU ($E(y_1 - y_0/d=0)$ can be estimated also.

Propensity score matching was used to correct for selection bias due to observable and unobservable differences between the groups and to estimate both the average treatment effects on the treated (ATT) and the average treatment effect on the untreated households (ATU). Because any farmer exposed to a new programme usually have full control over their decision to participate or not (i.e. the receipt of the treatment is endogenous), therefore the endogenous regression model consists of two stages. Conditional probability of treatment

$$p(x_i) = P(d=1|x_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (13)$$

where $p(x_i)$ is a consistent estimate of the propensity score evaluated at x_i, will be estimated in the first stage, after the propensity score is estimated and the score computed for each unit, the next step is the actual matching. The matching estimator such as those used by Abadie and Imbens (2006), Mendola (2007), Diamond and Sekhon (2008), that is, nearest neighbor matching method was used in this work and ATE (Average treatment effect), ATU (Average treatment effect on the untreated) and ATT (Average treatment effects on the treated) was estimated in the second stage. ATT was estimated by computing the differences across both groups (i.e participants and non-participants) by the following formula

$$ATT = 1/N\,(y_1 - y_0) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Where ATT = Average impact of Treatment on the treated, N = Number of matches (from regression model), y_1 = the poverty/productivity index by Participants, y_0 = poverty/productivity index by non-participants. A positive (negative) value of ATT suggests that rice farming household beneficiaries in the project have higher (lower) outcome variable than non-participants meaning that there is programme impact.

2.13.4 Local average treatment effect (LATE) model

The packaged nature of agricultural programme makes the evaluation of its effects quite difficult. In order to assess the impact of agricultural programme on productivity or poverty, the choice of the appropriate approach to use for estimation of impact depends on how the treatment (i.e. the technology) is disseminated and received by the intended beneficiaries. However, the propensity score matching method fails to deal appropriately with the problem of selection on unobservables, which may be handled by the double difference approach if the unobservables are time invariant. Moreover, neither of the two approaches deals appropriately with the problem of non-compliance.

Considering how agricultural programmes are carried out, the overall population of the farmers are not usually exposed to the project (the instrument for the policy intervention was not randomly distributed). On the other hand, farmers exposed to programme have full control over their decision to participate or not to participate (i.e. the receipt of the treatment is endogenous). When subjects do not receive the treatment to which they were assigned, the experimenter faces a “noncompliance” problem. Some subjects may need the treatment so badly that they will always take up treatment, irrespective of whether they are assigned to the treatment or to the control group. Noncompliance can make it impossible to estimate the average treatment effect (ATE) for

the population but it can be handled by LATE which was first discussed by Imbens and Angrist (1994).

LATE is an instrumental variables (IV) estimate that uses treatment assignment as an instrument for treatment received. One of the critical assumptions needed for successful IV estimation is the exclusion restriction. They essentially amount to the assumption that conditional on the treatment that was actually received, the treatment assignment is unrelated to the outcome, equivalently, and treatment assignment affects the outcome only through its effect on treatment received. If this assumption does not hold, the IV can be severely biased. Secondly, individuals in the control group do not have access to the treatment, ruling out situations of control group contamination, and noncompliance only occurs in the treatment group.

Following Imbens and Angrist (1994) LATE estimator, as adopted by Awotide, Diagne and Omonona (2012), we note that a farmer's exposure status to a project (i.e. his awareness or knowledge of the existence of the project) is a 'natural' instrument for the participation status variable (which is the treatment variable here). Firstly, one cannot participate in a project without being aware of it or having knowledge of it and we do observe some farmers participating in a project (i.e. awareness does cause participation). Secondly, it is natural to assume that exposure to project affects the overall farmers productivity and poverty outcome indicators only through participation (i.e. the mere awareness or knowledge of the existence of a project without participating in it, does not affect the productivity and poverty outcome indicators of a farmer). Hence, the two requirements for the exposure status variable to be a valid instrument for the project participation status variable are met.

Now, let z be a binary outcome variable taking the value 1 when a farmer is exposed to a project and the value 0 otherwise. Let d_1 and d_0 be the binary variables designating the two potential participation status of the farmer with and without exposure to a project, respectively (with 1 indicating participation and 0 otherwise). Because one cannot participate in a project without being exposed to it, we have $d_0 = 0$ for all farmers and the observed participation outcome is given by $d = zd_1$. Thus, the sub-population of potential participants is described by the condition $d_1 = 1$ and that of actual participants is described by the condition d = 1 (which is equivalent to the condition z = 1 and $d_1 = 1$). Now, if we assume that z is independent of the potential outcomes d_1, y_1 and y_0 (an assumption equivalent to assuming that exposure to a project is random in the population), then the mean impact of the project participation on the productivity and poverty outcome of the sub-population of the project potential participation (i.e. the LATE) is as given by

$$\text{LATE} = \frac{cov(y,z)}{cov(d,z)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(15)}$$

$$= \frac{E\langle y|z=1\rangle - E(y|z=0\rangle}{E\langle d|z=1\rangle - E(d|z=0\rangle} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. \text{(16)}$$

This is known as *Wald* estimator that can be estimated using two-stage least squares. This research work make use of Propensity score matching and LATE model to measure the impact of USAID-MARKETS II.

2.13.5 Stochastic frontier production function model

Stochastic Frontier Production Function model as developed by Aigner, Lovell and Schmidt (1977) is specified as $Y = f(Xi,\beta) + \varepsilon i$. ……………………………………………………..(17)

The model decomposed the error term into two parts under what is called the "composed error" model. The main idea of the decomposition is to derive one pure random term (vi) accounting for measurement error and the effects which cannot be influenced by the farmers such as weather etc.

this component is assumed to be an identically symmetric and independently distributed error with a mean zero and constant variance $\sigma^2 V$. The other one sided error term is a non-negative one (ui), it captures the effect of inefficiency relative to the farmers i.e errors that can be controlled by the farmer and it shows the shortfall of output from the most efficient production. As the error term $E(\varepsilon i) = -E(ui) \leq 0$, while $\varepsilon i = vi + ui$, is not symmetric thus the estimation by OLS cannot isolate technical efficiency from the residual term. And as the efficiency estimates fall between 0 and 1, normal distribution problem arises and thus Parameters of stochastic frontier can only be estimated by the Maximum Likelihood Method (MLE).

Therefore the technical efficiency of production of the ith farmer is given as

$TEi = \exp(-ui) = Yi/Y^*$ …….. (18)

Where Yi is the observed output and Y* is the maximum possible output.

$Y^* = f(Xi, \beta) + v$ …… (19)

where Y^* is the firm's observed output adjusted for the statistical noise captured by v

$Yi = f(Xi: \beta) + \varepsilon i$ …… (20)

$\varepsilon i = vi + ui$ ……... (21)

Where Yi = output of the farm; Xi = Vector of inputs used by the farmers ; β = vector of the parameter to be estimated; vi =Random error outside farmer's controlled; ui=Technical inefficiency effects.

Given the assumption of Cobb-Douglas technology, the frontier production function is self-dual. Thus the corresponding cost frontier derived analytically from the stochastic frontier production function is given in the general form as:

$C = h(P, Y; \gamma)$……. (22)

Where C is the minimum cost associated with the production, P is input price vector and γ is the vector of parameters. Using the Shephard's Lemma, we derive a system of minimum cost input demand equations written as: $\frac{dC}{dPi} = Xi\ (P,Y, \Psi)$ ……. (23)

Where Ψ is the vector of parameters, Substituting a firm's input prices and output quantity into the demand system in Eq. (23) yields the economically efficient input vector X. Since the cost function is derived from the original frontier production function, following Farrell (1957), economic efficiency (EE) and allocative efficiency (AE) indexes is given as follows:

$EE = (X'e\ P)/ (X'a\ P)$……..(24) and

$AE = (X't\ P)/ (X'a\ P)$……..(25)

Where X'e P is economically efficient costs of actual output production, while X'a P is the actual cost of production for any particular firm's observed level of output and X'tP is the cost frontier output production. In all cases, efficient production is represented by an index value of 1.0, and a lower index value is an indication of less efficient production (i.e., a greater degree of inefficiency).

2.13.6 Measures of poverty

Poverty lines are cut-off point separating the poor from the non-poor. They can be monetary (certain level of consumption) or non-monetary (certain level of literacy). The use of multiple lines can help in distinguishing different levels of poverty. There are two main ways of setting poverty lines in a relative way or absolute way (Olatomide, 2012).

Relative poverty lines are defined in relation to the overall distribution of income or consumption in a country.

Absolute poverty lines are defined as the absolute standard of what households should be able to count on in order to meet their basic needs. For monetary measure, these absolute poverty lines are based on estimates of the cost of a nutritional basket considered minimal for the healthy survival of a family, to which provision is added for non-cost needs. There is no official poverty line in Nigeria (Olatomide, 2012).

There are several methods of poverty measures as identified by Makoka and Kaplan (2005), as cited in Lamin (2010), which include: -

2.13.6.1 poverty incidence or poverty rate ($P_{o)}$

Poverty incidence or poverty rate, usually denoted as $P_{o,}$ is the share of the population whose consumption (or income) falls below the poverty line. It quantifies the share of population that cannot afford to buy a basket of goods. When individual are used as the unit of analysis, the measure is referred to as Poverty Headcount Index. The major advantages of the poverty rate as a measure of poverty have been given as its simplicity to construct and understand. It also adequately assesses the overall progress in reducing poverty. However, it has some major limitations too. First, it assumes that the poor are all in the same situation and therefore does not take into account the differences in well-being among different poor households. Second, it is not sensitive to changes in the welfare of individuals as long as they remain below the poverty line and finally it does not take into account the intensity of poverty.

2.13.6.2 poverty gap index (P_1)

The Poverty Gap Index denoted as P_1 is the average of the proportionate gaps between poor people‘s living standards and the poverty line. It is also called the Depth of Poverty Index. The Poverty Gap Index measures the depth of poverty i.e. the degree to which the mean income of the poor differs from the established poverty line. The major advantages of the Poverty Gap Index are that it measures the average shortfall of poor people and also shows how much would be transferred to the poor to bring their expenditure up to the poverty line. However, its major limitations are that it does not capture differences in the severity of poverty among the poor and it also ignores any inequality among the poor people.

2.13.6.3 the squared poverty gap index (P_2)

This measure of poverty is similar to the Poverty Gap Index except that poverty gaps are squared, thus giving the largest weighting to the largest poverty gap. It captures differences in income levels of the poor and is also referred to as the Severity of Poverty Index. The advantage of this measure of poverty is that it takes into account the poverty gap and also the inequality among the poor. However, its major limitation is that it is not easy to interpret, the reason why it is not widely used.

2.13.6.4 the foster-greer-thorbecke (FGT) poverty index

The Headcount Index, the Poverty Gap Index, and the squared poverty Gap Index belong to this group of poverty measures. They are referred to as decomposable poverty measures. If a poverty measure of a group is a weighted average of the poverty measures of the individuals in a group, then it is said to be decomposable (Aguirregabiria, 2003). This is the one adopted in this study because of its decomposable nature.

2.13.6.5 the human poverty index

The Human Poverty Index (HPI) is the only non-income measure of poverty. It measure deprivations in three basic dimensions of the human development. These dimensions are: first, a long and healthy life – as measured by the probability at birth of not surviving to the age of 40. Second, knowledge – as measured by adult literacy rate. Third, a decent standard of living – as measured by the unweighted average of two indicators, the percentage of population without sustainable access to an improved water source and the percentage of children under weight for age (UNDP, 2005).

2.13.7 Approaches to impact evaluations

In literature, three major approaches to impact assessment were identified which includes quantitative or scientific statistical method, qualitative method and participatory learning and action method.

2.13.7.1 quantitative or scientific statistical method

In this type of approach to impact evaluation, an experiment to establish causation between the outcome and the treatment or intervention is usually employed. This approach tend to ask a fundamental question like: What would the situation have been if the intervention had not taken place*?* Such a situation cannot be directly observed but it is possible to approximate it by constructing an appropriate counterfactual (Lamin, 2010). This is stimulated by comparing programme participants (treatment group) with a control or comparison group. Two major categories in this approach include experimental designs (randomized) and quasi-experimental designs (nonrandomized).

2.13.7.2 experimental or randomized evaluation design

This involves gathering a set of individuals (or other units of analysis) equally eligible and willing to participate in the programme and randomly dividing them into two groups by randomly allocating the intervention among eligible beneficiaries. The assignment process creates comparable treatment and control groups that are statistically equivalent to one another, given appropriate sample sizes, the control groups generated through random assignment serve as a perfect counterfactual, free from the problem of selection bias that exits in all evaluations. It usually takes the mean difference in the outcome of interest between treatment and control groups to assess the impact of an intervention (Lamin, 2010).

2.13.7.3 quasi-experimental (non-randomized) evaluation design

This is normally used to carry out an evaluation when it is impossible to construct treatment and comparison group through experimental design (Baker, 2000). This technique generates comparison groups that resemble the treatment group, through econometric methodologies, which include matching methods, double difference, instrumental variable methods, and reflexive comparisons. When treatment and control groups are selected after the intervention by non-random methods, these techniques are usually used to evaluate impact. The techniques applies statistical controls to address differences between treatment and comparison groups and also sophisticated matching techniques to construct a comparison group that is as similar as possible to the treatment group (Lamin, 2010). It is an inductive approach in which the data analyst is usually directly involved in the data collection. It uses interviews, participant observations, focus group discussions as the main tools of assessing impacts. This was adopted for this research work

2.13.7.4 qualitative approach

The qualitative approach does not use any statistical means to evaluate impact as in the quantitative methods; rather it seeks to provide an interpretation of the processes involved in an intervention and of the impacts that have a high level of plausibility (Hulme, 2000). Therefore its validity is dependent on the arguments and materials presented; the strength and quality of evidence provided; the degree of triangulation used to crosscheck evidence; and the quality of methodology (Lamin, 2010). Qualitative approach fail to establish a direct causal link as they are unable to generate a without programme control group.

2.13.7.5 participatory learning and action method

This method makes use of stakeholders at all stages of evaluation. It involves the stakeholders in the determination of the objectives of the study, identification and selection of indicators to be used, data collection and analysis. This method was developed by critiques of the other methods of impact evaluation which according to the advocators fail to take into account the complexity, diversity and contingency of winning a livelihood (Lamin, 2010).

2.14 Impact Framework

The study adopted Sustainable livelihood framework approach as was used by DFID (2001) and adopted by (Nguezet, Diagne Okoruwa, Ojehomon, 2011). The sustainable livelihoods idea was first introduced by the Brundtland Commission on Environment and Development as a way of linking socioeconomic and ecological considerations in a cohesive, policy-relevant structure. Most of the discussion on sustainable livelihood so far has focused on rural areas and situations where

people are farmers or make a living from some kind of primary self- managed production (Lasse, 2001). Sustainable livelihood recognizes that economic growth is necessary for poverty reduction as well as the capabilities of the poor to take advantage of the economic opportunities. It recognized that the poor know their situation and needs best and must therefore be involved in the identification, design and implementation of those projects intended to better their lots (Lasse, 2001). Sustainable livelihood framework gives insight of how to reduce poverty, the way the poor and vulnerable live their lives and the importance of structural and institutional issues. The sustainable livelihood approach offers both a conceptual and programming framework for sustainable poverty reduction. Unlike more traditional approaches that have sought to tackle poverty by identifying and addressing needs of poor people, the sustainable livelihood approach seeks to improve their lives by building on what they have (their assets).

DFID sustainable livelihood approach emphasizes that any poverty-focused development activity should be people-centered, participatory, multi-level, conducted in partnership, sustainable and dynamic (Lasse, 2001), it also believes that there is the portfolio of assets out of which people construct their living. This portfolio includes tangible assets such as stores (e.g., food stocks, stores of value such as gold, jewellery, cash savings) and resources (e.g., land, water, trees, livestock, farm equipment), as well as intangible assets such as claims (i.e., demands and appeals which can be made for material, moral or other practical support) and access, which is the opportunity in practice to use a resource, store or service or to obtain information, material, technology, employment, food or income.

Farmers in Nigeria possess resources which comprise natural capital – the natural resource stocks (soil, water, air, genetic resources, etc.) and environmental services (hydrological cycle, pollution sinks, etc.) from which resource flows and services useful for livelihoods are derived. Economic

or financial capital (cash, credit/debt, savings, and other economic assets, including basic infrastructure and production equipment and technologies) which are essential for the pursuit of any livelihood strategy, human capital (skills, knowledge, ability to labour and good health) and physical capability important for the successful pursuit of different livelihood strategies. Social capital (networks, social claims, social relations, associations) upon which people draw when pursuing different livelihood strategies requiring co-ordinated actions. These assets are usually affected by climate, macro-economic condition, agro-ecology conditions, which affect their productivity, as a result of these, there is need to introduced new technology practices (POP by USAID-MARKET II) which will likely increase productivity of these resources and reduce poverty of the people but this depend on how the new technology is implemented. Every farmer will always like to be part of any programme that will improve their methods of production for maximum yield, such anticipated benefit(which is unobserved) is what motivates them to participate in a programme and also they have full decision whether to be part of a programme or not even when being exposed to the programme. Hence, to estimate the real impact of USAID-MARKET II on productivity and poverty, we need an instrument that is independent of this unobserved anticipated benefit and which can affect productivity, income and poverty only through the act of participation and awareness was used by this study as the instrument variable.

2.15 Review of Empirical Studies

The empirical review of this research work was done in line with the objectives of the research as follows:-

2.15.1 Empirical reviews on determinants of participation in agricultural projects

Many factors were identified by empirical studies to be capable of influencing farmers into participating in agricultural projects and some of the empirical works were reviewed below:-

Akinmusola, Soyebo, Farinde, Amujoyegbe, Latifou, Gaya, Fatunbi and Ilesanmi (2016) in their work on determinants of cocoa farmer's participation in the innovation platform of the humid tropics programme in southwestern Nigeria revealed that the crucial factors determining variation in participation are psychological, experience, educational, community, economic and internal factors. They further conclude that three important variables level of education, resources accessibility and benefit derived from the participation were identified to be very crucial to predicting the level of cocoa farmer's participation in the southwest Nigeria. Likewise, Obi-Egbedi and Bankole (2017) who worked on determinants of participation in fertilizer subsidy programme among rice farmers in Ogun state, Nigeria revealed that marital status (married), household headship (male), ownership of a means of mobility (motorcycle), mobile phone ownership, access to credit, membership of farmers' association and total farm size were the factors that influences participation.

Omotesho, Ogunlade, Lawal and Kehinde (2016) in their work on determinants of level of participation of farmers in group activities in Kwara state, Nigeria revealed that income, farm size, access to training, access to credit, extension contact and membership of farmers' association positively influenced participation of farmers in group activities. Also, Tologbonse, Jibrin, Auta and Damisa (2013) who worked on factors influencing women participation in Women In Agriculture (WIA) programme of Kaduna state agricultural development project, Nigeria revealed that level of education, age and marital status were significantly related to level of participation at 5% level of significance.

Nnadi and Akwiwu (2008) in their work on determinants of youths` participation in rural agriculture in Imo state, Nigeria, revealed that youths' participation were determined by such factors as age, education, household size, marital status, parents' occupation, parents' income and youths' dependence status. Also, Farayola, Adedeji, Popoola and Amao (2013) in their work on determinants of participation of small scale commercial poultry farmers in agricultural insurance scheme in Kwara state, Nigeria found out that age, educational level, farm size and accessibility to credit were significant variables that influenced the participation of the farmers in agricultural insurance. Furthermore, Etwire, Dogbe, Wiredu, Martey, Etwire, Owusu and Wahaga (2013) in their work on factors influencing farmer's participation in agricultural projects: The case of the agricultural value chain mentorship project in the northern region of Ghana identified number of years in school, access to production credit and agricultural extension service as factors that significantly determine farmers' participation in agricultural projects in the study area.

2.15.2 Review of empirical works on impact assessment of selected programmes in Nigeria

Research Works have been carried out to assess the impact of different agricultural programmes introduced in Nigeria as a way of knowing their contributions into Nigerian agriculture; some of those research works are reviewed as follows:

Adenuga, Omotesho, Ojehomon, Diagne, Ayinde and Arouna (2016) in their work on adoption of improved rice varieties and its impact on multi-dimensional poverty of rice farming households in Nigeria revealed that adoption of improved rice varieties had a positive impact on the multi-dimensional poverty status of the rice farming households. still on impact of adoption, Awotide, Diagne and Omonona (2012) in their work on impact of improved agricultural technology adoption on sustainable rice productivity and rural farmers' welfare in Nigeria revealed that the

adoption of improved rice varieties had a higher positive impact on the poor households than the non-poor households in all the outcomes of interest considered in the study and they concluded that improved agricultural technology adoption can lead to the much desired increase in productivity, ensure national and households' food security and can also be a way out of the menace of rural poverty in Nigeria.

Olaolu, Akinnagbe and Agber (2013) in their work on impact of national Fadama development project phase (II) on poverty and food security among rice farming beneficiaries in Kogi state, Nigeria concluded that the programme made appreciable impacts on mean household food expenditure, poverty reduction and farmers' income. In a similar way, Adebayo and Olagunju (2015) in their work on impact of agricultural innovation on improved livelihood and productivity outcomes among smallholder farmers in rural Nigeria concluded that agricultural research interventions that use an innovation systems approach have a strong positive impact on some but not all aspects of rural livelihoods and productivity outcomes of the maize, cassava and yam farmers, with stronger positive impacts being seen for welfare proxied by per capita expenditure, incomes, and output (measured in kg/ha). In addition, their study revealed weaker positive impacts of the programme on rate of income diversification and fertilizer usage pattern but still considerably substantial with an indication that if intensify, stronger impact can be experienced.

Odurukwe, Matthews-Njoku and Ejiogu-Okereke (2006) in their work on impacts of the women-in-agriculture (WIA) extension programme on women's lives; implications for subsistence agricultural production of women in Imo State, Nigeria found out that the WIA programme, which has concentrated on value adding of agricultural products, has achieved much success in uplifting the socioeconomic well-being of both urban and rural women beneficiaries. However, the programme neglected most of the agricultural activities engaged in by women such as food crop

and livestock production. Also, Makusidi (2015) who worked on impact of Tungan-Kawo dam irrigation project on rice production among small holder farmers in Wushishi local government area of Niger state-Nigeria revealed that the project had a positive influence on the output, income and level of living of the participants.

Girei, Saingbe, Bitrus and Bassey (2017) in their work on revealing the impact of Fadama III project on the income level of beneficiary farmers in Plateau state, Nigeria revealed that the programme made appreciable impact on the average income of Fadama III user households based on their different enterprise activities and concluded that the project was able to increase the income of Fadama III beneficiaries by about 27.49% (from ₦61, 020 to ₦84, 160.00) as a result of participation in the project. Still on the same Fadama III, Osondu, Ijioma, Udah and Emerole (2015) in their work on impact of national Fadama III development project in alleviating poverty of food crop farmers in Abia state, Nigeria showed that the poverty line of Fadama III farmers was ₦20,445.83 and was higher than that of the non-Fadama III farmers which was ₦16,037.79.92 and also the study revealed that the incidence of poverty for Fadama farmers was lower (0.481) as against 0.522 for the non Fadama III farmers and poverty gap of 0.347 for Fadama III farmers as against 0.425 for non-Fadama farmers in the area and they went further to conclude that the indices showed greater propensity to escape from poverty amongst Fadama farmers in the area meaning that Fadama III had positive impact on its beneficiaries. Also, Folorunso (2015) who worked on impact of Fadama III on productivity, food security and poverty status of tuber farmers in North central states of Nigeria revealed that Fadama III root and tuber crop scheme has impact on the participants' productivity through their net farm income and efficiency and the study concluded that the net farm income of the participants was significantly different from that of the non-participants after the Fadama III programme than before the programme.

Tsado, Ojo, and Ajayi (2014) in their own work on impact of training the trainers' programme on rice farmers' income and welfare in north central, Nigeria revealed that a good number of participants benefited from the various services and training activities they were exposed to, this has greatly and significantly enhanced their output, income and consequently improved their standard of living. Likewise, Donkor, Onakuse, Bogue and Carmenado (2017) in their work on the impact of the presidential cassava initiative (PCI) on cassava productivity in Nigeria: implication for sustainable food supply and food security revealed that the PCI made some contributions to enhancing cassava output, food supply and food security and their study also revealed that cassava production was promoted by increasing land area, fertilizer application and agricultural machinery, which were resulted from the implementation of the PCI. Also, Ositanwosu and Xiong (2016) in their work on impact of agricultural transformation agenda (ATA) program in advancing the socio-economic statutes of smallholder rice farmers in Adani-omor zone, southeast, Nigeria concluded that ATA is a commendable intervention program for improved rice productivity for it enhanced income for farmers and food security in the study area. According to them, the program initiative led to operation of larger farm sizes, higher yield and increased income for the participant rice farmers which was mainly as a result of its appreciable impacts on participant farmers' access to farm inputs at comparatively lower prices, access to farm credit, irrigation and mechanization. They concluded that despite government policy challenges and the constraints experienced by the rice farmers, ATA program still hold a comparative advantage for increased productivity in rice and increased income among its participants.

Shabu, Gyuse and Abawua (2011) who worked on economic impact of olam out-grower programme on rice farming in kaambe district of guma local government, Benue state, Nigeria concluded that the Olam out grower programme had progressive impact which needs to be

consolidated in the subsequent years ahead. Their study revealed that the programme had impacted positively on the following areas of rice farming process: there was increased farm size in the area, increased yield per hectare, increased income and improved economic status of rice farmers and they concluded that the programme had impacted positively on the productivity of rice farmers, but the farmers do not benefit much from the economic value of their farm output. Also, Okwoche and Asogwa (2012) in their work on impact of extension services on cassava farming in Benue state, Nigeria revealed that some local government areas felt the impact of extension agents more than the others which is as a result of inability of the extension agents to reach some of the farmers that are far from their locations. Their study also showed that there is a significant relationship between farmers access to extension services and farmers profitability. Those that have access to extension services have higher profit than those that do not.

Awotide, Awoyemi, Salman and Diagne (2013) in their work on impact of seed voucher system on income inequality and rice income per hectare among rural households in Nigeria: a randomized control trial (RCT) approach, in their work, farmers in the treated group were given the seed voucher to procure certified improved rice seed at a subsidized rate, while those in the control were not given vouchers. Their work revealed that income inequality and poverty were significantly reduced among the rice farming households after the intervention and their study also revealed that, the use of a seed voucher system can be a way out of the prevalent poverty in Nigeria, particular in the rural areas where poverty is highly endermic.

2.15.3 Review of empirical works on technical, economic and allocative efficiency of Nigerian farmers

Many researches have been conducted to reveal how farmers in Nigeria are efficiently utilizing their inputs for profit maximization. Some of the empirical findings are reviewed as follow:

Abba and Abu (2015) in their work on technical efficiency of small scale rice production in Adamawa state, Nigeria revealed that the maximum technical efficiency of the irrigated rice farmer was of 0.9568 or (95%), while the minimum technical efficiency of the rice farmer was 0.1094 or (10%) with a mean technical efficiency of 0.7649 or (76%), implying that on the average, the farmers were able to obtain about 76% of the output from a given level of input and they concluded that in the short run, there is a room for increasing technical efficiency in rice productions in the study area by about 24%. Also, Okoye, Onyenweaku and Asumugha (2007) in their work on technical efficiency of small holder cocoyam production in Anambra state, Nigeria found out that in the Onitsha zone, the computed technical efficiency varies between 0.81 and 0.98, with a mean value of 0.91 and in Aguata zone, the computed technical efficiency varies between 0.47 and 0.98, with a mean value of 0.76 while in Awka zone, the computed technical efficiency varies between 0.77 and 0.98, with a mean value of 0.91.

Ogundari and Ojo (2006) in their work on an examination of technical, economic and allocative efficiency of small farms: the case study of cassava farmers in Osun state of Nigeria found out that the predicted technical efficiencies (TE) range between 0.686 and 0.981 with the mean TE of 0.903 which means if the average farmer in the sample was to achieve the TE level of its most efficient counterpart, then the average farmer could realize a 7.95 percent cost saving. Also, the predicted economic efficiencies (EE) estimated as inverse of cost of efficiencies differs substantially among the farmers, ranging between 0.325 and 0.952 with a mean EE of 0.807 and they concluded that if the average farmer in the sample area were to reach the EE level of its most efficient counterpart, then the average farmer could experience a cost saving of 15 percent.

Likewise, their study showed that the predicted allocative efficiencies (AE) differ substantially among the farmers ranging between value 0.411 and 0.979 with the mean AE of 0.893 which shows that if the average farmer in the sample was to achieve AE level of its most efficient counterpart, then the average farmer could realize 9 percent cost saving.

Ogundari (2008) who worked on resource-productivity, allocative efficiency and determinants of technical efficiency of rainfed rice farmers: a guide for food security policy in Nigeria found out that the minimum estimated technical efficiency is 0.285, the maximum is 0.997 while the mean is 0.754**.** For allocative efficiency, his work showed that none of the farmers optimally use their inputs. However, with respect to land, about 72% and 28% of the farmers under and over utilized the input respectively. Also, for seeds, about 89% and 11% of the respondents under and over utilized the input respectively. According to his work, about 3% and 97% under and over utilized labour respectively. Almost 64% and 36% under- and over-utilized fertilizer respectively, while about 80% and 20% under- and over-utilized herbicides respectively and he concluded that increasing the use of land, seeds, fertilizer and herbicide will add to the total profit by minimizing the costs of these variables in an efficient manner while increasing use of labour will reduce the total profit.

Nwaru and Iheke (2010) in their work on comparative analysis of resource use efficiency in rice production systems in Abia state of Nigeria found out that none of the three farmer groups achieved absolute allocative efficiency in the use of farm resources. The upland farmers are the least allocatively efficient with respect to all the farm resources, these farmers group under-utilized all the farm resources; that is they used less than the profit maximizing level. The inland valley rice farmers achieved their best allocative efficiency in the use capital inputs while the

swamp farmers achieved their best allocative efficiency in the use of hired labour. The inland and swamp rice farmers under-utilized farmland, other inputs and capital. The swamp rice farmers over-utilized hired labour and they concluded that to achieve maximum allocative efficiency and maximum profit, policies and programmes that would enable the inland farmers increase their use of farmland, other inputs and capital inputs by 978.3 percent, 655.0 percent and 188.9 percent respectively should be put in place.

Tijjani and Bakari (2014) in their work on determinants of allocative efficiency of rain-fed rice production in Taraba state, Nigeria revealed that average measure of allocative efficiency of 0.69 was recorded in the area showing that respondents were about 69% allocatively efficient while the remaining short fall can be attributed to their allocative inefficiencies. The minimum and maximum measures of allocative efficiencies in their study was 0.51 and 0.90 respectively and their study stated that the least allocatively efficient farmer was 51% efficient whereas, the most allocatively efficient farmer was 90% efficient and concluded that if the average rice farmers in the area were to achieve the level of allocative efficiency shown by the most efficient farmer, then they would realize a cost saving of 43.33%. Also, Tijani (2006) in his work on analysis of the technical efficiency of rice farms in Ijesha land of Osun state, Nigeria revealed that there is great variation in the levels of efficiency ranging from 29.4% to 98.2% with a mean of 86.6%. The study stated that the mean level of technical efficiency indicates that on average, that rice output falls 13.4% short of the maximum possible level and he concluded that in the short run it is possible to increase rice production in the study area by an average of 13.4 per cent by adopting the technology used by the best performers.

Osundare, Ajibefun and Aderionola (2016) in their work on comparative technical efficiency of maize production technologies in south western Nigeria, found out that in traditional technology, predicted technical efficiencies range between 0.27 and 0.93 with the mean technical efficiency estimated of 0.73. In improved technology and semi improved technology, the technical efficiency estimates range between 0.22 and 0.94, with mean technical efficiency of 0.65 and 0.69 respectively to give a better indication of the technical efficiency and they concluded that the frequencies of occurrence of the predicted technical efficiencies indicated that the three groups of production technologies appeared to be similar, the largest number of farmers having technical efficiencies of between 0.80 and 0.90 in all the types of technology. Still on technical efficiency, Enwerem and Ohajianya (2013) in their work on farm size and technical efficiency of rice farmers in Imo state, Nigeria found out that 34.5% of the large-scale and 36.4% of the small-scale farmers had technical efficiency levels of 0.51-0.60, while only 5.2% of the large-scale and 9.8% of the small-scale farmers had technical efficiency levels of 0.91-1.00. Also, their study revealed that 17.2% of the large scale and 4.9% of the small-scale farmers operated at a technical efficiency level of not more than 0.50. Their study therefore concluded that the mean levels of technical efficiency for the large-scale and small-scale rice farmers are less than 1.00, indicating that all the farmers are producing below the maximum technical efficiency frontier.

Idiong (2007) who worked on estimation of farm level technical efficiency in small scale swamp rice production in Cross River state of Nigeria found out that the technical efficiency ranged from 0.48 to 0.99. The mean estimate was 0.77. The efficiency distribution shown that, about 70.64 percent of the rice farmers attained between 0.71 and 1.00 efficiency levels, while none had below 50 percent level of efficiency. In a similar manner, Ajoma, Ezihe and Odoemenem (2016) in their work on allocative efficiency of rice production in Cross River State, Nigeria revealed that

estimate of allocative efficiency of production resources employed in rice farming were 282.90, 1.97, 241.80, 0.50, 223.12, and 194.05 respectively for farm size, labour, seed, fertilizer, pesticide and herbicide. Their work concluded that apart from fertilizer which was over-utilized, all other resources were under-utilized, implying sub-optimal resource allocation in rice farming in Cross River state, Nigeria.

Mallam (2013) in his work on comparative analysis of resource use efficiency in rice production among Fadama III and non-Fadama III beneficiary rice farmers in Niger state, Nigeria found out that Fadama III beneficiary rice farmers had a technical efficiency of between 0.41 – 081 and 45 percent of the group had a technical efficiency of between 0.81 – 1.0 while 43.4 percent of the non-Fadama III beneficiary rice farmers had a technical efficiency of 0.41 – 0.81 while 56.6 percent of the group recorded a technical efficiency of 0.81 – 0.98. From this distribution, the farmer specific indices of technical efficiency vary widely ranging between 0.411 and 1.00 in the Fadama III beneficiaries, and 0.435 and 0.989 in the non-Fadama III beneficiaries. The mean technical efficiency of 0.79 for the Fadama III beneficiary rice farmers indicates that technical efficiency in rice production in this group could be increased by 21 percent while the mean technical efficiency of 0.81 for the non Fadama beneficiary farmers suggests that rice production in this group could be increased by 19 percent through better use of available resources, given the current state of technology.

Olarinde (2011) in his study on analysis of technical efficiency differentials among maize farmers in Nigeria found out that technical efficiencies differ substantially among the farmers, it ranges from 0.1047 to 0.9997 in Oyo State, and from 0.1000 to 0.9923 in Kebbi State, with the mean technical efficiencies estimated as 0.5588 for Oyo State and 0.5758 for Kebbi State. Also, Yusuf and Nwachukwu (2015) in their work on technical efficiency of cowpea (SAMPEA II) production

in Niger state, Nigeria revealed that the technical efficiency in SAMPEA II production ranged from 16% to 98% with a mean of 76% for sampled farms. Notwithstanding, Girei, Maurice and Onuk (2016a) in their work on empirical analysis of allocative efficiency among FADAMA food crop farmers in Adamawa state, Nigeria revealed that the average allocative efficiency estimated was 0.78 indicating that the farmers were 78% allocatively efficient in food crop production. According to them, the best farmer has allocative efficiency of 0.99, while the least efficient farmer has an allocative efficiency of 0.41. All the studies so far have attest to the high mean of allocative, economic and technical efficiencies among the Nigerian farmers. Notwithstanding, farmers across all regions are below their production frontiers and consequently the opportunity exists to increase their productivity above existing levels, even given their current levels of inputs.

2.15.4 Review of empirical works on profitability of rice farming in Nigeria

Many research works attest to the profitability of rice farming in Nigeria, some of such research works are reviewed as follow:

Akande (2008) in his work on an overview of the Nigerian rice economy concluded that in all, rice production has been found to be quite profitable in Nigeria and that domestic rice is not as profitable as it would have been if there were no stiff competitions from imported rice. Also, IFPRI (2016b) concluded that despite many incentives in rice sector, the profitability of rice production has generally remained low, particularly in the irrigated and rainfed lowland ecologies, which are the major rice-production systems in Nigeria. Not left out is the work of Ben-Chendo, Lawal and Osuji (2017) who worked on cost and returns of paddy rice production in Kaduna state

found out that the gross margin was ₦179,600. They found the net farm income to be ₦152,600. According to Ben-Chendo, Lawal and Osuji (2017), the benefit cost ratio amounted to 1.77 and they explained it to mean that for every ₦1 incurred in production costs, the farmer can expect a benefit of ₦1.77 while they estimated the gross margin ratio to be 0.51 and concluded that for every ₦1 generated in sales of paddy, the farmer has ₦0.51 left over to cover basic operating costs and profit indicating that paddy rice production in the study area is profitable.

Girei, Usman and Onuk (2016b) investigated profitability of rice production in fufore local government area of Adamawa state, Nigeria and found a gross margin of ₦494, 940.00/ha. The net farm income was ₦469, 136.00 per hectare. The rate of return on investment of 0.37 was realized and they concluded that for every one naira invested in rice production by farmers, a return of ₦1.37 and a profit of ₦0.37 were achieved. Also, Kadiri, Eze, Orebiyi and Onyeagocha (2014) in their study on resource-use and allocative efficiency of paddy rice production in Niger delta region of Nigeria and found out that the net farm income of rice farmers in the study area was ₦300,071.84 which indicated that rice production is profitable. He stated that Niger delta rice farmers on the average made a net return of ₦264,063.22 per hectare that resulted in a return of ₦0.80k for every one naira invested. He found the average gross margin of rice enterprise in the study to be ₦319,046.84**;** this positive gross margin showed that rice enterprise is profitable.

Omuegbe, Zalkuwi and Moses (2016) in their work on cost and return of rice production in mubi north local government area, Adamawa state, Nigeria revealed that rice production had gross margin and net farm income of ₦49,562.16 and ₦42,320.98 per hectare. The study therefore revealed that, the business of rice cultivation in Mubi North Local Government Area is profitable since an average farmer in the study area whose average hectare is (2.3) of land earns ₦99,124.32

in 3months of rice farming which is far above the minimum wage earned by a civil servant at local government level. Also, Nwike and Ugwumba (2015) in their work on profitability of rice production in Aguata agricultural zone of Anambra state Nigeria found out that the gross margin of ₦4,278,691 and net farm income of ₦3,858,516 was realised. They concluded that positive gross margin (GM) and net farm income (NFI) values obtained by the farmers indicated that rice cultivation in the area was profitable. Again, they estimated the net return on investment to be 0.37 implying that for every ₦1.00 invested in rice production in the area, ₦0.37 was returned.

Ekpe and Alimba (2013) in their work on economics of rice production in Ebonyi state south east Nigeria revealed that the net return per hectare was ₦118, 900 for realized in the survey years. The gross return on investment was 1.19, implying that for every one naira invested in rice about N1.2k is returned. In the same manner, Nwinya, Obienusi And Onuoha (2014) in their work on comparative economic analysis of upland and lowland rice production in izzi local government area of Ebonyi found out that the gross margin realised in each hectare of land (lowland) cultivated, was ₦51,900 while from the upland rice, the estimated gross margin was ₦25, 200 in every hectare of land cultivated. Also, Nwalieji (2015) in his study on comparative profit analysis of rice production enterprise among farmers in Anambra and Ebonyi states, Nigeria revealed that in Anambra, farmers made gross margin/net profit of ₦59,105 and ₦55,355 from paddy sale using transplanting and broadcasting methods, respectively and with benefit/cost ratio (BCR) per 0.5 ha of paddy production of 1.83 and 1.85 for transplanting and broadcasting methods, respectively and he concluded that for every Naira invested in paddy rice production, the farmer realizes ₦1.83 using transplanting method, while farmer realizes ₦1.85 using broadcasting method. For Ebonyi, he indicated that benefit/cost ratio (BCR) per 0.5ha of paddy production of ₦1.56 and ₦1.73 for transplanting and broadcasting methods, respectively were realizes and stated that for every Naira

invested in paddy rice production, the farmer realizes ₦1.56 using transplanting method, while farmer realizes ₦1.73 in paddy rice production, using broadcasting method farmers in Ebonyi made gross margin/net profit of ₦53,800 and ₦48,100 from paddy sale using transplanting and broadcasting methods, respectively.

Banjoko, Opeyemi, Ifabiyi, Arotiba and Adedeji (2016) in their work on assessment of the profitability of paddy production in Edu local government area of Kwara state, Nigeria found out that the average profit per hectare was ₦66,679 while the net farm profit per farm unit was ₦126,690. Lawal, Agboluaje, and Liman (2013) also worked on profitability and productivity of growers of new rice for africa (NERICA) in the southern guinea savanna of Niger state, Nigeria found out that NERICA variety is profitable and competitive in upland crop system with a gross margin and net farm profit of ₦92,948.00 and ₦90, 302.66 per hectare respectively.

Ben-Chendo and Joseph (2014) who also worked on comparative analysis of rice productivity of farmers on different land tenure systems in Imo state revealed that the gross returns was ₦47, 299.70 and ₦71, 739.13 respectively for communal and individual land tenure system while the net returns was ₦8, 721.25 and ₦17, 327.91respectively and the returns per naira from the enterprise were 22.6% and 31.8% respectively implying that on every naira invested, a profit of 23kobo and 32kobo were realised respectively from communal and individual land tenure system .The Benefit Cost Ratio was found to be 1.23 and 1.32 respectively showing an increase in returns and they concluded that the enterprise on the different land tenure systems (communal and individual) is profitable.

2.15.5 Review of socio-economic factors affecting agricultural productivity

According to Osanyinlusi and Adenegan (2016) in their study on the determinants of rice farmers productivity in Ekiti state, Nigeria concluded that increasing these variables (farm size, quantity of fertilizer used, level of education, cost of labour and transportation) at their present levels would lead to increased productivity whereas, the increase in the present level of quantity of seeds used would decrease productivity and vice versa. Their farming experience was at variance with the *a priori* expectation; implying that increase in the year of farming experience does not necessarily translate to improved farm productivity. Also, other studies in different regions of the country have identified the scarcity and high cost of inputs (labor, agrochemicals, and fertilizer) as major impediments to raising the productivity of smallholder farmers (Ojo, 2005; Akintayo, 2011).

There are other several factors which have been identified in the literature as influencing productivity in the agricultural sector and these factors includes; research and development, extension, education, government programs and policies, health and among others.

(i) Research and Development

The results of agricultural research include higher yielding crop varieties, better livestock breeding practices, more effective fertilizers and pesticides, and better farm management practices. Agricultural research is required not only to increase agricultural productivity, but to keep productivity from falling. Farmers benefit from agricultural research in the short run because of lower costs and higher profits. However, the long run beneficiaries of agricultural research are consumers who pay lower food prices. Private agricultural research is mainly performed by manufacturers of farm machinery and agrochemicals, and by food processors. Public agricultural research is performed in national agricultural experiment stations and other universities. Both

public and private research has positive effects on agricultural productivity (Aymen, Boubaker, Aden, Samia and Ali, 2015).

(ii) Extension

Usually there is a time lag before Agricultural research start affecting productivity, usually a particular research project may take several years to complete and it takes time for farmers to learn and adopt the innovation. Extension system helps to reduce the time lag between development of new technologies and their adoption. Extension agents disseminate information on crops, livestock, and management practices to farmers and demonstrate new techniques. They consult with farmers on specific production and management problems. It is to assume that extension has an immediate effect on productivity (Aymen *et al*., 2015).

(iii) Education

Education provides individuals with general skills to solve problems. Education is considered as human capital investment. Education also hastens the rate of development of new technologies by training scientists and it speeds the rate of adoption of new technologies by the farmers. Educated farmers are able to assess the benefits of innovative technologies, and adopt them quicker than non-educated farmers, and successfully adapt a new technology to their particular situations. Another effect of education is that it helps consumers better evaluate the potential risks posed by new products and technologies. The potential benefits of a new technology may not be realized if consumers do not buy products (Aymen *et al.,* 2015).

(iv) Government Programs and Policies

Government programs usually affect productivity through enhancing both resource allocation and output distribution through control of its prices. Government farm programs are the most common example of government involvement in agriculture. Regulatory policies affect the rate at which new fertilizers and farm chemicals reach the market place. Some studies have showed a significant positive relationship between government program and agricultural productivity (Huffman and Evenson, 1993). Direct government payments may encourage substitution of improved capital inputs for labour and increase the rate of new technology adoption (Makki, Luther and Cameron, 1999) as cited in (Aymen *et al.,* 2015).

(v) Health

Health influences total factor productivity growth directly through household income and wealth and indirectly through labour productivity, savings and investments and demography, by reducing various forms of capital and technology adoption. Healthy workers are more productive than the unhealthy workers (Isaksson, 2007). Cole and Neumayer (2003) investigate the impact of poor health on total factor productivity and it was found out that poor health has a negative effect on total factors productivity.

(vi) Other factors that can affect productivity could be summarized as follows:

- Resources such as fertilizer, capital, labour etc
- Sustainable management
- Farm size.
- Biophysical factors which include agro-ecological conditions such as rainfall, soil type, altitude.

2.15.6 Empirical review on the determinants of poverty in Nigeria

Many researchers who worked on the determinants of poverty in Nigeria, found out that the major determinants of poverty in Nigeria are education, age, gender, per capita expenditure among others as discussed below: -

Etim and Patrick (2010) in their work on estimating the determinants of poverty among fishing households in Akwa Ibom state, Nigeria revealed that except for age, fishing income and remittances, household size greatly contribute to poverty among the fishing households in the state. In the work of Ogwumike and Akinnibosun (2013), the determinants of poverty were found to include socioeconomic characteristics of the household, physical assets and community factors which include location of residence and geopolitical zone. The major findings of the study include: the farmer's income is inversely related to the poverty status of the household; and that a one per cent increase in income from farming activities will reduce the probability of a farming household being poor by 16 per cent.

Apata, Apata, Igbalajobi and Awoniyi (2010) in their work on determinants of rural poverty in Nigeria: evidence from small holder farmers in South-western, Nigeria revealed that access to micro-credit, education, participation in agricultural seminars, livestock assets and extension services significantly reduce chronic poverty among rural households in Nigeria. On the other hand, female headed households and households located far away from local markets have a high probability of staying below chronic poverty line. Edoumiekumo, Karimo, and Tombofa (2013) in their work on determinants of households' poverty and vulnerability in Bayelsa State of Nigeria revealed that important determinants of poverty were household size, per capita expenditure on health, education and food while those of vulnerability included, gender, occupation, years of

schooling, household size, per capita expenditure on education, health, and food, and number of rooms occupied by the household.

Tsue, Obekpa and Iorlamen (2013) who worked on Analysis of poverty and its determinants among cassava farmers in Apa Local Government Area, Benue State, Nigeria revealed that age, cassava farming experience and cassava farm size were the major determinants of poverty in the study area. Duniya and Rekwot (2015) in their work on determinants of poverty among groundnut farming households in Jigawa state, Nigeria revealed that the important factors that are influencing poverty status in the study area were age of respondent, education and membership of cooperation which had significant effects in reducing the poverty intensity in the study area, while farming experience and extension contact were factors that significantly increase the intensity of poverty in the study area. Anyanwu (2013) in his work on Marital Status, Household Size and Poverty in Nigeria: Evidence from the 2009/2010 Survey Data shows that age increases poverty incidence but at a decreasing rate, gender does matter in determining poverty in Nigeria, male-headed households are less likely to be poor than female-headed households. Being a male reduces the odds of being poor by 0.864, education is another determinant of poverty in Nigeria, and not having any formal education increases the odds of being poor by 1.221.

2.15.7 Empirical review of the constraints/challenges facing rice production in Nigeria

Many researchers who worked on the constraints of rice production in Nigeria, found out that the major constraints militating against rice production in Nigeria are lack of fund, problem of land, pests and diseases, flood among others as discussed below: -

Mallam (2013) in his work on comparative analysis of resource use efficiency in rice production among Fadama III and non-Fadama III beneficiary rice farmers in Niger state, Nigeria found out that lack of tractor hiring service, low soil fertility, lack of finance, low price of local rice, competition from imported rice, high cost of fertilizer and inadequate storage facilities are regarded as very serious constraints by both Fadama III and non-Fadama III beneficiary rice farmers. In addition, Fadama III beneficiary rice farmers also see poor credit accessibility as a very serious constraint while the non Fadama III beneficiaries in addition see lack of high yielding seeds as a very serious constraint. Both groups regarded high production cost as a serious constraint.

Adams (2018) in his work on Challenges of Rice Production in Nigeria: A Case Study of Kogi State found out that (60%) of the respondents identified low level of income, 20% identified inadequate storage facilities, 30% identified government regulations, 10% of the respondents identified lack of irrigation facilities and 5% identified inadequate marketing channels as one of the major problem in rice production. Also, he found out that high cost of fertilizer was perceived to be the most serious constraint by about 40% of the farmers. Marketing is another constraint identified by 30% of the respondents, 20% of the rice farmer indicates short of labour as the major constraints in the study area and 10%of the rice farmers indicated that pest and disease were the most serious constraint reducing the quality and quantity of rice output in the study area. Also, Sanusi (2014) in his work on rice farming in Nigeria: Challenges, Opportunities and Prospects identified high cost of productive inputs such as seeds, fertilizers and agrochemicals; climatic factors such as flood, soil salinity and erosion, drought and global warming, weeds, pests and diseases problems; and improper handling/ management of soil and water resources as part of many challenges of rice farming in Nigeria.

Matanmi, Adesiji, Owawusi and Oladipo (2011) in their work on perceived factors limiting rice production in Patigi Local Government Area of Kwara State, Nigeria found out that financial constraints constituted very severe constraints to the respondents in their rice production, poor access to input constituted a severe constraint, illiteracy of the respondents constituted moderately severe constraints to rice production. Lack of storage facilities was not severe constraints to rice production, lack of processing machine was very severe constraints to rice production in the study area. Fluctuation on climate was a moderately severe constraints, poor transportation was severe in rice production while pests and disease constituted severe constraints. However, lack of extension service was not severe constraints to rice production.

Iwuchukwu, Ayogu and Udegbunam (2017) in their work on activities of farmers in rice production in Awka North Local Government Area, Anambra State, Nigeria grouped the constraints militating against rice production into three basic component factors which include: problems associated with soil fertility and biotic stress; problems associated with farm-farmer status and economic related problems. And they found out that Variables that loaded under factor I (soil fertility and biotic stress) were: weeding problem (0.785), rodent attack (0.783), high incidence of pests and diseases (0.775), low soil fertility (0.692) and insufficient organic manure (0.685). Problems related to soil infertility and plant protection measures are among the most significant factors causing decrease in the yield of rice production.

Ismaila, Gana, Tswanya and Dogara (2010) in their work on Cereals production in Nigeria. Problems, consraints and opportunities for betterment, found the factors militating against the level of rice production in Nigeria to includes; climate factors (rainfall, temperature and and solar radiation), edaphic factors, migration, government policies, use of local varieties, predominance of

weeds, pest and diseases. Alarima, Adamu, Masunaga and Wakatsuki (2011) in their work on Constraints to sawah rice production system in Nigeria, enumerated land acquisition and tenure economics, information, communication and training technical and mechanical factors to be the rice production constraints in Nigeria. Also, Akinbile, Aminu and Sokeye (2018) in their work on constraints encountered in Rice production by farmers in ogun state, Nigeria identify old age of the farmers, birds, high interest rate, and flood/water logging as very severe constraints, inaccessibility to land, lack of credit facilities, low soil fertility, high cost of inputs, use of crude technology and lack of fertilizer were considered as severe constraints in rice production in the study area.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area

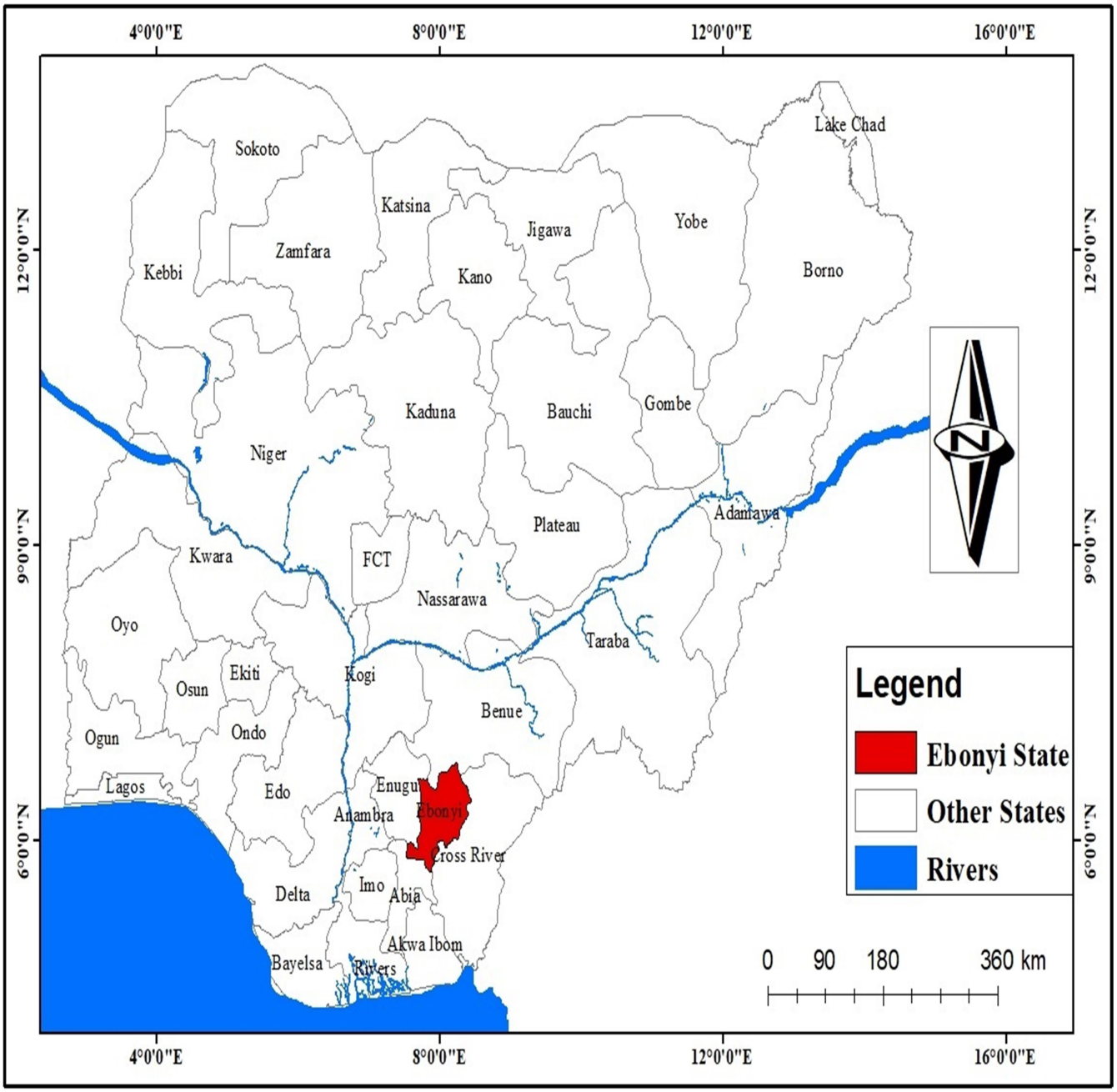
The study area (Ebonyi State) was created in 1996, making it one of the youngest states in Nigeria. Agriculture is a major occupation in the State, with an estimated 85% of the population earning

their living from one form of agriculture or another (Obasi, Agbo and Onyenekwe, 2015). It has a total land area of about 5,935 km^2 and savanna and semi tropical vegetation, with sandy and marshy soil (Obasi, Agbo and Onyenekwe, 2015). Ebonyi State is located within Latitudes 7^0 30E, and 8^0 30E and Longitudes 6^0 40N and 6^0 45N of South East zone of Nigeria. The State shares a border with Benue State to the North, Enugu State to the west, Imo and Abia States to the south and Cross River State to the east. The total population projected with an estimated growth rate of 3% is 2.9 million people in 2018. The state is also divided into thirteen local government areas (LGAs), namely: (1) Abakaliki, (2) Afikpo North, (3) Afikpo South, (4) Ebonyi, (5) Ezza North, (6) Ezza South, (7) Ikwo, (8) Ishielu, (9) Ivo, (10) Izzi, (11) Ohaozara, (12) Ohaukwu and (13) Onicha. Ebonyi people are predominately farmers and petty traders with very few in civil services.

Ebonyi State is endowed with enormous mineral resources: Salt lakes at Uburu, Okposi and Oshiri; Zinc and lead deposits at Enyigba as well as Kaolin and Limestone at Ishiagu, Afikpo and Nkalagu (EB-SEEDS, 2004) as cited in (Obasi, Agbo and Onyenekwe, 2015). The state is blessed with moisture land for growing of varieties of cash and food crops, such as rice, yam, cassava, maize and cocoyam, cash crop like cashew, cocoa and oil palm. The rainfall pattern is bimodal spreading between April and November with peaks in July and September. Total annual mean rainfall is 1750mm while the annual minimum and maximum rainfall range from 1700mm to 1800mm. The temperature ranged from 27^0C to 31^0C for night and day temperatures respectively. Relative humidity is usually high at 80% during rainy season and declines during the dry season to less than 65% (Ofomata, 1975) as cited in (Ekpe and Alimba, 2013).

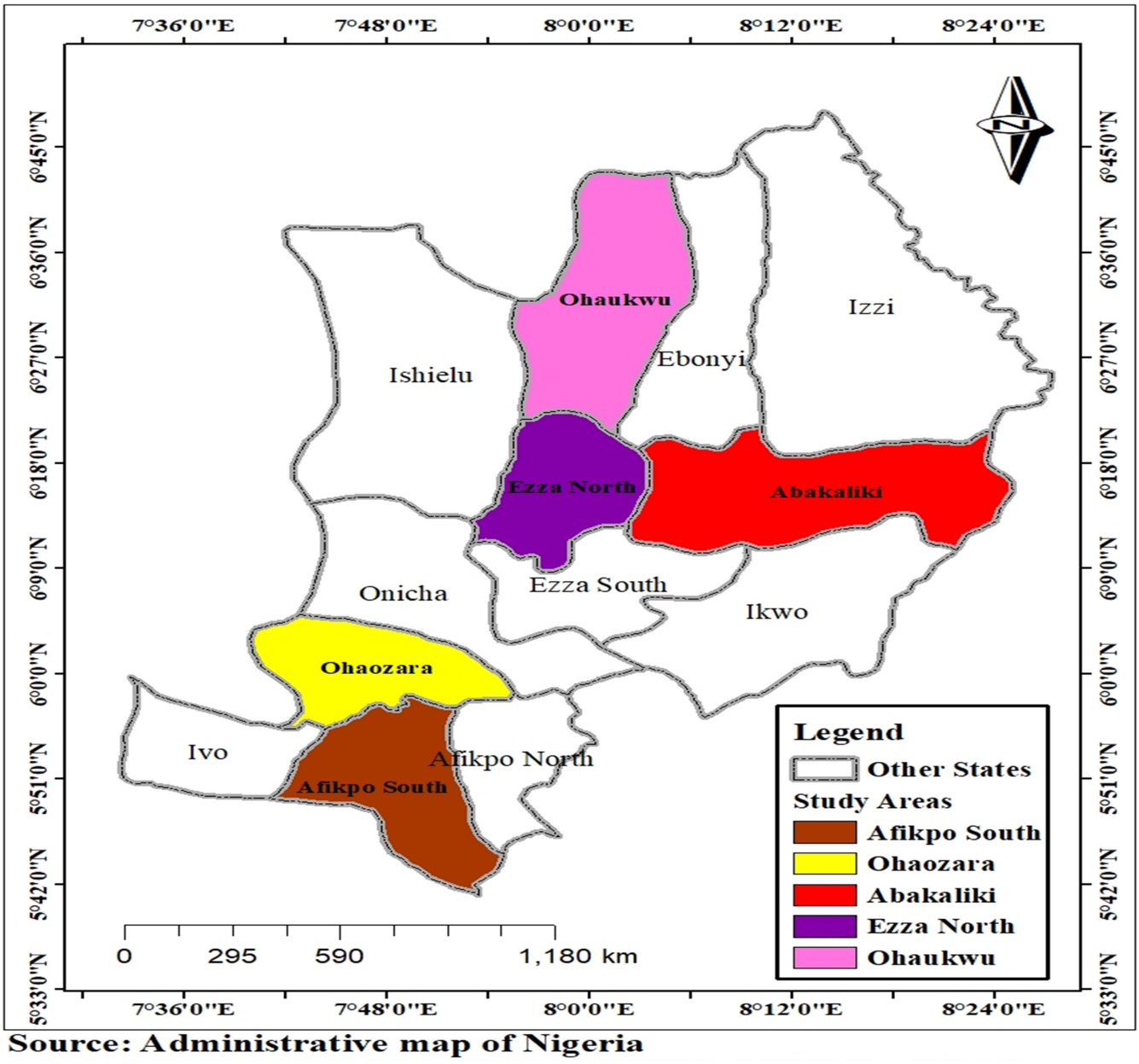
The State has several food processing factories including rice mills, quarry factories, fertilizer blending plants, and one of Nigeria's foremost cement factories (the Nigerian Cement Company at

Nkalagu). Among the agricultural potential is the production of the famous Abakaliki rice cultivated in an estimated land area of 311,208 hectares by over 140 thousand farmers which has made the state so popular and a beehive of commercial hub (Ebonyi State ADP, 2018). No visitor comes to Abakaliki, the state capital, without testifying to the high quality of Abakaliki rice compared with other rice produced locally and internationally. The Abakaliki rice is blessed with so many nutritional values, which is gotten from the salinity in the land of Abakaliki. It is even better and graded higher by those that know its nutritional values (Ebonyi State ADP, 2009; Nwelieji, 2015).



Source: Administrative map of Nigeria

Fig 3.1: Map of Nigeria showing Ebonyi state



Source: Administrative map of Nigeria

Fig 3.2: Map of Ebonyi State showing the study area

3.2 Sampling Technique

Multi-stage sampling procedures were used for this study. In the first stage, 4 Local Government Areas (LGA) out of 12 that participated in the USAID-MARKETS II in Ebonyi State were randomly selected. In the second stage, 3 villages each were randomly selected from the 4 LGAs making a total of 12 villages. The 3 villages (selected on equal proportion basis) captured above 10% of the total villages in each of the Local Government Areas and this is in line with Kajang, David and Jatau (2014) and adopted by Sani and Oladimeji (2017) who posited that ≥10% of the population is a fair representation especially where there is a large population. In the third stage, 239 participating rice farming households were selected from the list of USAID-MARKETS II participants in 12 sampled villages obtained from the Agricultural Development Programme (ADP) office in Ebonyi State, using the Yemen Taro (1967) scientific formula for calculating sample size. The randomization procedure adopted involved writing the names on cards, the cards were put into a box and reshuffle thoroughly and then drawn without replacement, this ensures that each one was given equal opportunity of being selected.

Yemen Taro (1967) scientific formula that was adopted in this study and used by Okpe, Uji and Okpachu (2014) is given as

$$n = \frac{N}{1+N(\propto^2)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(26)}$$

5% room for error was given and 95 percent confidence level in selecting the sample size. Where n is the sample size, N is the sample frame and $\propto^2$ is the precision level (0.05).

In order to control for spill-over effect, 6 villages (>10%) were randomly selected from one LGA that did not participate in USAID-MARKETS II in Ebonyi state to serve as the control group.

Also, from the list of non-participants of USAID-MARKETS II, using the Yemen Taro scientific formula for calculating sample size, 252 non- participating rice farming households were selected from the 6 sampled villages. In all, a total sample size of 491 rice farming households were selected for the study but 476 was used for the analysis because of outliers arising from dishonest answers, unrealistic answers, inconsistent responses and unanswered questions by the sampled farming households.

During the course of sampling the USAID-MARKETS II participating and non-participating rice farming households in Ebonyi state, 19 of the 234 participnats respondents and 20 of the 242 non-participants were upland rice farming households while majority are lowland rice farming households. Likelihood Ratio (LR) test was therefore carried out using their productive resources (inputs) against their output to ascertain if there is any significant difference between the inputs used and output of upland and lowland rice farm. Preliminary result of LR test showed that there was no significant difference at any level of probability and hence the data of the upland and lowland rice farming household were pooled together. Moreso, since USAID-MARKETS II rice project was carried out on both upland and lowland rice farming households, dropping the upland rice farming households will not give the true impact of USAID-MARKETS II rice project in the state which necessitated their inclusion.

Table 3.1: Population and sample size of participants and non-participants rice farming households

Participants				Non- participants			
L.G.A	selected Villages	Pop.	Sample size	L.G.A	Village	Pop.	Sample size
Abakaliki	Onu-ebonyi	57	24	Ezza-	oriuzor	123	52
	Agelegu	22	9	North	Amuda	81	34
	Ogbuchie	24	10		Umuogharu	129	54
					Ogboji	54	22
Afikpo-south	Ufueseni	42	17		umuezekaoha	138	58
	Ndikpo	61	25		umuezeoka	75	32
	Owutu	144	61				
Ohaozara	Agbaugo	21	8				
	Okpo	43	18				
	Enuogurugu Uchechi Okp	27	11				
Ohaukwu	Amoffia	55	23				
	Umuakpu	19	8				
	Ngbo	60	25				
Total 4	**12**	**575**	**239**		**6**	**598**	**252**

Source: Reconnaissance survey, 2018; Ebonyi State ADP, 2018.

3.3 Data Collection

Data were collected from primary source with the aid of structured questionnaire and field observations. The questionnaire was administered to both participants and non-participants rice farming households in the selected communities in Ebonyi State. Data were collected on rice output quantity and prices, farm size and rental prices, seed quantity and prices, fertilizer quantity and prices, agrochemical quantity and prices, labour and wages, age, household size, years of education, years of membership in association, farming experience, farm equipment, amount of credit received, number of extension contact, household expenditure and income, number of household dependent. The cost route survey approach was used in collecting the required data in

three stages – after planting, weeding and after harvesting of rice for 2018 cropping season. The researcher with other trained enumerators were fully involved in the data collection.

3.4 Analytical Tools

Data collected were analyzed using descriptive statistics which include percentage, means and frequency distribution tables and inferential statistics such as logistic regression model, Propensity Score Matching (PSM) and Local Average Treatment Effect (LATE), Foster, Greer and Thorbeecke (FGT) Index, stochastic frontier production model and Total Factor Productivity (TFP) model used by Coelli, (1996). The profitability of rice farming enterprise was analyzed using Net Farm Income (NFI) as used by Durga and Suresh (2013) and Returns Per Naira Invested (RNI). Z-statistics was used to test the hypothses of no significant difference between profitability, technical, economical and allocative efficiency of participants and non-participants rice farming households, Propensity Score Matching (PSM) and Local Average Treatment Effect (LATE) was used to check for the impact of USAID-MARKETS II on productivity and poverty status of rice farming households in Ebonyi state.

3.4.1 Logit model

Logit model emanated from cumulative standard logistic distribution. It is a non-linear regression model that forces the output (predicted values) to be either one or zero. Therefore, in logit model, the dependent variable takes the value of one or zero. The model was used to analyze objectives (ii) and (v) of this study. The logit regression model for determinants of USAID-MARKETS II participation (objective ii) is specified as:

$$Yi = f(X) = \log \frac{p_i}{1-p_i} \Sigma^{n}{}_{1} \beta iXi \quad \ldots\ldots(27)$$

The empirical model for objective ii is specified thus:

$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + \beta_9 X_{9i} + v_i$..... (28)

Y_i = participation in USAID-MARKETS II (a dummy variable, 1 for respondent that participated and 0 otherwise)

β_0 = constant,

$\beta_1 - \beta_9$ = parameters estimated,

X_{1i} = age (years),

X_{2i} = household size (number),

X_{3i} = farm size (ha),

X_{4i} = extension visit (number of visit within the rice farming season),

X_{5i} = years of membership in farm-based organization (years),

X_{6i} = education (years spent in formal education),

X_{7i} = gender (male 1, female 0),

X_{8i} = rice farming experience (years),

X_{9i} = Amount of credit obtained (Naira) and

vi = error term.

Logit model was also used to determine the factors that influence poverty status of rice farming households (objective vii).The selection of this model is in line with the studies of Giang, Wang and Yan (2014), Dorah (2015) and Yousaf (2014), variables that were included in the model are household monthly expenditure, age, household size, dependency ratio, sex, education, farm size, membership of association.

The logistic regression model is sated thus

$P_i = f(Z) = \log \frac{pi}{1-pi} \Sigma^n_1 \beta_i Z_i$ ……(29)

P_i denotes the probability that the farming households is below or above the poverty line, β_i are the coefficients and Z_i are poverty determinants variables

The model can be written in terms of the probability of being poor as follows:

$p_i = \frac{exp(\beta 0 + \beta i Zi)}{(1 + \exp(\beta 0 + \beta i Zi)}$ …….. (30)

Where p_i is probability of being poor, β_0 are constant and β_i and Z_i as defined in equation 3

To illustrate it in terms of the probability of being non-poor, it follows that:

$1\text{-}p_i = \frac{1}{(1 + \exp(\beta 0 + \beta i Zi)}$ …….. (31)

Where $1\text{-}p_i$ is probability of being non-poor, β_0, β_i, Z_i are defined in equation 3

The empirical logistic regression model is stated thus:

$Y_i = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \beta_6 Z_6 + \beta_7 Z_7 + \beta_8 Z_8 + e_i$ …… (32).

In the model, Y_i is the poverty status (is dummy variable that takes the value of 1 (p_i) when the rice farming household's per capita income is below the poverty line i.e 2/3 of mean per capita income and 0 ($1\text{-}p_i$) otherwise)

e_i is the error term,

β_0 = constant,

β_1 - β_8 = parameters estimated,

Z_1 = household monthly expenditure (Naira),

Z_2 = age (years),

Z_3 = household size (number),

Z_4 = dependency ratio (number of dependents divided by the number of independent members),

Z_5 = sex (1 for male and 0 for female),

Z_6 = education (years spent in formal education),

Z_7 = farm size (ha) and

Z_8 = membership of farm-based organization (years of membership).

3.4.2 Foster, greer and thorbeecke (FGT) index

The Foster, Greer and Thorbeecke (FGT) (1984) poverty index was used to determine poverty status among the respondents (objective vi). It is generally given as:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z-Yi}{Z}\right)^{\alpha} \quad \text{……… (33)}$$

Where: P = Foster, Greer and Thorbecke index

N = total number of respondents,

q = number of respondents below the poverty line i.e poor people,

Yi = per capita household income of the respondent and

z = the poverty line.

α is a non-negative poverty aversion parameter (0, 1,2). The analysis of the poverty status of the rice farming households was decomposed into three indicators: - prevalence poverty (P_0), poverty depth (P_1) and severity of poverty (P_2).If α = 0, the index become

$$P_0 = \frac{q}{N}. \quad \text{……… (34)}$$

This gives the head count ratio or the incidence of poverty which is the percentage of respondents in poverty i.e whose per capita income is below the poverty line where q is the no of poor in the

population and N is the total population. If α = 1, it reflects the depth of poverty or the proportion of the poverty line that the average poor will require to attain to the poverty line

$p_1 = \frac{1}{N}\sum_{i=1}^{q}(\frac{Z-Yi}{Z})$. ……..... (35)

If α = 2, the index measures the severity of poverty which is the mean of square proportion of the poverty gap $p_2 = \frac{1}{N}\sum_{i=1}^{q}(\frac{Z-Yi}{Z})^2$……... (36)

When multiplied by 100, it gives the percentage by which a poor household's per capita income should increase to push them out of poverty.

Poverty Line

In line with studies on poverty, per capita household income was adopted by this study as a measure for determining the poverty line. The total income of each household was calculated, and then corrected for each household size by dividing the household total monthly income by the number of people within the household.

$$\text{Per capita income (monthly)} = \frac{\text{total household monthly income}}{\text{adjusted household size}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (37)$$

$$\text{Mean per capita household income} = \frac{\text{total per capita income for all households}}{\text{total number of household}} \quad \ldots\ldots\ldots\ldots \quad (38)$$

From the mean of per capita household income, poverty lines were drawn as two thirds of the mean per capita household income. Organization for economic cooperation and development (OECD) equivalence scale were used to adjust the household size. This was used to achieve part of objectives (vi) and (vii) of the research work.

3.4.3 Profitability measures

The profitability of the farmers is usually a measure of their economic performance, therefore profitability of rice farming enterprise (objective iii) was analyzed using Net Farm Income (NFI) as was used by Durga and Suresh (2013) and Returns Per Naira invested.

3.4.3.1 net farm income (NFI)

Net Farm Income statement is usually a summary of revenue and expenses for a given accounting period (usually one year). It is sometimes called a profit and loss statement. The Net Farm Income (NFI) was used in this study to measure the difference between revenue and expenses of participants and non-participants in rice farming. A positive difference indicates a profit while a negative difference indicates a loss for the farming period. The Total costs incurred and the total revenue in monetary value obtained per hectare by USAID-MARKETS II participants and non-participants were estimated as well as their Net Farm Income.

The approach suggested by the Cost of Cultivation for Principal Crops as adopted by Durga and Suresh, (2013) was used to calculate the returns of rice farming. The total cost of farming comprises of fixed and variable costs. Fixed cost includes land payment, depreciation on farm tools and Implements, for owned land, rental value of the land was used. The variable cost includes cost of seeds, fertilizers, agrochemicals, labour and interest on working capital. Interest on working capital was calculated at the rate at which banks is advancing short-term loans. It was calculated for the duration of the rice crop. Net income is the difference between the gross return and total cost of farming as stated below

Net income = GR – TC……..…… (39)

Where GR = gross return (value of the paddy in Naira) and

TC = total cost of farming.

While TC = FC + VC ……..…… (40)

Where

FC = fixed cost and

VC = variable cost.

3.4.3.2 returns per naira invested (RNI) model

Returns Per Naira invested (RNI) = $\frac{TR}{TC}$ ……..…… (41)

Where RNI = Returns Per Naira invested,

TR = Total revenue in Naira and

TC = Total cost of rice production in Naira.

If RNI is less than unity, it means it is unprofitable to embark on the investment at the present production level and/or the present production price level. If RNI is more than unity, it means it is profitable to engage in producing the product at the present production level and/or the present production price level. If RNI is equal to unity, it means it is neither unprofitable nor profitable to engage in producing the product at the present production level and/or the present production price level that is it is breakeven point. These was used to achieve objective vii of the research work.

3.4.4 Stochastic frontier production function model

Stochastic frontier analysis is preferred for agricultural research due to inherent variability of agriculture production as a result of weather, soils, pests, diseases and environment factors.

Stochastic Frontier Production Function model was developed by Aigner, Lovell and Schmidt, (1977) and it is specified as

$Y = f(Xi,\beta) + \varepsilon i$ …….. (42)

Stochastic Frontier Production Function model was used to achieve objective iv (estimate technical, economical and allocative efficiency of participants and non-participants rice farming households).

The technical efficiency of production is given as

$TEi = \exp(-ui) = \frac{Y_i}{Y^*}$ ……. (43)

Where Yi is the observed output and Y* is the maximum possible output.

$Y^* = f(Xi, \beta) + v$ ……..... (44)

Where *Y** is the firm's observed output adjusted for the statistical noise captured by *v*

$Yi = f(Xij: \beta) + \varepsilon i$ …… (45)

$\varepsilon i = vi + ui$ ……..... (46)

Where Yi = output of the farm,

Xi = Vector of inputs,

β = vector of the parameters estimated,

vi = Random error outside farmer's control and

ui = Technical inefficiency effects.

Cobb Douglas production function is fitted into the stochastic frontier model and the empirical stochastic frontier production model is specified thus: -

$\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + v_i - u_i$ ……..…(47)

Where ln = logarithm to base e,

Y_i = output of rice (kg),

β_0 = constant,

β_1 - β_5 = parameters estimated,

X_1 = farm size (ha),

X_2 = fertilizer (kg),

X_3 = labour (man-days),

X_4 = herbicide (litre) and

X_5 = rice seed (kg).

The inefficiency effect is non-negative with half normal distribution. It is assumed that it is truncated at zero and thus it is specified as;

$$-u_i = \delta_0 + \delta_1 \ln Z_{1i} + \delta_2 \ln Z_{2i} + \delta_3 \ln Z_{3i} + \delta_4 \ln Z_{4i} + \delta_5 \ln Z_{5i} + \delta_6 \ln Z_{6i} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (48)$$

Where $-u_i$ = Technical inefficiency,

δ_0 = constant,

δ_1 - δ_6 = Parameters estimated,

Z_{1i} = age (years),

Z_{2i} = education (years spent in formal education),

Z_{3i} = household size (number),

Z_{4i} = years spent in farm-based cooperative society (years),

Z_{5i} = years of farming experience in rice production (years) and

Z_{6i} = number of contact with extension agent (number of visit within the rice farming season).

The cost efficiency (CE) of a farming household is defined in terms of the ratio of observed cost (Cb) to the corresponding minimum cost (Cmin) under a given technology

CE = exp (Ui) ……..……. (49)

Where: CE = Cost efficiency, Cb = the observed cost and represents the actual total production cost; Cmin = the minimum cost and represents the frontier total production cost.

Allocative efficiency is given by $\frac{1}{CE}$ …… (50)

The corresponding cost frontier derived analytically from the stochastic frontier production function is given as:

In Ci= α_0+ $\alpha_1$ln P_{1i} + $\alpha_2$ln P_{2i}+ α_3P_{3i}+ $\alpha_4$ln P_{4i}+ $\alpha_5$ln P_{5i}+ vi+ ui …….. (51)

Where: Ci = Total cost of production (Naira),

ln = logarithm to base e,

α_0 = constant,

α_1 - α_5 = parameter estimated,

P_{1i} = Rent on land per hectare (Naira),

P_{2i} = cost of fertilizer (Naira),

P_{3i} = cost of labour (Naira),

P_{4i} = cost of hrebicide (Naira) and

P_{5i} = cost of rice seed (Naira),

The cost inefficiency effects are defined as in equation 48 above. The economic efficiency is the product of technical and allocative efficiency.

3.4.5 Propensity score matching

The propensity score is defined as the conditional probability of receiving a treatment given pretreatment characteristics (Rosenbaum and Rubin, 1983; Adebayo and Olagunju, 2015). The propensity scores were computed using binary logit regression model given as:

$p(x_i) = P(d=1|x_i)$……..…….… (52)

Where $p(x_i)$ is a consistent estimate of the propensity score evaluated at x_i while x_i were the variables used for the matching. P-score was estimated in the first stage and computed for each farming household, the actual matching was carried out after pscore was computed. The matching estimator (nearest neighbor matching method) as was used by Abadie and Imbens (2006), Mendola (2007), Diamond and Sekhon (2008) was used in this study. Average Treatment Effect (ATE), Average Treatment Effect on the Untreated (ATU) and Average Treatment Effects on the Treated (ATT) were estimated in the second stage. ATT was estimated by computing the differences across both groups (i.e participants and non-participants) by the following formula:-

$$ATT = \frac{1}{N1}(Y_1 - Y_0) \quad \text{……..…… (53)}$$

Where ATT = Average impact of Treatment on the treated, N_1 = Number of matches (from regression model), Y_1 = the poverty/productivity index by Participants, Y_0 = the poverty/productivity index by non-participants. A positive (negative) value of ATT suggests that rice farming household beneficiaries in the project have higher (lower) outcome variable than non-participants. This was used to achieve part of objectives (v) and (vi) of this study.

3.4.6 Local average treatment effect (LATE) model

LATE is an instrumental variables (IV) estimate that uses treatment assignment as an instrument for treatment received, The propensity score matching method fails to deal appropriately with the problem of selection on unobservable, which may be handled by the double difference approach if

the unobservable are time invariant. Moreover, neither of the two approaches deals appropriately with the problem of non-compliance. In this regard, LATE model was also employed in this study.

Considering how USAID-MARKETS II was carried out in Ebonyi state, rice farming households exposed to USAID-MARKETS II have full control over their decision to participate or not to participate (i.e. the receipt of the treatment is endogenous). When subjects do not receive the treatment to which they were assigned, the experimenter faces a "non-compliance" problem. Noncompliance can make it impossible to estimate the actual impact of a project but it can be handled by LATE (Local Average Treatment Effect) which was first discussed by Imbens and Angrist, (1994). As a result of this, this study also adopted LATE Model to complement PSM in order to capture the impact of USAID-MARKETS II project on the productivity and poverty status of rice farming households in the study area.

LATE Model is as given by

$$LATE = \frac{cov(y,z)}{cov(d,z)} \quad \ldots\ldots\ldots\ldots \quad (54)$$

$$= \frac{E\langle y|z=1)-E(y|z=0\rangle}{E\langle d|z=1)-E(d|z=0\rangle} \quad \ldots\ldots\ldots\ldots \quad (55)$$

Where y is the treatment status variables, z is the instrument variable and d are the outcomes variables.This equation is known as *Wald* estimator that can be estimated using two-stage least squares. This was used to achieve objectives (v) and (vi) of the research work.

3.4.7 Total factor productivity (TFP) model

Productivity measures the performance of a sector (Conradie, Piesse and Thirtle, 2009). The productivity of rice farming households was estimated using the TFP model as was used by Coelli (1996) and adopted by Osanyinlusi and Adenegan (2016).

$$TFP = \frac{\text{Gross value of output}}{\text{gross value of inputs used}} \quad \ldots\ldots (56)$$

The higher the ratio, the more productive the farming household is. This was used to achieve part of objective v of the research work

3.4.8 Hypotheses testing

The Z statistic was used to test the hypotheses which state that there is no significant difference in the profit/technical/economical/allocative efficiency of participants and non-participants rice farming households.

The statistics is stated thus:-

$$Z = \frac{Y1 - Y2}{\sqrt{\frac{S1}{n1} + \frac{S2}{n2}}} \quad \ldots\ldots (57)$$

Where Z = the value of the statistic,

Y1 = mean of profit/technical/economical/allocative efficiency by the project participants,

Y2 = mean of profit/technical/economical/allocative efficiency by the non-participants,

S_1= variance of profit/technical/economical/allocative efficiency by the project participants,

S2 = variance of profit/technical/economical/allocative efficiency by the non- participants,

n_1= number of participants,

n_2 = number of non-participants.

3.5 Definition and *a priori* Expectation of Variables

Independent variables

Years of formal education - This is regarded as the years the respondent spent in formal education and it is considered as very important in determining how the respondent can utilize modern resources/equipment. It is expected to have a positive relationship with productivity, technical, allocative and economic efficiency and negative relationship with poverty status.

Farming experience – This is the number of years the respondent has been in the business of rice farming. It is the act of gaining knowledge through constant practicing of skill, which brings about specialization (Olaoye, 2010). Experienced farmers have the ability to use modern farming gears and able to know when to plant and to market their produce to make more profit. It is expected to have a positive relationship with productivity, technical, allocative and economic efficiency.

Years of membership in associations – This refers to the number of years the respondent has been in a cooperative society and it has been proven to have an influence on the level of production efficiency of the farmer. Membership of association provides a network connection among farmers which lead to mutual commitment (Ayoola, Dangbengnon, Daudu, Mando, Kudi, Amapu, Adeosun and Ezul, 2011). It affords the farmers access to soft loans and productive inputs such as improved seeds and fertilizer which are better sought by group rather than individuals. It is expected to have positive relationship with technical, allocative and economic efficiency.

Age - This refers to the number of years of the respondent attained from birth and it can influences the way a farmer thinks, view and act or take risks. It is expected to have a positive or negative relationship with technical, allocative and economic efficiency. Positive shows the

possibility that the farmers' age may contribute to their inefficiency and being negative shows the possibility that the farmers years of farming can increase efficiency.

Household size – This refers to the total numbers of person living in the same house and eating from the same pot. It is expected to have a negative relationship with technical, allocative and economic efficiency but it is expected to have a positive relationship with poverty status. From the household size, we can get the dependency ratio which is the number of independent members divided by the dependent members.

Extension visit - This refers to the number of times the respondent has been visited by the extension agent with regard to his rice farming business. Well-organized extension contacts enhance the application and utilization of information on improved technology by the farmers as well as their innovativeness (Umar, Ndanitsa and Olaleye, 2009). Interacting with extension workers affords the farmers the opportunity of sharing information on modern agricultural practices. It is expected to have a positive relationship with productivity, technical, allocative and economic efficiency.

Awareness - Refers to the knowledge of the respondent about the USAID- MARKETS II project, it is believe that no one can be part of any project he/she is not aware of. This was measured with a binary variable choice (being aware takes the value of 1 while otherwise is 0). This was used as the instrumental variable for the LATE model.

Gender – Refers to the role play by different sex which can be the role of men, women or youth. Njuki, Waithanji, Bagalwa and Kariuki (2013) defined gender as 'the socially constructed roles and status of women and men, girls and boys (youths). It was measured using a binary variable

choice (male takes 1 while female is 0). It is expected to have a positive relationship with participation.

Sex – Refers to rice farming household's head being male or female. It was measured using a binary variable choice (male takes 1 while female is 0). It is expected to have negative relationship with poverty status.

Amount of credit received - Refers to the amount of money the respondent borrowed from other sources order than his personal money. It can be from formal or informal sources. It is expected to have a positive relationship with productivity.

Household Expenditure – Refers to the total money spent by the rice farming household on their basic needs (food, shelter, education, clothing, health, transport) and other expenses incurred by the farming households before the period of planting, after planting and after harvesting of rice which makes up the period for the data collection. It is expected to have a negative relationship with poverty.

Farm Size: This refers to the amount of land put to rice cultivation, and measured in hectares. It is expected to have a positive relationship with productivity, technical, economic and allocative efficiency but have a negative relationship with poverty, this is because the more the land that is engaged in production, the more the yield that will be obtained and vice versa.

Herbicide: Chemical used for weeding and clearing of the farm, the quantity was measured in litres /hectare. It is expected to have a positive relationship with all the efficiencies.

Dependent Variables

Participation - Refers to the involvement of the respondent in the project and it was measured with a dummy variable of 1 if the respondent participated in the project and 0 if otherwise.

Poverty Status - This is regarded as the position of the household's per capita income at the poverty threshold (poverty line) when the per capita income of a household is below the poverty line, the household is considered to be poor and above it, is considered as non-poor.

Productivity - Productivity in this study is the ratio of gross value of output to the gross value of inputs.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-economic and Demographic Characteristics of Participants and Non-participants

A number of socio-economic and demographic characteristics of rice farming households which include age, years in formal education,income, sex, extension visit, years of rice farming experience, membership of association, household and farm sizes were examined and presented in Table 4.1.

Table 4.1: Socio-economics and Demographic Characteristics of Participants and Non-participants Rice Farming Households

Variables	Participants Frequency	Percentage	Non-participants Frequency	Percentage
Sex				
Female	68	29.06	72	29.75
Male	166	70.94	170	70.25
Total	**234**	**100**	**242**	**100**
Age				
21 – 30	11	4.70	13	5.37
31 – 40	64	27.35	67	27.69
41 – 50	75	32.05	85	35.13
51 – 60	65	27.78	57	23.55
61 – 70	17	7.26	19	7.85
71 – 80	2	0.86	1	0.41
Total	**234**	**100**	**242**	**100**
Mean	47.00		46.00	
Standard deviation	10.49		10.04	
Household size	72	30.77	61	25.21
1 – 5.0	141	60.26	158	65.29
6 – 10	17	7.26	20	8.26
11 – 15	4	1.71	3	1.24

16 – 20	**234**	**100**	**242**	**100**
Total				
Mean	7.00		6.00	
Standard deviation	2.83		2.47	

Table 4.1: Socio-economics and Demographic Characteristics of Participants and non-participants Rice Farming Households cont

Variables	**Participants Frequency**	**Percentage**	**Non-participants Frequency**	**Percentage**
Years in Education				
0	18	7.69	47	19.42
1 – 6	88	37.61	80	33.06
7 – 12	90	38.46	103	42.56
13 – 18	38	16.24	12	4.96
Total	**234**	**100**	**242**	**100**
Mean	9.00		8.00	
Standard deviation	4.52		4.81	
Years in cooperative				
0	5	2.14	219	90.50
1 – 10	150	64.10	12	9.09
11 – 20	76	32.48	1	0.41
21 – 30	2	0.85	0	0
31 - 40	1	0.43	0	0
Total	**234**	**100**	**242**	**100**
Mean	10.00		0.50	
Standard deviation	4.71		1.77	
Extension visits				
0	4	1.71	214	88.43
1– 3	220	94.02	28	11.57
4 – 6	10	4.27	0	0
Total	**234**	**100**	**242**	**100**
Mean	2.00		0.13	
Standard deviation	0.86		0.37	
Rice farm experience				
5 – 14	60	25.64	38	15.70
15 – 24	104	44.44	107	44.21
25 – 34	43	18.38	55	22.73
35 – 44	25	9.83	35	14.46
45 – 54	4	1.71	7	2.90
Total	**234**	**100**	**242**	**100**
Mean	21.00		23.38	
Standard deviation	9.37		9.60	

Rice variety				
Local	8	3.42	113	46.69
Improved	226	96.58	129	53.31
Total	**234**	**100**	**242**	**100**

Table 4.1: Socio-economics and Demographic Characteristics of Participants and non-participants Rice Farming Households cont

Variables	**Participants Frequency**	**Percentage**	**Non-participants Frequency**	**Percentage**
Rice farm size	142	60.68	162	66.94
0.2 – 1.1	71	30.34	63	26.03
1.2 – 2.1	16	6.84	16	6.61
2.2 – 3.1	4	1.71	1	0.41
3.2 – 4.1	1	0.43	0	0
4.2 – 5.1	**234**	**100**	**242**	**100**
Total				
Mean	1.28		1.12	
Standard deviation	0.83		0.61	
Land acquisition				
Inherited	57	24.36	126	52.07
Rent	139	59.40	97	40.08
Rent/inherited	15	6.41	6	2.48
Purchase/inherited	0	0	4	1.65
Purchase	7	2.99	2	0.83
Community owned	9	3.45	3	1.24
Lease	7	2.99	3	1.24
gift	0	0	1	0.41
Total	**242**	**100**	**242**	**100**
House type				
Mud house	80	34.19	173	71.49
Cement old house	148	63.25	64	26.44
Cement modern	6	2.56	5	2.07
Total	**234**	**100**	**242**	**100**
Occupation				
Full-time farming	67	28.63	76	31.40
Farming and others	167	71.37	166	68.60
Total	**234**	**100**	**242**	**100**
Monthly per capita income				
3,000 - 10,999	131	55.98	155	64.05
11,000 – 18,999	80	34.19	74	30.58

19,000 – 26,999	19	8.11	11	4.54
27,000 – 34,999	2	0.86	2	0.83
Above 34,999	2	0.86	0	0
Total	**242**	**100**	**242**	**100**
Mean	11,718		10.53	
Standard deviation	2966.52		2080.84	

Result presented in Table 4.1 showed that majority (70.94% and 70.25%) of participants and non-participants households were headed by male while less than 30% of both participants and non-participants households were headed by their female counterpart. This shows that male headed households participated in USAID-MARKETS II more than their female counterpart. This finding did not reflect the target of USAID-MARKETS II in Ebonyi state which was to involve more women than men in the project. The reason given by the farming households for low level of women participation was attributed to the fact that government have not kept to their promises in the past and as a result, the women have lost confidence in participating in government projects.

This finding is in line with Okwoche and Asogwa (2012) in their work on impact of extension services on cassava farming in Benue state, Nigeria, Olaolu, Akinnagbe and Agber (2013) in their work on impact of national FADAMA Development Project Phase II on poverty and food security among rice farming beneficiaries in Kogi state, Nigeria, Ositanwosu and Xiong (2016) in their work on impact of Agricultural Transformation Agenda (ATA) program in advancing the socio-economic statutes of smallholder rice farmers in Adani-Omor Zone, southeast and Girei, Saingbe, Bitrus and Bassey (2017) in their work on revealing the impact of Fadama III Project on the income level of beneficiary farmers in Plateau state, Nigeria where they all found that the males participated in their respective programmes more than their female counterpart.

Age of the farmers usually affects the ability of the farmer to perform farming operations. The older the farmer, the more experienced he/she is expected to be, which also aid in decision making. The result showed that the average age of participants was 47 while that of non-participants was 46. This implies that a typical participants and non-participants of USAID-MARKETS II was still within the productive and economic viable stage and can make positive contribution to agricultural production. This is in line with the work of Osondu, Ijioma, Udah and Emerole (2015) in their work on impact of national Fadama III development project in alleviating poverty of food crop farmers in Abia state, Nigeria who found average age of 42 and 45 years for participants and non-participants respectively. Large household size can be an asset to the farmers in terms of more labour force available and it can also be a liability in terms of more mouths to feed. However, the study revealed that the average size of the households of the participants and non-participants in the study area was 7 and 6 respectively, implying that majority of the participating and non-participating households have relatively high household sizes. Thus, rice farming households have a good source of family labour for their farm business. This is also a

positive indication of availability of family labour for farm work. This agrees with the findings of Osondu, Ijioma, Udah and Emerole (2015) who found average households size of 7 and 5 members for participants and non-participants respectively.

Education can enhance farmers' ability to make accurate and meaningful management decisions. It is believed that educational level of the households head affects his/her level of participation in programmes. Results presented in Table 4.1 revealed that the average years spent in formal education by the participants and non-participants was 9 and 8 years respectively. This shows that majority of the USAID-MARKETS II participants and non-participants had some level of formal education and can therefore understand productive information that can help them in making effective farm management decisions. This finding agrees with the work of Folorunso (2015) who worked on impact of Fadama III on productivity, food security and poverty status of tuber farmers in North central states of Nigeria who observed an average education of 8 and 9 years for participants and non-participants respectively. Membership of a cooperative society enables farmers to interact with other farmers, share their experiences. It creates an avenue through which innovation diffusion can occur. Membership of a cooperative or any farming group is a strong determinant of participation in a programme and it can afford farmers some benefits from financial institutions and/or lending agency. The results revealed that the average number of years spent in the cooperative society by the participants was 10 years which is long enough to share experiences and 0.5 year for the non-participants which is not long enough to share experiences.

Extension visits is believed to increase adoption of improved farm production technologies because through extension visits, farmers are better informed about new technologies. The results revealed that the average extension visit to the participants was 2 times per rice farming period

which is not adequate enough for the extension worker to guide them through the farming period. Extension visits was negligible for non-participants (0.13 almost non-existent for the entire production season), implying that adoption of an innovation will be quiet difficult for them. Umar, Ndanitsa and Olaleye (2009) observed that higher extensions contact would increase adoption of improved farm production technologies. They further observed that the frequency of extension contact is very essential as it guides the farmers from awareness to the adoption stage.

The longer a farmer practices farming, the better his performance tend to be. The average years of rice farming experience of the participants and non-participants was 21 years and 23.38 years respectively, which is long enough for the rice farming households to master the art of rice farming and improve their performance in rice operation. This finding is in line with Girei, Saingbe, Bitrus and Bassey (2017) in their work on revealing the impact of Fadama III project on the income level of beneficiary farmers in Plateau state, Nigeria who found average years of farming experience as 15 years for both participants and non-participants. The result as presented in Table 4.1 showed that majority (96.58%) of the participants planted improved varieties identified as FARO 44 and FARO 52 while minority (3.42%) of them planted local variety identified as MARS, R16 and 306. Also, a greater percentage (53.31%) of the non-participants planted improved varieties identified as FARO 44 only while a lesser percentage (46.69%) planted local variety identified as MARS, R16, R8, 306.

The average rice farm size of participants was 1.28 hectares and that of non-participants was 1.12 hectares. This shows that both participants and non-participants are mainly small holder farmers based on Federal Ministry of Agriculture and Rural Development, which classified farmers with land holdings less than 5 hectares as small scale (FMARD (2010). This is in conformity with the

work of Ilu (2015) who found average rice farm size of 2.6 hactares. Factors like high cost of land, high cost of labour and low income level of farming households could be responsible for the small rice farm size, for on average it cost participants ₦23,991. 12 to rent a hectare of rice land and ₦121,316. 21 to pay for labour for the same hectare of rice farm while for the non-participants it cost ₦25, 049. 80 on average to rent a hectare of rice land and ₦101,518. 58 to pay for labour for the same hectare of rice land. Small farm size is an impediment to agricultural mechanization because using farm machineries like tractors to plough the land or weeds the farm will be difficult. Land acquisition by participants showed that 24.36% of them are using inherited land only for their rice production while majority (59.40%) of them rented their lands for the rice production, lesser percentages (2.99%) cultivated their rice in purchase land and lease land respectively while 6.41% combined both rented and inherited land for their rice production and only 3.45% cultivated in a community owned lands. Also, land acquisition by non-participants revealed that 52.07% of them are using inherited land only while a lesser percentage (1.24%) cultivated their rice in community owned land and lease land respectively.

House type lived in by most of participants were cement old houses with 63.25% of them living in such houses while 34.19% of them are living in muds houses while only 2.56% of them are living in a modern cement houses. Further enquiry showed that 83.33% of the participants owned their houses while only 16.67% are living in a rented apartment. Also, House type lived in by most (71.49%) of non-participants were mud houses while 26.44% of them are living in cement old houses and only 2.07% of them are living in a modern cement houses. Further enquiry showed that 90.08% of the non-participants owned their houses while only 9.92% are living in a rented apartment. About 28.63% of the participants had farming as their only occupation and are therefore full-time farming households while majority (71.37%) of the participants households

combine farming with other occupations which was identified as masonry, trading, electricians, civil service, *okada* and *keke* riding, gate keeper, tailoring, hair stylist and carpentry work and for that of non-participants, about 31.40% had farming as their only occupation and are therefore full-time farming households while majority (68.60%) combine farming with other occupations which was identified as masonry, fishing, trading, civil service, *okada* and *keke* riding, gate keeper, photographing, pensioners, brick laying, *garri* engine operators, tailoring and wielding work.

Results as presented in Table 4.1 further revealed that household monthly mean per capita income of the participants of USAID-MARKETS II was ₦11, 718. This shows that majority of the participants were low income earners. When compared with the minimum wage received by a household head in Ebonyi state which is ₦13, 000 monthly which is to be shared by an average household size of 7 means that rice farming households in Ebonyi state are better off than the junior government workers in the state. The mean per capita income of the participants shows that average participant rice farming household had ₦82, 026 as their monthly household income. This comprised income from rice and other sources. In the computation the average household size of 7 was used. Also, the study revealed that the mean per capita income of non-participants was ₦10, 525 which means that the average non-participant household had ₦63,150 as their monthly household income and they are still better off when compare with their junior government workers. This shows that majority of the non-participants were low income earners.

4.2 Factors Influeuncing Participation in USAID-MARKETS II

The results of the logit model used to examine the factors influencing participation in USAID-MARKETS II in the study area are presented in Table 4.2. The log-likelihood ratio of -62.257, the

pseudo R^2 of 0.4022 and the LR (Chi^2) of 95.23 indicates statistical significant at 0.01 probability level, implies that the overall model is well fitted into the data and the explanatory variables used in the model adequately explained the probability of participation in USAID-MARKETS II in Ebonyi State. Among the included variables, age, household size, extension visit, years in cooperative society, education and years of rice farming experience significantly influenced participation in USAID-MARKETS II while farm size, sex and amount of credit received had no significant influence on participation in USAID-MARKETS II.

Table 4.2: Results of logit analysis on factors influeucing participation in USAID-MARKETS II

Variables	**coefficient**	**Standard error**	**Z**	**P>(Z)**	**Marginal effect**
Age	-0.151	0.065	-2.330	0.020	-0.369**
Household size	0.424	0.195	2.170	0.030	0.104**
Farm size	0.331	0.719	0.460	0.645	0.081
Extension visit	4.277	0.883	4.840	0.000	0.946***
Years of coop	0.806	0.131	6.170	0.000	0.197***
Education	-0.230	0.115	-1.990	0.047	-0.056**
Sex	-0.756	0.898	-0.840	0.400	-0.178
Yrs of exp.	-0.212	0.068	-3.110	0.002	-0.052***
Credit amount	2.2e-06	5.9e-06	0.370	0.712	5.3e-07
Constant	0.331	0.230	1.440	0.151	
No of observation		476			
LR Chi^2 (9)		95.230			
Prob >chi^2		0.000			
Pseudo R^2		0.402			
Loglikehood		-62.257			

Note: ***,** is significant at 1% and 5% levels respectively.

Results presented in Table 4.2 showed that coefficient of age of the household head was negative and significntly influenced participation in USAID-MARKETS II at 5%. This implies that households headed by younger respondents have higher tendency to participate in USAID-MARKETS II. This finding is also consistent with the findings of other researches like Nnadi and Akwiwu (2008) who found that age significantly and negatively affected participation in rural

agriculture in Imo state, and Farayola, Adedeji, Popoola and Amao (2013) who found that age significantly and negatively affected participation of small scale commercial poultry farmers in Agricultural Insurance Scheme in Kwara state. The marginal effect of 0.3689 indicates that additional (one) year to the age of the household head will decrease the probability of participating in USAID-MARKETS II by 36.9%.

Household size was positively related to participation in USAID-MARKETS II. The positive and significant (5%) coefficient of household size implies that households with more members are more likely to participate in USAID MARKETS II than those with fewer members. This maybe as a result of more mouth to feed, thereby making the household head to utilize every opportunities provided by the government and non-governmental agencies for better rice production. The marginal effect showed that an additional (one) member to the household will increase the probability of participating in USAID-MARKETS II by 10.37%. This finding is similar to that of Nnadi and Akwiwu (2008) who also found that household size positively and significantly influenced participation in rural agriculture in Imo state.

In conformity with the *a priori* expectation, extension visits had positive and significant influence on participation in USAID-MARKETS II at the 0.01 probability level. This implies that as the variable increases, the probability of a household participating in USAID-MARKETS II increases and vice versa. The marginal effect showed that an additional (one) visit of the extension agent to the rice farming household will increase the probability of participating in USAID-MARKETS II by 94.6%. This is also consistent with results of similar research works such as Omotesho, Ogunlade, Lawal and Kehinde (2016) who found that extension contact positively and significantly influenced participation in group activities in Kwara state.

Years of membership of farm-based cooperative society had a positive and significant (1%) influence on the participation of USAID-MARKETS II. The marginal effect showed that an additional (one) year in a cooperative society, will increase the probability of participation in USAID-MARKETS II by 19.72%. This is in line with result of similar research work such as Omotesho, Ogunlade, Lawal and Kehinde (2016) who observed that membership of farmers' association are significant and positively influencing participation of farmers in group activities in Kwara state and Obi-Egbedi and Bankole (2017) who found that membership of farmers' association significantly and positively influenced participation in fertilizer subsidy in Ogun state.

Against the *a priori* expectation, coefficient of education and years of rice farming experience were negatively signed and significantly influenced participation in USAID-MARKETS II in Ebonyi State, implying that increase in these variables will decrease the probability of participating in USAID-MARKETS II and vice versa. This could be attributed to past failed government promises, as reported by rice farming households during the field work. These failed promises discouraged the long-time rice farming households from participating in government projects. The result revealed that education and years of rice farming experience respectively had a negative and significant (5%) influenced on participation in USAID-MARKETS II. The marginal effect of 0.0561 and 0.05189 for education and years of rice farming experience showed that additional unit of these variables will decrease the probability of USAID-MARKETS II participation by 5.61% and 5.19% respectively. This could also be that the more educated ones and those who have stay in rice farming for long had utilized other means to train themselves in better rice practices and did not see the need to go through the same processes in USAID-MARKETS II.

4.3 Profitability of Rice Production among Participants and Non-Participants of USAID-MARKETS II

Net Farm Income (NFI) and Return on Naira Invested (RNI) were used to determine the profitability of rice production among USAID-MARKETS II participants and non-participants in Ebonyi state and the results are presented in Table 4.3.

Table 4.3: Profitability of rice production among USAID-MARKETS II participants and non-participants

Var/ha	participants Ave qty Per Ha	Unit price ₦	Ave. cost ₦	Non-part. Ave qty Per Ha	Unit price ₦	Ave. cost ₦
Fixed inputs						
Depreciation			3,819.59			2,222.24
Land rent			23,991.12			25,049.80
Total Fixed cost			**27,810.71**			**27,272.04**
Variable inputs						
Lab(mandays)	141.66	856.39	121,316.21	140.19	724.15	101,518.58
Fert(Kg)	232.41	145.78	33,880.73	145.32	130.85	19,015.12
Seed(Kg)	92.00	192.03	17,666.76	117.11	162.55	19,036.23
Herb(li)	10.30	1,732.09	17,840.53	2.50	2,775.75	6,939.38
Interest(**₦**)	106,528.60	5%	5,326.43	46,657.40	5%	2,332.87
Total Var. cost			**196,030.66**			**148,842.18**
Total farm cost			**223,841.37**			**176,114.22**
Farm cost - interest			218,514.94			173,781.35
Output(Kg)	5,272.94	135.96	716,908.92	3,296.12	151.46	529,522.34
Revenue(TR)			716,908.92			529,522.34
NFI			**493,067.55**			**353,408.12**
TR/TC	3.28			3.05		
RNI	**3.28**			**3.05**		

Results in Table 4.3 revealed that the participants of USAID-MARKETS II used an average of 92 kg of the rice seed which is within the recommended rate of 50- 100kg rice seed per hectare while the non-participants of USAID-MARKETS II used 117.11kg of rice seed. The reason for this may be as a result of training carried out by the officials of USAID-MARKETS II on the participants. For the fertilizer usage, the recommended rate is between 200 – 250kg of NPK in the ratio of 80 -

100N, 30-50P and 30-50K because of more Nitrogen need of rice plant. The participants used an average of 232.41kg of fertilizer which is within the recommended rate while the non-participants used 145.32kg of fertilizer. For the herbicide, the recommended rate is between 12 – 13litres. The sampled participants used an average of 10.3litre of herbicide while the non-participants used 2.5litre of herbicide. The yields obtained from rice farm by participants and non-participants was 5.273 tonnes/ha and 3.496 tonnes/ha of paddy rice respectively. The participants are within the expected/potential yield of between 5 – 6tons using improved practice while the non-participants rice yield was less than the expected/potential yield. From this result, participants obtained higher yield from rice farm than the non-participants. The reason for this difference may be due to the adherence to the better practices by participants as was taught by the USAID-MARKETS.

Also, the results presented in Table 4.3 showed that the total cost incurred in rice production per hectare by participants and non-participants was ₦223, 841.37 and ₦116, 114. 22 respectively. The total cost of rice production incurred by the participants was higher than that of the non-participants. This could be attributed to the fact that most of the agronomy practices adopted by the participants (line planting, nursery making, transplanting, among others) are cost effective. The total revenue/ha realized by the participants and non-participants in the rice production was ₦716, 908.92 and ₦529, 522.34 respectively. Also, the total revenue obtained by the participants was higher than that of the non-participants. The Net Farm Income (NFI) obtained by participants and non-participants was ₦493, 067.55/ha and ₦353, 408. 12/ha respectively, which indicates that rice production is profitable in the study area. This findings are in agreement with the findings of the work of Ben-Chendo, Lawal and Osuji (2017) who worked on cost and returns of paddy rice production in Kaduna state and found the NFI to be ₦152,600. Also, Girei, Usman and Onuk (2016b) who found the net farm income of ₦469, 136.00 per hectare in rice production in Fufore

Local Government Area of Adamawa state. Similarly, Kadiri, Eze, Orebiyi and Onyeagocha (2014) found that the NFI of rice farmers was ₦300,071.84 per hectare in paddy rice production in Niger Delta region of Nigeria which indicated that rice production is profitable. The higher difference in NFI of participants over that of non-participants may be attributed to the increase in yield realized by the participants of USAID-MARKETS II because they were taught better farming techniques which had impacted on their output and revenue.

The return on investment (ROI) for participants and non-participants was ₦3.28k and ₦3.05k respectively. This implies that for every one naira (₦1.00) invested by the participants and non-participants in rice production, a profit of ₦2.28k and ₦2.05k were realized respectively, implying that rice production is profitable in the study area. It is herefore more profitable for the participants and non-participants to invest in rice production than to invest in the Nigerian banking sector through savings. This is because using the 12 % annual interest rate on savings in Nigerian banks where, every ₦1 invested in the bank will generate ₦1.12 at the end of the year, the investor will end up realizing a profit of ₦0.12 which is far below ₦2.28 and ₦2.05k profit that will be realized from rice production by participants and non-participants in the study area. This findings is in line with the work of Girei, Usman and Onuk (2016b) in their work on profitability investigation of rice production in Fufore Local Government Area of Adamawa state, Nigeria, who found return on investment of ₦1.37.

4.3.1 Test of significant difference in net farm income (NFI) of rice production among participants and non-participants of USAID-MARKETS II

The results of Z-test of significant difference in NFI among participants and non-participants rice farming households are presented in Table 4.3.1. The results showed that Z- calculated is greater

than Z-critical. This implies that there is a significant difference between the profit of participants and non-participants at 1% level. Therefore the null hypothesis which stated that there is no significant difference between the profit of participants and non-participants of USAID-MARKETS II was rejected.

Table 4.3.1: Z-test on the profitability of participants and non-participants in rice Production

Variables	**Participants NFI (₦)**	**Non-Participants NFI (₦)**
Mean	493067.9	353408.9
Known variance	6.73E+11	6.12E+9
Observation	234	242
Hypothesized Mean Difference	0	
z-stat	4.70045***	
P(Z<=z) one tail	0.00001	
z-critical one tail	1.644854	
P(Z<=z) two tail	0.00003	
z-critical two tail	1.959964	

4.4 Estimation of Technical, Allocative and Economic Efficiencies of Participants and Non-Participants of USAID-MARKETS II

The stochastic frontier model was used to estimate the technical efficiency (TE), allocative efficiency (AE) and economic efficiency (EE) of participants and non-participants in USAID-MARKETS II.

4.4.1 Maximun likelihood estimates (MLE) of stochastic frontier model on rice production of participants of USAID-MARKETS II

The maximum likelihood estimates (MLE) of the Cobb-Douglas stochastic frontier model of technical efficiency of participants are presented in Table 4.4.1.

Tabble 4.4.1: Maximun likelihood estimate of stochastic frontier model on rice production of participants and technical inefficiency

variables	**Coefficients**	**Standard error**	**T-ratio**
Constant	7.516	0.380	19.774***
Rice farm size	0.768	0.073	10.517***
Fertilizer	0.052	0.025	2.099**
Labour	0.123	0.073	1.671*
Herbicide	0.006	0.008	0.720
Rice Seed	0.047	0.039	1.222
Inefficiency variables			
Constant	-6.571	2.123	-3.095***
Age	0.020	0.023	0.841
Yrs in formal edu	-0.282	0.094	-3.012***
Household size	-0.118	0.070	-1.680*
Yrs in coop	-0.130	0.056	-2.340**
Yrs of exp.	-0.099	0.026	-3.820***
Extension visit	-0.106	0.016	-0.647
Sigma-squared (σ^2)	0.657	0.102	6.415***
Gamma (γ)	0.798	0.040	19.918***
Log likelihood	-115.628		
LR test	61.453		
No of obs	234		

Note ***, **, * is significant at 1%, 5% and 10% levels respectively.

The sigma-squared (σ^2) estimate of 0. 66 which is significantly different from zero at 1% level indicates a goodness of fit and correctness of the distribution form assumed for the composite error term. The gamma (γ) estimate of 80% was significantly different from zero at 1% level of significant. This implies that the variation in output was as a result of technical inefficiencies of the participants. This also implies that the discrepancies between observed output and the frontier output are due to technical inefficiency of the participants. Suggesting a scope for improvement. It

implies that output could be increased by 20% by increasing the level of efficiency of the participating rice farmers.

The estimate of the parameter of the stochastic production frontier analysis in Table 4.4.1 revealed that the participants estimated elasticity of output with respect to area of rice cultivated was 0.77 and this is positively and statistically significant at 1% level of probability. This implies that as the area cultivated to rice increases, rice output will increase as well and vice verse. The result also showed that holding other variables constant, a 1% increase in the area cultivated to rice by the participants will increase rice output by 0.77%. The estimated elasticity of output with respect to fertilizer is 0.05. The coefficient was positive and statistically significant at 5%, which implies that as the fertilizer used in the rice production increases by 1%, rice output will increase by 0.05%. Also, the estimated elasticity of output with respect to labour inputs was 0.12 and statistically significant at 10%. This means that a unit increase in labour (mandays) used in rice production by the participants will increase rice output by 0.12%. Using the coefficients of all the production variables, the returns-to-scale parameter wass estimated to be 0.995, implying decreasing returns to scale in the rice enterprise. This means that the participants are at the stage 2 of production function. At this stage, a given increase in variable factor leads to a less than proportionate change in the output, hence, the producer will employ the variable factor in such a manner that the utilization of fixed factor is most efficient. This is the best stage to produce. This findings is in line with the work of Taphe, Agbo and Okorji (2015) who revealed that farm size had a positive and significant influenced on farm output.

4.4.2 The maximum likelihood estimate (MLE) of technical inefficiency of participants

Socio-economic and demograhpic variables were considered and estimated in the model and the result as presented in Table 4.4.1 showed that the estimated coefficient for years in formal education was negative and statistically significant at 1% level of probability. This implies that a participant who spent more years in formal education tend to be more technically efficient in rice production than those who spend less. This is because of their ability to read, write and understand rice market and farming situation more than the less educated ones. Also, they may have undertaken self training and other empowerment program that enrich their knowledge of the act of rice farming. The result revealed that holding other variables constant, 1% increase in the years spent in formal education will decrease the technical inefficiency by 0.28%. This is in line with the work of Taphe, Agbo and Okorji (2015) who found that education increases technical efficiency.

However, household size had a negative and significantly influenced inefficiency at 10% level of probability. This implies that households with more members tend to be more technically efficient in rice production than those with few members. This could be due to the fact that large household size enhances labour availability as most of the members are usually involved in the farming business. The result also showed that holding other variables constant, 1% increases in the household size of the participants will decrease technical inefficiency by 0.12%. This is in line with the work of Taphe, Agbo and Okorji (2015) who found that household size increases technical efficiency. Also, the coefficient of years in cooperative were found to be negative and statistically significant at 5% level of probability. This implies that a participant who spent more years in cooperative tends to be more technically efficient than others. This could be due to experiences and knowledge being shared in such organization and most times training are usually conducted for those who are in a cooperative society. The result further showed that holding other variables constant, 1% increase in the year spent in a cooperative will decrease inefficiency by

0.13%. This is in line with the work of Folorunso (2015) who found that years in cooperative increases technical efficiency.

Lastly, the coefficient of years of experience in rice farming were found to be negative and statistically significant at 1% level of probability. This shows that those with more experiences tends to be more technically efficient than those with less experience. This could be due to the fact that the more experience the rice farmers are, the better the ability of the farmer to obtain and process information relating to prices and new technology. Also, the more experienced rice farmer has master the act of rice farming than the less experience ones. This is in line with the work of Yusuf and Nwachukwu (2015) and Taphe, Agbo and Okorji (2015) who found that experiences increases technical efficiency.

4.4.3 Estimated stochastic frontier cost function (allocative efficiency) of participants

The Maximum Likelihood (ML) estimates of the stochastic frontier cost parameters for participants are presented in Table 4.4.2. The high value of the sigma square (0.66) indicates the goodness of fit, correctness of the specified assumption of the composite error terms distribution. The gamma ($\gamma = 0.96$) shows that the variability in the total rice production cost of the participants rice farming household results from the existence of allocative inefficiency.

Table 4.4.2: MLE estimates of stochastic frontier cost function (allocative efficiency) of participants

variables	Coefficients	Standard error	T-ratio
Constant	0.870	0.503	1.731*
Rice land rent	0.112	0.042	2.671***
Fertilizer cost	0.075	0.040	1.880*
Labour cost	0.843	0.065	12.926***
Herbicide cost	0.005	0.004	1.379
Rice Seed cost	0.031	0.055	0.571

Inefficiency variables			
Constant	-0.415	1.416	-0.29318
Age	-0.046	0.031	-1.493
Yrs in formal edu	-0.090	0.024	-3.801***
Housesize	0.131	0.088	1.483
Yrs in coop	-0.059	0.063	-0.944
Yrs of exp.	0.042	0.034	1.247
Extension visit	-0.289	0.232	-1.245
Sigma-squared (σ^2)	0.655	0.521	1.258
Gamma (γ)	0.958	0.027	35.856***
Log likelihood	-85.697		
LR test	58.530		
No of obs	234		

Note ***,* is significant at 1% and 10% levels respectively.

The estimated parameter of cost function presented in Table 4.4.2 revealed that the coefficients of rent on land, cost of fertilizer and labour were statistically significant at 1%, 10% and 1% level of probability respectively. This indicate that these variables greatly determine the total cost of production of the participants. Thus, an increase in these inputs may lead to an increase in the total cost of production. The coefficient of rent on land is statistically significant at 1%, impling that 1% increase in the rent on land will increase the total production cost by 0.112%. The coefficient of fertilizer cost is positive and statistically significant at 10%, implying that 1% increase in the cost of the fertilizer will increase the total cost of production by 0.08%. Also, 1% increase in the cost of labour will increase the total cost of production by 0.84%. In the inefficiency cost model, years of formal education were statistically significant and positively related to cost efficiency of the farmers. This implies that the more educated participant is likely to take cost decisions that will lead to cost efficiency compared to those who have little or no education. This is in line with the work of Taphe, Agbo and Okorji (2015) who found that education had positive and significant relationship with cost efficiency.

4.4.4 Frequency distribution of technical efficiency (TE) of the participants

The frequency distribution of technical efficiency levels for participants in the study area are presented in Table 4.4.3. The result revealed that the mean technical efficiency was 0.92, which suggested that an average participant were 8% less from the maximum possible rice output level due to technical inefficiency on which they can improve by employing the best practices they were taught. Therefore, in the short-run, there is room for increasing the rice output by 8% through adopting the techniques and technologies employed by the best technical efficient participants. Thus, participants were expected to be highly productive as a result of their high technical efficiency.

The distribution of technical efficiency indices indicates that the minimum and maximum technical efficiency scores ranged from 0.55 and 0.99. This shows that there was high variation between the least technically efficient participants and the best technically efficient one with an average of 0.92. This implies that if the average participants in the sample was to achieve the TE level of its most efficient counterpart, then the average participants could realized a 7% cost saving i.e (1-92/99 x100),a similar calculation for most technically inefficient participant reveals cost saving of 44%. This is in line with work of Ogundari and Ojo (2006) who found technical effiecincy of 0.903.

4.4.5 Frequency distribution of allocative efficiency (AE) for the participants

The frequency distribution of allocative efficiency levels for participants in the study area are presented in Table 4.4.3. The result revealed that the mean allocative efficiency was 0.66, which suggested that on the average, the observed cost was 34% less than the optimum mimimum cost on which they can improve by employing the techniques and technologies employed by the best allocative efficient participant.

The allocative efficiency score ranged from 0.17 and 0.95, showing that there was high variation between the least allocative efficient participant and the best allocative efficient participant. The most allocative efficient participantsoperated closer to their cost frontier of 1.00, with an average of 0.66. This implies that if the average participant in the sample was to achieve the AE level of its most efficient counterpart, then the average participants could realize a 31% cost saving i.e (1-17/95 x100),a similar calculation for most allocative inefficient participant reveals cost saving of 82%. This finding is in line with the work of Tijjani and Bakari (2014) in their work on determinants of allocative efficiency of rein-fed rice production in Taraba state, Nigeria who found average allocative efficiency of 0.69.

4.4.6 Frequency distribution of economic efficiency (EE) for the participants

The frequency distribution of economic efficiency levels for participatng households in the study area are presented in Table 4.4.3. The result revealed that the mean economic efficiency was 0.64. This implies that on the average, there was a fall in rice output cost by 36% from the maximum feasible level due to economic inefficiency of the participating households.

The analysis further revealed that the economic efficiency score ranges between 0.17 and 0.91. This shows that there was a high variation between the least economically efficient participant and

the best economic efficient participant, with an average of 0.64. This implies that if the average participants in the sample was to achieve the EE level of its most efficient counterpart, then the average participants could realized a 30% cost saving i.e (1-17/91 x100),a similar calculation for most economic inefficient participant reveals cost saving of 81%.

Table 4.4.3: Frequency distribution of technical, allocative and economic efficiencies of participants

	T E		AE		EE	
Ranges	**frequency**	**Percent**	**frequency**	**percent**	**frequency**	**percent**
0.10 – 0.24	0	0.00	4	1.71	4	1.71
0.25 -0.49	0	0.00	33	14.10	50	21.27
0.50 – 0.74	2	0.85	83	35.47	99	42.31
0.75 -1.00	232	99.15	114	48.72	81	34.61
Total	234	100.00	234	100.00	234	100.00
Min	0.55		0.17		0.17	
Max	0.99		0.95		0.91	
Ave.	0.92		0.66		0.64	

4.4.7 Maximun likelihood estimates (MLE) of stochastic frontier model on rice production (technical efficiency) of non-participants households

The maximum likelihood estimates (MLE) of the cobb-Douglas stochastic frontier model of technical efficiency of non-participants are presented in Table 4.4.4. The sigma-squared (σ^2) estimate of 0.79 was statistically significant different from zero at the 0.01 level of probability, indicating a goodness of fit and correctness of the distribution form assumed for the composite error term. The gamma (γ) estimate of 69% was statistically significant different from zero at 1%

level of probability and it shows that the discrepancies between observed output and the frontier output are due to technical inefficiency of the non-participant rice farming households.

Table 4.4.4: Maximun likelihood estimates of stochastic frontier model on rice production of non-participants and technical inefficiency

variables	Coefficients	Standard error	T-ratio
Constant	6.918	0.973	7.065***
Rice farm size	0.818	0.146	5.614***
Fertilizer	0.122	0.133	0.919
Labour	0.140	0.076	1.860*
Herbicide	0.006	0.004	0.134
Rice Seed	-0.169	0.127	-1.329
Inefficiency variables			
Constant	-0.077	0.927	-0.083
Age	0.002	0.020	0.082
Yrs in formal edu	-0.001	0.027	-0.038
Household size	-0.103	0.022	-4.761***
Yrs in coop	0.101	0.023	4.437***
Yrs of exp.	0.004	0.014	0.319
Extension visit	-0.106	0.017	-1.015
Sigma-squared (σ^2)	0.789	0.076	10.415***
Gamma (γ)	0.686	0.045	15.19***
Log likelihood	-130.697		
LR test	4.205		
No of obs	242		

Note ***.* is significant at 1% and 10% levels respectively.

The estimates of the parameter of the stochastic production frontier in Table 4.4.4 showed that the estimated elasticities of the output with respect to rice farm land was 0.82 and statistically significant at 1% level of probability. This implies that as the area cultivated to rice increases, rice output increases and vice versa. The result showed that 1% increase in the area cultivated to rice by non-participants will increase the output of rice by 0.82%. Likewise, the estimated elasticities of the output with respect to labour inputs is 0.14 and statistically significant at 10%. This means that as the mandays utilizes in the rice production by the non-participants increases, the output of

rice increases as well and vice versa. The result showed that a 1% increase in labour (mandays) used in rice production by the non-participants will increase their rice output by 0.14%. Using the coefficients of the all the production variables, the returns-to-scale parameter is estimated to be 0.917, implying decreasing returns to scale. This means that the non-participants are also at the stage 2 of production function. This is the rational or economic production region where production is maximized. This finding is in line with the work of Waheed (2017) who revealed that farm size had a positive and significant influenced on rice output.

4.4.8 The maximum likelihood estimates (MLE) of technical inefficiency of non-participants

The estimates of technical inefficiency model as presented in Table 4.4.4 showed that the estimated coefficient for household size was negative and statistically significant at 1% level of probability. This implies that non-participant household with larger members tends to be more technically efficient in rice production than those with fewer members. This could be because large household size enhances labour availability and it implies that most of the household members are involved in the rice production. This is in line with the work of Taphe, Agbo and Okorji (2015) who found that house size increases technical efficiency. Also, coefficient of cooperative was found to be positive and statistically significant at 1% level of probability, which is against the *a priori* expectation. This could be due to the fact that the non-participants of USAID-MARETS II have not stay in a cooperative for long in order to get benefits of information/knowledge sharing from the cooperative. Recall that the average number of years spent in a cooperative by the non-participants was 0.5 year, which is not enough for the cooperative to impact on their technical efficiency.

4.4.9 MLEs of stochastic frontier cost function (allocative efficiency) of non-participants

The Maximum Likelihood (ML) estimates of the stochastic frontier cost parameters for the non-participants are presented in Table 4.4.5. The sigma square of 0.43 which is significant at 1% level of probability, indicate the goodness of fit. The gamma ($\gamma = 0.1$) shows that the variability in the total rice production cost of the non-participants rice farming household results from the existence of allocative inefficiency.

Table 4.4.5: MLE estimates of stochastic frontier cost function (allocative efficiency) of the non-participants

variables	Coefficients	Standard error	T-ratio
Constant	0.5137	0.1654	3.1070***
Rice land rent	0.0400	0.0151	2.5730***
Fertilizer cost	0.0089	0.0117	0.7010
Labour cost	0.0265	0.0020	13.050***
Herbicide cost	-0.0006	0.0006	-1.0070
Rice Seed cost	0.1306	0.0127	10.2690***
Inefficiency variables			
Constant	-0.0680	0.0358	-1.8990*
Age	0.0019	0.0011	1.6790*
Yrs in formal edu	-0.0038	0.0014	-2.7170***
Housesize	-0.0086	0.0030	-2.8540***
Yrs in coop	0.0014	0.0034	0.4110
Yrs of exp.	-0.0003	0.0012	-0.2510
Extension visit	-0.0124	0.0150	-0.8280
Sigma-squared	0.4342	0.0474	9.1640***
Gamma	0.1000	0.0247	4.0330***
Log likelihood	-311.8680		
LR test	30.5840		
No of obs	242		

Note ***, * is significant at 1% and 10% levels respectively.

The estimated parameter of cost function presented in Table 4.4.5 revealed that rent on land, cost of labour and rice seed were statistically significant at 1% level of probability respectively. This indicates that they greatly determine the total cost of rice production of the non-participants. Therefore, when the cost of these variables increases, the total cost of rice production by non-participants will increase as well. The coefficient of rent on land was statistically significant at 1% level of probability. This implies that 1% increase in the rent on land will increase the total production cost by 0.04%. The coefficient of cost of labour was positive and statistically significant at 1% level of probability. This implies that 1% increase in the cost of lobour will increase the total cost of production by 0.027%. Likewise, the coefficient of cost of seed was positive and statistically significant at 1% level of probability. This implies that 1% increase in the cost of seed will increase the total cost of production by 0.13%.

The inefficiency cost model revealed that years in formal education was statistically significant (1%) and positively related to cost efficiency of the farmers. This implies that the most educated non-participants rice farming household are likely to take cost decisions that will lead to cost efficiency. This is in line with the work of Taphe, Agbo and Okorji (2015) who found that education increases cost efficiency. Also, household size was statistically significant (at 1%) and positively related to cost efficiency of non-participants indicating that larger household sizes are likely to use more of family labour to reduce the high cost of hired labour thereby enhancing cost efficiency. Likewise, the coefficient of age was statistically significant (10%) and negatively related to cost efficiency of non-participants. This implies that the younger non-participants tend to be cost efficient than the older ones. This could be because older farmers tend to attach little importance to minimising production costs when compared with younger farmers.

4.4.10 Frequency distribution of technical efficiency (TE) for non-participants

The frequency distribution of technical efficiency levels for non-participants of USAID-MARKETS II in the study area are presented in Table 4.4.6. The result revealed that the mean technical efficiency was 0.91, which suggested that on average, the observed output was 9% less than the optimum output. This implies that an average non-participants were 0.91 technical efficient and 9% less from the maximum possible level due to technical inefficiency. Thus, the non-participants are expected to be highly productive due to their high technical efficiency level.

The technical efficiency indices indicate that the minimum and maximum technical efficiency scores ranged from 0.38 and 0.99. This shows that there was high variation between the least technically efficient and the best technically efficient non-participants. The average of 0.91 implies that if the average non-participants was to achieve the TE level of its most efficient counterpart, then 8% cost saving could be realized i.e (1-91/99 x100). A similar calculation for most technically inefficient non-participant revealed cost saving of 62%. This is in line with work of Waheed (2017) who revealed a technical efficiency of 0.89.

4.4.11 Frequency distribution of allocative efficiency (AE) for non-participants

The frequency distribution of allocative efficiency levels for non-participants are presented in Table 4.4.6. The result revealed that the mean allocative efficiency was 0.67, which suggested that on average, the observed cost was 33% less than the optimum minimum cost due to allocative inefficiency. The result further revealed that allocative efficiency score ranged from 0.29 and 1.0. This shows that there was high variation between the least allocative efficient and the best allocative efficient non-participant. The most allocative efficient non-participants households

operated in the cost frontier or minimum cost of 1.00, with an average of 0.67. This implies that if the average non-participants was to achieve the AE level of its most efficient counterpart, then, 33% cost saving could be realized (1-29/100 x100). A similar calculation for most allocative inefficient non-participants reveals cost saving of 71%. This findings is in line with the work of Tijjani and Bakari (2014) who found allocative effieciency of 0.69 in Taraba state, Nigeria.

4.4.12 Frequency distribution of economic efficiency (EE) for non-participants rice households

The frequency distribution of economic efficiency levels for non-participants households are presented in Table 4.4.6. The result revealed that the mean economic efficiency was 0.62. This implies that there was a fall in rice output cost by 38% from the maximum feasible level due to economic inefficiency of non-participants.

The result further revealed that the non-participants economic efficiency score ranges from 0.22 and 0.98 showing that there was high variation between the least economically efficient and the best economic efficient non-participant, with an average of 0.62. This implies that if the average non-participants was to achieve the EE level of its most efficient counterpart, then the average non-participants could realized a 37% cost saving (1-62/98 x100).A similar calculation for most economic inefficient non-participant reveals cost saving of 77%. This is in line with the work of Folorunso (2015) in his work on impact of Fadama III on productivity, food security and poverty status of tuber farmers in central state of Nigeria who found economic efficiency of 0.59.

Table 4.4.6: Frequency distribution of technical, allocative and economic efficiency of non-Participants

	TE		AE		EE	
Ranges	**frequency**	**percent**	**frequency**	**percent**	**frequency**	**percent**
0.10 – 0.24	0	0.00	0	0.00	2	0.83
0.25 -0.49	5	2.07	9	3.72	35	14.46
0.50 – 0.74	14	5.78	187	77.27	171	70.66
0.75 -1.00	223	92.15	46	19.01	34	14.05
Total	242	100.00	242	100.00	242	100.00
Min	0.38		0.29		0.22	
Max	0.99		1.00		0.98	
Ave.	0.91		0.67		0.62	

4.4.13 Test of significance on technical, allocative and economic efficiency of participants and non-participants in rice production

Results presented in Table 4.4.7 showed that Z- calculated is less than Z-critical and it is not statistically significant at any level in all the three efficiencies. This implies that there is no significant difference between the technical, allocative and economic efficiency of participants and non-participants. This implies that more work need to be done by the USAID-MARKETS II in the areas of efficient use of resources by the participants. Therefore the null hypothesis which stated that there is no significant difference between the technical, allocative and economic efficiency of participants and non-participants was accepted.

Table 4.4.7**:** Z-test on the technical, allocative and economic efficiency of participants and non-participants

Variables	**Technical**		**Allocative**		**Economic**	
	Participant	**Non-part**	**Participant**	**Non-part**	**participant**	**Non-part**
Mean	0.924	0.911	0.664	0.671	0.635	0.625
Known variance	0.003	0.013	0.032	0.019	0.029	0.022
Observation	234	242	234	242	234	242
Hypothesized Mean Difference	0		0		0	
z-stat	0.856		1.143		1.239	
P(Z<=z) one tail	0.196		0.127		0.190	
z-critical one tail	1.645		1.645		1.645	
P(Z<=z) two tail	0.392		0.253		0.181	
z-critical two tail	1.960		1.960		1.960	

4.5 Impact of USAID-MARKETS II on Productivity in Rice Production

Due to the problem of selection bias and particularly non-compliance or problem of endogeneity, this study used a combination of methods to assess the impact of USAID-MARKETS II on rice productivity. Local Average Treatment Effect (LATE) model and Propensity Score Matching (PSM) were employed.

For propensity score, nearest neighbor matching method was used to match. It uses the propensity score of similar individuals in the treated and control group to construct the counterfactual outcome with its major advantage of having lower variance which is achieved because more information is used. To obtain the propensity score matching estimator through the logit regression, individual socio-economic and institutional variables (as used in section 4.2 above) were used to form matched pairs of observational similar individual characteristics. The propensity score is a probability measure. Results in Table 4.5 shows that the average probability in the treatment for all households was 48.9%. The probability that a particular rice farming

household will be a participant of USAID-MARKETS II (treatment assignment) is 48.9%. Using propensity scores for USAID-MARKETS II participation generated by the logit regression model, households in the intervention were matched on the basis of the proximity of their propensity scores of participation to households in the counterfactual. All other households (84) whose propensity scores for participation were different from the range of scores for the intervention households were dropped from the analysis.

Table 4.5: Propensity score

Variables	Observation	Mean	Std. dev	Min	Max
Propensity Score	476	0.489	0.2782	0.002	1

The result of the impact of USAID-MARKETS II on productivity are presented in Table 4.5.1.

Table 4.5.1: Impact of USAID-MARKETS II on productivity in rice production

	sample	Treated	Control	Difference	Std. err	t-stat
TFP	unmatched	2.822	2.415	0.407	0.126	3.23***
	ATT	3.144	2.069	1.075	0.544	1.98*
	ATU	2.265	3.321	1.056		
	ATE			1.178		
Estimation		Parameter		Robust std err		Z-value
LATE by WALD		0.396		0.143		2.77***
Estimation by mean diff						
Participants		2.821		0.123		22.90***
Non-participants		2.415		0.033		72.54***
Observed difference		0.406		0.128		3.18***

Note: *** and * is significant at 1% and 10% levels respectively.

The result revealed that the average Total Factor Productivity (TFP) of the participants was 2.822. This means that on the average, if the present level of the productive inputs were used by the

participants in the production of rice, it will more than double (2.822) the rice output. This is an indication of increasing returns to scale which is a situation in which an increment in the inputs used in the production more than double the output. The average impact estimation shows that USAID-MARKETS II had a significant and positive impact on productivity of the beneficiaries. The Treatment Effect on the Treated (ATT) on the average had a positive impact and increases productivity of the participants by 1.075 (38.1%). This implies that USAID-MARKETS II positively impacted on the participants' productivity and without the USAID-MARKETS II, the productivity of the participants would have be 38.1% less than its present level. The Average Effect of the Treatment (ATE) for sampled rice farming households is larger with a value of 1.178 (41.7%) compared to the treated category. The Treatment Effect on the Untreated (ATU) was estimated by matching a similar treated household to each non-treated household. The result showed that ATU had a significant and positive (1.056) impact on productivity, this is the counter factual outcome of the treated had it been they were not treated. The positive impact of USAID-MARKETS II on productivity is similar to the finding of Awotide, Diagne and Omonona (2012) in their work on impact of improved agricultural technology adoption on sustainable rice productivity and rural farmers' welfare in Nigeria who found that agricultural technology adoption had positive and significant impact on productivity of the rice farmers and Ositanwosu and Xiong (2016) who found that ATA had significant and positive impact on the rice farmers productivity in Adani-Omor Zone, southeast, Nigeria.

The LATE estimate was carried out for each of the two outcomes of interest (productivity and poverty) using WALD estimator proposed by Imbens and Angrist (1994). For the productivity, the result of its (LATE) mean difference as shown in Table 4.5.1 is that there was a significant difference of 0.406 (7.75% diference) in rice productivity between the participants and non-

participants which implies that the productivity of the participants of USAID-MARKETS II were 7.75% higher when compare with the non-participants counterpart. Specifically, the LATE estimate analysis as presented in Table 4.5.1 showed that USAID-MARKETS II significantly and positively increase rice productivity by 0.396 (14% increase in productivity). This is the average change in total productivity brought about by the participation in USAID-MARKETS II. LATE model does not over-estimate or under-estimate the impact of a project because of its ability to estimate the impact of project in a situation of non-conpliance and ability to bring out the actual impact of the project irrespective of other factors that might influence the outcome of interest. Therefore, the result of the analysis as presented in Table 4.5.1 showed that USAID-MARKET II had a positive and significant impact on productivity, implying that participation in USAID-MARKETS II increased on average the productivity of participants by 0.396 (14% increament) even with the non-compliance issue encountered in the course of executing the project. This finding is in line with the work of Awotide, Diagne and Omonona (2012) and Adebayo and Olagunju (2015) who found that their respective projects had impact on rice productivity.

With the outcome of both Propensity Score Matching and the LATE model analysis which shows that USAID-MARKETS II had a significant impact on the productivity of the participants, the null hypothesis which stated that USAID-MARKET II have no impact on productivity was rejected.

Studies like Nguezet, Diagne Okoruwa, Ojehomon (2011) and Awotide, Diagne and Omonona (2012) used rice yield as a proxy to determine productivity. This was also adopted in this study to analyze the impact of USAID-MARKETS II on rice yield. The result of the impact of USAID-MARKETS II on rice yield are presented in Table 4.5.2.

Table 4.5.2: Impact of USAID-MARKETS II on rice yield

	sample	Treated	Control	Difference	Std. err	t-stat
Rice yield	unmatched	5.273	3.496	1.777	0.378	4.70***
(tons)	ATT	7.064	3.178	3.886	1.489	2.61***
	ATU	3.185	5.883	2.698		
	ATE			3.620		
Estimation		Parameter		Robust std err		Z-value
LATE by WALD		1.742		0.339		5.14***
Estimation by mean diff						
Participants		5.273		0.338		15.62***
Non-participants		3.496		0.178		19.67***
Observed difference		1.777		0.882		4.66***

Note: *** is significant at 1% level.

The result as presented in Table 4.5.2 revealed that participants of USAID-MARKETS II realize 5.273 tons/ha of paddy from rice production. The average impact estimation shows that USAID-MARKETS II had a significant and positive impact on rice yield. The Average Treatment Effect on the Treated (ATT) on the average had a positive impact and increases rice yield of the participants by 3.886 tons/ha (73.7% increment in the yield). This implies that without USAID-MARKETS II, the participants would have been 73.7% lower in the rice yield. The Average Effect of the Treatment (ATE) for a rice farming households drawn from the overall population at random shows 3.62 tons increment in rice yield. The Average Treatment Effect on the Untreated (ATU) had a significant and positive (2.698tons/ha) impact on rice yield. This is the counter factual outcome of the treated had it been they were not treated. The positive and significant impact of USAID-MARKETS II on rice yield is similar to the findings of Shabu, Gyuse and Abawua (2011) and Ositanwosu and Xiong (2016) who found that their respective project had a positive and significant impact on rice yield.

The mean difference from the LATE result showed that there was a significant difference of 1.777tons/ha (which is 20.3% difference) in rice yield between the participants and non-participants (Table 4.5.2). This implies that the participants of USAID-MARKETS II was 20.3% higher in the yield realised from rice than the non-participants. This could be as a result of better practices adopted by the USAID-MARKETS II participants which has translated in increase in rice yield. The LATE estimate showed that USAID-MARKETS II significantly and positively increase rice yield of participants by 1.742tons (33% increment in rice yield). This is the average change in total rice yield brought about by the participation in USAID-MARKETS II. This positive impact of USAID-MARKET II on rice yield of the participants as shown by the LATE model is in line with the work of Nguezet, Diagne Okoruwa, Ojehomon (2011) who found that Nerica adoption had a positive and significant impact on the yield of rice farmers.

4.6 Impact of USAID-MARKETS II on Poverty

Due to the problem of selection bias and particularly non-compliance or problem of endogeneity, this study used a combination of methods to assess the impact of USAID-MARKETS II on poverty. Local Average Treatment Effect (LATE) model and Propensity Score Matching (PSM) were also employed.

4.6.1 Poverty status of participants and non-Participants of USAID-MARKETS II in Ebonyi state

The households' poverty status among the USAID-MARKETS II participants and non-participants were analyzed using three indicators; poverty incidence (Po), poverty depth (P1) and severity of poverty (P2) computed using the FGT Index. Results of poverty analysis presented in

Table 4.6, revealed that the mean household monthly per capita income of respondents was ₦11,112.60 while the poverty line was ₦7408.40. This implies that any households with monthly per capita income below ₦7408.40 are considered poor while those above it are considered non-poor. Results showed that the poverty incidence for the USAID-MARKETS II participants and non-participants was 0.38 and 0.57 representing 38 percent and 57 percent of the participating and non-participating rice farming households in the study area respectively were poor. Also, 0.62 and 0.43 representing 62 percent and 43 percent of the participants and non-participants were non-poor. The poverty depth was 0.15 and 0.22 representing 15 percent and 22 percent respectively for participants and non-participants whose average monthly per capita income was below the poverty line. This gap represents the percentage of income required to bring poor households below the poverty line up to the poverty line. This result can be compared with Mbanasor, Nwachukwu, Agwu, Njoku and Onwamere (2013) who found a poverty incidence of 0.567 and poverty gap of 0.568 in their work on analysis of income inequality and poverty dynamics among rural farm households in Abia State, Nigeria. Also, it can be compared with the work of Omonona (2009) who found a poverty gap of 0.12 in his work on quantitative analysis of rural poverty in Nigeria and Adetayo (2014) who found a poverty incidence, poverty gap and severity of poverty of 0.781, 0.558 and 0.43% respectively in his work on analysis of farm households poverty status in Ogun states, Nigeria. The severity of poverty was 0.05 and 0.12 representing 5 percent and 12 percent respectively of the participating and non-participating households who are poorest of the poor rice farming households. They are vulnerable to poverty and require attention of the government to come out of poverty.

All these three poverty measures showed that poverty was more prevalent and severe among non-participants than participants of USAID-MARKETS II. This could be as a result of increase in

yield and income realized by the participants of USAID-MARKETS II due to employment of better practices in rice production activities.

Table 4.6: Poverty Indices of participants and non-participants of USAID-MARKETS II

Poverty categories	**Participants**	**Non-participants**
Non- poor	0.62	0.43
Poor	0.38	0.57
Poverty indices		
Poverty incidence(p_o)	0.38	0.57
Poverty depth (p_1)	0.15	0.22
Poverty severity (p_2)	0.05	0.12
Mean per capita income(MPI)	11112.60	
Poverty line 2/3 of MPI	7408.40	

4.6.2 Gender analysis of poverty status of participants and non-Participants of USAID-MARKETS II

The poverty status among the USAID-MARKETS II male participants and female participants and also among USAID-MARKETS II male non-participants and female non-participants were also analyzed using three indicators; poverty incidence (Po), poverty depth (P1) and severity of poverty (P2) computed using the FGT Index (Table 4.6.1). The poverty incidence was 0.30 and 0.57 representing 30 percent and 57 percent of the USAID-MARKETS II participants' rice farming households headed by male participants and their female counterpart respectively were poor. About 0.70 and 0.43 representing 70 percent and 43 percent of the USAID-MARKETS II male participants and female participants respectively were non-poor. The poverty depth was 0.10 and 0.25 representing 10 percent and 25 percent respectively of the USAID-MARKETS II male participants and female participants respectively whose average monthly per capita income was

below the poverty line. This result can be compared with the finding of Abur (2014) in his work on assessment of poverty status among rice farmers in Guma Local Government Area of Benue State who found a poverty incidence of 0.521 for male and 0.833 for female, he also found that the poverty gap for male and female respectively was 0.119 and 0.247 with poverty severity of 0.039 for male and 0.086 for female. The severity of poverty was 0.02 and 0.09 representing 2 percent and 9 percent respectively of the male participants and female participants of USAID-MARKETS II which represents the poorest among the poor rice farming households.

Also, the result in Table 4.6.1 showed that poverty incidence for the USAID-MARKETS II non-participating males and female non-participants was 0.54 and 0.65 representing 54 percent and 65 percent of the rice farming households headed by male non-participants and their female counterpart respectively were poor while 0.46 and 0.35 representing 46 percent and 35 percent of the USAID-MARKETS II male non-participants and female non-participants were non-poor respectively. The poverty depth was 0.20 and 0.27 representing 20 percent and 27 percent respectively for male and female non-participants whose average monthly per capita income was below the poverty line. The severity of poverty were 0.07 and 0.10 representing 7 percent and 10 percent respectively for male and female non-participants who were poorest of the poor rice farming households. These are similar to Abur's (2014) findings but not in conformity with the work of Adetayo (2014), who found that poverty incidence was higher among male headed households with a value of 0.60.

In summary, results of the analyses in Table 4.6.1 shows that female-headed households have higher poverty incidences than male-headed households for both participants and non-participants respectively. This could be due to the fact that women have reduced access to production

resources. This is a pointer to the existence of gender inequality among the rice farming households. This is more pronounced in their rice farm size where the male participants are having an average of 1.403916 hectare while their female counterpart had average rice farm size to be 0.964706 hectare. For the non-participants, the average rice farm size for their male is 1.207353 hectares while their female had 0.9125 hectare of land. From all the analysis above, it appears that participants were better-off than the non-participants which could be due to more income realized from rice production as a result of better practices employed.

Table 4.6.1**:** Gender analysis of poverty status of participants and non-participants of USAID-MARKETS II

Poverty categories	**Participants**		**Non-participants**	
	Male	**female**	**Male**	**female**
Non- poor	0.70	0.43	0.46	0.35
Poor	0.30	0.57	0.54	0.65
Poverty indices				
Poverty incidence(p_o)	0.30	0.57	0.54	0.65
Poverty depth (p_1)	0.10	0.25	0.20	0.27
Poverty severity (p_2)	0.02	0.09	0.07	0.10
Mean per capita income(MPI)	11,112.60			
Poverty line 2/3 of MPI	7,408.40			

4.6.3 Estimates of the impact of USAID-MARKETS II on poverty

Results of the estimates of the impact of USAID-MARKETS II on poverty are presented in Table 4.6.2. Household monthly per capita income was used as a proxy for poverty. Income indicates the ability of a typical rice farming household to purchase its basic needs of life. The results showed that Average Treatment Effect on the Treated (ATT) had a positive impact on participants'

poverty reduction by increasing their monthly per capita income by ₦5,336.9 (45.5% increment). This implies that without the USAID-MARKETS II, the monthly per capita income of the participants would have been 45.5% less than its present level. This could be as a result of more income realized from rice production due to better practices adopted by the participants The Average Effect of the Treatment (ATE) for sampled rice farming household had a value of ₦4,828.1 (41.2%) increase in monthly per capita income. Results further showed that ATU had a significant positive impact on poverty with a value of ₦1,064.2. This is the counter factual outcome of the treated had it been they were not treated. The positive impact of USAID-MARKETS II on poverty reduction is in line with the findings of Olaolu, Akinnagbe and Agber (2013) who revealed that Fadama project had a positive and significant impact on poverty in Kogi state, Nigeria and Adenuga, Omotesho, Ojehomon, Diagne, Ayinde and Arouna (2016) who found that adoption of improved rice varieties had a positive and significant impact on poverty of rice farming households in Nigeria.

Results of LATE estimates are presented in Table 4.6.2. The results of its mean difference indicate that there was a significant difference of ₦1,192.57 (5.4% difference) in per capita income of participants and non-participants. The LATE estimates showed that USAID-MARKETS II significantly and positively increased per capita income of participants by ₦1,193.86 (10.2% increment). This is the average change in total monthly per capita income brought about by the participation in USAID-MARKETS II. This increment implies that without USAID-MARKETS II, participant's monthly per capita income would have been 10.2% lower than the present value. The LATE results further revealed that the impact (increment in per capita income) is more (₦1,585.52 that is 13.5% increment) on the poor participating households than on their non-poor counterparts (₦1,144.94 that is 9.8% increment) showing that the USAID-MARKETS II is pro-

poor in nature. This finding is in line with the findings of Osondu, Ijioma, Udah and Emerole (2015) who found that Fadama III project had a positive and significant impact on poverty reduction of food crop farmers in Abia state.

Results of both Propensity Score Matching and the LATE model analysis revealed that USAID-MARKETS II had a significant impact on the poverty reduction of the participants. Therefore, the null hypothesis which stated that USAID-MARKET II have no impact on poverty was rejected. There is therefore indication that the objective of USAID-MARKETS II was achieved in the study area in relation to rice farm productivity and poverty reduction.

Table 4.6.2: Impact of USAID-MARKETS II on poverty

	sample	Treated	Control	Difference	Std. err	t-stat
Per capita	unmatched	11,717.90	10,525.30	1,192.60	467.20	2.55***
Income₦	ATT	13,331.70	7,994.80	5,336.90	1534.10	3.48***
	ATU	8,532.20	9,596.40	1,064.20		
	ATE			4,828.10		
Estimation		Parameter		Robust std err		Z-value
LATE by WALD		1,193.86		262.68		4.54***
Estimation by mean diff						
Participants		11,717.90		390.03		30.04***
Non-participants		10,525.33		262.34		40.12***
Observed difference		1,192.57		470.05		2.54***
Impact on poverty status						
Non-poor		1,144.94		762.87		1.50
poor		1,585.52		197.99		8.01***

Note: *** is significant at 1% level.

Studies by Nguezet, Diagne Okoruwa, Ojehomon (2011) and Adebayo and Olagunju (2015) used expenditure as a proxy to determine household poverty. This study further analyzed the impact of

USAID-MARKETS II on monthly household expenditure. The results of the impact of USAID-MARKETS II on Monthly household expenditure are presented in Table 4.6.3.

Table 4.6.3: Impact of USAID-MARKETS II on monthly household expenditure

sample		Treated	Control	Difference	Std. err	t-stat
monthly	₦	49,981.30	32,333.70	17,647.60	821.70	21.47***
unmatched		46,700.90	31,438.80	15,262.20	4555.00	3.35***
expenditure	ATT	35,142.70	36,377.00	1,234.30		
	ATU			12,256.20		
	ATE					
		Parameter		Robust std		Z-value
Estimation		18,229.40		err		11.09***
LATE by WALD				1644.47		
Estimation by mean diff						
Participants		49,981.25				59.34***
Non-participants		32,333.68		842.25		53.97***
Observed difference		17,647.57		599.11		17.07***
				1033.59		

Note: *** is significant at 1% level.

Impact of USAID-MARETS II on monthly household expenditure is presented in Table 4.6.3. Results shows that participants spent an average of ₦49, 981.30 on their living expenses which comprised of health care, education, feeding, shelter and utilities bills (fuel, electicity and transportation). The Treatment Effect on the Treated (ATT) had a positive impact on household expenditure by increasing the participants' monthly household expenditure by ₦15,262.2 (30.5% increase). This implies that without USAID-MARKETS II, participants' households expenditure would be lower than their present level. This is because USAID-MARKETS II provided an avenue through which participants increased their income which translated in increased expenditure. The Average Effect of the Treatment (ATE) for a rice farming household drawn from the overall population at random showed a value of ₦12256.2 increase in monthly household expenditure. The result showed that ATU had a significant positive impact on monthly household

expenditure, with a value of ₦1,234.3. This represent the counter factual outcome of the treated had it been they were not treated. The positive impact of USAID-MARKETS II on Monthly household expenditure is in line with the findings of Adebayo and Olagunju (2015) who revealed that agricultural innovation had a positive impact on huseholds expenditure of smallholder farmers in rural Nigeria.

The LATE estimate result are presented in Table 4.6.3. The results of its mean difference showed that there was a significant difference of ₦17,647.57 (21.4%) between the monthly household expenditure of participants and non-participants. This implies that the participants of USAID-MARKETS II increased their monthly expenditure by 21.4% above their non-participants counterpart. This may be attributed to the increased income realized through using better practices in rice production by the USAID-MARKETS II. The LATE estimates showed that USAID-MARKETS II significantly and positively increase the monthly household expenditure of participants by ₦18,229.40 (36.5% increment). This is the average change in total monthly household expenditure brought about by the participation in USAID-MARKETS II. With the outcome of this result, it can deduce that USAID-MARKETS II had impact on the participant's household expenditure. This might be due to the high income realized by the participants as a result of adopting better practices for their rice production.

4.7 Factors Influencing Poverty Status of Participants and Non-Participants of USAID-MARKETS II in Ebonyi State

Logit regression was used to analyze the factors influencing poverty status of participants and non-participants of USAID-MARKETS II in order to identify those factors/variables that significantly influence poverty status of the sampled rice farming households.

4.7.1 Factors influencing poverty status of participants of USAID-MARKETS II

The estimates of the logit Model used to examine the factors influencing poverty status of USAID-MARKETS II participants in Ebonyi State are presented in Table 4.7.

Table 4.7: Logit estimates of factors influeuncing poverty status of participants

Variables	Coefficient	Std error	Z	P>(Z)	Marginal effect
Monthly expd.	-0.000012	0.000015	-0.72	0.471	-0.000024
Age	-0.014299	0.022438	-0.64	0.524	-0.003250
Household size	0.221044	0.089346	2.49	0.013	0.050238**
Dependenc ratio	0.146116	0.102744	1.42	0.155	0.033209
Sex	-0.688213	0.346803	-1.98	0.047	-0.161252*
Yrs of education	-0.067233	0.041832	-1.61	0.108	-0.015281
Farm size	-0.845386	0.190435	-4.46	0.000	-0.192140***
Membership of coop	-0.026549	0.040262	-0.66	0.510	-0.006034
Constant	1.730570	1.195995	1.45	0.148	
No of observation		234			
LRChi^2(8)		50.40			
prob>chi^2		0.0000			
RseudoR^2		0.1616			
Loglikelihood		-130.707			

Note: ***, **,* is significant at 1%, 5% and 10% levels respectively.

The log-likelihood of -130.707, the pseudo R^2 of 0.1616 and the LR (Chi^2) of 50.40 (Significant at 1% level), implies that the overall model is well fitted in the data and the explanatory variables used in the model were collectively able to explain the poverty status of USAID-MARKETS II participants in Ebonyi State. Among the included variables, household size, sex and farm size significantly influenced poverty status of participants while monthly expenditure, age, dependency ratio, years in cooperation and years in formal education had no significant influence on poverty status.

The result presented in Table 4.7 showed that household size positively influenced poverty status of participants of USAID-MARKETS II. The positive and statistically significant (5%) coefficient of household size implies that participants household with more member are likely to be poorer than those with few members even with increased productivity and income realized as a result of USAID-MARKETS II participation. This is so because the share of the household income by each household member will be less with more members than those with few members. The marginal effect showed that as the household size of the participants increases with additional one member, poverty of the household will increase by 5%. This is in conformity with the *a priori* expectation and other research work like Etim and Patrick (2010) who revealed that households size had a positive and significant influenced on poverty of fishing households in Akwa Ibom state.

Also, Sex had a negative and significant (10%) influence on USAID-MARKETS II participants' poverty status. This implies that households being headed by a woman will likely be poorer than that of their male counterpart even with increased productivity and income realized as a result of USAID-MARKETS II participation. This confirm the report of NBS (2012) that female headed households are poorer than their male counterpart. The marginal effect from this analysis showed that a household being headed by a male decreased the probability of the household being poor by 16.1%. This is in line with the work of Apata, Apata, Igbalajobi and Awoniyi (2010) who found that female headed households are poorer than their male counterparts among small holder farmers in South-western, Nigeria.

Results further revealed that farm size had a negative and significant (1%) influence on the USAID-MARKETS II participants' poverty status, implying that as the farm size of the participants increases, there will be reduction in their poverty level and vice versa. This is so

because as the farm size increase, rice production will increase as well and possibly the income realized from rice production. The marginal effect showed that an additional (one) hectare of land cultivated by the USAID-MARKETS II participating rice farming households will decrease the probability of participants being poor by 19.2%. This finding is in agreement with the work of Omonona (2001) who found that farm size had a negative and significant influenced on poverty of rural farming households in Kogi State and Asogwa, Okwoche and Umeh (2012) who revealed that farm size had a negative and significant influenced on poverty of rural farmers in Nigeria.

4.7.2 Factors influencing poverty status of non-Participants of USAID-MARKETS II

The estimate of the logit Model used to examine the factors influencing poverty status of USAID-MARKETS II non-participants in Ebonyi State are presented in Table 4.7.1.

Table 4.7.1**:** Logit estimates on Factors influencing poverty status of non-participants

Variables	**Coefficient**	**Std error**	**Z**	**P>(Z)**	**Marginal effect**
Monthly expd.	-0.00002	0.00003	-0.82	0.413	-5.e-06
Age	0.0148	0.0244	0.61	0.544	0.0036
Household size	0.3785	0.1269	2.98	0.003	0.0914***
Dependenc ratio	0.1759	0.1515	1.16	0.246	0.0425
Sex	-0.2317	0.3640	-0.64	0.524	-0.0554
Yrs of education	0.0063	0.0435	0.15	0.884	0.0015
Farm size	-1.4428	0.2325	-6.21	0.000	-0.3482***
Membership of coop	0.0334	0.0949	0.41	0.678	0.0095
Constant	0.3335	1.2317	0.27	0.788	
No of observation		242			
LRChi^2(8)		68.88			
prob>chi^2		0.0000			
RseudoR^2		0.2091			
Loglikelihood		-130.305			

Note: *** is significant at 1% level.

The log-likelihood of -130.305, the pseudo R^2 of 0.2091 and the LR (Chi^2) of 68.88 (Significant at 1% level of proability), implies that the overall model is well fitted in the data and the explanatory variables used in the model were collectively able to explain the poverty status of USAID-MARKETS II non-participants in Ebonyi State. Among the included variables, only household size and farm size significantly influenced poverty status of non- participants while monthly expenditure, age, dependency ratio, sex, years in formal education and years in cooperation had no significant influence on their poverty status.

Results of the analysis in Table 4.7.1, shows that household size positively and significantly influenced poverty status of non- participants households. The positive and significant (1%) coefficient of household size implies that a household with more member is likely to be poorer than those with few members. The marginal effect showed that if the households size of non-participants' households increased with additional one member, poverty of the household will increase by 9.1%. This is in conformity with the *a priori* expectation and other research work like that of Nwahia *et al* (2012) who found that household size had a positive and significant influence on poverty of Obudu people.

Moreso, the results revealed that farm size had a negative and statistically significant (1%) influence on the USAID-MARKETS II non-participants' poverty status. This implies that as the farm size of the non-participants increased, poverty level decreased and vice versa. This is so because households with larger farm holdings were expected to generate more income from increased production, which would enhance their consumption level/income and subsequently reduce the incidence of poverty. The marginal effect showed that additional (one) hectare of land to the area cultivated by non-participants households will decrease the probability of being poor by

34.8%. This finding is in agreement with the work of Asogwa, Okwoche and Umeh (2012) who found that farm size had a negative and significant influence on poverty and Tsue, Obekpa and Iorlamen (2013) who revealed that farm size had a negative and significant influence on poverty of cassava farmers in Apa Local Government Area of Benue state, Nigeria.

4.8 Constraints Faced by USAID-MARKETS II Participants and Non-Participants in Rice Production

A number of constraints were enumerated by USAID-MARKETS II participants and non-participants in rice production in Ebonyi state. Results of the analysis of the constraints encountered by the sampled rice farming households in rice production are presented in Table 4.8.

Table 4.8: Constraints faced by participants and non-participants in rice production

Variables	Freq	participants Percentage	Rank	Freq	Non-part Percentage	Rank
Lack/inadequate fund for rice production	229	97.86	1st	241	99.59	1st
High cost/inadequate labour	140	59.83	4th	176	72.73	3rd
Birds, pests and disease	90	38.46	5th	205	84.71	2nd
Fulani herdsmen grazers	145	61.97	3rd	142	58.68	4th
Inadequate land for massive rice production	168	71.80	2nd	104	42.98	6th
High cost/poor access to fertilizer	70	29.92	6th	116	47.93	5th
Difficulty in obtaining credit	47	20.09	9th	93	38.43	7th
High cost /poor access to herbicide and insecticide	60	25.64	7th	17	7.03	12th
Bad roads and difficulty in marketing products	35	14.96	12th	25	10.33	9th
High cost of technologies introduced	49	20.09	8th	-	-	-
Late supply of inputs	42	17.95	10th	2	0.83	15th
Flooding/drought	38	16.24	11th	3	1.24	14th
Low/fluctuation in price of rice output	14	5.98	13th	21	8.68	11th
Lack/poor extension service to farmers	3	1.28	16th	28	11.57	8th
High cost/poor access to	12	5.13	14th	14	5.79	13th

improved seeds	4	1.71	15th	22	9.09	8th
Lack/inadequate training of farmers on the improved technology						

Multiple responses recorded

Results presented in Table 4.8 showed that inadequate fund for rice production constituted 97.86% and 99.59% respectively for participants and non-participants. And ranked first amongst the constraints faced by participants and non-participants in the study area. Inadequate fund has always been a major constraint to the farming households. Funds are needed by the farming households to utilize new technologies, clear land and purchase inputs such as seed, fertilizer and pay for labour. Also, most of the farming households lacked collateral to secure loans from commercial banks. The result further revealed that inadequate land for rice production was ranked as the second constraint by 71.80% of the participants while the non- participants ranked it as the sixth constraint. This was attributed to the land tenure system being practice in Nigeria which does not give individual right to land ownership.

Results in Table 4.8 revealed that Fulani herdsmen grazers (clash with pastoralist) was ranked as the third constraint as reported by 61.97% of the participants while the non- participants ranked it as the fourth constraint. The issue of farmers/herdsmen clash have been all over the national newspapers and major concern in recent time. For instance premium times on Feb. 27, 2018 and March 12, 2018 reported clashes between Ebonyi farmers and herdsmen. This is to show that the problem of Ebonyi farmers and herdsmen clash is a serious one that require urgent attention as these farmers hightlighted it as one of their major problems. High cost/inadequate labour was ranked as the fourth constraint by 59.83% of the participants while 72.73% of the non-participants ranked it as the third constraint. High cost of labour is a major constraint in rice production,

because most of operations in rice production such as land clearing, weeding, harvesting, threshing, winnowing, processing and transportation require labour. Most rice farming households rely on hired labour which has cost implications and most times the funds to pay for it is not readily available.

Results further revealed that birds, pests and disease were ranked as the fifth (38.46%) by the participants while 84.71% of the non- participants ranked it as the second constraint. This finding confirmed what the deputy chairman of Rice Farmers Association of Nigeria (Sanuni Mohammed) listed as some of their challenges in rice production in the Nigeria Rice Investment Forum (NIRIF, 2014). This finding is in line with the work of Mallam (2013) and Adams (2018) who listed lack of fund, pest and diseases, high cost/inadequate labour as the major challenges encountered by rice farmers in Kogi State. Also, the result as presented in Table 4.8 showed that lack/poor extension services to farmers, high cost/poor access to improved seed and lack/inadequate training of farmers on the improved technology were listed as the least constraints by the participants with 1.28%, 5.13% and 1.71% respectively while late input sypply, flooding/drought and high cost/poor access to improved seed were listed as the least constraints by the non-participants with 0.83%, 1.24% and 5.79% respectively. This is in line with Matanmi, Adesiji , Owawusi and Oladipo (2011) who found that lack/poor extension services was a least constraint in his work on perceived factors limiting rice production in Patigi Local Government Area of Kwara State, Nigeria.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The research focused on the impact of USAID-MARKETS II project on productivity and poverty status of rice farming households in Ebonyi state, Nigeria. Multi-stage sampling procedure was employed to select 239 participants and 252 non- participants, giving us a total sample size of 491. However, due to some issues beyond the researcher control such as outliers arising from dishonest answers, unrealistic answers, inconsistent responses and unanswered questions by the sampled respondents, 476 questionnaires were used for the analysis. Data were collected from primary source with the aid of structured questionnaire and field observations. Data collected were analyzed using descriptive and inferential statistics.

Results that emanated from the study showed that majority (70.94%) of participating households in USAID-MARKETS II were headed by male while only 29.06% of the participating households were headed by female. The average age was 47, average household size of 7 with average years spent in formal education as 9 and average years of rice farming experience of 21 years while for

the non-participants, the result showed that majority (70.25%) of non-participating households in USAID-MARKETS II were headed by male while only 29.75% of the non-participating households were headed by female. The average age was 46, average household size of 6 with average years spent in formal education as 8 and average years of rice farming experience of 23.38 years.

Also, the results from the study showed that age, household size, extension visit, years in cooperative society, years in formal education and years of rice farming experience significantly influenced participation in USAID-MARKETS II in Ebonyi State. However, farm size, sex and credit amount had no significant influence on USAID-MARKETS II participation. On the other hand, household size, sex, and farm size significantly influenced participants' poverty status while household size and farm size significantly influenced non-participants poverty status.

The total cost of farming per hectare of participants and non-participants of USAID-MARKETS II were found to be ₦223, 841.37 and ₦176, 114.22 respectively while the total revenue/ha for participants and non-participants were ₦716, 908.92 and ₦529, 522.34 respectively with Net Farm Income (NFI) for participants and non- participants as ₦ 493, 067.55/Ha and ₦353408.12 /Ha respectively showing that rice production is profitable in Ebonyi state. Also the return on investment for participants and non-participants were found to be ₦3.28k and ₦3.05k respectively. The test of significance of participants and non-participants profitability in rice production showed a significant difference between the two profits, the null hypothesis which stated that there is no significant difference between the two profits was rejected.

The result showed also that participants' technical efficiency scores ranged from 0.55 and 0.99 with an average of 0.92. The scores for allocative and economic efficiency ranged from 0.17 - 0.95

and 0.17 - 0.91 with an average of 0.66 and 0.64 respectively. While for the non-participants, technical efficiency scores ranged from 0.38 and 0.99 with an average of 0.91. The scores for allocative and economic efficiency ranged from 0.29 - 1 and 0.22 - 0.98 with an average of 0.67 and 0.62 respectively. The study revealed that there was no significant difference between the mean technical, allocative and economic efficiency in rice production of participants and non-participants of USAID-MARKETS II project in the study area.

The estimate of PSM revealed that the productivity of the participants of USAID-MARKETS II increase by 1.075 (38% increase in TFP) and this was significant at 1% level while the LATE estimate showed that USAID-MARKETS II significantly and positively increased rice productivity of participants by 0.396 (14%). This is the average change in total productivity brought about by the participation in USAID-MARKETS II. Also, the study revealed that participation in USAID-MARKETS II project increases the participants monthly per capita income by N5336.9 (45.5% increment) as showed by PSM while the LATE estimates showed that USAID-MARKETS II significantly and positively increased per capita income of participants by ₦1193.86 (5.4% increment). This is the average change in total monthly per capita income brought about by the participation in USAID-MARKETS II and it showed also that the increment was more on the poor participants' monthly per capita income than on their non-poor counterpart.

The major constraints impeding rice production in Ebonyi state as reported by the sampled households were inadequate fund for rice production, high cost/inadequate labour, birds, pests and disease, fulani herdsmen grazers (clash with pastoralist) and inadequate land for rice production.

5.2 Conclusion

Age, household size, extension visit, years of membership of farm-based cooperative, education and years of rice farming experience were the significant factors that influenced participation in USAID-MARKETS II in Ebonyi State. Also, houseold size, sex and farm size were the significant factors that influenced poverty status of participants and non-participants. Rice production is profitable in the study area as ₦1 invested generated ₦2.28 and ₦ 2.05 respectively as return on investment for participants and non-participants.

There was no significant difference between the mean technical, allocative and economic efficiency of participants and non-participants. USAID-MARKETS II had positive and significant impact on the productivity of participants farming households in the study area. Poverty indices, namely, incidence, depth and severity were observed to be higher in households of non-participants. Also, USAID-MARKETS II participants had higher per capita income than the non-participants.

5.3 Recommendations

Based on the findings of this research, the following recommendations were made:-

(i) Agricultural Development Programme (ADP) of Ebonyi States should as a matter of urgency provide adequate extension services to rice farmers in Ebonyi State as extension education was found to be positive and had significant influence on the participation of the programme.

(ii) USAID-MARKET II programme should be extended to Ezza North Local Government Area of Ebonyi state and replicated in other parts of the state that were not involved in the project because of its pro-poor nature and positive impact it exerted on the participants.

(iii) More funds should be channeled into USAID-MARKET programme by the intervention partners, donor agencies, world powers, government of different countries in order to sustain laudable programme of this nature that enhanced productivity, impacted significantly on farm incomes and reduced widespread poverty.

(iv) There is need for the government at the federal, state and local government levels to consider establishing grazing reserves or commercial ranches across various area in Ebonyi state to reduce the issue of farmers and herdsmen clashes so as the teeming umemployed Nigerian youth will be encourage to take up rice farming as a business.

(v) Also, government through agricultural development bank and other financial institution should make fund/credit readily available to farmers to speed up their production process and farmers should employ the services of these financial institution for adequate fund for rice production because inadequate fund for rice production posed as the major challenge.

(vi) Farm size signicantly reduced the poverty of both participants and non-participants, therefore, in formulating policy on poverty, there is the need for government at the federal, state and local government levels to look into land tenure system being practice in Nigeria with a view of coming out with a favourable land tenure system which will give individual right to land ownership.

5.4 Suggestion for Further Research/Study

From the findings and conclusion of this study, the following suggestions for further studies were made:-

(i) There is the need to conduct studies designed to estimate the contribution of the USAID-MARKETS II in job creation, welfare and food security.

(ii) There is need to conduct USAID-MARKETS II impact assessment study on the rice value chain stakeholders for rice market development.

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APPENDIX

QUESTIONNAIRE ON IMPACT ASSESSMENT OF USAID-MARKETS II PROJECT ON PRODUCTIVITY AND POVERTY STATUS OF RICE FARMING HOUSEHOLDS IN EBONYI STATE, NIGERIA. DEPT. OF AGRICULTURAL ECONOMICS, AHMADU BELLO UNIVERSITY, ZARIA.

Dear Respondent,

This questionnaire is designed to assist the researcher in assessing the impact of USAID-MARKETS II project on productivity and poverty status of rice farming households in Ebonyi state, Nigeria. You are kindly requested to provide genuine information as possible as you can.

Please note that your genuine response to the questionnaire will go a long way in helping to increase productivity and devise measures to be used in handling poverty situation in Ebonyi State.

Thanks.
Nwahia Ogechi Cordelia
Researcher

QUESTIONNAIRE FOR PARTICIPANTS OF USAID-MARKETS II

Instruction: kindly tick (√) or fills in the blank spaces as appropriate

Questionnaire No. …….. Village ……. L.G.A. …….……..

Name of respondent (optional)……. Phone No (optional) ……..

A. SOCIO-ECONOMIC AND DEMOGRAPHIC DATA

1. Sex: 1 Male ( ) 2 Female ( )

2. Age…….. (Years)

3. Marital status: 1 Single ( ) 2 Married ( ) 3 Divorced ( ) 4 Widow ( ) 5 separated ( )

4. How many of you are living together and sharing meals daily?……

5. Number of wives …….

6. Number of male children under/or 12 years old ……..…….

7. Number of male children above 12 years old ……..……..…

8. Number of female children below/or 12 years old ……..…

9. Number of female children above 12 years old ……

10. Within the household, how many are contributing to household income? ……..

11. What is the total household monthly income? …….

12. Number of years spent in formal Education by household head ……

13. What is your primary occupation? Farming ( ) Trading ( ) Civil Service ( ) others please specify…….

14.Are you engaged in any other occupation? Yes ( ) No ( ), if yes, please specify ……

15. How much do you make monthly from the non-farm occupation? ……

16. Are you a member of any cooperative/organization? Yes ( ) No ( )

17. if 16 above is yes, how long have you been a member? ……

18. What is your status in the co-operative organization or in the community? ……

19. Have you been visited by an extension agent before? Yes ( ) No ( ), if yes, how many times in this production season? ……..

B. RICE PRODUCTION

20. How many years of experiences do you have in the rice farming? …….

21. What type of rice variety are you cultivating? Improved variety ( ) Local Variety ( )

22. Where do you get your rice seed? ADP ( ) Open market ( ) fellow farmer ( ) company ( ) from previous season ( )

23. Types of rice grown: upland ( ), lowland ( ), irrigated ( )

24. What is your farm size……

25. What is the farm size devoted to rice production …….

26. How did you acquire your land? Purchase ( ) rent ( ) lease ( ) community owned ( ) inherited ( ) Gift ( ).

27. What does it cost to rent one hectare of land per farming season in your village? ……

28. Do you produce other crops beside rice production 1 Yes ( ) 2. No ( )

29. If 28 above is yes, how much do you make from those crops per season……

30. Source of credit personal savings ( ), friends/relatives ( ), bank loan ( ), local money lender ( )

31. If borrowed, what is the amount of money you borrowed? ……

32. At what interest do they lend you the money? ……

33. Did you fall sick during the rice farming season? yes ( ) No ( ) if yes, how much did you spent to treat yourself, ……..

INPUTS INFORMATION.

34. List the equipment you used in rice farming, e.g hoe, cutlass etc. the amount you purchased it and duration of use

Equipment	quantity/ amount bought	duration of use
		`

35. Fill the following accurately

operations	No of adult	No of adult	No of hired labour	Cost of hired

	men family labour/hours worked	female/child family labour and hours worked	of adult men or women/hours worked	labour
Land clearing Ridge making/ploughing Planting Weeding Spraying chemical Harvesting threshing Winnowing Others specify				

36. What does it cost to hire labourer per day in your village? …….

37. List the quantity of inputs used and their prices?

Inputs	Quantity(kg/ha)	Price (kg/ha)
Rice seed Fertilizer Manure Agrochemicals Herbicide pesticide others	Quantity (li/ha)	Price (li/ha)

OUTPUT INFORMATION.

38. How many bags of paddy rice did you obtain this concluded planting season? ……

39, How much did you sell a bag of paddy rice? ……

40. How many bags of rice goes into;- Home consumption. ( ) Gift ( ) Sale ( )

41. Do you process your paddy before sale? Yes ( ), No ( ) if yes, how much does it cost you to process a bag ……...……

42. How much did you realized from the sales of the milled rice? …….

MARKETING INFORMATION

43.Where do you market your produce? At farm gate ( ), at village/community markets ( ), urban market ( ), others, please specify----------

44. What is the distance from your farm to the place of market? …….

45. How much do you pay to take your bags of paddy from farm to the market place? ……

46. Do you sell your paddy immediately after harvest? Yes ( ) No ( )

47. if 46 above is No, what does it cost you to store the paddy until you sell it? ……

USAID-MARKETS II INFORMATION.

48. Are you aware of USAID-MARKETS II yes ( ) No ( )

49. How did you come to know about USAID-MARKETS II ……

50. What are your reasons for being part of USAID-MARKETS II?

i ……

ii ……..

iii ..……..

51. What did you think you benefited from USAID-MARKETS II that other farmers that were not in the programme did not benefit?

i, ……..

ii, ……..

iii, ……..

52. How did you participate in USAID-MARKETS II

……..

……

……..

PROBLEMS ENCOUNTERED IN RICE PRODUCTION.

53. Rank the problems encountered in rice production as listed below in order of most experienced to the least experienced

i, Inadequate land for massive rice production ( ) ii, Difficulty in marketing products ( )

iii, Difficulty in obtaining credit ( ) iv, Poor access to fertilizer ( ) v, Poor access to herbicide and insecticide ( ) vi, Poor access to improved seeds ( ) vii, High cost of technologies introduced ( ) viii, Late supply of agro-input by the service providers ( ) ix, Inadequate training of farmer on the improved rice technology ( ), x, Poor extension service to farmer ( ) xi, Inadequate fund for start-off ( ) xii, Expensive and inadequate labour ( )xiii, Disease, pests and drought ( ) xiv Low price of rice output ( )

54. If there are other problems you encountered that are not listed above, you can list and rank them as well

……

……

C. HOUSEHOLD EXPENDITURE

55. What type of house do you live in? mud house ( ) cement old house ( ) cement modern house ( )

56. Is the house your own? Yes ( ) No ( )

57. How much does it cost to rent a house per month in your village? ……..

58. How much do you save in a month? ……..

59. How much do you spend on assets per month? ……..

60. List the items you have in your house, e.g radio, television, handset, Refrigerator, vehicle etc, the amount and duration of use?

Items	Quantity/Amount purchased	Duration

61. How much do you spend on each of the following below?

Items	Money spent

	1st month 2nd month 3rd month
Clothing Foot wear Healthcare Education Fuel Electricity Transportation Rent Kerosene Firewood Gas Other expenses	

62. What amount of money do you spend on the following food items?

Food items	Money spent 1st month 2nd month 3rd month
Rice Beans Garri fufu Pap Yam Cocoyam Plaintain Abacha Vegetable	

Potatoes Bread Egg Meat Fish Fruits Oil (both palm and vegetable oil) Tea Milk Butter Sugar soup Others, please specify …….. …….. ……..	

Thanks for your genuine information.

QUESTIONNAIRE ON IMPACT ASSESSMENT OF USAID-MARKETS II PROJECT ON PRODUCTIVITY AND POVERTY STATUS OF RICE FARMING HOUSEHOLDS IN EBONYI STATE, NIGERIA. DEPT. OF AGRICULTURAL ECONOMICS, AHMADU BELLO UNIVERSITY, ZARIA.

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Thanks.
Nwahia Ogechi Cordelia
Researcher

QUESTIONNAIRE FOR NON-PARTICIPANTS OF USAID-MARKETS II

Instruction: kindly tick (√) or fills in the blank spaces as appropriate

Questionnaire No. …….. Village ……. L.G.A. …….……..

Name of respondent (optional)……. Phone No (optional) ……..

A. SOCIO-ECONOMIC AND DEMOGRAPHIC DATA

1. Sex: 1 Male ( ) 2 Female ( )

2. Age…….. (Years)

3. Marital status: 1 Single ( ) 2 Married ( ) 3 Divorced ( ) 4 Widow ( ) 5 separated ( )

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7. Number of male children above 12 years old ……

8. Number of female children below/or 12 years old ……

9. Number of female children above 12 years old ……

10. Within the household, how many are contributing to household income? ……..

11. What is the total household monthly income? …….

12. Number of years spent in formal Education by household head ……

13. What is your primary occupation? Farming ( ) Trading ( ) Civil Service ( ) others please specify……..….

14. Are you engaged in any other occupation? Yes ( ) No ( ), if yes, please specify ……

15. How much do you make monthly from the non-farm occupation? ……

16. Are you a member of any cooperative/organization? Yes ( ) No ( )

17. if 16 above is yes, how long have you been a member? ……

18. What is your status in the co-operative organization or in the community? ……

19. Have you been visited by an extension agent before? Yes ( ) No ( ), if yes, how many times in this production season? ……..

B. RICE PRODUCTION

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22. Where do you get your rice seed? ADP ( ) Open market ( ) fellow farmer ( ) company ( ) from previous season ( )

23. Types of rice grown: upland ( ), lowland ( ), irrigated ( )

24. What is your farm size……

25. What is the farm size devoted to rice production …….

26. How did you acquire your land? Purchase ( ) rent ( ) lease ( ) community owned ( ) inherited ( ) Gift ( ).

27. What does it cost to rent one hectare of land per farming season in your village? ……

28. Do you produce other crops beside rice production 1 Yes ( ) 2. No ( )

29. If 28 above is yes, how much do you make from those crops per season……

30. Source of credit personal savings ( ), friends/relatives ( ), bank loan ( ), local money lender ( )

31. If borrowed, what is the amount of money you borrowed? ……

32. At what interest do they loan you the money? ……

33. Did you fall sick during the rice farming season? yes ( ) No ( ) if yes, how much did you spent to treat yourself, …….

INPUTS INFORMATION.

34. List the equipment you used in rice farming, e.g hoe, cutlass etc. the amount you purchased it and duration of use

Equipment	quantity/ amount bought	duration of use

		`

35. Fill the following accurately

operations	No of adult men family labour/hours worked	No of adult female/child family labour and hours worked	No of hired labour of adult men or women/hours worked	Cost of hired labour
Land clearing Ridge making/ploughing Planting Weeding Spraying chemical Harvesting threshing Winnowing Others specify				

36. What does it cost to hire labourer per day in your village? …….

37. List the quantity of inputs used and their prices?

Inputs	Quantity(kg/ha)	Price (kg/ha)
Rice seed		

Fertilizer Manure Agrochemicals Herbicide pesticide others	Quantity (li/ha)	Price (li/ha)

OUTPUT INFORMATION.

38. How many bags of paddy rice did you obtain this concluded planting season? ……

39, How much did you sell a bag of paddy rice? ……

40. How many bags of rice goes into;- Home consumption. ( ) Gift ( ) Sale ( )

41. Do you process your paddy before sale? Yes ( ), No ( ) if yes, how much does it cost you to process a bag ……...……

42. How much did you realized from the sales of the milled rice? ……..

MARKETING INFORMATION

43. Where do you market your produce? At farm gate ( ), at village/community markets ( ), urban market ( ), others, please specify----------

44. What is the distance from your farm to the place of market? …….

45. How much do you pay to take your bags of paddy from farm to the market place? ……..…

46. Do you sell your paddy immediately after harvest? Yes ( ) No ( )

47. if 46 above is No, what does it cost you to store the paddy until you sell it? ……

USAID-MARKETS II INFORMATION.

48. Are you aware of USAID-MARKETS II project in Ebonyi state? Yes ( ) No ( )

49. if 48 above is yes, what are your reasons of not being part of it? i ……

ii ……..

iii ..……..

PROBLEMS ENCOUNTERED IN RICE PRODUCTION.

50. Rank the problems encountered in rice production as listed below in order of most experienced to the least experienced

i, Inadequate land for massive rice production ( ) ii, Difficulty in marketing products ( )

iii, Difficulty in obtaining credit ( ) iv, Poor access to fertilizer ( ) v, Poor access to herbicide and insecticide ( ) vi, Poor access to improved seeds ( ) vii, High cost of technologies introduced ( ) viii, Late supply of agro-input by the service providers ( ) ix, Inadequate training of farmer on the improved rice technology ( ), x, Poor extension service to farmer ( ) xi, Inadequate fund for start-off ( ) xii, Expensive and inadequate labour( )xiii, Disease, pests and drought ( ) xiv Low price of rice output ( )

51. If there are other problems you encountered that are not listed above, you can list and rank them as well

……

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C. HOUSEHOLD EXPENDITURE

52. What type of house do you live in? mud house ( ) cement old house ( ) cement modern house ( )

53. Is the house your own? Yes ( ) No ( )

54. How much does it cost to rent a house per month in your village? ……..

55. How much do you save in a month? ……..

56. How much do you spend on assets per month? ……..

57. List the items you have in your house, e.g radio, television, handset, Refrigerator, vehicle etc, the amount and duration of use?

Items	Quantity/Amount purchased	Duration

58. How much do you spend on each of the following below?

Items	Money spent 1st month 2nd month 3rd month
Clothing Foot wear Healthcare Education Fuel	

Electricity Transportation Rent Kerosene Firewood Gas Other expenses	

59. What amount of money do you spend on the following food items?

Food items	Money spent 1st month 2nd month 3rd month
Rice Beans Garri fufu Pap Yam Cocoyam Plaintain Abacha Vegetable Potatoes Bread Egg Meat Fish Fruits Oil (both palm and vegetable oil)	

Tea Milk Butter Sugar soup Others, please specify …….. …….. ……..	

Thanks for your genuine information.