COVER PAGE

KWARA STATE UNIVERSITY, MALETE, NIGERIA

SCHOOL OF POSTGRADUATE STUDIES (SPGS)

ROLES OF MICROCREDIT ON PROFIT EFFICIENCY OF VEGETABLE FARMS IN KWARA STATE, NIGERIA

BY

Ganiyat Omowumi POPOOLA

B. Agric (Agricultural Economics)

(Matric No. 18/27/MAE005)

FEBRUARY, 2021

TITLE PAGE

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M.Sc. THESIS SUBMITTED

BY

GANIYAT OMOWUMI POPOOLA

B. Agric (Agricultural Economics)

(Matric No. 18/27/MAE005)

In Partial Fulfilment of the requirement for the award of Masters of Science (M.Sc) Degree in Agriculural Economics and Farm Management.

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION SERVICES,

FACULTY OF AGRICULTURE,

KWARA STATE UNIVERSITY, MALETE

NIGERIA

FEBRUARY, 2021

DECLARATION PAGE

I hereby declare that this thesis titled (Roles of Microcredit on profit efficiency of vegetable farms in Kwara State, Nigeria) is a record of my research. It has neither been presented nor accepted in any previous application for higher degree.

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GANIYAT OMOWUMI POPOOLA **Signature /** Date

APPROVAL PAGE

This is to certify that this thesis by (Ganiyat Omowumi POPOOLA) has been read and approved as meeting the requirements of the Department of Agricultural Economics and Extension Services for the award of the degree of Masters of Science (M.Sc.) in Agricultural Economics and Farm Management.

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DEDICATION

First and foremost, I dedicate this project work to Almighty God for His guidance and protection over me. He is the only benefactor who is worthy of being relied upon. Also, I dedicate the work to my inestimable Jewel (Mum), Mrs. Atinuke Jumoke Popoola.

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ACRONYMS AND ABBREVIATION

CBN	Central Bank of Nigeria
FAO	Food and Agricultural Organization
WHO	World Health Organization
MI	Microcredit Institution
PE	Profit Efficiency
TE	Technical Efficiency
AE	Allocative Efficiency
DEA	Data Envelopment Analysis

CB Credit Beneficiaries

NCB Non-credit Beneficiaries

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Abstract

Vegetable farming is one of the sources of livelihood for millions of growers and thousands of traders and processors in Nigeria. The extent of financial services in form of credits transmission for investments in an economy is one of the foremost elements responsible for its future efficiency and growth. In actual fact, inadequate credit facility is the major restraining factor facing the vegetable farmers. Achieving farm efficiency is therefore necessary. Thus, this study assessed the roles of Microcredit on profit efficiency of vegetable farms in Kwara State, Nigeria, using stochastic profit frontier methods to measure profit efficiency. After the estimation of the profit efficiency of both microcredit beneficiary and non-beneficiary, a Welch's t-test was used to test for their statistical difference. A total of 90 Microcredit beneficiaries and 150 Microcredit non-beneficiaries were sampled for this study. Primary data was collected for this sample using structured interview schedule. The study revealed that about 63.7% of the vegetable farmers were females with an average age of 44 years. About 40% of them spent 0-5years in school with 95.8% of farmers being married. The study further revealed that there is presence of large household size with a mean size of nine (9). Agriculture constitutes a source of income to the majority of the populace in Kwara State with 74.6% of the respondents having a start-up capital of not more than ₦100, 000. More importantly, the mean of profit efficiency of Microcredit beneficiaries was 0.807 while that of Microcredit non-beneficiaries was 0.560 and there is a 10% statistical difference in profit efficiency level of microcredit beneficiary and non-beneficiary. Furthermore, Access to microcredit has a positive and preponderance influence on profit efficiency. Years of schooling, working capital and farm size were factors that influence access to microcredit and were positive and statistically significant at 1%, 1% and 10% respectively. It is recommended that agricultural credit should be made available to the vegetable farmers to enable them buy farm inputs so as to increase their farm size which will translate to more efficiency. Also, education opportunities especially informal extension education should be provided for the farmers so as to improve their knowledge and skills.

Keywords: Microcredit, Profit efficiency, stochastic profit frontier, vegetable farms

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the study

Agriculture remains an important sector of the Nigeria economy concerned with provision of raw materials for industries, employment opportunities for the populace and food for the teeming population (CBN, 2018). Agriculture is divided into 3 major sub-sectors which include: crop production, livestock and forestry. Vegetable is a sub-unit of crop production sub-sector, which serves as an essential source of proteins, vitamins, minerals, and amino acids.

Vegetables are horticultural crops which are one of the world most important foods consumed by more than half of the world's population (FAO 2013). Vegetables are important source of micronutrients for human nutrition. When taken in sufficient quantities, vegetables help to prevent cardiovascular diseases such as diabetes and cancer (FAO 2013; Uusiku *et al*. 2010). Given then nutritional importance of vegetables, the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) recommend the consumption of fruits and vegetables at least 400 grams per capita per day (excluding starchy root crops) to avoid micronutrient deficiencies, heart and cancer related diseases (FAO 2014). The vegetable sub-unit is the source of livelihood for millions of growers and thousands of traders and processors. In 2017, 7.2

million tonnes of vegetables were produced in Nigeria (FAO, 2017), thus, vegetable has been an important cash crop, as well as staple food commodity for most households in Nigeria. Vegetables are highly perishable and this could result in a significant post-harvest loss for the farmers which in turn results into low income, contribute to low level of consumption and poor standard of living for the farmers.

In Nigeria, vegetable farming is dominated by small scale farmers who are mostly women and still use traditional farming systems and crude implements, which alongside their varying socioeconomic characteristics have influence on their resource use efficiency in production (Olowa *et al.*, 2015).

Efficiency implies an economic state in which every resource is optimally allocated to serve each person in the best way while minimizing wastes and inefficiency. Efficiency analysis in agricultural production is associated with the possibility of farms producing certain level of output from a given bundle of resources or certain level of output at least cost. Analysis of production efficiency is important to ensure resource maximization and sustainable use of available resources to create utility at minimum cost. The essence of production is to produce a product or service which may be in the form of food or any other form that has the potentials to create maximum utility. We have two types of efficiency; Production efficiency and profit efficiency. Productive efficiency can be measured as technical, allocative or economic efficiency (Farell, 1957). Technical efficiency is associated with physical economies of scale and involves the measurement of the firms' success in producing maximum output from a given set of inputs, while allocative efficiency is the ability to choose the optimum input level given factor prices. Economic efficiency is the multiplicative product of technical and allocative efficiencies.

Profit efficiency refers to a firm's ability to manage its resources and produce outputs with greater economic value.

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One of the factors of farm efficiency is availability of farm credit. According to Ajibola et *al.,* 2015, vegetable farmers face difficulty in accessing credits and loans thereby reducing their level of farm efficiency. Access to credit for smallholder farmers is constrained by a number of factors, the most relevant being the lack of collateral (FAO, 2015).

In order to make Nigerian populace, including farmers, have access to credit facilities, the Central Bank of Nigeria (CBN) set up the microcredit scheme as an instrument to access financial services when succour was not coming from the conventional financial institutions in the country (Adewumi *et al.,* 2013). Microcredit is a common form of microfinance that involves an extremely small loan given to an individual to help them become self-employed or grow a small business i.e provision of microloans to poor entrepreneurs, small businesses and farmers lacking access to credit. Microcredit facilities include micro-finance loans, inputs, micro-savings, micro-insurance, and money transfers been attributed with enabling micro-entrepreneurs to build businesses and increase their income, as well as improving the general economic wellbeing of the poor (Ouma and Ogaga, (2015). According to Olawuyi et al. (2010), microfinance/microcredit institutions (MIs) believe in people and not collaterals solely, it recognizes the credibility of the people and trusts them.

One of the benefits of microcredit is that it is very accessible. Banks today simply won't attend to those with little or no assets, and generally don't engage in small size loans typically associated with microfinancing. Microcredit institutions aim to bridge that gap, bringing financial services to people who otherwise wouldn't have them especially farmers.

1.2 Statement of Research Problem

The extent of financial services in form of credits transmission for investments in an economy is one of the foremost elements responsible for its future efficiency and growth. Inadequate credit facility is the major restraining factor facing the vegetable farmers. Access to credit facility is controlled by a number of factors, the most relevant being the lack of collateral (FAO, 2015).

Low incomes and savings capacity of people in most developing countries (especially Nigeria) prevent farmers from investing in new technology. Therefore external capital is required to facilitate agricultural production which is dominated by small scale farmers.

Another reason why commercial banks are reluctant to lend to farmers aside lack of collateral as security for loan is the high uncertainty of their incomes which is highly dependent on weather and providence. Since the Nigeria government is investing in agriculture, it has established microcredit institutions to help farmers in accessing credit with no collateral and no asset. Microcredit is very accessible because banks today simply will not attend to those with little or no assets, and generally don't engage in small size loans. Microcredit institutions aim to bridge

that gap, bringing financial services to people who otherwise would not have them especially farmers. Thus, the role of Microcredit to diversification of agriculture cannot be overemphasized. Also, the inability to procure inputs by vegetable farmers arise due to capital-constraint and this may lead to lower profit than those vegetable farmers that have access to microcredit.

Unfortunately, previous studies in Nigeria stressed the impact of microcredit on output, household food security and women empowerment but paid little attention to the farm efficiency aspect. This study analyzed the roles of Microcredit on efficiency of vegetable farmers' in Kwara State. Also, it seeks to provide answers to the following research questions:

i. What are the socioeconomic characteristics of the vegetable farmers in the study area?
ii. What is the role of microcredit on efficiency of vegetable farms?
iii. What is the comparison between profit efficiency of microcredit beneficiary and non-beneficiary?
iv. What are the factors that influence access to microcredit by vegetable farmers?

1.3 Objectives of the study

The broad objective of this study was to estimate the influence of microcredit on profit efficiency of vegetable farms in Kwara State, Nigeria.

The specific objectives were to:

i. describe the socioeconomic characteristics of the vegetable farmers in the study area;
ii. estimate the roles of microcredit on profit efficiency of vegetable farms;
iii. compare profit efficiency of microcredit beneficiary and non-beneficiary

iv. identify factors that influence access to microcredit by vegetable farmers;

1.4 Hypothesis of the study

H0: Microcredit access does not have significant effect on profit efficiency of vegetable farms.

1.5 Significance of the study

The study focused on the roles of microcredits on efficiency of vegetable production and identified factors associated with access to microcredits among vegetable farmers in Microcredit Institutions. It helped to indicate an entry point for further policy interventions towards enhancing farm efficiency of vegetable farmers through access to Microcredits. Therefore, this study generated adequate understanding of the issues that led towards taking appropriate actions for sustainable welfare of vegetable producers. Hence, the outcome of this study does have important implications for the professionals and for the policy formulation purposes. Finally, it served as source for future empirical literature for scholars and students interested in the area of efficiency and in the field of agricultural economics and related fields.

1.6 Plan of the thesis

Chapter two centers on the review of the literature relevant to this study. Chapter three discusses methodology adopted for collecting and analyzing data. Chapter four focuses on the results and discussion of the findings. Finally, chapter five presents the summary, conclusion, and recommendation based on the findings of the study.

CHAPTER TWO

2.0 REVIEW OF LITERATURE

This chapter is organized into three sections. The first section, discusses the conceptual issues, including the concepts of microfinance and farm efficiency. The second section looks at the theories of microcredit and farm efficiency. Review of relevant empirical literature on the impact of microfinance banks on farm efficiency of vegetable farmers as well as the observed empirical research gaps are presented in the third section.

2.1 CONCEPTUAL FRAMEWORK

2.1.1 Microcredit

Financial services such as microcredit saving and repayment services are the main tools of microfinance institutions which have the power to help developing countries in their battle against poverty and advance families' wellbeing. The formal birth of microcredit was in 1970 when the professor Mohamed Yunus who is the Bangladeshi banker introduced credit services in the Carmen Bank. Nowadays, microcredit becomes a buzzword among the formal and informal

moneylenders which includes pawn shops, friends and relatives, informal groups, non-government organization credit, and the provided credit of conventional banks such as agricultural, livestock credit and others. The main reason behind the popularity of microcredit in the moneylenders' market is owed to its goal of serving poor people and alleviating their poverty, while other types of moneylender are motivated by profit. Moreover, the given loan is required social collateral rather than physical collateral which opens a wide window for poor to participate in the economic market and exploit the exits opportunities.

The concept of microcredit is referred to the small amount of credit given to poor people, small scale farmers especially women at reasonable interest for generates income through self-employment. The importance of microcredit can be interpreted from different angles. It can be seen from empowerment angle as a human right because it empowers the most vulnerable people especially women through enabling them to get job and generate income. Haile, Bock, and Folmer (2012) indicated that microcredit empowers women in Ethiopia through allowing them to improve their ability in decision making and gain money as well as enhance their household expenditures. Microcredit is also read from the angle of the sustainable livelihood approach because it reduces the poverty and enhances the wellbeing of poor. Garikipati (2008) emphasized that microcredit allows poor to advance the quality of their life through enabling poor to generate income and acquire assets in India. Nader (2008) confirmed that microcredit played a significant role in the families' wellbeing in Cairo. It helps them to gain assets and generate income, improve children's education as well as advance their health condition and harmony. Mokhtar (2011) underlined to the significant role of microcredit in enhancing clients' income, assets and the quality of their life in Malaysia.

Microcredit can also interpret as a tool of economic development because it promotes start-up new business, reducing poverty and creating jobs. Mamun et al. (2012) assured to the important of microcredit on businesses' development and job creation in the Malaysian microfinance's clients.

A microcredit institution (MI) is an organization that provides financial services to the poor. This very broad definition includes a wide range of providers that vary in their legal structure, mission, and methodology. However, all share the common characteristic of providing financial services to clients who are poorer and more vulnerable than traditional bank clients through Consultative Group to Assist the Poor (CGAP).

Microcredit/finance refers to a variety of financial services that target low-income clients, particularly women. Since the clients of microcredit institutions (MIs) have lower incomes and often have limited access to other financial services, microfinance products tend to be for smaller monetary amounts than traditional financial services. These services include loans, savings, insurance, and remittances……." (MIX, 2010).

Microcredit is a common form of microfinance that involves an extremely small loan given to an individual to help them become self-employed or grow a small business. Microfinance is the supply of loans, savings and other financial services to the poor. The term "micro" is in reference to the small amounts typically involved in the practice. These services are small – "micro" – because a person who does not have a lot of money most likely will not need a loan of several thousand dollars....." (MIX, 2010).

Microfinance is the provision of a broad range of financial services such as deposits, loans, payment services, money transfers and insurance to poor and low-income households and their microenterprises" (ADB, 2011). The entities who operate in the microfinance space are

commercial banks (mostly nationalized), agricultural and credit cooperatives, local area banks, charitable institutions including societies and trusts and non-banking financial companies.

2.1.1.2 Roles of microcredit

Microcredit is important because it provide resources and access to capital to the financially undeserved, such as those who are unable to get checking accounts, lines of credit, or loans from commercial banks. Without microcredits, these groups may have to resort to using loans or payday advances with extremely high-interest rates or even borrow money from family and friends. Microcredit helps them invest in their businesses and as a result invest in themselves. Microcredits help farmers in accessing credit with no collateral and no asset.

It is very accessible because banks today simply will not attend to those with little or no assets, and generally don't engage in small size loans. Microcredit institutions aim to bridge that gap, bringing financial services to people who otherwise would not have them especially farmers (which help to facilitate agricultural production dominated by small scale farmers).

2.1.2 Farm Efficiency

Farrell (1957) defined efficiency as the ability of farm's production to attain optimum level of output from a given bundle of input. Many scholars used productivity and efficiency interchangeably and consider both as the measure of performance of a given firm.

However, these two interrelated terms are not precisely the same things (Coelli, 1995). In simple term, production frontier defines the current state of technology in an industry, firms in that industry would presently be operating either on that frontier, if they are perfectly efficient or beneath the frontier if they are not fully efficient. On the other hand, productivity improvements can be achieved in two ways. One can either improve the state of the technology by inventing

new ploughs, pesticides, rotation plans, and the like. This is commonly referred to as technological change and can be represented by an upward shift in the production frontier. Alternatively, one can implement procedures, such as improved farmer education, to ensure farmers use of the existing technology more efficiently. This would be represented by the firms operating more closely to the existing frontier. It is thus evident that productivity growth may be achieved through either technological progress or efficiency improvement, and that the policies required to address these two issues are likely to be quite different. Production technology is commonly modeled by means of production function, which in the scalar output case specifies the maximum output obtainable from an input vector. The degree to which the actual output of a production unit approaches its maximum is the technical efficiency of production.

Productivity is the quantity of a given output of a firm per unit of input. Technical efficiency (that part of efficiency which explains the physical performance of a firm) measures the relative ability of a firm to get the maximum possible output at given input or set of inputs. Technically efficient firms are those firms that are operating on the production frontier that represents the maximum output attainable from each input level (Coelli, 1995). The concept of efficiency is considered with the relative performance of processes used in transforming given inputs into output. Farrell (1957) identified at least two types of productive efficiency and profit efficiency. These are technical and allocative efficiencies.

2.1.2.1 Technical Efficiency

Technical Efficiency (TE) is the achievement of maximum potential output from a given quantity of input under a given technology. Thus, it is the attainment of production goals without wastage as stated by (Jandrow *et al*., 1982; and Amaza & Olayemi, 1999). Technical efficiency is defined as the ability to achieve a higher level of output given similar level of production inputs.

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2.1.2.2 Allocative Efficiency

It measures the distance between the farm and the point of maximum profitability, given market prices of inputs and outputs. In other words, the allocation efficiency shows whether the use of different proportions of production factors guarantees the attainment of maximum production with a particular market price (Forsund et al, 1980). Allocative efficiency deals with the extent to which farmers make efficiency decisions by using inputs up to the level at which their marginal contribution to production value is equal to the factor cost.

2.1.2.3 Profit efficiency,

Profit efficiency is defined as the ability of a farm to achieve highest possible profit given the prices variable inputs and levels of fixed factors of that farm. Profit inefficiency in this context is defined as the loss of profit for not operating on the frontier Ali and John (1989). Battese and Coelli (1995) extended the stochastic production frontier model by suggesting that the inefficiency effects can be expressed as a linear function of explanatory variables, reflecting farm-specific characteristics.

2.1.3 Vegetable and related concepts

Vegetables are herbaceous plants and plant parts which sometimes can be consumed raw or with minimal cooking (Raman, 2011). Vegetables can be bulb; fruity; inflorescent; leafy; root and stalk. Vegetables can be grown in a wide range of climates with extreme heat, cold, excessive rainfall or drought (Babalola et al., 2007; Gambo, 2008). Vegetables form an important part of

our daily food. They help in protecting body against diseases. Almost all vegetables are low in fat and calories and many of them are good sources of fiber. The high level of fiber in vegetable keeps the digestive system healthy and prevents constipation. Vegetable production also serves as sources of livelihood for small-scale farmers, create employment opportunities for the populace, generate income and reduce poverty (AVRDC, 2006; Oladoja et al., 2006). Kwara State is one of the States in Nigeria where vegetable production is highly practiced. Production of vegetable is largely carried out during dry season under irrigation condition, although it is also grown under rain fed agriculture. About 10,000 hectares of land is devoted to vegetable cultivation in the State. The vegetable crops commonly grown in Kwara State include onion, tomato, pepper, okra, egg-plant, Amaranthus, sorrel, lettuce, cabbage and carrot. Most of these are grown as mixed crops especially onion, tomato and pepper, Amaranthus and sorrel, cabbage and lettuce and so on. An average yield of about 15.25 tonnes per hectare, 6.09 tonnes per hectare and 9.65 tonnes per hectare of onion, tomato and pepper, respectively, were reported to be produced in the State (BOSADP, 1993; NFRA, 2008; NAERLS, 2009; Lawan et al., 2010). Production of vegetables in the State is still at small-scale level, in spite of its economic growth potentials. Studies involving farmers' efficiency and productivity measure could be a sound basis for harnessing the growth potentials in vegetables farming. Vegetables are an important source of micronutrients for human nutrition. When taken in sufficient quantities, vegetables help to prevent cardiovascular diseases such as diabetes and cancer (FAO2013;Uusiku et al. 2010; Yang and Keding2009).Given the nutritional importance of vegetables, the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) recommend the consumption of fruits and vegetables at least 400 grams per capita per day (excluding starchy root crops) to avoid micronutrient deficiencies, heart and cancer related diseases (FAO 2014). Generally, cropping

enterprise interest in the humid tropics of Cameroon has mainly focused on the potential of technologically intensive root and tuber crops, other staple food crops, timber, non-timber forest products, coffee and cocoa (Nchare 2007; Binam et al.2008). Traditional and exotic vegetables have received little research and development attention in SSA in terms of their contributions to reducing malnutrition and poverty, and by extension for improving national economic growth (Drechsel and Keraita 2014; FAO 2014; Shackleton et al.2009).Some efforts though are being recorded owing to synergy between local government institutions, and regional and international agricultural research centers such as the World Vegetable Center and the Consultative Group on International Agricultural Research centers(for instance the Humid tropics program and the Traditional African Vegetables project). Smallholder vegetable farming in the humid tropics of Cameroon is one of the major drivers for change towards sustainable agricultural production with optimal efficiency. Inefficiency in farming at the small holder level has been identified as one of the major constraints hampering the effective development of the agricultural sector (Dewbre and Borot de Battisti 2008).

2.2.0 Theoretical Framework

2.2.1 Theory of production and productive efficiency

A production function defines the technological relationship between the level of inputs and the resulting level of outputs. If estimated econometrically from data on observed outputs and input usage, it indicates the average level of outputs that can be produced from a given level of inputs (Schmidt, 1986). A number of studies have estimated the relative contributions of the factors of production through estimating production functions at either the individual farmers' level or total firms' level. These include Cobb-Douglas production functions (Hannesson, 1983), CES production functions (Campbell and Lindner, 1990) and Translog production functions (Squires, 1987; Pascoe and Robinson, 1998).

As highlighted by Ajibefun and Daramola (2003) the economic theory of production provides the analytical framework for most empirical research on productivity and efficiency. Productive efficiency means the attainment of a production goal without waste. Beginning with this basic idea of "no waste", economists have built up a variety of theories of efficiency. The fundamental issue underlying all efficiency measures, however, is that of the quantity of goods and services per unit of input. In standard microeconomic theory, the production technology is represented by

the transformation of (production) function that defines the maximum attainable output from different combinations of inputs. Hence, the transformation function describes a boundary or a frontier. An implicit assumption of production functions is that all firms are producing in a technically efficient manner, and the representative (average) firm therefore defines the frontier. Variations from the frontier are thus assumed to be random, and are likely to be associated with mis-or un-measured production factors. In contrast, estimation of the production frontier assumes that "best practice" firms define the boundary of the production function. It therefore indicates the maximum potential output for a given set of inputs along a ray from the origin point. Some white noise is accommodated, since the estimation procedures are stochastic, but an additional one-sided error represents any other reason firms would be away from (within) the boundary. Observations within the frontier are deemed "inefficient", so from an estimated production frontier it is possible to measure the relative efficiency of certain groups or a set of practices from the relationship between observed production and some ideal or potential production (Greene, 1993).

The main issue in the neoclassical theory of production is efficiency in the allocation of resources. A producer is considered to be efficient in resource allocation if the optimality conditions are satisfied. Similarly, a producer is technically efficient if maximum possible output is obtained from a given quantity of input. Efficiency of a firm is therefore concerned with its relative performance of the processes used in transforming inputs into outputs (Mijindadi, 1981). But, Olukosi and Erhabor (1988) also defined efficiency as the quantity of output per unit of input used in the production process, in other words, it is the average physical productivity. Farrel (1957) defined the efficiency of particular firm in terms of two separate concepts: technical and allocative efficiency. Technical efficiency (TE) measures how efficiently the firm

uses the available inputs to produce a given output. In other words, technical efficiency determines whether the firm achieves maximum output using a given bundle of factors of production. Technical efficiency is concerned with how closely the production unit operates to the frontier of the production possibility set allocative efficiency (AE) determines whether the factors of production are used in proportions that ensure maximum output at minimum cost. That is, it measures how far the firm is from the point of maximum profitability given existing market prices.

The profit efficiency of an individual farmer in the context of stochastic frontier profit function is derived as a ratio of the predicted, observed or actual profit to the corresponding predicted maximum profit for the best farm or frontier profit given the price of variable inputs and the level of fixed factor(s) of production of that farmer. Mathematically, it is expressed by Sunday et al., (2013) as:

$$Profit\ Efficiency\ (EE) = \frac{Actual\ farm\ profit}{Frontier\ profit} = \frac{\pi_i}{\pi_i^*} = \frac{(q_i, z)\exp(v_i - u_i)}{(q_i, z)\exp(v_i)}$$

$$Profit\ Efficiency = \frac{\exp(v_i - u_i)}{\exp(v_i)} = \exp(-u_i)$$

The stochastic disturbance term (e_i) consists of two independent elements: *"v" and "u".* The symmetric two sided error term (v) account for random variation in profit attributed to factors outside the farmer's control (random effects, measurement errors, omitted explanatory variables and statistical noise). The one-sided component (u_i) is a non-negative error term accounting for the inefficiency of the farm. Thus represents the profit shortfall from its maximum possible value that will be given by the stochastic profit frontier. However, when $u = 0$, it implies farm profit lies on the efficiency frontier (i.e. 100% profit efficiency) and $u < 0$ implies that the farm profit

lies below the efficiency frontier. Both *v* and *u* are assumed to be independently and normally distributed with zero mean and constant variance.

2.2.2 Efficiency frontier models

There are basically two main types of efficiency frontier models. These are the parametric and non-parametric models.

2.2.2.1 Non-parametric frontiers

Non-parametric frontiers were originally proposed by Farrel (1957). Their estimation was based on linear programming techniques where a convex disposal was constructed based on observed input-output combinations. Farrell approach has been extended by Charnes, Cooper, and Rhodes (1978) as well as Fare and Grosskopf (1995) to include multiple input multiple input technologies and non-constant returns to scale. Data Envelopment Analysis (DEA), is an example of a non-parametric, linear programming-based frontier analysis that was originally developed to analyze the performance of organizations whose goal are not limited to profit maximization. Though, it estimates efficiency relative to the Pareto-efficient frontier which estimates best performance, its main limitation is that the estimated production frontiers have no statistical properties to be evaluated upon. Further, as in the case of deterministic statistical properties non-parametric frontiers attributes all deviations from the frontier to inefficiency as

they lump random effects and measurement errors with technical inefficiency and do not account for random inefficiencies. Hence, they are particularly sensitive to outliers.

The main characteristic of non-parametric frontiers is that they do not assume any parametric form. Their procedures lay piecewise surface on top of the observations instead of attempting to fit a regression surface the center of the data.

2.2.2.2 Parametric frontiers

The main characteristics of parametric frontiers are that a specific functional form is hypothesized as a mathematical representation of the production frontier. Such frontiers can be constructed with both programming and statistical procedures. Parametric Production frontier models are of two major types, the deterministic frontiers and stochastic frontiers models. For convenience of exposition, these two models will be discussed such that the dependent variable is the original output of the production process, denoted by Y, which is assumed to be expressed in terms of the product of a known function of a vector, x, of the inputs of production and a function of unobservable random variables and stochastic errors.

2.2.3 Theory of microcredit

Jonathan Swift inspired loan funds of the 18th and 19th centuries (Hollis and Sweetman, 1997). In the mid-19th century, Lysander Spooner wrote about the importance of microcredit for enterprises as a way to reduce poverty (Spooner, 1846). According to Spooner, Friedrich Wilhelm Raiffeisen founded the first microcredit cooperative that support farmers in Germany (Raiffeisenverband, 2011). While using the Camilla Model, Akhtar Hameed Khan distributed

microcredit in East Pakistan in the 1950s through community initiatives (Bateman, 2010). Organizations in Bangladesh, most especially the Grameen Bank initiated the origins of microcredit. Thus, founded in 1983 by Muhammad Yunus, the Grameen Bank is generally considered the first microcredit organiztion (Bateman, 2010). Latin America experienced the effect of microcredit when it was introduced in Bolivia in 1986 with the establishment of Promocion y Desarollo de la Microempresa (PRODEM) later known as BancoSol (Armendariz, 2005). Microcredit helped to reduce poverty and ushered in economic development through many organizations in developing countries (Bateman, 2010). It is widely used in developing countries and popular for its potential as a poverty alleviation tool (Coons and Paprocki, 2008).

Microcredit is the expansion of small loans to poor borrowers, who do not have the collateral, fixed income stream and proven credit culture. Microcredit is part of microfinance which renders various services especially to the less privileged. The loan officers found it very difficult to grant microloans to villagers and community member because of default in payment (Bateman, 2010). Bank workers decided that it was necessary to build trust before introducing their loan scheme. The microcredit loan itself is structured typically from a few dollars to less than two hundred dollars. The high interest charged by microcredit loans could not be settled by Government social policy; this situation led to the shutdown of markets (Crabb, 2008; Elahi and Danopoulos, 2004; Tsai, 2004).

Some challenges such as access to microcredit was caused by lack of collateral by poor household businesses. No benchmark was in place to guide how financial organizations could profit from bearing the costs risks of giving out loans to the poor in the community. Microcredit loans offered to groups instead of individuals brought investment capital to the entrepreneur instead of the entrepreneur applying for loan. This practice removes bottlenecks such as specific

social and structure hurdles that renders orthodox forms of financial backing ineffective Navajas et al., (2000).

Lending to groups influence the behavior of the less privileged shifting economic motivation through the provision of microcredit and social development resources intended to control behaviors. Dignity and self-esteem is restored to the less privileged entrepreneurs when lending to groups. This is essential for the fact that the poor entrepreneurs can have control over the future of their lives and household (Crabb, 2008).

2.4 Empirical Framework

There are several studies on microcredit and farm efficiency of farmers in several parts of the world. For the purpose of this study, only the relevant and recent studies were reviewed in the following paragraphs.

2.4.1 Evidence from Nigeria

Ogidi e*t al.,* 2019 conducted a study on the effect of Microcredit access, utilization and repayment on catfish production enterprises in Benue State. Multistage sampling technique was used in selecting respondents for the study. Thus, a total sample size of 300 catfish production enterprises was selected for this study. The study used descriptive statistics to examine and analyze the objectives. The findings revealed that, of the total sum of ₦ 39,189,185 microcredit accessed by catfish production enterprises; a huge sum of ₦ 28,582,422 was utilized in catfish production business. However, the utilization index for accessed microcredit was 0.73; this translates into 73% of utilized microcredit in the study area.

Oladimeji *et al.,* 2017 examined the impact of microcredit utilization on profitability and productivity efficiency of maize farmers in Kaduna state, Nigeria. Data were collected with the

use of well-structured questionnaire, from 336 small-scale maize farmers in Kaduna state of Nigeria, categorized into beneficiary and non-beneficiary of microcredit through multi-stage sampling procedure. Descriptive statistics, profit and the Stochastic Frontier Production Function (SPFF) models were used to analyze the data. The findings revealed that three variables seed, pesticide and fertilizer were statistically significant at 1% for microcredit beneficiaries and variables seed and labour were statistically significant for non-beneficiaries. The result gives a mean technical efficiency of 0.93 and 0.89 for the beneficiaries and non-beneficiaries. The results revealed that profits per hectare of beneficiary farmers is higher (N103,990) than that of non-beneficiary farmers (N74,887), suggesting that, access to credit could lead to improved farmers' productivity and higher income in form of revenue and profit.

Daniyan-Bagudu, Khan and Roslan (2016) examined the impact of microcredit factors on women empowerment in Nigeria. Using property ownership (specifically land) by women to proxy empowerment, 357 women borrowers of microfinance banks were sampled in Niger state. Employing OLS and logistic regression to analyze the data obtained, the study concluded that access to microfinance has a positive impact on women's property ownership while age and family size also have a significant influence.

Kingsley *et al.,* 2014 examined contributions of microcredit institutions to economic efficiency of cassava farmers in Abia state, Nigeria, using a multistage random sampling technique in collecting cross sectional data on a sample size of 240 cassava farmers with the aid of structured questionnaire. The result showed that economic efficiency of MFI beneficiaries was influenced by wage rate, price of fertilizer and adjusted Y (output), while wage rate, price of fertilizer and price of cassava cuttings are variables that influenced economic efficiency of non-beneficiaries

and was also confirmed that MFI beneficiaries had higher economic efficiency advantage compared with non-beneficiaries.

Furthermore, Ambali (2013) examined the effect of microcredit on technical efficiency of rural farm households in Egba division of Ogun State. Multistage sampling procedure was used to collect data from 160 rural farm households. Descriptive statistics, probit regression model and stochastic frontier production models were used to analyze the data. The findings revealed that age, farming experience, education, household size and credit increase the technical efficiency of the farmers.

2.4.2 Evidence from Other Countries

Arbelo et al; (2020) examined the Profit Efficiency as a Measure of Performance and Frontier Models: A Resource-Based View. This study argues that it is more appropriate to measure firm performance using profit efficiency than traditional financial or accounting measures and that frontier models have great potential in empirical research on the RBV. To test this idea empirically, we used a stochastic frontier model with random coefficients to evaluate the impact of corporate reputation on profit efficiency.

Tasila et al; (2019) studied Profitability and profit efficiency of certified groundnut seed and conventional groundnut production in Northern Ghana: A comparative analysis using cross-sectional data. The two-step stochastic metafrontier profit model was used to estimate profit efficiencies and their determining factors for CGS and CG producers. The study found that CGS production is more profitable and profit efficient than CG production.

Abbas *et al.,* 2019 examined the impact of agricultural credit and farm size on the technical efficiency of rice productivity in Sindh, Pakistan, using a cross-sectional random sampling

technique to collect data from 180 rice growers through a face to face interview, stochastic production frontier technique was employed to analyze the survey data. The study revealed that credit, farm size, fertilizer, and labor significantly influenced the rice productivity in Sindh, Pakistan.

Ogunleye (2018) conducted a study on the effect of access to microcredit on the productivity and profitability of cassava production. A multi-stage sampling procedure was used to obtain the data from 100 respondents. Primary data collected were analyzed using descriptive statistics, budgetary analysis and stochastic production frontier. Result showed that cassava farming in the study area was dominated by male farmers with about 81.3% and82.7% for microcredit users, and non-microcredit users, respectively. It also revealed that few farmers (48%) had access to credit. The farm budgetary analysis revealed that the net profit per hectare were ₦68,719 for microcredit users and ₦68,298 for non-microcredit users. The distribution of the technical efficiency according to accessibility to credit showed that the microcredit users were little more technically efficient (TE=0.9638) than the non-microcredit users (TE=0.9556). The result showed that labour, farm size, and fertilizer significantly influenced technical efficiency among users while farm size, fertilizer, gender and extension visits significantly influenced technical efficiency among non-microcredit users. The study concluded that cassava production was more profitable and efficient among cassava famers who had access to microcredit in the study area.

Yahaya et al (2016) examined the profit efficiency among paddy farmers: a Cobb Douglas stochastic frontier production function analysis using a cross-sectional data obtained from a sample of 397 Paddy households via Multi-stage and simple random sampling techniques. Maximum likelihood estimates of the specified profit model revealed that profit efficiencies of the producers varied between 30.5% and 94.8% with a mean of 73.2% suggesting that an

estimated 26.8% of the profit is lost due to a combination of technical and allocative inefficiencies in Paddy production.

Finally, Masuku *et al.,* (2015) assessed the impact of credit on technical efficiency among vegetable farmers in Swaziland. The findings of the study showed that credit had positive impact on the technical efficiency of tomato, cabbage and beetroot farmers. These results were in accordance with Duy et al. (2012) in a study to examine the impact of formal and informal credits on rice production efficiency of households in the Mekong Delta.

2.5.0 Gaps in the Empirical Literature

Several studies have been carried out in the area of microcredit and farm efficiency in different countries as seen from the empirical review above. However, few studies (Oladimeji *et al.,* 2017) have been carried out on impact of microcredit utilization on profitability and productivity efficiency of maize farmers in Kaduna state, Nigeria. I have not come across studies in literature that focus on the roles of microcredit on profit efficiency of vegetable farms in the study area (Kwara State). Hence, this study attempted to fill the missing gap in literature.

2.6.0 Analytical Framework

2.6.1. Modeling framework

Various approaches have been used to empirically measure efficiency and these techniques can be classified based on whether they impose a functional form on the underlying production function or not (i.e. parametric versus non-parametric). The two most popular techniques used in the literature are Data Envelopment Analysis (DEA) or non-parametric and Stochastic Frontier

Analysis (SFA) or parametric. The DEA technique first introduced by Farell (1957) and further developed by Charnes et al. (1978) employs a nonparametric approach to estimate technical efficiency. However, the main criticism of this technique as underscored in the literature is that it ignores the effect of stochastic error and ascribes all deviation from the frontier to inefficiency (Kopp and Smith 1980; Thiam et al. 2001; Murillo-Zamorano 2004). Moreover, the non-inclusion of a disturbance term makes it difficult to perform statistical tests. The Stochastic Frontier Analysis (SFA) technique is usually preferred in the agricultural economics literature because unlike DEA which attributes shortfalls to inefficiency, SFA allows for distinction between deviation from the frontier that is due to inefficiency and that which is due to measurement error and exogenous shocks (Coelli 1995).

Given the agricultural context of this study where most small-scale farmers seldom keep records of farm transactions and where farm yields are vulnerable with respect to erratic weather, pest attacks and other external factors, attributing all deviation to inefficiency would indeed be a very strong assumption and might bias our estimates. Thus, SFA was used to estimate farm efficiency in this study.

2.6.2. Measurement of profit efficiency: stochastic frontier analysis Aigner et al. (1977) and Meeusen and van den Broeck (1977). Unlike DEA, SFA is a parametric technique that is better suited to the concept of profit efficiency discussed above. In the SFA, it is said that a firm is inefficient in profit if its profit is less than the best-practice profit after eliminating the random error. That is, the performance of a specific firm is evaluated with respect to the efficient frontier, and any deviation from this efficient frontier is due to random errors and inefficiency. In the SFA, this deviation is represented by a compound error term.

However, Battese and Coelli (1995) propose a model that relaxes this assumption and suggest that the determinants of inefficiency can be expressed as a linear function of a set of explanatory variables that reflect the inherent characteristics of a firm. Therefore, the model of Battese and Coelli (1995) enables estimation of the efficiency for each firm and of the factors that explain the efficiency differences between firms in a single stage estimation procedure. This study uses the Battese and Coelli model (1995) to estimate the alternative profit frontier function and the effects function of inefficiency. The alternative profit function can also be expressed as

$\pi = \alpha + X_i \beta + V_i - U_i$……1.1

i = 1. . ., N *f*arms, where (π) is the profit of firm i, α is an intercept, X is the vector of the explanatory variables (output quantities and input prices), β is the vector of the parameters to be estimated, U_i represents inefficiencies found that reduce profit, and V_i represents random error. To facilitate the estimation of inefficiency, it is assumed that random error and inefficiency, v and u, respectively, are separable from the remainder of the profit function. Furthermore, it is assumed that random errors V_i are independent and identically distributed as N v (0,σ 2) and independent of U_i .

I assumed a Cobb-Douglas technology for the profit function since the interpretation of its coefficients is straightforward.

2.6.3 Model specification

The stochastic frontier production function model of Cobb-Douglas functional form was employed to estimate the firm level profit efficiencies of the farmers' in the study areas. The Cobb-Douglas functional form was used because, the functional form has been widely used in farm efficiency for the developing and developed countries, the functional form meets the

requirement for being self-dual, allowing an examination of economic efficiency, and lastly, Kopp and Smith (1980) suggested that functional form has a limited effects on efficiency measurement. The Cobb-Douglas production functional form which specifies the production technology of the farmers is expressed as follows:

$\pi_i = f(x_i:\beta) \exp V_i - U_i$ 2.1

Where: π – represents the profit which is measured in (N); V_i – represents the quantity of input used in the production. The V_i's are assumed to be independent and identically distributed random error, having normal N(O,δy2) distribution and independent of the U_i's which are profit inefficiency effects, which are assumed to be non-negative truncation of the half-normal distribution N(μ, δi2).

I assumed stochastic model specification for this finding as it does not only address the noise problem but also permit the estimation of standard errors and tests of hypotheses which were not possible with the early deterministic model because of the violation of the maximum likelihood condition.

CHAPTER THREE

3.0 METHODOLOGY

3.1 The Study Area

The study was conducted in Kwara State ($8^{o}30$"N and $5^{o}00$"E), Nigeria. Kwara State is bounded in the north by Niger state, in the south by Oyo state, Osun state and Ekiti state, in the east by Kogi state and in the west by Benin Republic. It has 16 local governments, with headquarters located at Ilorin. Kwara State is divided into four Agricultural Development Project zones (Zone A, B, C and D). Zone A comprises of Baruten and Kaiama LGA, Zone B comprises of Patigi and Edu LGA, Zone C comprises of Ilorin West, Ilorin South, Ilorin East, Moro and Asa LGA and the Zone D comprises of Ifelodun, Irepodun, Isin, Offa, Oyun, Ekiti, Oke –Ero LGA. The topography is mainly plain to slightly gentle rolling lands. The annual rainfall ranges between 1000mm and 1500mm. Average temperature ranges between 300C and 350C. It also has an estimated figure of 203,833 farm families with the majority living in the rural area. Agriculture is the main source of the economy and the vegetable crops produced in the state especially in Zone C include tomato, pepper, okra, corchorus, amaranthus, onions and cabbage. There are various microcredit institutions in the State. The state has a number of water bodies comprising of the

Asa river side, cut through of the River Niger among others. The vegetation type lies between the tropical rainforest and the guinea savannah with average rainfall of about 1381.9mm and average temperature of about 36^{o}c with land area of about 36,825 square kilometers (14,218 sq miles). The main ethnic groups are Yoruba, Fulani, Nupe with an inclusion of Hausa.

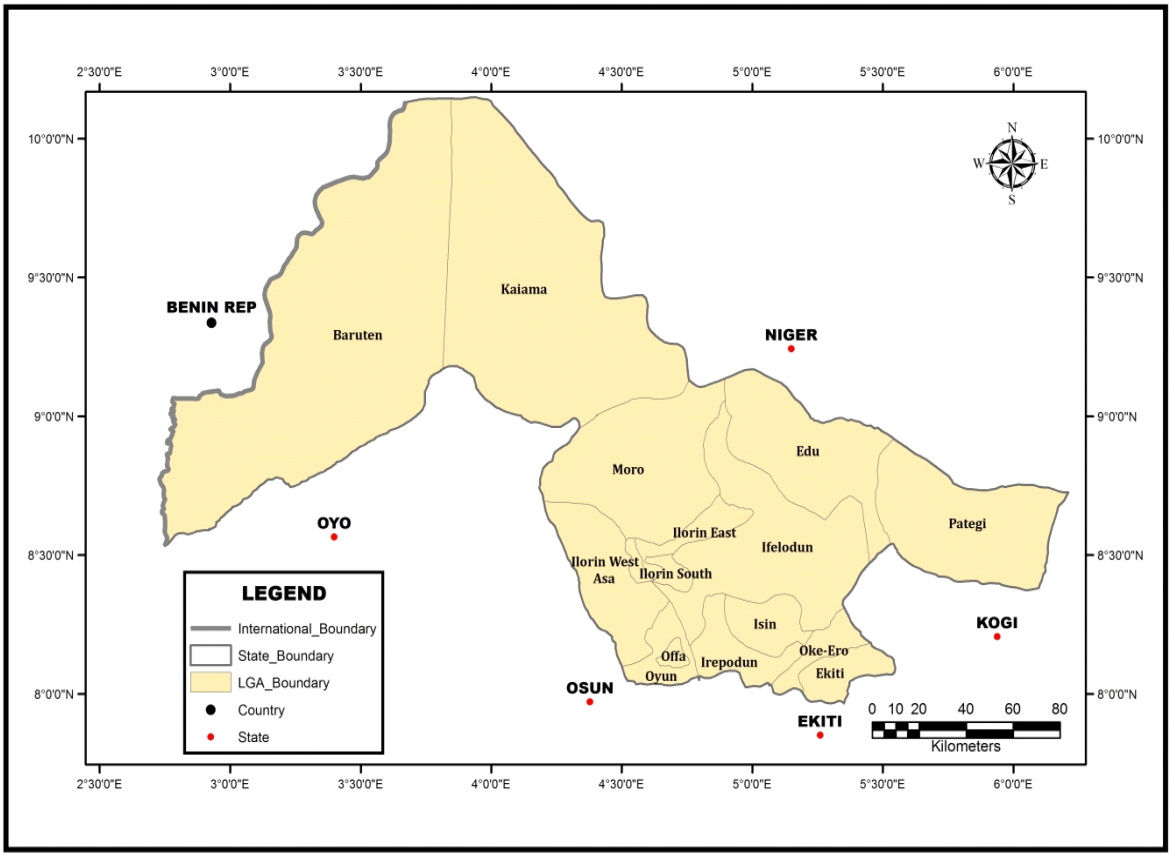


Figure 1.0: Map of Kwara State, Nigeria

3.2 Data collection and sampling techniques

Primary data was used for this study through structured interview schedule designed in line with the objectives of the study to respondents. The population for this study comprises all vegetable farmers in Kwara State derived from Ministry of Agriculture, Kwara State. A three-stage

sampling technique was used to select the respondents in the study area. The first stage involved purposive selection of Zone C from the four (4) ADP zones in the study area because of the predominance of vegetable farmers in the zone. The second stage involved random selection of three (3) LGAs (Asa, Ilorin East and Moro) from the (5) LGAs in the Zone. Lastly, 240 vegetable farmers were selected from population of 2553 using Taro Yamane formular as follows:

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

$$\text{n} = \frac{2553}{1 + 2553(0.061)\text{^}2}$$

n = 240

Selected LGAs	Numbers of Vegetable farmers	Numbers to be sampled proportionately
Asa	1163	$\frac{1163}{2553} \times 240 = 109$
Ilorin East	790	$\frac{790}{2553} \times 240 = 74$
Moro	600	$\frac{600}{2553} \times 240 = 56$
Total	2553	240

3.3 Analytical Techniques

Descriptive and inferential statistics were used to analyze the data to achieve the objectives of the study. The descriptive statistics involved frequency distribution, mode, median and use of

percentage while inferential statistics included Stochastic Profit frontier analysis and Logistic Regression analysis.

3.3.1 Descriptive statistics

This involved the use of percentage and frequency distributions to examine the socio-economic characteristics of respondents.

3.3.2. Inferential Statistics

This involved using stochastic profit frontier analysis to determine the profit efficiency. Farm efficiency is the ability of farm's production to attain optimum level of output from a given bundle of input. Measuring the profit efficiency of smallholder vegetable farms included the estimation of the Cobb-Douglas production function in which both the output and inputs were expressed in logarithmic form.

To determine the profit efficiency of vegetable farms that is Microcredit beneficiary and non-beneficiary. Stochastic profit frontier analysis (Cobb-Douglas production function model) was used. The model was stated as

$$\boldsymbol{Ln\pi = \beta_0 + \sum_{x=1}^{6} \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 + \beta_5 lnX_5 + \beta_6 lnX_6 + V_i - U_i}$$

Where, the subscript *i* indicates the i[th] farmer in the sample;

π = normalized profit

Ln = natural log

β_0 = constant term or intercept;

$\beta_1, \beta_2 \ldots\ldots \beta_6$ = unknown parameters to be estimated;

X_1 = price of vegetable seeds (tomato, pepper, okra, corchorus, amaranthus) in naira (₦)

X_2 = farm size (ha);

X_3 = wage labour in naira (₦)

X_4 = price of pesticides in naira (₦)

X_5 = price of fertilizers in naira (₦)

X_6 = price of vegetable output of farmers

X_7 = loan accessed (amount)

V_i = random errors; and

U_i = profit inefficiency effects.

U_i represents the profit inefficiency in production and V denotes the random errors as a result of estimation errors and climate variability in production. It was defined as:

$$\mathbf{U_i = \alpha_0 + \sum_{z=1}^{6} \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + \alpha_6 Z_6}$$

Where,

$\boldsymbol{\alpha 0}$ = constant term or intercept;

$\boldsymbol{\alpha_1, \alpha_2 \ldots \alpha_6}$ = unknown parameters to be estimated;

$\mathbf{Z_1}$ = the age of the *ith* respondent in years;

$\mathbf{Z_2}$ = years of farming experience of the *ith* respondent in years;

$\mathbf{Z_3}$= is a dummy variable for level of education of respondents which has value of 0 for no formal educational attainment, 1 for those with Arabic and/or Adult education, 2 for those with primary school education, and 3 and 4 for those with secondary as well as those with tertiary education respectively;

$\mathbf{Z_4}$ = household size of respondents;

$\mathbf{Z_5}$= is a dummy variable for marital status. These were included in the model to indicate their possible influence on the farm efficiencies of the vegetable farmers.

$\mathbf{Z_6}$ = access to microcredit (access = 1, no access = 0)

3.3.3 To compare the profit efficiency of microcredit beneficiary and non- beneficiary of the vegetable farms, The Welch's t-test was used and specified as:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}}$$

Where χ_J, S_J and J^{TH} sample mean, sample standard deviation and sample size, respectively

J= (1, 2). i.e the mean of profit efficiency, standard deviation and sample size of both microcredit beneficiary and non-beneficiary.

After the estimation of the profit efficiency of both microcredit beneficiary and non-beneficiary, a Welch's t-test was used to test their statistical difference. Due to the fact that the sample size is unequal and the fact that the variances are assumed to be unequal.

3.3.4 Regression Analysis

To identify factors that influence access to Microcredit by vegetable farms in the study area, a logistic regression model was used.

The model was stated as:

$\mathbf{P} = n_o + n_1J_1 + n_2J_2 + \ldots + n_kJ_k + s$

Where **P** = access to microcredit (P= 1 for access, 0 for non-access)

N_o= Constant

$n_1, n_2,\ldots,n_k$ = the regression coefficients which interpret the effect of J on P

J = explanatory factors

k = number of explanatory factors

s = error term

The explanatory factors are:

J_1= Educational Qualifications (Years)

J_2= Working Capital (amount)

J_3= age of the respondent (years)

J_4 = Years of farming experience (years)

J_5 = Farm size

J_6 = Household size

3.3.5 Limitation to the Study

- Difficulty in getting information from microcredit institutions. They said they cannot disclose any information about their customers but told me the farms where I can get those farmers (beneficiaries) to get the information.
- Most of the vegetable farmers are reluctant (especially Asa LGA) in giving information of their farms reason being that, many people (basically non researchers) have come to them to get some crucial information, captured and promise them that the Government is going to pay them. But with the help of the extension agents from Ministry of Agriculture, I was able to convince them that I am a researcher not politician and the information I needed was provided.
- It is important to state here that, this study cannot be generalized for Nigeria as a whole because the study is based on the vegetable farms in Kwara State, might be different compared to other States in the country.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socioeconomic Characteristics of the respondents

Socioeconomic characteristics are important in determining the roles of microcredit on profit efficiency of vegetable farms. This chapter therefore presented the status of the vegetable farmers' socioeconomic characteristics.

The results presented in Table 1 are derived from the socioeconomic characteristics of the vegetable farmers in the study area.

Table 1: Socioeconomic Characteristics of Vegetable farmers in Kwara State.

Variables	Frequency	Percentage
Age		
1-20	1	0.4
21-30	10	4.2
31-40	89	37.1
41-50	81	33.7
51-60	18	7.5
61 and above	41	17.1
Mean	44	
Gender		
Male	87	36.3
Female	153	63.7
Marital status		
Married	230	95.8
Single	5	2.1
Divorced	5	2.1
Years of schooling		
0-5	97	40.4
6-10	82	34.2
11-15	55	22.9
16 and above	6	2.5
Family size		
0-5	31	12.9
6-10	120	50
11-15	83	34.6
16-20	4	1.7
21 and above	2	0.8
Mean	9	
Working Capital		
0-100,000	179	74.6
100,001 –200,000	37	15.4
200,001 –300,000	15	6.3
300,001 – 400,000	2	0.8
400,001 – 500,000	4	1.7
500,001 – 600,000	1	0.4
600,001 –700,000	0	0

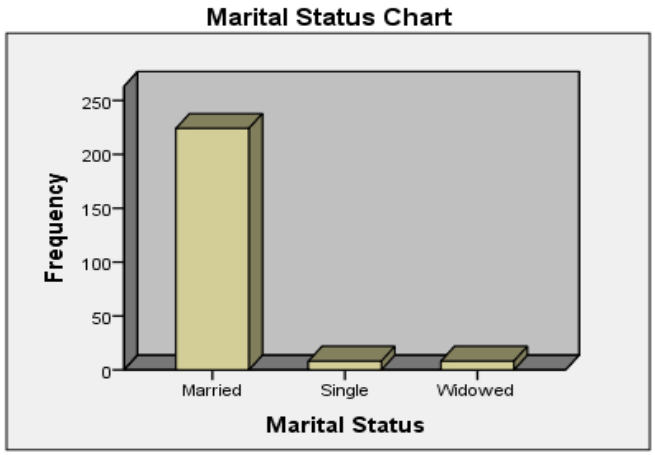
700,001 –800,000	2	0.8
Years of Farming Experience		
1-10	13	5.4
11-20	48	20
21-30	123	51.3
31-40	54	22.5
41 and above	2	0.8
Farm size		
1-2	220	91.3
3 and above	20	8.7
Total	240	100

4.1.1 Age of the respondents

Age is the major determinant of how agile and experienced a person can be. Table 1 revealed that most (37.1%) of vegetable farmers fall within the age bracket of 31-40 years, with mean age of 44 years. 33.7% fell into the category of 41-50 years, 17.1% at category of 61 and above, 7.5% at category of 51-60 years, 4.2% at category of 21- 30 years and 0.4% at category of 1-20. This implies that the vegetable farmers are in their middle age with good agility and are expected to be productive. This finding concurs with that of Olooto *et al.,* 2018 and Ngegba *et al.,* 2016, which revealed that the farmers have mean age of 40.

4.1.2 Marital Status of the Respondents

Majority of vegetable farmers were married with frequency level of 230 at 95.8% while others are single and widowed with frequency level of 5 at 2.1% respectively as reported in Table 1. The highest frequency and percent level of the married respondents indicates a higher chance of involving family labour in vegetable farming. This implies that marriage is a momentous institution in the rural area. This agrees to the finding of Olooto *et al.,* 2018, Moriba, *et al.* 2011 and Sesay, 2007 who stated that rural farmers were mostly married.



Source: Field survey, 2020

4.1.3 Gender of the Respondents

Tables 1 revealed that majority (63.7%) of the vegetable farmers are females while 36.3% are male. This result is not surprising as it concurs with the findings of Masuku *et al.*, (2015) who reported that women were the major participants in vegetable farming.

4.1.4 Years of schooling

A year of schooling is also known as educational status. Education shows whether a person is literate or learned. Education is very important in the development of any country's economy. It is expected to have important influence on the respondents' ability to adequately keep record and manage their vegetable farming profitably. The table above revealed that majority (40.4%) of vegetable farmers fell within the year bracket of 0-5 years, 34.2% at category of 6-10 years, 22.9% at category of 11-15 years and 2.5% at category of 16 and above. This finding showed that less educated people were involved in vegetable farming in the study area. A high years of schooling upsurges the farmers' ability and propensity to adopt new ideas and techniques of production which will translate to higher output. This finding agrees with the findings of Olooto

et al., 2018 which reported that majority of the women farmer had no formal and primary education.

4.1.5 Family Size

Family/household size is the sum total number of people that are living with the respondents and benefit from the income generated in the production. The distribution of household size of the respondents is shown in table 1. Majority of the respondents had relatively large family size. About 50% had 6-10 persons in their household, 34.6% had 11-15, 12.9% ranges from 0-5 persons, 1.7% had 16-20 persons and 0.8% had 21 and above. The mean family size was 9 persons. This implies that the high family size indicates a higher chance of involving family labour in vegetable farming and the high profit margin in the industry may have been the motivational factor sustaining the business and their family size for years. This agrees with findings of Yusuf & Adenegan, 2009 who reported that the average household size among women farmers in Kwara State as 7 persons.

4.1.6 Working Capital

This showed that 74.6% of vegetable farmers had start-up capital of less than or equal to ₦100, 000, while less than 1% had between the range of ₦500, 001 and above. This indicates that vegetable farming in the study area was not capital intensive.

4.1.7 Years of Farming Experience

Table 1 revealed that 51% of vegetable farmers had experience between 21-30 years, 22.5% had between 31-40 years, 20% had between 11-20 years, 5.4% had 1-10 years while 0.8% had 41 and above years' experience in vegetable farming. It is expected that increase in farming experience predisposes farmers to acquisition of skills and better farming practices which will increase their

farm efficiencies. This report concurs with Yusuf & Adenegan, 2009 who reported the average years of farming experience among women farmers in Kwara State as 20.42.

4.1.8 Farm Size

Majority (91.3%) of the respondents had farm size less than or equals to 2ha. This implies that the larger the area cultivated, require efficient resource allocation so as to translate to higher outcome. The vegetables planted include tomato, pepper, okra, corchorus, amaranthus and onions.

Table 2: Maximum Likelihood Estimates for profit efficiency of Vegetable Farms

Variables	**Microcredit beneficiary Coefficient**	**Standard Error**	**Microcredit non-beneficiary Coefficient**	**Standard error**
Constant	12.539	2.569	8.687	1.297
Price of vegetables seed (X_1)	0.444*	0.044	0.956	0.155
Farm size(X_2)	0.362**	0.322	0.086*	0.186
Wage of labour(X_3)	-0.737	0.015	-0.029	0.141
Price of pesticides (X_4)	0.489**	0.059	-0.620**	0.193
Price of fertilizer (X_5)	0.659***	0.017	0.412*	0.217
Price of vegetable output	0.379*	0.109	0.316*	0.155
Amount of loan accessed	0.527 **	0.066	0.000	0.000
Inefficiency model				
Constant	-11.084	7.524	-18.795	47.309
Age (Z_1)	0.256	1.282	1.395	1.647
Farming experience(Z_2)	0.999	1.005	-2.067	2.301
Level of education (Z_3)	-3.492**	1.711	-2.076**	2.375

Household size (Z_4)	-0.238	1.822	-12.269	8.389
Marital status(Z_5)	0.655	0.404	3.978	12.769
Access to microcredit(Z_6)	-0.0863*	0.219	0.000	0.000
Diagnostic statistics				
Sigma-squared (δ^2)	0.623812**		0.573812	
Gamma (γ)	0.825503 ***		0.535503	
R^2	0.75		0.82	
N	90		150	

****, **, *** p-value indicates significant at 1, 5 and 10% level respectively***

Source: Field survey, 2020

Table 2 shows the MLE estimates of stochastic frontier profit function. The estimated value of gamma (γ) was 0.825 and is significantly different from zero thus ascertaining the fact that a higher level of inefficiencies exist in vegetable production. The estimated gamma parameter of 0.75 is highly significant at 1% level of significance. This revealed that 75% of variation in the actual profit from the maximum profit (frontier profit) among the farms was mainly due to the differences in farmers` practices rather than random variability. The table indicates that the coefficients of the estimated parameters of the stochastic profit function for microcredit beneficiary were positive except the wage of labour. This implies that a unit increase in the price of inputs with positive coefficients will lead to increase in the profit realized from the production of vegetable and vice-versa.

Furthermore, the coefficient for price of fertilizer with positive value of 0.659 was statistically significant at 10% level of significance and this was revealed to be the most important variable determining the profit efficiency. This mean that for a 1% increase in the price incurred through fertilizer purchase, the profit obtained from the vegetable production will increase by 65.9%.

Oladeebo et al; (2012) reported similar results. The positively signed and significant coefficient of farm size (0.362) at 5% level of significance indicates the fact that vegetable farmers in this study area were operating at small scale level, therefore increasing their cultivated farm size will improve profit other things being equal. Alternatively a 1% increase in cultivated farm size will lead to 36.2% increase in profit obtained from the production of vegetable. The result shows that continuous increase in the price incurred through labour purchases will lead to the reduction in farm level profit of vegetable farmers in the study area.

The estimated coefficient for amount of loan accessed was positive and significant at 5% level. It implies that this input increased the profit efficiency of vegetable farms. In other words, farmers who have used the loan were having greater efficiency since farmers with less liquidity constraints may obligate the farmers to use the optimal input and thereby closed to the optimum output.

The study noted that wage of labour and price pesticide negatively influence profit efficiency level in microcredit non-beneficiary. This implies that increasing the price of these factors reduces the profit level in vegetable farm of microcredit non-beneficiary. As 1% increase in the inputs will decrease the profit efficiency of vegetable farms for microcredit non-beneficiary. The positively signed and significant coefficient of farm size (0.086) at 1% level of significance indicates the fact that vegetable farmers in this study area were operating at small scale level, therefore increasing their cultivated farm size will improve profit other things being equal. Alternatively a 1% increase in cultivated farm size will lead to 8.6% increase in profit obtained from the production of vegetable

More so, for the inefficiency parameters for both microcredit beneficiary and non-beneficiary, the estimated coefficient of farmer's year of schooling was negative and statistically significant

at 5%. This result implied that the higher level of years of schooling could decrease the inefficiency effect or increase profit efficiency on vegetable farms i.e. the more educated farmers were more likely to be efficient farmers due to their better skills, access to information and good farm management practices. The same result was obtained by Coelli and Battese (1996), Dhungana et al. (2004), Linh (2012) and Isvanto et al (2013).

Finally, access to microcredit variable has a negative coefficient and statistically significant at 1% level, suggesting a positive influence on profit efficiency. Small scale vegetable farmers who have access to microcredit to produce are more economically efficient than those who do not have access to microcredit. Access to microcredit eases financial constraint in vegetable farming and also enhances the acquisition of inputs such as seeds, fertilizers etc. therefore, vegetable farms who have access to microcredit are able to buy inputs in bulk, finance and expand their operations to enjoy economies of scale to be efficient.

Table 3: Frequency distribution of profit efficiency

Efficiency level	**Beneficiaries**		**Non-beneficiaries**	
Class	**Frequency**	**Percentage**	**Frequency**	**Percentage**
≤ 0.30	2	2.20	20	13.3
0.31-0.40	5	5.60	4	2.7
0.41-0.50	14	15.56	26	17.3
0.51-0.60	25	27.78	22	14.7
0.61-0.70	12	13.33	45	30.0
0.71-.080	18	20	28	18.7
0.81-0.90	4	4.44	4	2.7
>0.90	10	11.11	1	0.7
Total	90	100	150	100
Mean	0.806		0.560	
Minimum	0.37		0.28	
Maximum	0.95		0.92	

Source: Field survey, 2020

Table 3 revealed that vegetable farms of microcredit beneficiaries achieved on the average 80.6% level of profit efficiency. The result had revealed profit inefficiency gap of about 19.4%. This implies that the average farm in the study area could increase profit by 19.4%.

The vegetable farms of beneficiary of microcredit exhibited varied profit efficiencies ranging from 37% to 95%. However, the least profit efficient vegetable farm needs an efficiency gain of 80.6% (1-0.37/0.95)100 of production if such a farm is to attain the profit efficiency of the best efficient farm in the study area. Likewise for an average profit efficient farm will need an efficiency gain of 19.4% (1-0.37/0.95)100 to attain the most efficient level of profit. However, despite the variation in efficiency, it could be seen that about 84.5% of vegetable farms seemed to be skewed towards efficiency level of not greater than 0.8.

On the other hand, vegetable farms of non-beneficiaries of microcredit exhibited varied profit efficiencies ranging from 28% to 92%. However, the least profit efficient vegetable farm needs an efficiency gain of 56% (1-0.28/0.92)100 of production if such a farm is to attain the profit efficiency of the best efficient farm in the study area. Likewise for an average profit efficient farm will need an efficiency gain of 44% (1-0.28/0.92)100 to attain the most efficient level of

profit. It could be seen that about 72% of vegetable farms skewed towards efficiency level of not greater than 0.6. This finding conforms to that of Yahaya et al., 2020 who reported 75 percent as the mean profit efficiency of paddy farmer.

4.4.0 Welch's t- test for Profit efficiency of Microcredits beneficiaries and non-beneficiaries among vegetable farms

Table 4 shows the comparison of profit efficiency among beneficiaries and non-beneficiaries of Microcredits.

There was a statistical significant difference in the mean profit efficiency between Microcredit beneficiary (0.806 ± 0.234), and Microcredit non- beneficiary (0.560 ± 0.195), t = 2.502, p-value = 0.0321.

Table 4: Comparison of Technical efficiency of MFB participants and non-MFB participants

Variable	**MFB participants** Mean ± SD	**Non-MFB participants** Mean ± SD	**t-statistic**	**p-value**
profit Efficiency	0.806 ± 0.234	0.560 ± 0.195	2.502	*0.0321

Difference =−0.0954
0.0423t-Value = 2.502
p-Value (T<t) = 0.0307

**p-value < 0.05 indicates significance*

Source: Field survey, 2020

Welch's t- test for profit efficiency of microcredit beneficiaries and non-beneficiaries among vegetable farms. The result revealed that there is a statistical difference in profit efficiency level.

From the table, vegetable farms that benefits microcredit recorded average profit efficiency score of 8.5% efficient more than their counterparts. This means that microcredit beneficiary are10% more profit efficient that non-beneficiaries.

4.3.0 FACTORS INFLUENCING ACCESS TO MICROCREDITS.

Table 5: Regression Analysis for factors influencing access to microcredits

Variables	Coefficient	Standard error	p-value
Constant	-0.356430	0.189556	0.06131 ***
Years of Schooling	0.0481674	0.00635399	<0.00001 *
Working Capital	1.11132E-06	3.91434E-07	0.00492 *
Age	0.00401550	0.00405134	0.32264
Years of farming experience	0.00359790	0.00496392	0.46930
farm size	0.0146859	0.00886216	0.09884 ***
Household size	0.0146859	0.00886216	0.19884
$R^2 = 0.642$			

****, *** p-value indicates significant 1 and 10% respectively***

Source: Field survey, 2020

Table 5 revealed that year of schooling was positive and statistically significant at 1% level of probability. This implied that the more years an average vegetable farmer spends in school the more the tendency of the farmer to access microcredits. This might be due to the fact that banking itself requires some level of literacy and accessing loan from microcredit institution involve reading and understanding some terms and conditions.

Working capital was found be positive and statistically significant at 1% level of probability. This implies that the more the working capital for vegetable production, the more likely a farmer is to access microcredits. This might be as a result of the fact that loans can easily be assessed at microcredit institutions when compared with the commercial banks. According to Ajibola *et al.*, (2015), insufficient capital is one of the major constraints faced by vegetable farmers in Kwara State. This might be a game changer.

Table 5 further revealed that farm size was positive and statistically significant at 10% level of probability. This implied that cultivating a large farm size may command more inputs such as

seeds, labour, fertilizer and herbicides which in turns upsurge the cost of production. This might then force farmers to access loans and other benefits from microcredit institutions.

CHAPTER FIVE

5.0 SUMMARY, CONCULSION AND RECOMMENDATIONS

5.1 Summary

This study assessed the roles of microcredit on profit efficiency of vegetable farms in Kwara State, Nigeria, using stochastic profit frontier methods to estimate profit efficiency. A total of 90 microcredit beneficiaries and 150 microcredit non-beneficiaries were sampled for this study.

The study showed that about 63.7% of the vegetable farmers are females with an average age of 44 years. About 40% of them spend 0-5years in school with 95.8% of farmers being married. The study further revealed that there is presence of larger household size with a mean size of nine (9). Agriculture constitutes a source of income to the majority of the populace in Kwara State with 74.6% of the respondents having a start-up capital of not more than ₦100, 000.

Furthermore, the study revealed that prices of vegetable seed, pesticide, fertilizer, vegetable output, amount of loan accessed and farm size were critical variables that influence profit efficiency for microcredit beneficiary. Access to microcredit is a crucial variable that influences profit efficiency for microcredit beneficiaries. On the other hand, the study noted that wage of

labour, price of pesticide and year of schooling negatively influence profit efficiency level in microcredit non-beneficiary.

More importantly, the mean of profit efficiency for microcredit beneficiaries was 0.807 while that of microcredit non-beneficiaries was 0.560 and there is a statistical difference in profit efficiency level of microcredit beneficiary and non-beneficiary

Lastly, from the result of the field survey, years of schooling, capital outlay and farm size were factors that influence access to microcredit by vegetable farms.

5.2 Conclusions

Evaluating the roles of microcredit on profit efficiency of vegetable farms in Kwara State, Nigeria and also factors influencing access to microcredit, this empirical research revealed that Microcredit momentously influence profit efficiency of vegetable farms in Kwara State. Specific conclusions that were reached from the findings are:

i. Access to microcredit has a positive and preponderance influence on profit efficiency
ii. Amount of loan accessed also influence the profit efficiency level of microcredit beneficiary
iii. The result indicates that vegetable farms profit efficiency could still be increased by 19.4% and 44% for microcredit beneficiaries and non- beneficiary respectively using available technology.

iv. There is a statistical difference in profit efficiency level of microcredit beneficiary and non-beneficiary

v. Working capital was positive and strongly influences access to microcredit.

vi. Years of schooling has a positive influence on access to microcredit

vii. Farm size has a positive and strong influence on access to microcredit.

5.3 Recommendations

Based on the findings of the study, the following recommendations could be made to improve vegetable farms in Kwara State.

i. Agricultural credit should be made available to the vegetable farmers to enable them buy farm inputs so as to increase their area of operation which will translate to more outputs leading to greater profit.

ii. Farm inputs such as fertilizers, pesticides and seeds should be made available to farmers to use. The inputs should be made available before the onset of planting season every year at affordable prices so as to achieve profit efficiency (profit maximization) through cost minimization

iii. Education opportunities especially informal extension education should be provided for the farmers so as to improve their knowledge and skills.

REFERENCES

Abbas, A., Yuansheng J., Abrham T.G. and Rahman D (2019). The Nexus of Agricultural Credit, Farm Size and Technical Efficiency in Sindh, Pakistan: A Stochastic Production Frontier Approach. Journal of the Saudi Society of Agricultural Sciences. 18 (3), 348-354

ADB (2011), *Microfinance: Financial Services for the Poor*, Asian Development Bank. Available at http://www.adb.org/microfinance/ (accessed January 2020).

Adesina, A.A. & Djato, K.K. (1997). Relative efficiency of Women as farm manager; Profit Function Approach in Cote d'voire *Journal of Agricultural Economics* 16:47-53.

Adewumi, M. O., Ayinde, O. E., Falola, A. & Adeyemi, O. O. (2013) Economic Analysis Of The Role of Microfinance Banks in Funding Agriculture in Rural Areas of Kwara State, Nigeria.

Ahmad, S. Z. (2012). Microfinance for women micro and small–scale entrepreneurs in Yemen: Achievements and challenges. *International Journal of Entrepreneurship and Small Business, 16*(1), 102-120. http://dx.doi.org/10.1504/IJESB.2012.046920

Aigner, D.J. & Chu, S.F. (1968). Estimating the Industry Production Function. *American Economic Review* 58:826-839.

Aigner, D.J. Lovell, C.A.K. & Schmidt, P. (1977). Formulation and Estimation of stochastic Frontier production Model. *Journal of Econometrics* 6:21-27.

Ajibefun I.A, Daramola A.G 2003. Determinants of technical and allocative efficiency of micro-enterprises: Firm-level evidence from Nigeria. African Development Bank, 353-395

Ajibola B. O, Komolafe S. E, & Akangbe J. A. (2015). Constraints Faced by Women Vegetable Farmers in Kwara State, Nigeria and Its Agricultural Practices. *Jordan Journal of Agricultural Sciences*, 11 (4)

Amaza, P.S. & Olayemi, J.K. (1999). An Investigation of Production Efficiency in Food Crops enterprises in Gombe State. *Nigeria Journal of rural Economics and Development* 13:111-122.

Ambali O.I, 2013. The Effect of Microcredit on Technical Efficiency of Rural Farm Households in Egba division of Ogun State.

Arbelo A., Arbelo M., and Pilar P; (2020). Profit Efficiency as a Measure of Performance and Frontier Models: a resource based view. Business Research Quarterly. 1-7

Armendariz, B.A and Morduch, J. (2005). *The Economics of Micro-finance*. Middlesex, MA: Massachusetts Institute of Technology Press. 216.

Asian Vegetable Research Development Center, AVRDC(2006). Improving Vegetable Productivity.Journal/ejournal, icrisat.Org 4(1):1-2.

Babalola, L. A., Ojo, O.D., Fagbola, O., Etukudo, O.O. (2007). Effect of Mycorhira,Organo-mineral and NPK fertilizer on performance of celosia Argentine.Hurston. Annual Conference Proceedings Soil Science Society, Ibadan. 54 –56.

Bateman, M. (2010). *Why Doesn't Microfinance Work? The Destructive Rise of Local Neoliberalism*. London: Zed Books. 124.

Battese, G.E. & Cora, G.S (1977). Estimation of a Production Frontier Model with Application to the Pastoral Zone of Eastern Australia. Australian *Journal of Agricultural Economics* 21:169-179.

Battese G.E, & Coelli, T.J. (1988). "Production of Firm-level Technical Efficiencies with a Generalised Frontier Production Function and Panel Data" *Journal of Economics*, 6, 21-37.

Binam J N, Gockowski J, Nkamleu G B. 2008. Technical efficiency and productivity potential of cocoa farmers in West African countries. *The Developing Economies*, XLVI, 242-263.

Burjorjee, D., & Jennings, M. (2008). *Microfinance Gender Study: A Market Study of Women Entrepreneurs in Yemen.* Sana'a: Social Fund for Development

Campbell H.F., Lindner R.K., 1990. The production of fishing effort and the economic performance of license limitation programmes. Land Economics, 66 (1990), 55-66

Central Bank of Nigeria, CBN (2018). Roles of Agricultural sector in Nigeria. http://www.punchng.com/2018/02/roles-of-agricultural-sector-in-Nigeria

CGAP and The World Bank Group (2010) *Financial Access 2010: The State of Financial Inclusion Through the Crisis,* Consultative Group to Assist the Poor (CGAP) and The World.

Charnes, A., W. W. Cooper and E. Rhodes (1978), "Measuring the Efficiency of Decision Making Units," European Journal of Operational Research 2:6, 429-444.

Coelli, T.J. (1995): "Recent Development in Frontier Modeling and Efficiency Measurement. *Australian Journal of Agricultural Economics.*39 (3), 219-245.

Coelli, T.J. & Battese, G.E. (1996). Identification of Factors which Influence the Technical Inefficiency of Indian Farmers. *Australia Journal of Agricultural Economics.* 40, 103-128.

Coelli, T., Rao, D.S.P. & Battese, G.E. (1998). An Introduction to Efficiency Productivity Analysis. Boston: Kluwer Academic Publishers.

Coelli, T; Rahman, S. & Thirtle, C. (2002). Technical, Allocation, Cost and Scale Efficiencies in Banglash Rice Cultivation: A Non-paramatic Approach. *Journal of Agricultural Economics;* 53, 607-626.

Coons, K. and Paprocki, H. (2008). *Mulieres Suadentes - Persuasive Women: Female Royal Saints in Medieval East.* NY: University Press. 48.

Crabb, P. (2008) Economic Freedom and the Success of Microfinance Institutions. *Journal of Developmental Entrepreneurship*, 13(2): 205-219

Daniyan-Bagudu H., Khan S.J., Roslan A., 2016. The impact of Microfinance Factors on Women Empowerment in Nigeria. Research Journal of Applied Sciences. 11 (9): 799-802.

Dewbre J, Borot de Battisti A. 2008. *Agricultural Progress in Cameroon, Ghana and Mali: Why it happened and How to Sustain it.* OECD Publishing.

Dhungana, B. R., Nuthall P.L & Nartea G.V., 2004. Measuring the economic inefficiency of Nepalese rice farms using data envelopment analysis. Aust. J. Agric. Res. Econ., 48:347-369.

Drechsel P, Keraita B. (Eds.). 2014. *Irrigated Urban Vegetable Production in Ghana: Characteristics, Benefits and Risk Mitigation* (2nd ed.). Sri Lanka: International Water Management Institute (IWMI).

Elahi, K.Q. and Danopoulos, C.P. (2004) Microcredit and the Third World: Perspectives from moral and political philosophy, *International Journal of Social Economics*, 31(7): 643-654

Farrell, M.J., 1957. The measurement of productive efficiency. J. R. Stat. Soc. Ser. A (Gen.) 120, 253–290.

FAO. 2013. *A Vegetable Garden for All* (5th ed.). Rome: Food and Agriculture Organization of the United Nations.

FAO. 2014. *Food and Nutrition in Numbers 2014.* Rome: Food and Agriculture Organization of the United Nations.

FAO, 2015. Country Fact Sheet on Food and Agriculture Policy Trends.

FAO. 2017. FAOSTAT. Online statistical database (Retrieved January 20, 2020) (available at http://faostat.fao.org).

Folmer (2012). The Impact of Institutional Credit on Agricultural Production in Pakistan. *The Pakistan Development Review*, 42(4):469-485.

Forsund, F.R., Lovell, C.A.K., and Schmidt, P., A survey of frontier production functions and of their relationship to efficiency measurement, *J. Econometrics*, 1980, 13, 5–25.

Gambo, B.A. (2008). Effect of Nitrogen, Potassium, Cow Dung and Weed Interference on the Growth and Yieldof Onion (Allium cepa L.) in Semi-Arid Environment. Unpublished Ph.D Thesis, Department of CropScience, UsmanuDanfodio University, Sokoto. 152.

Garikipati, S. (2008). The Impact of Lending to Women on Household Vulnerability and Women's Empowerment: Evidence from India. *World Development, 36*(12), 2620-2642. http://dx.doi.org/10.1016/j.worlddev.2007.11.008

Greene, W. (1993). "The Econometric Approach to Efficiency Analysis," in H. Fried, K. Lovell, and S. Schmidt, eds., The Measurement of Productive Efficiency, Oxford University Press, Oxford.

Haji, J. (2006). Production efficiency of smallholders' vegetable-dominated mixed farming system in Eastern Ethiopia: A non-parametric approach. *Journal of African Economies*, 16, 1-27.

Hollis, A. and Sweetman, A. (1997). Microcredit in Pre-Famine Ireland. *SSN*, 8(2):1- 44.

Isyanto, A.Y., M.I. Semaoen, N. Hanani & Synfrial. Measurement of farm level efficiency of beef cattle fattening in West Java Province, Indonesia. J. Econ. Sustain. Dev., 4: 100-104.

Jandrow, J., Lovell, C.A.K., Materow S.I. & Schmidt, P. (1982). On the Estimation of Technical Efficiency in then Stochastic Frontier Production function Model. Journal of Econometrics 9:233 – 238.

Kingsley, C. O., Charles K. O., Christopher O. E. (2014) Contributions Of Microcredit To Economic Efficiency Of Cassava Farmers In Abia State, Nigeria.

Kopp, R.J. & Smith, V.K. (1980): Frontier Production Function Estimations for Steam Analysis Generation: A Comparative Analysis. *Southern Economics Journal* 47:1049-1059.

Lawan, M., Sastawa, B.M. and Kabir, B.G. (2010). Spraying Regime of Cypermenthrin for the control of tomato fruit worm Helicoverpaarmigera, during Dry Season Tomato Production in Maiduguri, Sudan Savanna of Nigeria. Journal of Arid Agriculture.19: 36-40.

Mamun, A. A., Adaikalam, J., & Wahab, S. A. (2012). Investigating the Effect of Amanah Ikhtiar Malaysia's Microcredit Program on Their Clients Quality of Life in Rural Malaysia. *International Journal of Economics and Finance, 4*(1), 192-203.

Mailena L., Shamsudin M. N., Radam A. & Mohamed Z. (2014). Efficiency of Rice Farms and its Determinants: Application of Stochastic Frontier Analysis. Trends in Applied Sciences Research 9(7): 360-371, 2014. ISSN 1819-3579/ DOI: 10.3923/tasr.2014.360.371.

Masuku, M.B., Raufu, M., Malinga, N.G., 2015. The impact of credit on technical efficiency among vegetable farmers in Swaziland. Sustain. Agric. Res. 4, 114.

Meeusen, W. & Van-den Brock, J. (1977). Efficiency Estimation from Cobb-Douglas Production Function with Composed error. *International Economics Review* 18:435–444.

MIX (2010), *Microfinance Information Exchange*. Available at http://www.themix.org (accessed 15 February 2020).

MIX (2010a), *MIX Market,* Microfinance Information Exchange. Available at http://www.mixmarket.org/ (accessed 20 February 2020).

Mijindadi, B.N., 1981. Production Efficiency of Farms in Northern Nigeria. published PhD Thesis, Cornell University, U.S.A 567–570.

Mokhtar, S. H. (2011). *Microfinance Performance in Malaysia.* Doctor of Philosophy, Lincoln University, New Zealand. Retrieved from http://hdl.handle.net/10182/4186.

Morduch, J. (1999). The microfinance promise. *Journal of Economic Literature, 37,* 1569–1614.10.1257/jel.37.4.1569.

Moriba , S., M. Craig Edwards., J. Shane Robinson., D. Dwayne Cartnell II & David M. Henneberry (2011)., Sesay (2007). Investigating the International Awareness of Students Meeting Their International Dimension Requirement through Course Offerings in a College of Agriculture. *Journal of gricultural education, 53(4), 98-111. DOI: 10.5032/jae.2012.04098.*

Nader, Y. F. (2008). Microcredit and the socio-economic wellbeing of women and their families in Cairo. *The Journal of Socio-Economics, 37*, 644-656. http://dx.doi.org/10.1016/j.socec.2007.10.008

National Agricultural Extension Research Liason Services, NAERLS,(2009). Pepper Production under Irrigation. Extension Bulletin No 206, Agric. Engineering Series, 7,25.

National Food Reserve Agency, NFRA,(2008). Annual Report of National Food Reserve Agency, Abuja. 113.

Navajas, S., Schreiner, M., Meyer, R.L., Gonzalez-vega, C. and Rodriguez-meza, J. (2000). Microcredit and the Poorest of the Poor: Theory and Evidence from Bolivia, *World Development*, 28:2, 333-346.

Nchare, A. (2007). Analysis of factors affecting the technical efficiency of Arabica coffee producers in Cameroon. African Economic Research Consortium. (AERC) research paper.https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/2675/RP%20163.

Ngegba M.P., Sesay M & Elizabeth T. B. 2016. The impact of vegetable farming on the livelihood of small-scale farmers in koinadugu district northern Sierra Leone. Global Journal of Bio-science and Bio-technology (G.J.B.B). 5 (1) 2016: 42-49.

Ogidi A. E., (2019). The effect of Microcredit access, utilization and repayment on catfish production enterprises in Benue State.

Ogunleye A.S (2018). Agro-Science Journal of Tropical Agriculture, Food, Environment and Extension 17(2), 51-57

Ogundari, K. (2006) Determinants of Profits Efficiency among Small-Scale Rice Farmers in Nigeria: A profit function approach. A paper prepared for presentation at the *International Association of Agricultural Economist* August, 12-18.

Oladeebo J. O. and Oluwaranti A. S. (2012) "Profit efficiency among Cassava producers: Empirical evidence from South Western Nigeria," *Journal of Agricultural Economics and Development,* 1, 46–52, 2012.

Oladimeji, Y. U., Idi A. S., Damisa M.A., Edekhegregor O. I. Impact Of Micro-Credit Utilization On Profitability And Productivity Efficiency Of Maize Farmers In Kaduna

State, Nigeria. Dutse Journal of Economics and Development studies (dujeds). *7(2), June (2019)*

Oladoja, M.A., Akinbile, L.A. and Adisa, B.O. (2006). Assessment of the Environment-Related Problem andProspect of Vegetable Production in Peri-Urban Lagos State, Nigeria. Journal of Food, Agriculture and Environment, 4(380): 271-275.

Olawuyi S. O, Olapade O. F, Fabiyi Y.L and Ganiyu M.O., (2010). Effects of Microfinance Bank Credit Scheme on crop farmers revenue in Ogbomoso south LGA of Oyo State.

Olooto, F.M., Yusuf O.J., Ayanda I.F. & Salawu O.L. (2018). Perceived Effect of Climate Change on Vegetable Production among Women Farmers in Kwara State, Nigeria. *International Journal of Agriculture, Enviroment and Bioresearch. 3(3), 2018. ISSN: 2456-8643.*

Ouma O.R and Ogaga W., (2015). Effects of microcredits facilities on the welfare of Households. Evidence from Suna East sub-county, Migori county, Kenya. 7(29).

Pascoe, S., Robinson C. (1998). Input controls, input substitution and profit maximization in the english channel beam trawl fishery**.** Journal of Agricultural Economics, 49 (1998), 16-33.

Rahman R., Nie Q., International Journal of Economics. Finance. 3, 207 (2011).

Rahman A. (1999). Micro-credit initiatives for equitable and sustainable development. World Development, 27(1), 67-82.

Raiffeisenverband, D. (2011). *Credit Cooperative Institutions in European Countries.* NY: Springer. 284

Raman, A. M. (2011). Vegetable Crops.Drought Advisory. EM4830E: 1 -2.

Shackleton C M, Pasquini M W, Drescher A W. (Eds.). 2009. *African Indigenous Vegetables in Urban Agriculture.* London, UK: Earthscan

Schmidt, P., 1986. Frontier production functions. Econometric Rev., 4: 289-328.

Spooner, R. (1846). *Natural Right to Labour.* NY: Library of Liberty. 176.

Squires, D.E. (1987). Fishing effort: its testing, specification, and internal structure in fisheries economics and management. Journal of Environmental Economics Management, 14 (1987), 268-282

Sunday, S., Hagman, J., Gralla, J. and Sigel, E. (2012). Bridging the Gap between Ocean Acidification Impacts and Economic Valuation. *Rev,* 20: 331–4.

Tasila D. K., Franklin N. M and Richard O. F; (2019). Profitability and Profit Efficiency of certified groundnut seed and conventional groundnut production in Northern Ghana: A Comparative analysis. Cogent Economics and Finance. 7(1).

Thiam, A., Bravo-Ureta, H.E., & Rivers, T.E (2001). Technical Efficiency in Developing country Agriculture: A Meta-analysis. *Journal of International Association of Agricultural Economics* 25(2-3): 137 – 412.

Tijani, I.A. (2011). Analysis of the Effect of Microcredit on Food Crops Production in Ogun State, Nigeria. M. Agric. (Agricultural Economics) Dissertation, Department of Agricultural Economics and Farm Management, UNAAB, Nigeria.

Tijjani A, Bakari U (2014) Determinants of allocative efficiency of rainfed rice production in Taraba state, Nigeria. Eur. Sci. J 10(33):220–229.

Tsai, K.S. (2004). Imperfect Substitutes: The Local Political Economy of Informal Finance and Microfinance in Rural China and India. *World Development*, 32(9):1487-1507.

Uusiku, N. Oelofse A, Duodu K, Bester M, Faber M. 2010. Nutritional value of leafy vegetables of sub-Saharan Africa and their potential contribution to human health: A review. *Journal of Food Composition and Analysis*, 23, 499-509.

Yahaya K, Mad N. S., Alias R. and Ismail A. (2016). Profit Efficiency Among Paddy Farmers; A cobb Douglas Stochastic Frontier Production function Analysis. Journal of Asian Scientific Research, 2016, 6(4): 66-75

Yusuf T. M & Adenegan K.O (2009). Technical Efficiency Among Women Farmers In Kwara State: Data Envelopment Analysis Approach. *Agrosearch (2008 & 2009) 10 (1&2) 31-45.*