AGRICULTURAL CREDIT ACCESSIBILITY AND ITS EFFECTS ON OUTPUT OF SMALLHOLDER FARMERS IN PLATEAU STATE, NIGERIA

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A RESEARCH THESIS SUBMITTED TO THE SCHOOL OF BUSINESS, ECONOMICS, AND TOURISM IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN ECONOMICS OF KENYATTA UNIVERSITY

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DECLARATION

This research thesis is my original work and has not been presented for a degree in any other university

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I dedicate this thesis to my wife, Mrs. Sunday, and our four children, Uwengkizi, Uwengzansum, Uwengkatum, and Uwengreng, in appreciation of their prayers and support.

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ABBREVIATIONS AND ACRONYMS

ACGS Agricultural Credit Guarantee Scheme

ACGSF Agricultural Credit Guarantee Scheme Fund

ADBP Agricultural Development Bank of Pakistan

ADF Augmented Dickey Fuller

AMOS Analysis of Moment Structures

ASOGDP Agricultural sector output percentage to gross domestic product

CBCA Commercial Bank Credit to Agricultural sector

CBN Central Bank of Nigeria

CIMMYT International Maize and Wheat Improvement Centre

ESRM Endogenous Switching Regression Model

FAO Food and Agriculture Organization

FMARD Federal Ministry of Agriculture and Rural Development

FMA Federal Ministry of Agriculture

GDP Gross Domestic Product

IFAD International Fund for Agricultural Development

KM Kilometres

MDG Millennium Development Goals

NBS National Bureau of Statistics

NACRDB Nigerian Agricultural Cooperative and Rural development Bank

OLS Ordinary Least Square

PP Phillips Perron

PRONAF National Program for Strengthening Family Farming

RBDA River Basing Development Authority

SEM	Structural Equation Model
SMA	States Ministries of Agriculture
SPSS	Statistical Package for Social Sciences
TFP	Total Factor Productivity
UBL	United Bank Limited
UNDP	United Nations Development Programme
USD	United States Dollars

OPERATIONAL DEFINITION OF TERMS

Agricultural credit accessibility: availability of funding for agricultural production.

Input cost: the amount of money spent during the last farming season

Poor households: refer to households that live below two dollars a day

Sales: refer to the amount of money generated from the sale of agricultural produce both crop production and livestock production by smallholder farmers

Smallholder Farmers: refers to those who embark on agricultural activities which support a single family with a mixture of cash crops and subsistence farming

ABSTRACT

Agricultural credit improves smallholder farmers' purchasing power by allowing them to use modern technologies for their farm production. Credit is therefore imperative for agriculture which had previously been a non-commercial venture for the rural inhabitants. Studies have shown that unless credit is made available on suitable terms, majority of the smallholder farmers cannot acquire modern technology for production. Farmers are therefore faced with the challenges of low productivity, inadequate access to logistic support, input, crop infestations by pests and diseases and loss of crops and livestock. The overall objective of the study was to investigate agricultural credit accessibility and its effects on output of smallholder farmers in Plateau State, Nigeria. The specific objectives of the study were to: find out the determinants of access to agricultural credit by smallholder farmers; to investigate how credit accesses by smallholder farmers affect the agricultural output and to investigate the credit utilisation behaviour of smallholder farmers on agricultural output The target population for the study was the smallholder farmers that were engaged in agricultural practices in Plateau State, Nigeria. The sample size was 399 households that par-took in agricultural practices in sampled State. The study used structured questionnaires to collect primary data. The collection of primary data was done through the administration of questionnaires to selected smallholder farmers. From the data collection process, the researcher was assisted by research assistants that made frequent follow-up on the respondents to ensure that high response rate was achieved. In objective one, the study used probit model because the dependent variable is credit access. The dependent variable was measured using binary scale and therefore the study tried to find the likelihood of the variable, while the independent variables influencing access to credit. The study adopted treatment effect model using the method of Propensity Score Matching. Access to credit was considered in this case a treatment hence the study tried to establish veracity of access to credit on agricultural output of smallholder farmers. Utilisation behaviour was also considered in this case a treatment hence the study tried to establish the veracity of credit utilisation behaviour on agricultural output of smallholder farmer. The first specific objective was to analyse the determinants of agricultural credit access by smallholder farmers. The study found that the level of education; farm size; source of income; household size; credit information; distance to the scheme; distance to the cooperative society and the type of agricultural activity served as determinants of credit access to smallholder farmers. The second objective was to determine the effect of access to agricultural credit on agricultural output by smallholder farmers. The study found that average treatment effect on the treated (ATET) coefficient was positive and significant, meaning that the output small holders farmers realized is not much. The third objective was to investigate the effect of credit utilisation behaviour of smallholder farmers on agricultural output. The study found that the coefficient for ATET was negative and significant because the output that smallholder farmers get at the end of each farming season is insignificant. The study recommended that there is the need for government to come up with more efficient credit facilities to enable smallholder farmers to access credit easily.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Smallholder farmers, who make up the majority of the sector, are essential to Nigeria's socioeconomic development in the area of agriculture. Smallholder farmers make up a sizeable section of the population in Plateau State, as they do in many other places, and they make a substantial contribution to both employment and food production. Smallholder farmers play a crucial role, but despite this, they frequently encounter a variety of obstacles that reduce their output, with inadequate access to agricultural credit being the main one.

For smallholder farmers to invest in cutting-edge farming methods, buy high-quality inputs, and manage the risks involved in agricultural output, they must have access to credit. Environmental and climatic uncertainties in Plateau State, where smallholder farmers largely practice rain-fed agriculture, aggravate the difficulties they encounter. In addition, many of these farmers are unable to receive formal loan from traditional financial institutions due to a lack of collateral, which forces them to turn to unfavorable terms and high interest sources of informal credit.

Chisasa (2014) asserted that the major source of revenue for the most of rural residents is farming. Agriculture contributes more to global economic expansion, fights poverty, and protects the environment. The existence of Agriculture is because it is a significant imperative productive sector in a number of low-income countries, which is how poverty reduction targets are attained (Food and Agricultural

Organization) (FAO, 2011). Increased agricultural profits are required, together with growth in non-agricultural industries, to assist nations that a large share of the labour force is employed in agriculture (Chisasa, 2014). Base on the aforementioned reason, agriculture has a comparative advantage over other sectors of the economy, and poverty levels vary from one nation to another. Most of the population in Africa is in rural settlements and depends exclusively on agricultural techniques for their means of subsistence. Small-scale farming is essential and seen as a focal point for continuing the battle against poverty and reducing the threat of food shortage on the African continent (Garvelink, Wedding, & Hanson, 2012).

Since the early 1980s, West Bengal changed its approach to agricultural financing by offering loans, which paved the way for the State's rapid agricultural output increase. By using their share cropping certificates as guarantees, the government served as a catalyst to ensure institutional credit flows, guaranteeing high agricultural production. Giving out credit for the emerging economies while taking into consideration the way of changing the rural agrarian economy is thought to require agricultural purposes at subsidized rates of interest. Implementing effective agricultural inputs through better approaches to financial difficulties boosts agricultural activity, which has significant effects in maintaining the living standards of rural farmers. In other words, promoting modern farming practices through wise resource allocation would probably overcome the technological barriers that still exist for traditional forms of production (Laha, 2013).

Agricultural credit trends can be captured by the share of financial institutions lending to the agricultural sector. Figure 1.1 therefore shows the agricultural credit trends for some selected countries in Africa.

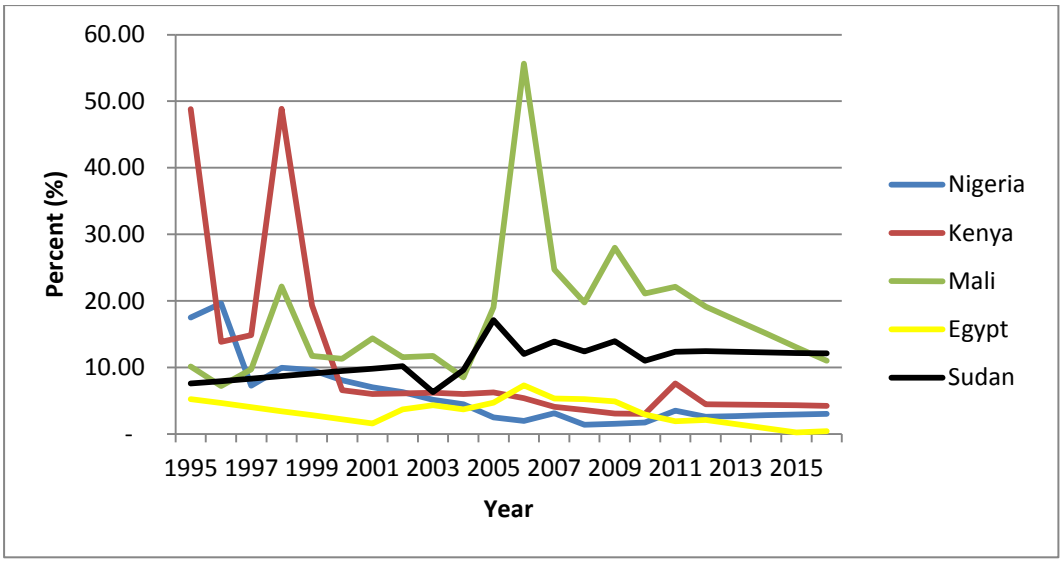


Figure 1. 1: Share of Agricultural Sector Lending by Commercial Banks, 1995–2015 (Total Portfolio Percentage)

Source of data: Various Countries' Central Banks, 2017

The figure shows the disbursement of loans to some African countries by commercial banks. The figure above shows how some countries availed agricultural credit to the agricultural sector more than other countries. The countries that gave out more agricultural credit through commercial banks allowed smallholder farmers in those countries had access to agricultural credit than those countries such as who had not considered lending agricultural credit to farmers as a priority. Varied African governments have adopted different policies, which is why there are disparities in how various African nations issue agricultural credit. As shown by the following graph, some nations, like Mali and Sudan, placed agriculture a higher priority than other nations.

1.1.1 Nigerian Policies to Credit in Agricultural Sector

Nigerian Central Government created credit institutions, plans, and programs to enable agricultural credit flow to farmers in response to the financial demands of Nigerian farmers. The Agricultural Credit Guarantee Scheme Fund (ACGSF) founded in 1978 seemed to be the most ideal program (Nwosu, Oguoma, Ben-Chendo & Henry-Ukoha, 2010). The Nigerian Central Bank (CBN) guaranteed 75 per cent of the loan, and in determining the maximum amount that smallholder farmers were allowed to receive under this program, it had to take into account the principle and interest of the loans they received from agricultural financial institutions (Manyong, Ikpi, Olayemi, Yusuf, Omonona, & Idachaba, 2003). The Nigerian central government established the ACGSF to promote agricultural growth in the nation.

The Federal Government of Nigeria (FGN) created credit institutions, plans, and programs to enable the flow of agricultural credit to farmers in response to the financial demands of Nigerian farmers. The 1978 ACGSF seemed to be the ideal program (Nwosu, Oguoma, Ben-Chendo & Henry-Ukoha, 2010). Considered in terms of the principal and interest of the loan received by smallholder farmers from the agricultural sector, the Central Bank of Nigeria (CBN) guaranteed 75 per cent of the loan and the financial institutions had to set the maximum amount in a way that smallholder farmers were expected to receive through this program (Manyong, Ikpi, Olayemi, Yusuf, Omonona, & Idachaba, 2003). Although not the first agricultural credit policy implemented in Nigeria, the Nigerian Federal Government launched the

ACGSF to encourage agricultural growth in Nigeria. The initiative is among the best agricultural credit policies in the country.

According to Nwosu *et al*. (2010), further farm credit programs, institutions, and schemes include the Nigerian Agricultural Cooperative and Rural development Bank (NACRB) of 1972, the River Basing Development Authority (RBDA) of 1979, the Agricultural Development Programme (ADP) of 1972, and the Expansion of Commercial Bank of 1976. The ongoing incapacity of the aforementioned institutions and conventional banks to manage agricultural practises effectively, on the other hand, forced Nigeria to implement additional financial and institutional reforms that would strengthen the agricultural sector by ensuring a constant flow of institutional funds to finance agricultural activities. Changeable and the type of risk involved in agricultural production, the importance of agriculture to Nigeria, the desire to increase motivation so that agriculture can be improved and expanded in order to address food shortages, as well as being able to address the challenges commercial banks and other allied banks encounter and to properly adopt risk-avoidance strategies, all of which, of course, gave reasons as to why (ACGSF) was established by the government (Mafimisebi, Oguntade, & Mafimisebi 2009).

The FGN launched the program using Decree 20 March 1977. It was reviewed again on 13 June 1988, and the program provided N100, 000,000, of which 60 per cent was contributed by the FGN and 40 per cent by ACGSF (Nwosu *et al.,* 2010). ACGSF was upgraded on 8/12/1999 for one billion dollars, and then shortly after that, in early 2006, it was upgraded to four billion dollars (CBN, 2007). 698,200 loans totalling

N42.15 billion have been guaranteed since the scheme's commencement in 1978. Thanks to CBN, it also guarantees 50, 849 loans totalling N7.74 billion in 2010. The amount and value of recovered loans in 2010 totalled 50,119 loans for N5,850,000,000, bringing the total amount and value of loans that have been fully repaid since the ACGSF began operations to 492,845 and N24.05 billion, respectively (CBN, 2010).

These were created to address insufficient agricultural financing issues by banks and other loaning institutions. In addition, to protect these agricultural and commercial banks from the effects of the highest risks associated with agricultural businesses, and also increase the incomes from agricultural ventures in order to enable the repayment default rates among smallholder farmers to be reduced (Ogwuma, 1985; Eyo, 1985; Oguoma, 2002). The growth of particular agricultural products including cassava, cocoa, and palm oil is intended to be financed by a number of recent measures that the presidency has recommended. Additionally, in order to boost the agricultural sector, the Federal Government of Nigeria has given the Central Bank of Nigeria permission to give N200 billion to both large-and small-scale farmers. Smallholder farmers in Nigeria have adopted the outcomes of improved agricultural inputs, innovations, and skills on agricultural output due to their burning desire. Most farmers in Nigeria are smallholder farmers and are confronted with challenging cultural, social, and economic situations, agricultural inputs use and high yielding methods acceptance have prepared the way for the demand for agricultural loans to increase (Ihegboro, 2014). Despite the fact that more than 70 per cent of Nigerians are involved in agricultural practices, the contribution of the GDP to agricultural productions in

Nigeria is continuously declining and cannot satisfy the country's food needs. Due to this, Nigerian agriculture is unable to fulfil its essential responsibility of providing the country with food, and food imports have continued (Ihegboro, 2014).

Awotide, Aihonsu, and Adekoya (2012) claimed that the Nigerian Government recognised agricultural credit access and developed various agricultural programs like Agricultural Credit Support Scheme (ACSS) and Agricultural Credit Guarantee Scheme (ACGS) that were tasked with making sure that smallholder farmers could access agricultural credits more easily. The FGN established the ACGS fund in 1977 with the intention of providing a security for any loans made by financial institutions for agricultural production-related purposes. The Agricultural Guaranteed Scheme Fund was established primarily in the hope that banks would lend money to smallholder farmers so they could engage in agro-processing and agricultural production activities with the aim of improving Nigeria's internal commerce and for domestic consumption. On the other hand, this looked as to put large-scale farmers at a disadvantage position over smallholder farmers, who have a hard time getting bank loans, and also makes it obvious how neglected smallholder farmers are.

1.1.2 Agricultural Credit Accessibility in Nigeria

The moneylenders or intermediaries who buy the finished goods are the peasant farmer's most accessible source of loan. The informal source gives the bulk of the general agricultural credit to smallholder farmers out of all the sources of agricultural credit available to peasant farmers (Miller, 1998). Osuntoguna and Adewunmi (2003) stated that the primary groups that agricultural producers have access to capital

markets are the institutional and the non-institutional sources. In addition to family and friends, produce purchasers, traders, and private moneylenders make up the non-institutional sources of credit. Smallholder farmers typically go to places where people know them and have some amount of trust in them, thus the money they receive from such sources always tends to tilt directly in their favour. Miller (1998) stated that non-institutional source and informal lenders played an important part in providing funds to smallholder farmers.

However, Osuntogun and Adewunmi (2003) moved quickly to make loans available, even though they occasionally tack on exorbitant interest fees. On the other side, the institutional source included commercial and merchant banks, lending organizations, and farmer's cooperatives. Institutional credit has been divided into sources from home and abroad (Akinade, 2002). Domestic sources of financing include cooperatives, friendly societies, and conventional lending groups like "*Esusu*."

However, smallholder farmers in Nigeria are unable to profit from loan programs because they lack a security, which prevents them from receiving financing (Ahmad, 2011, Rahman, Hussain, & Taqi, 2014). Smallholder farmers have trouble getting loans from banking institutions because of security concerns. Because of the sources' rapid payment, which makes it evident that no collateral is required and also offers a certain level of comfort in loan dealings, smallholder farmers in this situation turn to informal sources for agricultural financing. The majority of smallholder farmers would not dare contact banks to request loans due to a lack of collateral because they do not possess the appropriate qualifications (Khandker & Faruqee, 2003; Rahman,

Hussain, &Taqi, 2014). Smallholder farmers frequently want to apply for modest loans to buy agricultural supplies but are reluctant to do so because of insufficient security for larger loans to buy capital equipment for managing the farm (Hussain & Thapa, 2012). The ease with which smallholder farmers in Nigeria can receive agricultural loans depends on socioeconomic parameters like income, age, and family size.

According to Hussain *et al.*, (2012), increasing agricultural output levels through financial institution loans would reinforce the use of a variety of earlier measures. The Central Bank of Nigeria's rule mandated all commercial banks to give loan to the agricultural sector, the nation's most valuable industry, using a fixed portion of their deposits. ACGS asserts that loans seem to imply that certain laws and regulations are either too complex or insufficient to be applied. Central Bank of Nigeria (2016) examined the manner in which the Gross Domestic Product (GDP) has changed with the contribution of the agricultural sector, found a large disparity, and predicted a future fall from 60 per cent at the end of the 1960s.

This disconcerting movement showed how the government's efforts to bring about the desired outcome nevertheless fell short. According to Olaitan (2006), the government's attempt to improve the performance of the agricultural sector has progressively encouraged the issuing of credit to help smallholder farmers improve their financial situation thereby improving agricultural activities. The lending guidelines provided by the government to boost agricultural practices, over time, have proven to be woefully insufficient to fund agricultural production to raise agricultural

sector contribution to GDP. Nwachukwu (2008) supported the notion that the government was required to give loans to smallholder farmers or pay a fine.

If everything else is equal, a limited output capability is basically the result of insufficient financing in the agricultural sector. According to Iheancho (2006), the government's inadequate support, as seen by the annual budgets over the years, has seriously impacted Nigeria's agricultural sector's performance. They believe that 65 per cent of Nigeria's economically engaged population lacks the funds to use banks, which inhibits farmers from investing in the capital equipment they want for their farms. As a result, not up to 50 per cent of Nigeria's arable land is uncultivated (Manyong, Ikpi, Olayemi, Yusuf, Omonona, & Idachaba, 2003).

Smallholder farmers in rural areas are seeing an upsurge in poverty due to Nigeria's ideal endowment of vast mineral resources. Due to adverse policies governing loan borrowing, smallholder farmers are forced to deal with this unfavourable economic condition. Smallholder farmers are rural dwellers who grow their land using outdated farming equipment. They lack the requisite production skills and practices. This is corroborated by the fact that smallholder farming is still very common, despite the government's participation in a number of agricultural initiatives and programs.

The Central Bank of Nigeria (CBN) created the Agricultural Credit Guarantee Scheme (ACGS) to meet the demands of promoting agricultural practices in Nigeria. The ACGS program needs to take proper financing into account in order to give smallholder farmers the funding they need. The ACGS credit is the main source of

financing for agriculture in Nigeria. The ACGS encourages financial institutions to support the agricultural activities of smallholder farmers in rural settlements with the aim of increasing agricultural activity (Olaitan, 2006). The structure of the ACGS loan program makes it very simple for rural farmers, at least roughly 75 per cent of them, to obtain agricultural finance.

1.1.3 Smallholder Farmers, Credit Accessibility and Utilization of Agricultural Credit

Agriculture in Nigeria is not carried out with intention and enterprise. Many farmers work in agriculture for sustenance rather than for profit. Poor output, low income, low savings, low investment, and a lack of collateral for access to credit could all contribute to this. These prevent farmers from amassing the assets required for successful and long-lasting agricultural operations, which results in very poor capital utilisation on their part. To completely shift smallholder agriculture from a subsistence-oriented to a market-oriented one, there must be adequate credit or loan availability (Mgbebu, & Achike, 2017).

One of the most important methods for raising agricultural production is to have access to agricultural loans. Small loans offered to smallholder farmers, known as "microloans," improve the agricultural standing of small-scale farmers by investing the money considered to be loans into tangible assets and people (Okurut, Schoombee & VandarBerg, 2004). The amount of agricultural production will undoubtedly increase with the availability of sufficient and timely finance, and adoption of new knowledge will undoubtedly improve the acquisition and use of some superior

agricultural inputs that are currently out of the farmer's reach (Oladeebo & Oladeebo, 2008). In addition to education level, marital status, and family size status, a study by Nweze (1991) found that loan size, the process by which agricultural financial institutions distribute loans, and promptness in payment and repayment are essential for enabling smallholder farmers to benefit from the loans the agricultural financial institution lent to them and, as a result, improving the agricultural output of smallholder farmers in Nigeria.

Smallholder farmers are thought to generate between 80 person and 90 person of all agricultural products in Nigeria, however they have difficulties since there is a dearth of agricultural funding, often known as capital. The food that is consumed domestically and some of the goods that are traded internationally obviously generate some foreign currency for Nigeria as a nation (Ojo, 1998). The Nigerian Agricultural and Cooperative Bank (NACB), later known as the Nigeria Agricultural Cooperative and Rural Development Bank (NACRDB), the Nigerian Agricultural Credit Guarantee Scheme Fund (ACGSF), Community Banks (CB), and also given hope to the founding of Co-operative Societies in order to provide the agricultural sector, are just a few of the institutions that FGN established as a result of her fascination with this condition (Oladeebo, 2003). Additionally, the Nigerian Federal Government had authorised the country's numerous financial institutions to provide agricultural credit services to the country's agricultural industry (Ajakaiye, 1998).

Even though the Federal Government of Nigeria implemented these policies, it appeared that few smallholder farmers' financial situations had really improved. As a

result, there were food shortages and a shortage of raw materials. The practices and operating methods used by smallholder farmers have not changed. Finding good improved procedures that may entice banks to offer their services to smallholder farmers, who make up 70 per cent of the population, is the fundamental issue that most African countries face (Oriaku, 2010).

Credit is a crucial part of financial services that are required for marketing, product servicing, and all levels of production. To encourage the growth and development of the agricultural industry, sources of agricultural financing must be improved. For older agricultural practices to be adopted, agricultural financing is crucial. The primary justification for agricultural loans is that a greater percentage of smallholder farmers produce modest marketable surpluses that they find it challenging to conserve from their farm incomes and do not fully take advantage of newly developed technology and market privileges (Mgbebu, & Achike, 2017). Agba, Adewara, Nwanji, Yusuf, and Ojipkong (2018) found that credit users had higher productivity, profitability, and net farm income compared to non-users in a study conducted in Kwara State, Nigeria. It was also shown that farmers who had access to funding suffered from poverty less frequently than those who did not.

These authors (Okorie, 1998; Olaitan, 2006; Nto & Mbanasor, 2008; Nwagbo, 1993) have discussed the difficulties in implementing strategies for obtaining agricultural loans. According to Lawal and Muyiwa (2009), the challenges of implementing alternate methods of acquiring agricultural financing cause a delay in the performance of smallholder farmers since these farmers lack the funds to acquire agricultural

inputs and are unable to establish markets for their produce. Of course, the smallholder farmers' current financial predicament has the potential to negatively impact both their productivity and welfare.

Even if smallholder farmers may not have adequate farm resources to operate on, according to Isitor, Babalola, and Obaniyi (2014), the money they receive as loans from financial institutions helps or enables them to perform better. Eswaram and Kotwal (1990) thought that having access to agricultural financing would provide farmers greater resources to work with on the farm and improve smallholder farmers' productivity. It would also enable smallholder farmers to acquire physical capital. Smallholder farmers' performance would be improved, they would be able to buy capital-intensive, better technology, and they would also be able to buy assets if they were able to obtain agricultural credit in the form of loans from financial organisations. More yields would be obtained by the smallholder farmers as a result of better seedlings being added to their agricultural methods, which would also increase their technical efficiency and degree of profit. The same applies to Qureshi (1996) who was of the opinion that increasing agricultural credit as loans would increase smallholder farmers' ability to produce food and increase their income simply because there would be a greater chance of obtaining the loan. As a result, the farmers' ability to support themselves would increase (Ammani, 2012).

According to Nwaru and Onuoha (2010), where farmers' loans are properly expanded and widening, this leads to some stability, increases the production of agricultural

resources, and eventually raises smallholder farmers' incomes because the adoption of agribusiness and its objectivity would have been accomplished (Enweze, 2006).

In the Satara District in Maharashtra, researchers studied the borrowing patterns and cooperative credit usage (Sapkal, 2010). They uncovered and determined that 24.94 percent of the credit amount was not well spent when they examined this situation at the highest level and in the context of medium- and long-term loans. It was observed that 15.12 and 17.95 per cent, respectively, of the total loan amount through borrowing were not appropriately spent. Chidambaram and Ganesan (2002) conducted research on past-due accounts in Madurai district primary agricultural cooperative banks. They noticed that several Primary Agricultural Co-operative Bank borrowers used the money for other purposes than agricultural purposes. They used the borrowed money for social and pious events. When Rao (1987) examined the credit usage framework, it was found that the repayment rate and smallholder farmers' crop credit volume received by from the Andhra Pradesh-based Chaitanya Grameena Bank were intangible. The results of his investigation showed that less than three-fourth of the respondents, 71.25 per cent, utilized the loan fully used for what was intended, and 28.75 per cent had partially used the credit.

1.2 Statement of the problem

World Bank (2019) reported that only 22 per cent of adults' access credit in developing countries compared to about 82 per cent in developed countries. The differences in access to credit between developed and developing countries mirrors the economic growth differences. This shows that access to credit is associated to

growth and development of nations as observed by Osabohien, Adeleye, & De Alwis, (2020). Similarly, Chenaa, Maria and Teno (2018) analysed credit access for agricultural purposes in Africa and found that access to finance is one of the problems that has effect on productivity and by implication on the incomes of smallholder farmers.

However, the United Nations (UN) estimated that 2.7 billion people in the world had no access to formal financial services such as savings accounts, credit, insurance, and payment services, where 80 percent of these are in Africa. Awotide, Abdoulaye, Alene and Manyong, (2015) conducted a study in Nigeria that revealed that only 17 per cent of smallholder farmers had access to the credit for agricultural production purposes. A study conducted in Plateau State by Dawang (2018) also found that only 21 smallholders out of a sample of 80 farmers indicated that they had credit access.

Despite the issue of credit accessibility being evident as described, its link to agricultural output is contradictory. In their interrogations, Ammani (2012) demonstrated that credit access improves agricultural output. This was supported by the findings of Baffoe, Matsuda, Nagao and Akiyama (2014) who analyzed the dynamics of rural credit and its impact on agricultural productivity in rural Ghana Chandio, Magsi, Rehman and Sahito (2017) also found similar results in Pakistan.

On the contrary, Chisasa and Makina (2015) in their interrogation of bank credit and agricultural output in the South African context opined that in the short run, agricultural credit has a negative effect on agricultural output. This is shared with

Reyes, Lensink, Kuyvenhoven, and Moll, (2012) and Enilolobo and Ode-Omenka (2018) who discovered that credit access did not have any effect on agricultural output.

Despite these researches, studies conducted in Plateau State on credit access and agricultural outputs of smallholder farmers are very scanty. For instance, Awotide, *et. al.*, (2015) analysed socio-economic factors and smallholder cassava farmers' access to credit with a focus on Southwestern Nigeria. Another study conducted in Plateau State by Dawang (2018) focused only on the impact of fishery regulatory innovation on income, and nutrition of smallholder households. The effect of credit accessibility, utilisation and agricultural output of smallholder farmers in Plateau State has received very limited attention in the existing literature. Similarly, methodological approach for existing studies was different from the current study. While Awotide, *et. al.*, (2015) focused on cassava farmers and Dawang (2018) focused on fish farmers only. This study adopted a heterogeneous approach on all types of farming activities among smallholder farmers in Plateau State. The purpose of this study was to investigate agricultural credit accessibility and its effects on output of smallholder farmers in Plateau State.

1.3 Research Questions

The study answered the following research questions:

i. What are the determinants of access to agricultural credit by smallholder farmers in Plateau State, Nigeria?

ii. What is the effect of access to agricultural credit by smallholder farmers on agricultural output in Plateau State, Nigeria?
iii. What is the effect of smallholder farmers' credit utilisation behaviour on agricultural output in Plateau State, Nigeria?

1.4 Objectives of the Study

The general objective of this study was to investigate credit accessibility, utilisation and agricultural output of smallholder farmers in Plateau State, Nigeria. The specific objectives were to:

i. Find out the determinants of agricultural credit access by smallholder farmers in Plateau State, Nigeria.
ii. Determine the effects of access to agricultural credit by smallholder farmers on agricultural output in Plateau State, Nigeria.
iii. Examine the effect of smallholder farmers' loan utilisation behavior on agricultural output.

1.5 Significance of the Study

By reporting the Nigerian case, the study added to the body of knowledge on agricultural credit and the Smallholder farmers' agricultural output. Most importantly, the analysis supported the campaign that has been going on to diversify the economy of Nigeria in order to stabilize the declining oil prices. The study clarified how smallholder farmers in Nigeria obtain agricultural finance and how this credit influences agricultural output. The Federal Ministry of Agriculture (FMA), various State Ministries of Agriculture (SMA), the National Bureau of Statistics' (NBS)

agricultural division, the Central Bank of Nigeria (CBN), and research organizations all used this study.

1.6 Scope and limitation of the Study

The study included all Nigerian smallholder farmers, with a specific emphasis on those engaged in agricultural production in Plateau State. This study's main focus was on the availability of agricultural credit to ascertain the agricultural output of smallholder farmers in Nigeria.

Plateau State, like many regions in Nigeria, has a significant portion of its population engaged in agriculture. Understanding the dynamics of agricultural credit accessibility and its impact on smallholder farmers is crucial for sustainable agricultural development in the state. Agriculture is a major contributor to the economic well-being of many communities. Investigating the accessibility of credit for smallholder farmers helps to assess the economic viability of agricultural activities and their potential contribution to the overall state economy. Access to credit can play a pivotal role in enhancing the productivity and output of smallholder farmers. With global concerns about food security, it is essential to examine how credit accessibility influences the ability of farmers to adopt modern agricultural practices and increase their yields.

Governments and policymakers are often interested in understanding the effectiveness of existing agricultural credit policies and programs. This type of research can provide

insights into the strengths and weaknesses of current policies and inform the development of more targeted and effective strategies. Smallholder farmers are often located in rural areas, and their economic well-being is closely linked to the overall development of these regions. Examining the accessibility of credit and its effects on agricultural output can shed light on the potential for rural development and poverty alleviation. The study might be driven by a broader goal of promoting financial inclusion. Understanding the challenges faced by smallholder farmers in accessing credit can inform initiatives aimed at improving financial services tailored to the needs of this specific demographic. There might be a gap in the existing literature regarding the specific relationship between agricultural credit accessibility and the output of smallholder farmers in Plateau State. This study could be an attempt to fill that gap and contribute valuable knowledge to the academic and policy communities. Research on agricultural credit accessibility could also be motivated by a desire to empower local communities. By understanding the challenges and opportunities related to credit, the research may aim to provide actionable recommendations for empowering smallholder farmers and improving their livelihoods.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

For the inquiry, both theoretical and empirical literatures were reviewed. The theory of rational choice, the production function theory, the risk-averse peasant theory, and the credit information asymmetry theory were all discussed in the first section. The second section reviewed empirical literature on factors influencing smallholder farmers' access to agricultural credit, as well as the link between credit access and agricultural output. The third section gave an overview of the literature and discussed how smallholder farmers used their credit.

2.2 Theoretical Literature Review

The study adopted expected utility theory, rational choice theory, production function theory, risk-averse peasant theory and Credit information asymmetry theory in order to explain the agricultural output of smallholder farmers.

2.2.1 Expected Utility Theory

The general normative and taking into account descriptive literature uncertainty under risk has been really occupied by expected utility theory. It is a reality to consider while analyzing input and production choices in agricultural production. (Babcock, Hennessy, & Chavas, 1998; Chavas & Holt, 1990 & 1996; Ramaswami, 1992; Collender & Zilberman, 1985; Feder & Gershon, 1980; Hennessy, 1998). The utility function, which regarded wealth as concave, was a key component of the expected utility theory's framework for explaining risk aversion. Consumers possessed lesser

infinitesimal utility for more wealth. Rabin (2000) propounded a theorem that showed and explained expected utility theory having a completely improbable clarification for substantial risk aversion over small and modest likelihoods. The concave utility function can have relatively minimal risk aversion over tiny and modest likelihoods, indicating that there was a ridiculously high degree of risk aversion over large likelihoods, within the context of anticipated value theory. Winter and Neilson (2001) did a study and found that a utility function of risk trade-off data and wage fatality portfolio choice can both be explained by a single constant relative risk aversion (CRRA) model that takes into account both small- and large-scale hazards. The coefficients of constant relative risk aversion compatible with wage fatality risk premium data according to Neilson and Winter (2001) were lesser than the coefficients compared to the portfolio choice data, and opined that a utility function used to assess high risks are regarded as lesser risk averse compared to those utilized in evaluating small and moderate risks.

Undeniably, the most firmly and empirically well-known characteristic of risk preference, loss aversion, denoted a total deviation to straight and detailed explanation which paved way aversion to risk on a small and moderate scale. According to some, It is said that, smallholder farmers' loss aversion is importantly having more averse to losses compared to the class of smallholder farmers that are attracted by gains (Rabin, 2000). This theory gave good starting point in trying to study how smallholder farmers take decision on how to look for credit for agricultural purposes and whether or not, for the reasons solely for the production of agriculture. Smallholder farmers would like to invest their personal monies into the agricultural activities that have

lower and certain agricultural output other than seeking large amount of credit from lending institutions that they are uncertain about whether the agricultural output will be sufficient to repay the credit.

2.2.2 Rational Choice Theory

According to Green (2003), this theory was utilized by social scientist in a way that the behaviour of consumers was ascertained, and this has really dominated the economic sphere. In the recent decades, other disciplines have adopted the usage of this theory because of its relevance most especially in the social sciences (Green, 2003). The theory considered choice behaviour of either one or more units of decision making of either firms (farms) or consumers. Preferences were considered in the rational choice theory with a utility function. Considering utility, it can be seen that a good or service has the ability to satisfy a definite human want. Foundationally, utility theory was assumed to be seen as that, the farmer who always looked out for different alternatives his/ her expected value of the utility was maximised or utilised. For example, usually a farmer who farmed crops was always faced with the decision of how much of his farm resources such as land and labour should be used in farming cultivation or which crop to produce.

The theory's approach to the above-mentioned challenge was fundamentally dependent on the choices the farmer made in view of the fact that that would assist him/her to realize the goal of properly achieving profit and reducing cost base on other factors that were beyond the control of the farmer. Subsequently, this theory was dependent on some assumptions of consumer preferences. The assumptions were

that the consumer was faced with some alternatives, among these pair of alternatives (A and B), the consumer can decide to prefer A to B, or can decide to prefer B to A, or can decide to be indifferent between A and B. Thirdly, the consumer can decide to prefer A to B and can decide to prefer B to C, it then implied that the consumer definitely preferred A to C but the consumer was certainly indifferent between A and B and also the consumer was certainly indifferent between B and C, then the consumer was indifferent between A and C. The consumer can be indifferent between two choices or more that were preferred to others, the consumer would choose one of the choices with a particular choice that was indeterminate. There were certain properties of the utility function ant they were as follows: Firstly, there was change in utility that related to small increase in the consumption of the quantity of goods. This implied that marginal utility was positive. The second reason was that, the diminishing marginal utility implying positive marginal utility of each good tended to be smaller and smaller even if more goods were consumed. An example of a utility function gave the consumer the leeway to buy two goods. Assuming *x* denoted the number of units of good A that were bought and consumed by the consumer, and *y* denoted the number of units of good B that were bought and consumed by the consumer. In this case, the utility function of the consumer took the following equation

$$U = (x, y) \tag{2.1}$$

U as a function allotted a number on any given set of x and y values.

This theory had results that were known with some level of certainty. Even though, this theory was extended to account for the level of uncertainty. For example, in the

decision of the financial institution to extend credit facility to the smallholder farmer, the banks considered the probability of the farmer in the capacity of the farmer being able to pay or not. Not being able to repay the loan was denoted by pA and being able to repay the loan was denoted by pB. There was a high chance of the occurrence of either of the two with a 100 per cent chance of occurring. The bank maximised the expected utility which was the sums utility in each outcome of the probability that the outcome would occur.

$$pA + pB = 1 \qquad (2.2)$$

The rational choice theory provided the foundation to analyse both the behaviour agriculture credit lender and the farmer. Agricultural credit lender and the farmer made a choice on the type of crop to be produced and or how much of the farmers' farm resources like land and labour should be used in farming cultivation. While the lender of agricultural credit also makes a decision on whom to be given the agricultural credit expecting that farmers will be able to pay back the loans.

2.2.3 Agricultural Production Theory

Several authors defined production as the process through which inputs (factors of production) are changed into outputs. Technology in use and any restrictions on the quantity of inputs had an impact on the quantity of outputs. According to Chambers, (1988); Jehle, and Reny, (2000) production function or production frontier was referred to as the maximum output produced with a given quantity of inputs and given technology. A graph or a mathematical function can be used to define the production function. This theory was expressed as:

$y = f(x_{1,}x_{2,\ldots,}x_i)$ X i was the amount of the ith variable input required to produce the output, and I = 1, 2,..., n (2.3).

y stood for the quantity of the output, and X i was the quantity of the input. Production input was described as being random, fixed, and variable.

These categories were taken into consideration when rewriting the production function as follows:

$$y = f(X_1, X_{2,\ldots,}X_i|X_{i+1\ldots}X_m|X_{m+1}\ldots X_n) \quad (2.3)$$

$(X_{1,}X_{2,\ldots,}X_i)$. Describe the input variables. In the short term, the farmer might change these inputs as he pleased, such as seed and fertilizer. ($X_{i+1}..X_m$) represented set of inputs that the farmer cannot alter immediately. This type of component was identified as land. ($X_{m+1}..X_n$) showed variables that the farmer had no control over. Despite being outside the control of the farmer, these factors occasionally had a considerable impact on yield. This category was represented by the environment and social structures. f(X) must meet a number of requirements in order to be recognized as a legitimate production function, which according to Chambers (1988); Jehle and Reny (2000) are: a) X i0 is finite (inputs must be positive and real); b) $Y \geq 0$ was finite, non-negative) $f(X)$ was for all inputs, f(X), which was everywhere continuous and twice continuously differentiable, was subject to the rule of diminishing returns.

The situation where the marginal physical product eventually started to drop when an extra unit of input was employed was defined by the law of diminishing returns. This necessitated that, at least for a certain range of input use, the second derivative be

negative. Across the economically relevant spectrum of input utilization, $\frac{\partial Y}{X_i} > 0$, and $\frac{\partial^2 Y}{\partial X_i^2} < 0$

2.2.4 Risk - Averse Peasant Theory

According to Ellis (1992), smallholder farmers had to cultivate their crops in extremely difficult conditions that were full of uncertainty, as well as natural hazards like weather, pests, diseases, and natural disasters; market inflations; and social uncertainties like insecurity that was linked to the control of resources like: land tenure, government actions, and war. Peasant farmers' output was put at risk as a result of the circumstances, which forced smallholder farmers to exercise prudence when making decisions (Walker & Jodha, 1986). A smallholder farmer who is risk-averse would prefer to smooth consumption compared to the uncertain stream, which is obviously the case in the context of the incomplete capital markets or underdeveloped institutional arrangements that require a lower risk portfolio adoption of productive activities (Murdoch, 1994; Korir, 2013).

On the other hand, some analysts claimed that the complexity of risks faced by smallholder farmers had prompted them to claim that developing a probabilities model that is independent of the ability to calculate expected returns for a wide range of different prospects or knowledge would result in a complex probability distribution of outcomes (Korir, 2013). The risk-averse peasant theory examined how smallholder farmers engage in agricultural activities and produce under extremely high levels of uncertain conditions. This uncertainty was brought on by natural disasters, which

created threats to farmers' production and influenced smallholder farmers' decisions, forcing them to be cautious.

2.2.5 Credit Information Asymmetry Theory

Some scholars contend that there is knowledge asymmetry between banks and farmers (Conning, 1996; Hof & Stiglitz, 1990 & korir, 2013). According to Schiefer's (1992) definition, agriculture is any production that can be categorized as an activity focused on the economy, This theory focuses on the production and processing of agricultural products, which involves two intricate webs of flows of raw materials, such as inputs for manufacturing, agricultural products, and information of any kind. On the other hand, historically, agricultural credit had received insufficient attention from the research initiatives that had been undertaken. According to Sourovi De (2010), production agriculture needs to be improved via finance sources. Adequate credit at fair interest rates would actually become a crucial factor in the development of agriculture, which, of course, highlights the necessity for wise decision-making. Smallholder farmers who have access to more credit information will make more thoughtful and well-informed decisions than those who do not. Due to the information imbalance that occurs between financial institutions and smallholder farmers, the credit information asymmetry theory examined how smallholder farmers frequently choose informal sources of agricultural finance over official agricultural credit.

2.2.6 Utility Maximization Theory

The utility maximization model was developed primarily to serve as a foundation for analyzing how household behavior responds to interventions in order to compare the

relative advantages of various policies (Mendola, 2007). It takes into account the dual roles that households play as consumers and producers, and it makes it possible to examine how they behave when making decisions about consumption and production at the same time. The concept of full income is included. Households were envisioned as being both a production unit that converted both owned resources and acquired commodities and services into use values or utilities when consumed. It aimed to optimize utility by use of all accessible commodities, including leisure, market-purchased products, and things that were created at home (Singh, Squire, & Strauss, 1986). The consumer's issue was described as follows

$$Max\ U = U(X_a, X_m, X_l) \quad (2.4)$$

Subject to

$$P_m X_m = P_a(Q_a - X_a) - P_t(L - F) - P_v V + E \quad (2.5)$$

$$X_t + F = T \quad (2.6)$$

$$Q_{a=}(L, V, A, K) \quad (2.7)$$

where; (2.6), (2.7) and (2.8) were the cash income constraint, time constraint and production constraint, respectively; *Xa, Xm and* X_l represented an agricultural staple, a market purchased good and leisure, respectively. *Pm, Pa,* P_l and *Pv* were the market prices for market purchased commodity, agricultural output, the market wage and price of variable input such as fertilizer, respectively; *Qa* was the market surplus; *L* was total labour input and F was family labour input; *V* was a variable input such as fertilizer; *E* was any non-labour or non-farm income; *T* was total stock of household time; A and K were fixed quantities of land and capital inputs.

Where production involved one crop and there was perfect substitution between family and hired labour, riskless production, and all markets exist in which the farmer is a price taker in all, maximisation of the farm household utility subject to the full income constraint yielded the following first order conditions:

$$\frac{\partial Q_a(L,V,A,K)}{\partial l} = \quad P_l \tag{2.8}$$

$$\frac{\partial Q_a(L,V,A,K)}{\partial V} = P_v \tag{2.9}$$

$$\frac{\frac{\partial u}{\partial X_a}}{\frac{\partial u}{\partial X_m}} = \frac{P_a}{P_m} \tag{2.10}$$

$$\frac{\frac{\partial u}{\partial X_l}}{\frac{\partial u}{\partial X_m}} = \frac{P_l}{P_m} \tag{2.11}$$

The usual first order requirements for profit were given by equations 2.5 and 2.6. maximisation (Varian 1992; Mas-Colell, Whinston and Green, 1995; Onono, Wawire & Ombuki, 2014). As functions of output and input prices (P (a,) P l, and P v), the technological parameters of the production function, and the fixed components, their solutions provided the optimal labor (L*) and the variable input V* requested. The absence of the three endogenous variables (X_a, X_m, and X_1) from the functions suggests that they had no impact on household production choices. Their solutions provided the optimal labor (L*) and the variable input V* requested, as functions of output and input prices (P (a,) P_l and P_v), the technological parameters of the production function, and the fixed components. The absence of the three endogenous variables (X_a, X_m, and X_1) from the functions suggests that they had no effect on household production choices. Decisions about production and consumption could therefore be made independently of one another, leisure time and productive time

were separate, and the utilization of family labor was directly related to the wage rate set by the market.

By substituting an implicit production function that links various outputs to inputs for the single crop's production function, the model was expanded to allow many crops:

$$G = \left(Q_{1,\ldots,}Q_{n,}V_{1\ldots,}V_{m,}A_{1,\ldots,}A_{k}\right) = 0 \qquad (2.12)$$

Where Q represents output, V is variable inputs and A is fixed factors.

The extension meant that prices of all the crops under consideration will affect the equilibrium values of inputs assigned to each crop, the farm profit, and the household's overall income so long as a farmer is a price taker in all the relevant marketplaces. (Singh *et al.*, 1986; Meier, 1989).

The decision may not be recursive, though, if there are market inefficiencies present or if some markets are absent because the farm household must determine how much of its total time will be spent on production and how much will be spent on leisure (Meier, 1989; Mendola, 2007). The analysis enlarged the range of limitations to include market inefficiencies and missing markets in order to analyze their effects while maintaining the utility maximization aim to capture such situations. In this approach, the utility maximization model offered a foundation for expanding the output supply function to include pricing of other crops and other variables that can influence production choices. The model was expanded, for instance, in the study by Key, Sadoulet, and de Janvry (2000) to take into consideration the impact of transaction costs on farm household market participation. The utility maximization

theory looked at how households can function as production units that can influence the purchases of products and services as well as possess resources that, when used, can become utilities. According to the theory, utility could be maximized by consuming all available goods, including those made at home, those bought on the market, and leisure time, as long as smallholder farmers abided by their strict income constraints.

2.3 Empirical Literature Review

2.3.1 Determinants of Access to Agricultural Credit

A study on the factors influencing farmers' access to finance in rural Eastern and Western Kenyan areas was conducted by Kiplimo (2013). The credit monetary service providers in the study area were contacted using structured interviews to collect qualitative and quantitative data. Baseline survey data from the International Maize were used for the analysis, and additional data from the Wheat Improvement Center were used to supplement the information acquired. To analyze the data, descriptive and inferential statistics based on the logit model were employed. The study's findings indicate that Eastern and Western regions, in that order, accounted for 41.76 and 58.24 percent, respectively, of the sampled farming households who received credit and financial services. The findings of the combined logistic regression demonstrated that the minor level of influence of education, occupation, and the services of an extension worker were paramount with favorable implications on the availability of credit and financial services in Kenya's Eastern and Western Regions. The current study attempted to borrow from (Kiplimo, 2013) in order to determine whether or not Nigerian agricultural credit factors affect access to credit.

Baffoe and Matsuda (2015) predicted the factors influencing loan amount and credit availability in Ethiopia using both Tobit and probit. Existing resources, a guarantee, particularly high debt, and the head of the household's marital status are some of the primary variables that the study recommended. According to Baffoe and Matsuda (2015), who advocated and implemented a binary method to simply look at the determinants of access to credit and to establish some significant variables like: household size, household efficiency, savings accounts, and livelihood expansion-more importantly, the factors that affected the smallholder farmers' way of behavior to access credit. The current study, which was inspired by Baffoe and Matsuda (2015), likewise used the binary logistic model to determine the relationship between factors affecting access to credit and factors affecting agricultural credit

Biyase and Fisher (2017) conducted study on the factors influencing how some economically disadvantaged families in South Africa obtain formal credit. Despite the fact that there has been significant success in reducing poverty in recent years, the level is still astonishingly high when viewed from a historical and global perspective. Income Dynamics Study (NIDS) data were analyzed using the Heckman Selection model. The study's findings imply that the location of households geographically affects the rate of borrowing by economically disadvantaged families in South Africa, as does the household head's age, race, level of education, gender, and employment. The current study examined whether the same previously described factors of access to credit had an impact on the access to agricultural credit or whether any other

distinct characteristics were responsible for access to credit, drawing on (Biyase & Fisher, 2017).

2.3.2 Credit Access and Agricultural Output

Credit availability was the focus of research by Quach, Mullineux, and Murinde (2005), who discovered a decline in family poverty in rural Vietnam. In the years 1992 and 1993, a cross-sectional study of the surveys from the two families was started. In the years 1997 and 1998, a study was also started. The findings demonstrated that family credit significantly increases the economic well-being of families in line with income per head expenditure, income per head on food, and income per head on non-food. Whether a family is wealthy or poor, credit has a clear impact on their financial well-being in both cases. Credit was shown to have some influence on economically disadvantaged families' well-being, and it was also discovered that criteria including family size and head of household age were practical and thought to have an effect on family borrowing. To determine if credit has a higher favorable impact on agricultural productivity, the current study attempted to borrow from (Quach *et al.,* 2005).

In a study on sectoral allotment, Avinash and Mitchell-Ryan (2009) examined how it affected commercial banks' credit, agricultural development, and growth in Trinidad and Tobago. The study found that commercial bank lending played a crucial role in how people and businesses in Trinidad and Tobago finance enterprises with economic value. According to the study's findings, credit had an effect on agricultural growth by influencing capital investment because of the manner it was distributed through

monetary transmission mechanisms. In order to establish that there is a relationship between credit and investment and to determine its directionality, the vector error correction model was taken into consideration in the research. The model demonstrated clear correlations between requests and the rise of all credit. Nonetheless, a leading study of the relationship between economic growth and lending in a significant non-oil sector revealed the need for further research. The current study attempted to draw from Avinash and Mitchell-Ryan (2009) in order to determine the effects of sectoral credit allocation from commercial banks on agricultural development and improvement.

Using data from Lahore, Punjab, and Pakistan, Bashir, Mehmood, and Hassan (2010); Bashir et al. (2010) conducted research on the effects of credit on agricultural output of wheat crops. Also designated to represent institutional credit sources as an agent is United Bank Limited (UBL). By stratifying the data into the districts, well-designed questionnaires were employed as the research's principal source of data. Ten people from each village were then randomly selected from a list of loanees given by the UBL after two villages from each stratum were randomly chosen. Similarly, the number of non-loanees was picked for the purpose of contrast. The analysis of multiple regressions was performed. Findings indicated that agricultural loans were particularly effective in accelerating agricultural development and enabling farmers to participate in the production process. The existing study employed the treatment effect model to determine the relationship between loan access and agricultural output, whereas the study by (Bashir et al., 2010) used the ordinary least square (OLS) model.

On the institutional effects of loans on Pakistani agriculture's output, Ahmad (2011) conducted research. In the study of Pakistan's agricultural industry, the position of credit was examined. Credit research initially began as a side effect of the agricultural industry. The time series data used in this study covered the years 1974 through 2008. Information was evaluated using the Phillips Perron test and the Augmented Dicky Fuller test (ADF). The study's findings indicated that there are some significant credit positions in the agricultural sector and that having access to credit actually helps to increase agricultural production. In order to demonstrate that access to finance increases agricultural productivity in Nigeria, the current study attempted to draw from (Ahmad, 2011).

Were, Nzomoi, and Rutto (2012) conducted a study in Kenya that examined the performance of the economy, the performance of some sectors, such as manufacturing, health, education, and agriculture, as well as access to bank credit. According to Were et al. (2012), credit had a positive effect on sectoral gross, with the house product being calculated as the real value added. On the other hand, it was also taken into account to what extent the labor that was employed affected the prior economic success of the aforementioned sectors. According to the research, key economic sectors' access to private sector financing has a significant chance of aiding the sectoral expansion of the economy. Since the banking industry is the primary source of credit for the private sector, it plays a crucial role in monetary intervention to ensure that financial resources are obtained for investment purposes. This is necessary to acknowledge that this would lead to the kind of rapid economic growth

that Kenya Vision 2030 foresees. The current study attempted to build on Were et al. (2012) to determine whether or not access to bank credit has an impact on agricultural output in Nigeria.

In a study on the effects of commercial banks published by Ehikioya and Mohammed (2013), they looked at the ease of credit access and productivity performance of several industries in the Nigerian economy between the years 1986 and 2010. The enhanced growth model, which was utilized in the study, was evaluated using Ordinary Least Square (OLS) techniques to show how it incorporates a range of commercial bank credits and the expansion of sector production. In order to assess the variables, the study used stationarity and co-integration. It also examined the use of the Augmented Dickey-Fuller test and carried out an error correction test. The study found that there was a long-term relationship between the performance of sectoral production and a number of parameters, including the provision of credit from commercial banks and other incorporated factors. In Nigeria, it was believed that the manufacturing sector had the highest demand for credit expertise, thus it should receive the highest attention. The study's findings showed that, in addition to influencing credit supply and demand, commercial bank credit also has an impact on sectoral productivity performance historically having a direct impact on the growth of the manufacturing, services, and agricultural sectors. The study, which took inspiration from Ehikioya and Mohammed (2013), set out to determine how loan access affected sectoral production performance, notably in the agriculture sector.

Obilor (2013) evaluated the commercial banks' lending to Nigeria's agricultural sector via the activities of the Agricultural Credit Guarantee Scheme Fund. The study demonstrated that in the middle of the 1970s, agriculture served as the backbone of the Nigerian economy, bringing in more foreign cash than any other sector, ceding its top spot to the mineral industry. The performance of the agricultural sector was threatened by a number of factors, with a lack of funding being the most significant. The findings showed that the distribution of government funds to the agricultural sector, the prices of agricultural produce, and the actions of commercial banks in providing credit to the agricultural sector, as well as agricultural credit guarantee loans for specific purposes, were factors that impacted the agricultural output in Nigeria. According to the research, farmers should be willing to ask for agricultural financing from financial institutions in order to support smallholder farmers' activities and increase agricultural output. The current study attempted to draw on Obilor (2013) in order to investigate the effects of commercial banks' lending on the agriculture sector.

In order to evaluate Pakistan's smallholder farmers' agricultural productivity, Hussain and Taqi (2014) conducted study on ZaraiTaraqiati Bank Limited's impact and the manner in which it provided loans to them. The main informational support for the research was derived from the field survey conducted in Bahawalpur Tehsil, which covered its whole. An analysis of logit regression was conducted. The study came to the conclusion that factors such as family size, household income, farmer education, agricultural credit, and short- and long-term loans all had a favorable impact on agricultural yield per acre. The positive relationship between credit and agricultural

output demonstrated that credit enables farmers to buy better-value or loftier yield variety seeds, fertilizers, and pesticides, and agricultural yield increases because inputs are timely and sufficient. Hussain and Taqi's (2014) regression estimation was utilized in the current investigation to discover the relationship between agricultural finance availability and productivity. Nevertheless, this study also included treatment effect estimation.

Chisasa (2014) used the structural equation model (SEM) method to conduct a study to investigate the relationship between banks' credit availability and growth in South Africa's agriculture sector. A total of 500 smallholder farmers in the provinces of Mpumalanga and the North West were surveyed using structured questionnaires, statistics from 362 responses, and analysis using Analysis of Moment Structures. The survey was limited to the use of the Statistical Package for Social Sciences and included the two provinces. It was discovered that the rise in smallholder farmers' output is not boosted by either long- or short-term loans. On the other hand, it was achieved by the use of short-term debt to acquire improved farm inputs. As an alternative, long-term agricultural debt is employed to acquire capital equipment. The impact of labor on smallholder farmers' increase productivity was also discovered to be favorable. The current study looked at the connection between the availability of bank loans and the expansion of the agricultural industry, drawing on Chisasa's (2014) work.

Ibe (2014) conducted research on the effect that banks' financing of public sector initiatives has on Nigeria's agricultural output. According to the research, elements

that can have a favorable impact on Nigeria's agricultural production include government funding for agriculture, the prices of agricultural products, and commercial banks' cooperative effort to credit the agricultural sector. The study intended to determine the effect of banks' and the public sector's financing actions on agricultural output, using on Ibe (2014).

Awotide, Abdoulaye, Alene, and Manyong (2015) conducted research on the availability of credit and its effects on smallholder farmers' agricultural output in Nigeria. In order to investigate the statistics, the study employed the use of the Endogenous Switching Regression Model (ESRM). The first stage of the ESRM found that the total farm size and livestock unit were favorable in influencing the smallholder farmers' access to financing. The second stage displayed the size of the entire farm and the livestock component, which had a substantial impact on the output of cassava and connected the smallholder farmers who were eligible for credit. Along with the smallholder farmers who had no access to financing, the size of the family, the size of the farm, and the availability of information about assets had a negative impact on the output of cassava. Obtaining loans has a significant impact on cassava production. The current study used data from Awotide et al. (2015) to determine how access to credit affected agricultural productivity.

In order to determine the relationship between total agricultural productivity at the national level in Bangladesh and banking sector funding for agriculture, Sarker, Ghosh, and Palit (2015) conducted a study. An uncomplicated linear regression model was created to aid in the study. The findings suggested that Bangladesh's agricultural

productivity and banking sector financing of the industry were strongly correlated. Also, it was clear that Bangladesh's banking sector credits were promoting monetary insertion. The study, which cited Sarker, Ghosh, and Palit (2015), aimed to determine whether financial institutions in Nigeria finance agricultural activities in order to affect the output of the sector.

In order to investigate the effects of funding on agricultural productivity, economic growth, and poverty reduction in Nigeria, Egwu (2016) carried out a study. The T-test, R-Square, Standard Error Test, Durbin Watson test, ADF/PP unit root and co-integration tests were run in the study using an ordinary least square regression approach. The study's findings showed that the Agricultural Credit Guarantee Scheme Fund (ACGSF) loan to Nigeria's agricultural sector and Commercial Bank Credit to Agricultural (CBCA) sector loans were essential for the agricultural segment output percentage to gross domestic product, thereby lowering the poverty rate in Nigeria. In order to examine the effects of funding on agricultural productivity, the current study attempted to borrow from Egwu (2016) and employed treatment effect estimation.

2.3.3 Credit Utilisation Behaviour of Smallholder Farmers

In his 1991 study, Harikumar looked at the use of loans, past-due amounts, and the issues that prevent an adequate refund and overdue amounts. Unlike Rambabu and Eswaran (1994), it was proven that socioeconomic characteristics do not influence loan repayment. The primary causes of loan non-payment were acknowledged to be crop disappointment and price decline. The current study requested a loan from

Harikumar (1991), which examined the effects of small-holder farmers' credit-use habits on agricultural productivity in Nigeria.

Njoku (1997) looked at the socioeconomic characteristics of the credit beneficiaries and found that it had a significant effect on the farmers' participation in terms of the farmers' performance and their capacity to repay loans under the specific urgent circumstance loan plan in Nigeria. The Cobb-Douglas results showed that a farmer's credit society's performance and ability to refund loans in cases of non-payment depended heavily on the volume of loans, the number of years that members have accrued experience, formal education, household size, loan period, farm size owned by households, farm output of smallholder farmers, asset value, and interest paid on loans by smallholder farmers. The current study attempted to draw on Njoku (1997) regarding how smallholder farmers' actions impacted agricultural output in Nigeria.

Arene (2002) used regression analysis to identify the variables that had a significant impact on the efficiency of the credit repayment process by farmers' groups in Anambra State, Nigeria. Factors include the quantity of the loan, income, educational attainment, and number of years that smallholder farmers have been engaged in farming. At the same time, the distance and size of the family were recognized as not being particularly significant. The current study used Arene's (2002) work on smallholder farmers' credit refund performance as a source of information.

Nguyen (2007) conducted a study and proposed that the success of credit refund from outside sources depends on the length of loan servicing, the size and amount of the

loan obtained, and the profit received by smallholder farmers from their agricultural activities, while the success of credit refund from internal sources, or from the capital of members, depends on the following: length of membership, size of the household, a number of other factors. To analyze the outcomes of gender, loan amount, member experience, and household size that were part of the study, a standard probability model was utilized. The study sought to borrow from Nguyen, (2007) about the credit repayment performance of smallholder farmers.

Ifeanyi, and Blessing, (2012) did a study in Nigeria and adopted regression analysis to find out the factors that might have impacted on the behaviour of smallholder farmers base on the performance of credit refund by smallholder farmers. Among others, factors like: size of loan, income, educational level and number of years of farming experience were put in order to be statistically important whilst on the other hand, it was found that distance and size of households were not vital. For the fact that the size of the households and distance were not well thought out in the study, this made the study to have unfinished outcomes and inadequate information. Borrowing from Ifeanyi and Blessing (2012), the present study looked at the credit refund performance of farmers.

2.4 Overview of Literature

Theoretical research has demonstrated that the anticipated utility theory, rational choice theory, production function theory, risk-averse-peasant theory, and credit information asymmetry theory were all used to examine agricultural loan accessibility and its implications on agricultural production. The rational choice theory established

a correlation between the behavior of smallholder farmers who use credit and agricultural output. The expected utility theory established a correlation between the factors that influence smallholder farmers' decisions to seek out agricultural credit. The production function theory established a correlation between smallholder farmers' access to credit and agricultural production. The risk-averse peasant theory established a link between smallholder farmers' aversion to risk and their ability to produce a crop, and credit information asymmetry explained why there was imbalance in the information available to them from financial institutions.

Agricultural loan availability has been the subject of empirical research, which has indicated that it has an impact on agricultural output. The majority of studies examined the relationship between access to agricultural credit and agricultural output; the current study examined the relationship between agricultural credit access and agricultural output in light of the fact that food scarcity is currently occurring in Nigeria due to a decline in agricultural output. According to empirical research on agricultural output, smallholder farmers were abandoned when it came to obtaining agricultural loans, which prevented them from participating in substantial agricultural activities and, as a result, caused a decline in agricultural output.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This particular chapter served as the study's methodology. The areas that were covered were the research design, the theoretical framework, the empirical model, the definition and measurement of variables, the types and sources of data, the data analysis, the diagnostic tests, and the estimating method.

3.2 Research Design

Cross-sectional research design was used in the study. This research design only involved gathering data from a sizable sample of people regarding the pertinent traits, viewpoints, and behaviors. By examining the correlations between the variables, this unique study strategy accelerated the description of the quantitative nature of the complete population (Glasow, 2005). The design was appropriate for this study because it provided a means for the collection of data on attitudes, perceptions, and preferences of attitudes regarding the accessibility of agricultural credit and its effects on the output of smallholder farmers. It also included the development of a model that was tested against the observations from the sample.

3.3 Theoretical Framework

Due to the fact that the farmers had to choose whether or not to access financing, the study was founded on the rational choice theory (Becker, 1976; 1991; 1996; Kiratu, 2014). The farmers were given a range of options $X_1 \ldots, X_n$. However, as there were

only two sets of possibilities when deciding to obtain credit, the sets were represented as follows:

letA=$\{X_1;X_2\}$ (3.1)

A is the set of potential choices, X_1 is the decision to access credit and X_2 is the decision not to access credit. But being reasonable means taking the big picture into account and prioritizing long-term outcomes over immediate ones. Most of the time, the final and long-term outcomes are dependent on one's views and not always understood with confidence (Grune-Yanoff, 2010; Kiratu, 2014), then X_1 and X_2 become probabilities and thus equation (3.1) became:

A=$\{X_1$,p; X_2, p-1$\}$ (3.2)

Where p is the probability such that $1 \geq p\,(X) \geq 0$ and p + (1- p) =1. Given that farmers in Plateau State are both producers and consumers, utility maximization is applied in this context rather than profit maximization (Caviglia-Harris, 2003), and the likelihood of the following event is thus:

$U(X) = \sum_i [P_i \times U(X_i)]$ (3.3)

This is the case due to the fact that the utility of a probability is equal to the total of outcome utilities weighted by the likelihood that that event will occur (Caviglia-Harris, 2003). As a result, the farmer will select the options based on the utility that each one provides, like in the following scenarios:

$U(X_1) = \sum_1 [p_1 \times U(X_1)] > U(X_2) = \sum_2 [(1 - p_1) \times U(X_2)]$ (3.4)

Then the farmer chooses X_1 and vice versa.

But the utilities $U\,(X_1)$ and $U\,(X_2)$ are in the context of uncertainty because the farmer does not know the outcome with confidence. Moreover, the utilities derived from the

decision (for example, higher productivity, higher revenue) are summed up, therefore the utility derived is expected utility (Varian, 2010). As a result, the predicted utility maybecalculatedasfollows:$E[U(X_1)]$-$E[U(X_2)$ >0 (3.5)

$E[U(X_1)]$-$E[U(X_2)$ <0 (3.6)

Hence if A* be a latent variable denoting accessing credit or not, and A*i* be the indicator of whether smallholder farmer *I* accesses credit or not, so that A*i* =1 if the farmer accesses credit and A*i* = 0 if not, then:

A*i*=A*i*=1 $E[U(X_1)]$-$E[U(X_2)]$ >0; (3.7)

A*i*=A*i*=0 $E[U(X_1)]$-$E[U(X_2)]$<0 (3.8)

Equations 3.7 and 3.8 therefore indicated that the dependent variable was dichotomous in nature, with values 1 if the smallholder accessed credit and 0 if not; as a result, the study employed binary choice models. Equations 3.7 and 3.8 demonstrated that smallholder farmers would use credit if it would provide them with greater utility than it would have if they had not used credit (Caviglia-Harris, 2003; Kiratu, 2014).

3.4 Model Specifications

3.4.1 Determinants of Access to Agricultural Credit

A simple dichotomous variable (Y) with a dummy equal to 1 if the respondent accessed credit or zero otherwise served as the dependent variable for the first objective, which was to determine the effects of smallholder farmers' access to agricultural credit on agricultural output. Due to the estimation and interpretation issues, it was not possible to use traditional regression techniques like OLS in this case (Maddalla, 1983; Muturi; 2012). In order to handle this, a binary quantitative

response model was built, which led to the selection of probit techniques that relied on normal distribution assumptions. This binary variable was thought to be a stand-in for a genuine continuous normal distribution underneath. Within the framework of profit and utility maximization, a group of household demographic and socioeconomic factors had an impact on the farmers' decision to borrow.

Let's consider the farmers' anticipated utility for obtaining credit.

(U_a) be expressed as:

$U_a = \beta_a Z_a + \varepsilon_a$ (3.9)

And the farmers' expected utility for not accessing credit was expressed as:

$U_b = \beta_b Z_b + \varepsilon_b$ (3.10)

Where the Z_a and Z_b were the farmers' observed characteristics, β_a and β_b were parameters, ε_a and ε_b were the random errors associated with choices a and b respectively, for credit access and non-credit access.

Then the difference in expected utility was given as:

$U_a - U_b = (\beta_a Z_a + \varepsilon_a) - (\beta_b Z_b + \varepsilon_b)$ (3.11)

if $U_a > U_b$, then the farmers accessed credit i.e., $U_a - U_b > 0$, on the other hand, if $U_a \leq U_b$, then the farmers did not access credit, i.e., $U_a - U_b \leq 0$. The nature of utilisation of agricultural credit was a discrete choice problem since the farmer might opt to borrow or not to borrow. This was expressed more specifically using a binary choice model such that:

$y_i^* = x_{i'}\beta + \varepsilon_i$ (3.12)

$y_i = 1$ if $y_i^* > 0$ (individual farmer had access to agricultural credit)

$y_i = 0$ if $y_i^* \leq 0$ (individual farmer had no access to agricultural credit)

Where y_i^* was a latent univariate (not observed) which represented the difference in farmers' expected utility between credit access and non-access y_i^* $(U_a - U_b)$. If the difference between expected utility y_i^* was greater than 0, then the farmer accessed credit $y_i = 1$, otherwise the farmer did not access credit $y_i = 0$. The variable $y_i^*$was observed after the farmer had made a decision. Empirically, the model in equation (3.14) was estimated using Binary Probit. In this study, x_i was a vector of individual socio- economic observed characteristics specifically, age, education, marital status, gender, farm size, household income, distance and household size, casual workers, distance to bank, distance to scheme, distance to cooperative, and credit information.

The probability of accessing credit by farmers was;

$$P(y_i = 1 | x_i) = x_i'\beta + \varepsilon_i \quad (3.13)$$

More specifically;

$$P(y_i=1|x_i) = \alpha + \beta_1 Age_i + \beta_2 Education_i + \beta_3 Gender_i + \beta_4 Marital\ Status_i + \beta_5 Sources\ of\ Income_i + \beta_6 Farm\ Size + \beta_7 HH\ Income_i Extra\ worker + \beta_9 HH\ Ssize_i + \beta_{10} Credit\ Information_i + \beta_{11} Distance\ to\ Bank_i + \beta_{12} Distance\ to\ Scheme_i + \beta_{13} Distance\ to\ Cooperative_i + \beta_{14} Type\ of\ Agriculturl\ Activitiy_i + \varepsilon_i \quad (3.14)$$

The coefficients of the model (3.14) were estimated using maximum likelihood estimation (MLE). The equation (3.14) could have also been estimated using OLS, however, this method had some limitations (Verbeck, 2012). Firstly, the value of

$x_i'\beta$ was bounded between 0 and 1, since it was a probability and this may not be achieved in practical application. Secondly, the error term of the linear probability model (LPM) was heteroscedastic.

Before running the probit model, diagnostic tests were conducted to ensure that probit regression assumptions were adhered to before estimation. In this study, the diagnostic tests conducted included test for multicollinearity, link test, Hosmer-Lemeshow (H-L) Test and test for heteroskedasticity.

a) Multicollinearity Test

Variance Inflation Factor (VIF) was employed to determine whether multicollinearity existed in the calculated model. The correlation between the regressors, as well as the degree of that correlation, were determined by the VIF, which has a scale from 1 to 10. Multicollinearity is generally considered to be present when a variable's VIF is greater than 10. (Field, 200).

b) Link Test

When one or more variables are left out of the model or when unnecessary variables are added, the model may be misspecified. The common variance shared by the variables included may be improperly attributed to those variables, inflating the error term, if pertinent variables are mistakenly removed (Obebo, 2018). Model misspecification typically has a significant impact on estimations of the regression coefficients. Link test was performed to determine if the model was appropriately stated (Obebo, 2018). The test is predicated on the idea that if a model is properly

described, any more independent variables cannot be discovered other than by accident. Two new variables are produced by the link test: the prediction variable (*hat*) and the squared prediction variable (*hatsq*). The prediction variable (*hat*), but not *hatsq*, should be significant for a model that has been properly described.

c) Hosmer-Lemeshow (H-L) Test

The Hosmer-Lemeshow goodness of fit test can be used to determine whether observed binary answers, Y, conditional on a vector of variables, x, are consistent with predictions,. In other terms, it is a test of the hypothesis.

$$H_0: Pr(Y=1|x) = \pi \qquad (3.15)$$

Using the Hosmer-Lemeshow (H-L) test, the fitted probit model's goodness of fit was determined. The test examined if binary answers that were observed were consistent with predictions when they were conditional on a vector of covariates (confounding factors). If the number of outcomes in the regression corresponds to the number of outcomes that were actually seen in the data. The probability value of H-L is statistically insignificant when the predictions in the model closely match the data.

d) Breusch-Pagan Test of Heteroskedasticity

The model's heteroskedasticity was examined using the Breusch-Pagan approach. The alternative to the null hypothesis, which was that the error variances are a multiplicative function of one or more variables, was that the error variances are constant (homoscedastic) (heteroscedasticity). When the P-value is significant (Sig 0.00), the null hypothesis of homoscedasticity is rejected. Robust standard errors are

applied when heteroskedasticity is present. Robust standard errors are more resistant to the issue of heteroscedasticity and have a tendency to give a more accurate indication of the real standard error of a regression coefficient.

3.4.2 Effect of Access to Agricultural Credit by Smallholder Farmers on Output

The second objective of the study was to determine the effect of access to agricultural credit by smallholder farmers on agricultural output. Regression discontinuity requires a large number of farmers close to the discontinuity to draw meaningful conclusions, but this is challenging because the characteristics of the variables continue to change as one moves away from the discontinuity line. Therefore, Propensity- Score Matching (PSM) was chosen instead of regression discontinuity method. Similar to the instrumental variable approach, regression discontinuity also produces a local treatment effect. A PSM makes the assumption that farmers who received treatment and those who did not differed not just in terms of the type of therapy but also in terms of factors that affected access and the result. Because the control group (untreated farmers) are statistically equivalent to the treated farmers, it looks out untreated farmers who share the same characteristics as the treated farmers and matches them using propensity scores, establishing a quasi-experiment (Winter, Salazar & Maffioli, 2010). Using the observed variables, the propensity score was used to assess the likelihood of receiving treatment (Pi=1).

(X): Pr Pi = Pr (Pi=1|X) (3.16)

Since 0 < Pi < 1, a probit model was used to estimate the conditional likelihood of participation (propensity score), with the dependent variable being a dummy variable with a value of one if the farmer used credit and zero otherwise (Wooldridge, 2002).

The qualities that affected agricultural output served as the independent variables, recreating the selection process. As recommended by Rosenbaum and Rubin (1983), PSM was used to compare the scores of individuals who received treatment vs those who did not. The result for the treatment and control groups, as well as the difference between the two, served as a gauge for the impact of loan availability related to agricultural output. Hence, the estimated ATE is obtained by taking the mean of these individual impacts (Gertler, Martinez, Premand, Rawlings &Vermeesch, 2011).

$$ATE=E[Y_1(t=1, \mathrm{D}=1) - Y_0 (t=1, D=0)] \quad (3.17)$$

Where Y_1 is the outcome for the treated, Y_0 is the outcome for the non-treated, $t=1$ represents the period of post-treatment, $D=1$ represents credit accessed and $D=0$ did not access credit.

3.4.3 Smallholder Farmers' Credit Utilisation Behaviour

The third objective of the study was to investigate the effect of farmers' credit utilisation behaviour on agricultural output and Propensity Score Matching (PSM) was again chosen simply because of the above stated reason. The study made the assumption that a farmer would produce much more agricultural output if he or she had used the financial resources available to him or her for agricultural production as opposed to not using them. As a result, the study's goal was to quantify how credit

usage behavior affects agricultural output within the framework of impact evaluation or treatment effect, with "accessed credit utilisation" serving as the treatment variable.

Following Heinrich, Maffioli and Vasquez (2010) and Njuguna (2019), suppose δi was the difference between the potential outcome in case of credit use ($Y_1 i$) and the actual outcome in absence of credit use $(Y_0 i)$, which is:

$$\delta i = Y_1 i - Y_0 i \quad (3.18)$$

In general, an evaluation seeks to estimate the mean effect of the treatment by averaging the effect across all the smallholder farmers. This is known as average treatment effect (ATE) given as:

$$ATE = E(\delta) = E(Y_1 - Y_0) \quad (3.19)$$

Where E (.) represents the average (or *expected value*)

The main area of interest, however, is the average treatment effect on the treated, or ATET, which measures the effect of credit use on those individuals who participated expressed as:

$$ATET = E(Y_1 - Y_0 \mid D = 1) \quad (3.20)$$

This equivalently maybe written as:

$$ATET = E(Y_1 \mid D = 1) - E(Y_0 \mid D = 0) \quad (3.21)$$

Where:

D is a dummy variable for whether a farmer has or has not utilized the accessed credit, specifically:

D = 1 if a farmer had used the accessed credit resources.

D = 0 if a farmer had not used the accessed credit resources.

Moreover,

$E\ (Y_1|\ D=1)$ is the expected or average value of agricultural output for those who have used accessed credit in agricultural production or those who received treatment (credit used). These are in the treated group.

$E\ (Y_0|\ D=1)$ is the expected or average value of agricultural output that would have been if those who have used accessed credit in agricultural production had not used it. These are the untreated group.

The problem is that, not all of the parameters in equation 3.20 are observable. Only the $E\ (Y_1|\ D=0)$ is observed since $E\ (Y_0|\ D=1)$ is not observed and depends on counterfactual outcomes. This poses a missing data problem. However, what is observed is the $E\ (Y_0|\ D=0)$, that is, the value of agricultural output for those farmers who have not used the credit resources they had accessed to (Y_0). Thus, one can calculate the difference between agricultural output of those who have used and those who have not used the accessed credit resources, Δ as:

$$\Delta = E\ (Y_1|\ D=1) - E\ (Y_0|\ D=0) \qquad (3.22)$$

By adding and subtracting the term, $E\ (Y_0|\ D=0)$ in equation (3.22) and assuming that there is no selection bias, it can be shown that ATET is equivalent to equation (3.21) (see Heinrich *et al.*, 2010; Njuguna, 2019), that is:

$$\Delta = ATET + E\ (Y_1|\ D=1) - E\ (Y_0|\ D=0)$$

$$\Delta = \text{ATET} + \text{SB}$$

Or

$$\text{ATET} = E\ (Y_1|\ D=1) - E\ (Y_0|\ D=0) \qquad (3.23)$$

where *SB*, the selection bias is the difference between the counterfactual for agricultural output of those farmers who used their credit resources (treated individuals) and the observed outcome for those who did not use their accessed credit (untreated individuals). If this term was equal to 0, then the ATET was estimated by the difference between the mean observed outcomes for treated and untreated.

e) PSM Diagnostic Tests

Model diagnostics used to estimate propensity scores differ from those used in standard logistic regression models. Concern with propensity score estimation is not with the model's parameter estimations but rather with the ensuing balance of the covariates (Augurzky & Schmidt, 2001). As a result, common collinearity worries are unfounded. Similar to model fit statistics, stepwise selection models do not aid in variable selection since they do not employ covariate balancing as a criterion (such as the c-statistic), which is a measure of classification skill (Rubin, 2004). Examining the balance of variables, their squares, and interactions in the matched samples is a useful tactic. This includes covariates that were not initially included in the propensity score model. If imbalance on specific variables or functions of variables is discovered, such terms can be added to a re-estimated propensity score model, which should enhance their balance in the ensuing matched samples (Dehejia & Wahba, 2002).

In this study, it was necessary to check for overlap in the range of propensity scores between the treatment and comparison groups (referred to as "common support") after propensity scores had been computed for each observation. In order to determine whether the matching was successful in balancing the distribution of important

variables in both groups, a balancing test was also carried out to determine whether the differences in the means of the covariates for both groups (those who accessed credit versus those who did not access credit) were insignificant.

3.5 Definitions and Measurement of Variables

Table that follows presents the variable operationalization, indicators and scale used in the measurements.

Table 3. 1: Definitions and Measurement of Variables

Variable	Definition	Measurement
Agricultural Output	Refers to the monetary value of production from agricultural activities	Ratio Scale (Naira)
Access to Credit	Refers to the ability of the smallholder farmer to obtain a loan from a lending institution (bank, scheme or cooperative)	Nominal Scale 1= Yes (Accessed Credit) 0 = No (Not accessed)
Amount of Credit Accessed	Amount of money borrowed and accessed by a small holder farmer from a lending institution	Ratio Scale (Naira)
Credit Utilization Behaviour	Refers to how the smallholder farmer utilized the money that she/he took on credit	Nominal Scale 1= Didn't utilize the credit on agricultural activities 2= Partially utilized the credit on agricultural activities 3 = Fully utilized the credit on agricultural activities
Age	Refers to the age of a small holder farmer in years	Ratio Scale (Years)
Source of income	Refers to where smallholder farmers get income	Nominal Scale 1= Farm Income Only 2= Farming and Employment 3= Framing and business
Education	The total number of schooling years of the HH head of a small holding HH	Ratio Scale (Years)
Sex	Refers to the sex of smallholder farmer as either male or female	Nominal Scale 1= Male 0 = Female
Marital Status	Refers to the marital status of the smallholder farmer either being single, married, widowed, separated or divorced	Nominal Scale 1= Single 2 = Married 3 = Divorced 4 = Widowed
Farm Size	Farm size is the total cultivatable farm land owned by a small holder farmer	Ratio Scale (Hectares)
Household Income	Income refers to the gross earnings of the smallholding household in a year from farm and non-farm activities	Ratio Scale (Naira)
Distance	It refers to the distance (in KM) of the smallholder farmer to the nearest credit institution (Bank, scheme or cooperative)	Ratio Scale (KMs)
Information Availability	Refers to accessing information regarding agricultural credit	Nominal Scale 1= Accessed 0 = Did not access
Household size	This refers to the total number of household members in a smallholding household under the care of the HH head	Ratio Scale (Number)
Number of extra workers	Refers to the number of extra workers engaged by a small holder farmer solely for agricultural activities	Ratio Scale (Number)
Quantity of Fertilizer	The amount of fertilizer used by a small holder farmer on their cultivated farm	Ratio Scale (Amount in Kgs per hectare)
Extension Services	Refers to whether a small holder farmer got a visit from an agricultural officer on their farm to guide them on their agricultural activities	Nominal Scale 1= Yes 0 = No
Quantity of Seeds	The amount of seeds used by a small holder farmer on their cultivated farm	Ratio Scale (Amount in Kgs per hectare)
Mechanized Equipment	Refers to whether a small holder farmer used mechanized method in their farming activities such as the use of a tractor, modern irrigation methods, motor bikes	Nominal Scale 1= Yes 0 = No

Source: Author's Computation (2021)

3.6 Study Area

Plateau received its name from the Jos Plateau and is the twelfth largest State in Nigeria. Nigeria's Plateau lies roughly in the country's center. Plateau State is singular in the nation merely due to its borders, and Plateau takes up a sizeable portion of the Northern and Central regions of Nigeria. Plateau State has a population of 3.5 million people. Despite being in a tropical area, Plateau State has a near-temperate climate with an average temperature between 130°C and 22°C thanks to its higher altitude. The coldest weather, which contributes to Harmattan, occurs between December and February.

Typically, during the months of the dry season, the temperatures are the highest.

In the southern section of Plateau State, the mean annual rainfall ranges from 52 inches to 131.75 inches (57in). The highest rainfall is seen in the months of July and August, which are the rainy season. Tropical diseases like malaria have decreased because of the Plateau's lower average temperatures. This State made it possible for numerous rivers, like the Hadejia Kaduna, Gongola, and Yobe rivers, to originate in the northern part of Nigeria. The majority of Plateau residents engage in mixed farming, which is the main industry in Plateau State (Ejembi, Omoregbee & Ejembi, 2006).

3.7 Target Population

There are 3,206,531 people living in Plateau State, with 458,075 households, of which 10,218 are small-scale farmers, according to the National Population Commission of Nigeria (2006). Due to the fact that agriculture has been the area's primary economic

activity, the study focused on these households that were involved in agricultural activities (National Bureau of Statistics of Nigeria, 2016).

Table 3. 2: Target Population

Zone	Small Holding Households	Percentage
Northern zone	4, 394	43
Central zone	2, 657	26
Southern zone	3, 168	31
Total	**10, 218**	**100**

Source of data: National Bureau of Statistics (2016)

The three geopolitical zones that were selected for this study are made up of Plateau State. The three zones are comparable in that smallholder farmers can be found in each of them. These smallholder farmers start their smallholder farming. Their economic foundation is also the same, and their standard of living is comparable throughout the State. These smallholder farmers from each zone do not cultivate the same crops or raise the same animals, which is the distinction between these three regions.

3.8 Sampling Frame

According to data from the National Bureau of Statistics of Nigeria (2016), the sample frame for the current study included a list of all 10, 218 small holding households in Plateau State, Nigeria . In Plateau State, the smallholder farmers were divided into three strata: the Northern Zone, the Central Zone, and the Southern Zone. This was done as part of the study's stratified multistage random sampling technique. With the assistance of local government and agricultural officers in each region, the respondents were chosen by a straightforward random sampling technique following stratification by region. Each of the smallholders in the sample group had their information recorded, they had been told of the study's goal, and permission to use

their information to conduct the questionnaires had been requested. The HH was directed to specific areas in each home.

The Yamane (1967) formula, however, was employed to calculate the sample size. According to Mugenda & Mugenda, the population was assumed to have a normal distribution with a confidence interval of 95% in order to calculate the sample size (2009). Below is the Yamane formula:

$$n = \frac{N}{1+N(\varepsilon)^2} \quad (3.24)$$

Where n = Sample Size, N = Total population of small holder households, ε = Error tolerance (level) considered to be 0.05 in this study (Mugenda & Mugenda, 2009). Replacing the values in the formula gives:

$$n = \frac{10{,}218}{1+10{,}218(0.05)^2}$$

n = 384 Households

According to Suresh & Chandrashekara (2012); Wayne (1975), a sample size can be adjusted for non-response in order to obtain the desired sample size overall using the following formula:

$$Desired\ Sample\ Size, adjusted\ for\ non\ response = \frac{Obtained\ Sample\ Size}{1 - Non\ Response\ Rate}$$

If there are more than 10,000 people in the population, Mugenda & Mugenda (2009) predicted a non-response of 1 to 10 percent. The overall desired sample size changed when Mugenda & Mugenda (2009)'s estimate of a 5 per cent non-response rate was taken into account.

$$n = \frac{384}{1-0.05}$$

= 404

404 smallholder farmers in Plateau State were thus specifically selected by the study to take part in the survey. The small holding households' HH heads were thus the target.

3.9 Data Type and Source

The study used primary data that was pertinent in establishing the relationship between the study variables, which are the factors that determine smallholder farmers' access to agricultural credit in Plateau State, Nigeria; the impact of access to agricultural credit on agricultural output; and the impact of smallholder farmers' credit utilization behavior on agricultural output in Plateau State, Nigeria. Smallholder farmers were the main source of the original data.

3.10 Pilot Test

Pilot testing was done to see if the questions were clear and easy for respondents to understand. To accomplish this, a thorough pilot exercise was carried out to examine the validity and reliability of the study questionnaire before it was used. After the university's issuance of a data collecting letter, the questionnaire underwent a pilot test in the month of May 2019. This procedure took 14 days to complete. The pilot test's geographical area was Plateau State, Nigeria's Jos North region. A total of 30 questionnaires were pilot tested. Based on Browne's (1995) proposal that a pilot sample size can be as low as 30 depending on the population, this sample size was determined.

Pilot testing was done to see if the questions were written correctly and if the responders would understand them. To do this, a thorough pilot exercise was carried

out to evaluate the validity and reliability of the study questionnaire before to usage. Once the university sent out a letter requesting data, the questionnaire was pilot tested in May 2019. The process took 14 days to complete. The pilot test was conducted in the Nigerian Plateau State region of Jos North. Thirty surveys in total were pilot tested. This sample size was determined using Browne (1995)'s proposal that a pilot sample size can be as low as 30 depending on the demographic. A pilot size should be between 1 percent and 10 percent of the study population, according to Mugenda & Mugenda (2009).

In this instance, a sample size of 30 represented 8% of the 384 people who were the target demographic. The month of December 2020 saw the execution of a second pilot test. This was carried out as a result of the questionnaire's revision. This pilot test revealed that agricultural inputs like fertilizer, extension services, seeds, and mechanized equipment had been overlooked. Before creating the final questionnaire for the main survey, which is attached (Appendix 1), the questionnaire was changed appropriately to make sure that these farm inputs were included. The optimal pilot test strategy for these questions, according to Mohamad, Sulaiman, Sernand, and Salleh (2015), was the use of Inter-Rater Reliability (IRR), which was determined using Measure of Percent Agreement. The identical questionnaires were distributed to the same respondents twice over a two-week period in both pilot study situations.

The percent agreement measure was computed using any differences in the response that were noticed (PAM). With the exception of the second pilot test, which included farm inputs, the two data sets that were obtained in this case did not differ at all from

one another and so had a 100 per cent Agreement with one another. The fact that the respondents responded the same way in both cases showed that they were able to understand the questionnaire. The questionnaire was approved for use in the primary survey based on that reliability metric.

The distribution of a questionnaire to each chosen smallholder farmer served as the primary method of gathering data. A research assistant helped the researcher during the data collection procedure and frequently followed up with the respondents to ensure that a high response rate was attained.

3.11 Data Cleaning, Coding and Presentation

Following the field interviews, the questionnaires were carefully reviewed to ensure that the data had not been corrupted by mistakes, omissions, or inconsistencies. To allow for adjustments and verification with the respondents, this was done on the spot. The replies to the surveys were coded once they had all been completed in order to make analysis easier. The gathered data was then used in analysis with the help of the statistical software STATA.

3.12 Data Analysis

The study used probit regression analysis to accomplish the first objective, which was to examine the factors influencing smallholder farmers' access to agricultural loans in Plateau State, Nigeria. The probit model was appropriate since the dependent variable—access to credit—was measured using a binary scale, and the study sought

to determine the likelihood that the independent factors would have an impact on access to credit.

The study used a treatment effect model and the Propensity Score Matching method to examine the second objective, which was to ascertain the impact of smallholder farmers' access to agricultural loans on agricultural output in Plateau State, Nigeria. The study attempted to prove the validity of access to credit on smallholder farmers' agricultural productivity because it was thought to be a treatment in this particular scenario.

The study also used a treatment effect model employing the Propensity Score Matching approach to examine the impact of smallholder farmers' loan usage behavior on agricultural output in Plateau State, Nigeria, as its third goal. Usage behavior was also thought of as a treatment in this case, therefore the study set out to determine the importance of credit use behavior on smallholder farmers' agricultural output.

CHAPTER FOUR

EMPIRICAL RESULTS AND DISCUSSIONS

4.1 Introduction

The results of the investigation are reported in this chapter together with their analyses. The chapter opens with a presentation and discussion of the findings from the descriptive statistics of all the variables utilized in the analysis. Analyses and discussions of the findings for each of the study's objectives are included in the section that follows.

4.2 Descriptive Statistics

The subsection gave an explanation of the information gathered. There was a presentation of the description of the continuous data as well as the categorical data in this part. Also, a cross-tabulation of loan availability and a few categorical demographic parameters was carried out to describe the demographic profile of the small holder farmers in connection to other category demographic factors. Moreover, independent sample t-tests were conducted to see whether there was a statistically significant difference between the farmers who received finance and those who did not in regards to a few chosen criteria.

4.2.1 Descriptive Statistics of Continuous Variables

In order to ascertain the socioeconomic background of the respondents, a description of their profile was done. This subsection also includes a description of the profile of smallholder farmers in Nigeria based on continuous data. Age, education (years of

education), farm size (Ha), farm size under cultivation (Ha), amount of household income (Naira), household size, number of household members who work on the farm, number of extra workers engaged on the farm, number of extra workers engaged on the farm per month, amount of credit accessed, and distance to the nearest bank, scheme, and cooperative (Kms) descriptive statistics for continuous variables were also established.

Additionally, there was a descriptive analysis of agricultural output that included crop output in Naira, livestock output in Naira, total agricultural output in (Naira), percentage of crop produce sold, percentage of livestock produce sold, percentage of agricultural produce sold, crop output per hectare in Naira, livestock output per hectare in Naira, and total output per hectare. The lowest value, maximum value, mean, and standard deviations were established in this section. The descriptive statistics for the continuous data were displayed in Table 4.1.

Table 4. 1: Descriptive Statistics of Continuous Variables

Factor	N	Minimum	Maximum	Mean	Std. Deviation
Age	399	23	80	51.07	16.74
Education (Years of Schooling)	399	0	16	10.23	5.18
Farm Size (Ha)	399	0.3	4	2.12	1.13
Farm Size under Cultivation (Ha)	399	0.2	3.6	1.82	0.94
Amount of Household Income (Naira)	399	30,000	6,860,000	1, 858,170	1,623,251
Household Size	399	1	7	4	1.89
Number of Household members who work on the Farm	399	1	5	2	1.18
Number of Extra Workers engaged on the Farm	399	0	7	1	1.45
Number of Extra Workers engaged on the Farm per Month	399	0	5	1	0.96
Amount Credit accessed	399	396,184	65,355,000	1,093,697	5,105,559
Distance to the nearest Bank (KMs)	399	0.1	10	6.92	2.02
Distance to the nearest Scheme (KMs)	399	0.1	10	6.27	2.36
Distance to the nearest Cooperative ((KMs)	399	0.1	10	6.59	2.16
Total value of Agricultural Output (Naira)	399	26,340	5,372,000	1,470,173.29	1,274,071.88
Proportion of Agricultural Produce Sold	399	0.104	0.982	0.402	0.153
Total value of agricultural Output per Hectare	399	24,366	8,166,000	843,648.48	1,095,755.39
Quantity of Seeds per Ha (For Mixed and crop farmers only)	317	534.1	6,630	1195.96	737.14
Quantity of Fertilizer Per Ha (For Mixed and crop farmers only)	317	0	1,697.5	347.28	245.21
Total Sample Size (n) = 399					

Source: Source: Author's computation based on Survey data (2021)

The findings (Table 4.1) showed that the sampled small-holder farmers in Nigeria's Plateau State were 51 years old on average. The small-holder farmers whose samples were taken ranged in age from 23 to 80. With a standard deviation of 16.74, it was clear that there was little variance in the average age of the small-scale farmers, suggesting that the bulk of them were between 51 and 65 years old.

This suggests that the small-scale farmers in Nigeria's Plateau State were, on average, 51 years old. In contrast, few young people in Nigeria are involved in small holdings, which Dan-Azumi (2011) argued that it is likely due to their migration to

metropolitan areas and their decision to attend school. The results are in line with a World Bank report from 2014, National Survey and Segmentation of Smallholder Households in Nigeria, which showed that a sizable older generation makes up the majority of Nigeria's smallholder population. Of the heads of smallholder households, 55 per cent are over the age of 49, and only 10 per cent are under 30.

A farmer's knowledge, education, skills, health, and values all have a direct impact on how productive their farm is (FAO, 2018). Farmers' use of and combinations of inputs are influenced by their knowledge and expertise. They also aid in obtaining and digesting technology and knowledge, and they have an impact on farmers' capacity to modify their methods in response to a given circumstance or to changing demands. Human capital is frequently measured by economists using the number of years spent in school (a type of human capital stock) or expenditures on education and health (human capital investments) (FAO, 2018). Hence, the number of years spent in school was used in this study to evaluate human capital.

The study's findings showed that, given Nigeria's adoption of the 6-3-3-4 educational system, the sampled small-holder farmers in Plateau State had an average amount of schooling of 10.23 years, which is equivalent to junior secondary school. The highest number of years of education recorded was 16 (equivalent to a university degree), while the lowest was 0. (equivalent to lack of formal education). The results also showed that there was a large variation in the number of years of schooling among the small holder farmers sampled for the study, with the standard deviation for years of schooling being 5.18, which is considered to be wide.

According to the results, the majority of small-holder farmers in Plateau State, Nigeria, have had an average of 10 years of education, which is the equivalent of a secondary education. In comparison to other nations, an FAO (2015) analysis showed that Ethiopian small holdings had less years of education, at 2 years, 4.6 years in Tanzania, and 3 years in both Nicaragua and Bangladesh. These results are in line with a World Bank (2014) National Survey and Segmentation of Smallholder Households in Nigeria report, which found that four out of ten smallholder household heads in Nigeria didn't go to school, while 20 percent of them went to primary school and 26 percent went to secondary school. Those who completed secondary school were only 9 per cent.

The results in Table 4.1 also showed that the small holder farmers sampled for the study had an average farm size of 2.12 Ha. The small-scale farmer who owned the smallest plot of land had 0.3 hectares, whilst the one who owned the largest had 4 ha. The majority of the small holder farmers in Plateau State, Nigeria, had a piece of land that was not significantly different from 2.12 Ha, according to a standard deviation of 1.13, which suggested that the difference in farm size among the farmers was quite minor. These results suggest that smallholder farmers in Nigeria's Plateau State typically own up to 2.12 Ha of land. When comparing these results to those from other areas, the size of the farms varies just slightly.

According to FAO (2015) research on the analysis of smallholder farmers based on data from 9 countries, the average size of a smallholder farm in Asian nations is comparatively smaller, such as 0.24 Ha in Bangladesh and 0.32 Ha in Vietnam.

Nonetheless, smallholder farms in Africa can be comparatively larger, averaging 0.47 Ha in Kenya and 0.9 Ha in Ethiopia. Smallholder farms are typically larger than 2 hectares in Latin American nations, such as Nicaragua, where the average small farm size is 5 hectares. According to the National Agriculture and Food Security Strategy (NAFSS) (2010-2020), Federal Republic of Nigeria, the land size of a small-holder farmer in Nigeria ranges from 0.1 to 4.99 hectares.

According to the study's findings, which are presented in Table 4.1, the sampled small holder farmers' cultivated farms ranged in size from 0.2 ha to 3.6 ha. The minimum size was 0.2 ha. The study's small-holder farmers sampled cultivated up to 1.82 Ha on average. With a standard deviation of 0.94, the study's sample of small holder farmers showed that the amount of their farmed land did not differ significantly from one another. The results suggest that small-scale farmers in Nigeria's Plateau State typically cultivated up to 1.82 Ha of land. So, the majority of the farmers fulfill the broad definition of smallholder farmers that is common in many of Africa's developing nations and is the focus of this study. This is in line with a study by Dan-Azumi (2011), which found that the majority of Nigeria's small-holder farmers cultivate between 0.2 ha and 2 ha of land, while 40.4 per cent of them do so between 2 ha and 4 ha.

With a large standard deviation of 1,623,251, it was determined that the average household income of the small holder farmers sampled in Plateau State, Nigeria, was 1,858,170 Naira (4,556 USD) annually. This indicates that there was a wide range in the HH income among the small holder farmers. Moreover, among the sampled HH,

the lowest annual HH income was 30,000 Naira (73.24 USD) and the highest was 6,860,000 Naira (16,746.42 USD). This suggests that a small-holder farmer in Plateau State earned an average HH income of 1,858,170 Naira (4,556 USD) year. The results are in line with a survey conducted by the FAO in 2009 on the demographics of small holdings in Africa, which determined that small-holder farmers in Kenya generate an annual gross income from farming alone of approximately $2,527, depending on the size of their farm. The number is probably going to rise given the variety of sources of income from non-farm activity. The results don't match those of a research by Dan-Azumi (2011), which found that, depending on the activities undertaken in addition to farming, the shared HH income of a small holder farmer in Nigeria ranges from 2.2 million Naira (16,272 USD) to 2.2 million Naira (16,272 USD).

In Nigeria's Plateau State, the studied small-holder farmers' average household size was 4, which suggests that there are typically 4 people in each family. Among the sampled smallholder farmers, the minimum and maximum HH sizes were 1 and 7, respectively. The sampled farmers' HH sizes varied little from the mean of four, according to the standard deviation of 1.89. According to the data, small-scale farmers in Nigeria's Plateau State typically have a family of four. In a similar vein, Yusuf et al. (2016) observed that the average HH size of a small holder farmer in Nigeria was 5.

The Federal Republic of Nigeria Ministry of Agriculture and Rural Development reported that the average household size of small holders in Nigeria was 5.5 in its National Agricultural and Food Security Strategy (NAFSS) (2010-2020). According

to statistics from the National Bureau of Statistics, Nigeria (2020), a rural home in Nigeria has an average size of 5.1 people, while an urban household has an average size of 4.7 people. According to the findings in Table 4.1, an average of 2 members each family worked on the farm, which is the number of HH who are employed there. The lowest and maximum numbers were 1 and 5. A standard deviation of 1.18 denotes a minimal difference in the number of HH among the households who worked on the farms. According to the data, family members are used by small-scale farmers in Nigeria's Plateau State to help out on the farm; each household has an average of two family members working there.

According to FAO (2015) analysis on the demographic characteristics of small holdings in a few chosen countries, family is the primary source of labor for smallholders. In Kenya, there are typically two family members working on a hectare of land, nearly five family members work on a household farm in Nepal, two family members work on a hectare of land in the Plurinational State of Bolivia, and three family members work on a hectare of land in Albania, which has a more developed agricultural sector. According to the Federal Republic of Nigeria's National Agricultural and Food Security Strategy (NAFSS) (2010-2020), smallholder farmers in Nigeria consider farming as a family business. As a result, family members make up the majority of the labor force, which ranges from 2 to 5 people per hectare.

More information on the households' use of additional farm employees was determined by the study. According to the findings in Table 4.1, the sampled respondents employed 1 more worker on the farm in average. 7 more workers were

hired at most, while none were hired at the very least. Given that the small holder farmers sampled for the study had a high standard deviation of 1.45, it is likely that these farmers employed a variety of additional labor. The fact that no additional farmers were employed on a monthly basis on average was also disclosed. While some were unable to hire additional labor, some small-scale farmers employed as many as 7 laborers per month.

According to the data, some small-holder farmers in Nigeria's Plateau State reportedly hire an extra one to no one person per month to help with agricultural tasks. So, the hiring of additional labor may only be classified as seasonal when it is necessary and not on a regular basis. Smallholders do employ workers, albeit on a seasonal basis, according to an FAO (2015) research on the demographic characteristics of small holding in selected countries. For farms between 0.18 ha and 3.5 ha in size, supplemental labor typically consists of two individuals in Kenya, Ethiopia, and Nicaragua, and three people in Nicaragua. According to a study done in Nigeria by Dan-Azumi (2011), the majority of small-holder farmers there were unable to employ more labor, whereas 23% of those that did so were limited to hiring only a few individuals (between 2 and 5) on occasion during the crop season.

According to Table 4.1's statistics, the sampled small-holder farmers had access to credit on average for 1,093,697 Naira (2,655 USD). Furthermore, it was mentioned that some small-scale farmers had no access to finance at all, but others did. Amounts accessed ranged from 396,184 Naira (1,039 USD) for those who used agricultural credit to 65,355,000 Naira for those who didn't (158,693 USD). The small holder

farmers' access to finance was highly variable among them, as seen by the large standard deviation number of 5,105,559, which was reported. According to the results, Nigeria's Plateau state's small-holder farmers got credit in significantly varying amounts. These results are in line with a survey conducted by the International Financial Corporation (IFC) in 2014 on the availability of financing for smallholder farmers in Latin America, which found that, on average, they borrow between 1, 175 and 2, 350 USD for agricultural purposes. For each smallholder farmer selected, the study determined the typical travel time in kilometers to the closest agricultural lending institution, such as a bank, scheme, or cooperative.

According to Table 4.1's data, some of the study's small-holder farmers traveled only 0.1 kilometers to the bank, scheme, or cooperative that was closest to them, while others traveled as far as 10 kilometers. It was found that, on average, the studied small-holder farmers had to travel 6.92 kilometers, 6.27 kilometers, and 6.59 kilometers to reach the nearest cooperative, bank, or scheme. Given that the majority of the small holder farmers were from the same region and had minor standard deviation values of 2.02, 2.36, and 2.16, it was determined that these institutions' distances from the small holder farmers were not significantly different.

The results indicate that although while the tested small-holder farmers traveled less than 10 kilometers to the closest cooperative, bank, or scheme, the average distance to the nearest bank was 6.92 kilometers, which was greater than the distance to the nearest cooperative or scheme. In actuality, the distance to the closest scheme (6.27 km) was the shortest in comparison to the distance to the closest cooperative or bank.

To put it another way, if proximity and distance are taken into account, it was significantly simpler for the small holder farmer in Nigeria's Plateau State to access a program than a bank or a cooperative. This can also be supported by the argument that, in comparison to banks and cooperatives, more scattered schemes (with larger coverage) exist in the research area.

The Federal Government of Nigeria (FGN) established numerous Agricultural Credit Guarantee Schemes (ACGS) to extend agricultural credit products to small holding farmers. By doing so, the federal government increased its coverage and decreased the distance to the nearest scheme in comparison to other financial institutions throughout Nigeria (Enh). This program justifies the distribution of schemes. Smallholder farmers in Tanzania who had their access to bank credit evaluated by Isaga (2018) claimed that commercial banks were by far their preferred source of funding when compared to other options.

It was determined that the average annual value of agricultural output for small-holder farmers in Plateau State, Nigeria, was 1,470,173.29 Naira (USD 3,588.94). The sampled farmers' output ranged from 26, 340 Naira (USD 64.3) to 1,470,173.29 Naira, with the largest figure recorded at 1,470,173.29 Naira (13,113.96 USD). Given that the sampled small holder farmers' agricultural output values fluctuated greatly, the high standard deviation of 1,274,071.88 suggests that this was the case. Adeniyi (2019) noted that the minimum value of agricultural output of the smallholder farmers in Northern Nigeria was N17 000 Naira in their study on sustainable irrigated

agriculture for food security and poverty reduction among these farmers (USD. 41.5). A factsheet from an FAO (2019) survey on Nigeria's small family farms revealed.

It was discovered that the small holder farmers sampled in the study generate an average of 843,648.48 Naira (USD 2,223.20) per hectare per year, which was the value of agricultural production per hectare, which was a more thorough indicator of productivity. According to an FAO (2018) research, smallholder farmers in Tanzania who cultivate an average of 0.9 hectares of land generate $780 worth of food per hectare. The results are in line with those of a survey by Consultative Group to Aid the Poor (CGAP) from 2017, which found that the average value of agricultural produce per hectare for a small-scale farmer in Nigeria was USD 3,180 per year. When it comes to the percentage of food sold, it has been determined that small-holder farmers sell an average of 40.2 percent of their crop, with a standard deviation of 25.3 suggesting that the variance in the percentage of produce sold among the farmers is quite wide. In addition to local marketplaces, the majority of small-scale farmers sold their produce informally. According to the results, a bigger portion (59.8%) of agricultural output in Nigeria is produced for subsistence, which qualifies the FAO's (2015) description of small holdings, according to which the majority of small holders produce for subsistence. The results, however, are in line with an FAO research from 2018 that suggested that up to 31 per cent of a small holder farmer's farm output could be lost to eutrophication.

To guarantee consistency across the small holders, the number of seeds (measured in kg) that each farmer utilized on their land was estimated per hectare. This was based

on the methodology used in reports by the FAO (2015), FAO (2019), and the Federal Government of Nigeria on small holdings, which found that calculating the amount of seeds (in kg) that a farmer used per hectare was a better measure than determining the value of seeds in monetary terms because farmers buy the seeds from different shops (wholesale or retailers), and others receive them at subsidized rates, which significantly vary. The findings showed that the crop farming or mixed farming smallholder farmers who took part in the survey used an average of 1,195.96 Kg of seeds per Ha. The minimum and greatest amounts used per hectare were respectively 534.1 and 6, 630. These results are in line with the findings of the FAO (2019) research on small holding in Nigeria, which showed that small holders there used 1,040 kg of seeds on average per hectare.

To maintain uniformity among the small holders, the amount of fertilizer each farmer used on their land was calculated (in kg) per hectare. This was also based on the methodology used in reports by the FAO (2015), FAO (2019), and the Federal Government of Nigeria on small holdings, which found that calculating the amount of fertilizer (in kg) that a farmer used per hectare was a better measure than determining the value of fertilizers in money terms because farmers buy the fertilizers from different shops (wholesale or retailers), and others receive it at subsidized rates, which significantly vary.

The findings showed that small-holder farmers who engaged in crop farming or mixed farming on average used 347.28 Kg of fertilizer per ha. The minimum and greatest amounts used were 534.1 per ha and 6, 630 ha, respectively. While some farmers only

used manure or no organic fertilizer at all (particularly mixed farmers who used livestock dung), others used up to 1,697.5 Kg of fertilizers per Ha. These results are in line with the FAO's (2015) analysis on small holdings worldwide, which found that fertilizer use by small holders varied greatly between nations. The typical use of inorganic fertilizer is 20 kg per acre for Ethiopian farmers, Almost 130 Kg of fertilizer are used on average per acre in Europe. Smallholders in Bangladesh utilize 181 kg of fertilizer per hectare, suggesting that they use inputs more intensively than larger farmers, who apply 66 kg per ha on average. The average crop yield for small-holder farmers was also examined, as seen in Figure 4.1.

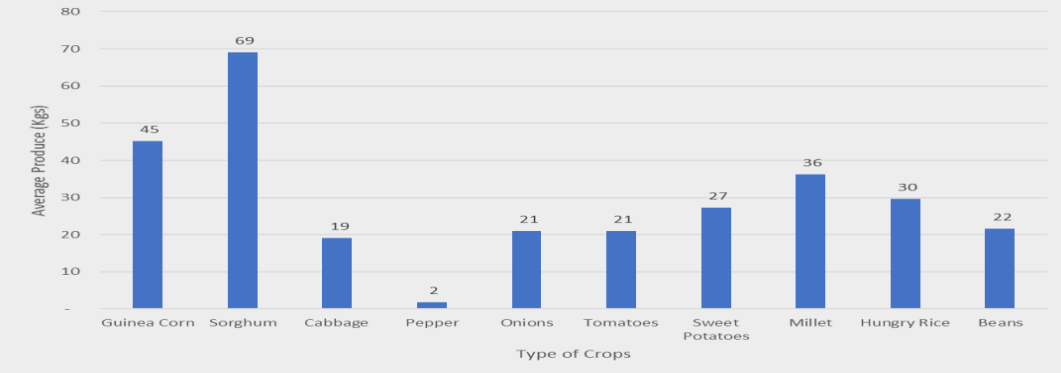


Figure 4. 1: Average Produce per Crop (Kgs)

Source: Author's computation based on Survey data (2021)

According to Figure 4.1, the average yield of Guinea corn produced by smallholder farmers in Plateau, Nigeria, is 45 kg, and the average yield of sorghum produced by smallholder farmers in Plateau State is 69 kg. Sorghum production is more popular among farmers than any other crop because of its high economic worth. Farmers in Plateau State produce an average of 19 kg of cabbage per cropping season. Farmers also produce 2 kg of pepper, despite the fact that households in the state do not eat a lot of the crop and that it has little economic value. 21 kg of tomatoes and onions are

produced by farmers in Plateau State. This indicates that farmers start their production with the same inputs and that the crops have the same economic worth because the rate of consumption of these products is the same. In Plateau State, farmers grow 27 kilograms of sweet potatoes. Since this crop is one that produces carbohydrates, farmers often enjoy starting a production of it because it is very cost-effective for the farmers in the State and serves as a food and a cash crop. In Plateau State, farmers grow up to 36 kg on average of millet due to its economic importance. Due to the fact that after harvesting, farmers consume some of it and sell some of it, it serves as both a food crop and a cash crop. The average amount of hungry rice produced by Plateau State farmers is 30 kg. This further demonstrates the significant economic significance of hungry rice, which is another reason why farmers in the State start producing it. Finally, although beans have economic worth, it is not comparable to other crops that have been addressed. Farmers in Plateau State produce 22 kg of beans.

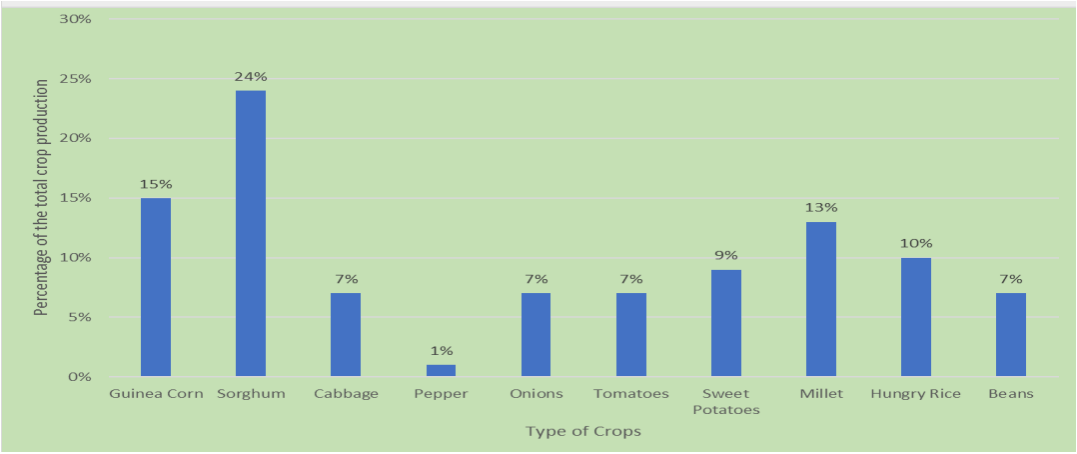


Figure 4. 2: Small Holder Crop Diversification

Source: Source: Author's computation based on Survey data (2021)

It was found that people who practiced either mixed farming or single crop farming grew more than five different types of crops on the same piece of land, including, but not limited to, cabbage, pepper, tomatoes, onions, sorghum, millet, guinea corn, sweet potatoes, beans, and hunger rice. Also, those that engaged in mixed farming or livestock husbandry kept more than three different species of animals at once, including cattle, goats, sheep, chickens, turkeys, and dugs, among others. Sorghum (24 per cent) Guinea corn (15 per cent) Millet (13 per cent) and Hungry rice (10 per cent), which are main commodities in Plateau State, Nigeria, made up the majority of the food produced on average. Although the small farmers supplemented these with other crops, pepper, which was mostly grown for domestic use, was the least produced.

The fundamental justification for growing a range of crops is that small, underprivileged farmers, who might not be fully integrated into markets, opt to produce both their main staple and a variety of other crops in order to improve nutrition. Smallholders diversify their crops as a risk management technique to sustain their income, even if they are commercialized and sell and purchase food in the market. They reduce their exposure to risk, such as price shocks, by planting a variety of crops. Even though specializing in a single crop boosts efficiency, underprivileged smallholders diversify to disperse risk across a variety of crops.

These findings are in line with an FAO (2015) report that shown how small farmers produce more than four different types of crops in Kenya, Tanzania, Nigeria, Brazil, and other nations throughout the world to supplement their diets while reducing risk.

Similar findings were made by Nosiru (2010), who found that small landowners in Nigeria's Ogun state grew more than five different kinds of crops on their farms.

Figure 4. 3: Average Number of Livestock Owned

Source: Source: Author's computation based on Survey data (2021)

The results indicated that the sampled smallholder farmers have diversified their livestock and each farmer keeps an average of 4 goats, 4 sheep, 5 poultry such as chicken and turkey and 4 cattle among other livestock. The most reared animals were poultry making up 34 percent of the entire number, followed by goats and sheep making up 22 percent each and cattle which was 23 percent. Most of the smallholders kept the poultry for eggs and meat; goats and sheep were kept for milk and meat while cattle were mainly kept for milk apart from oxen and bulls which were also partly used for cultivation. Additionally, the smallholders used manure from the livestock as fertilizer. In cases where the animals were sold, it was mainly in emergencies and the frequency of selling livestock was very low, mostly when an emergency arises.

This is consistent with FAO (2015) report which documented that most smallholders kept more poultry and other smaller livestock like sheep and goats compared to cattle since cattle is more costly to buy and maintain whereas the smaller animals are more convenient to sell quickly when in need. Additionally, poultry and smaller animals breed faster and can often thrive on harsher terrain. For many smallholders' "backyard" poultry production is the least costly and offers the highest return on investment.

From Figure 4.3, the average number of goats, sheep and cattle produce per hectare is 4 each. It can be seen that the rate at which farmers keep goats, sheep and cattle are the same and also in Plateau State, farmers consider their economic value to be the same. Farmers in Plateau State embark into the rearing of chicken and produce 5 chickens per hectare on the average. This is consistent with FAO (2015) report which documented that most smallholders kept more poultry and other smaller livestock like sheep and goats compared to cattle since cattle is more costly to buy and maintain whereas the smaller animals are more convenient to sell quickly when in need. The following table shows the type of Livestock Kept.

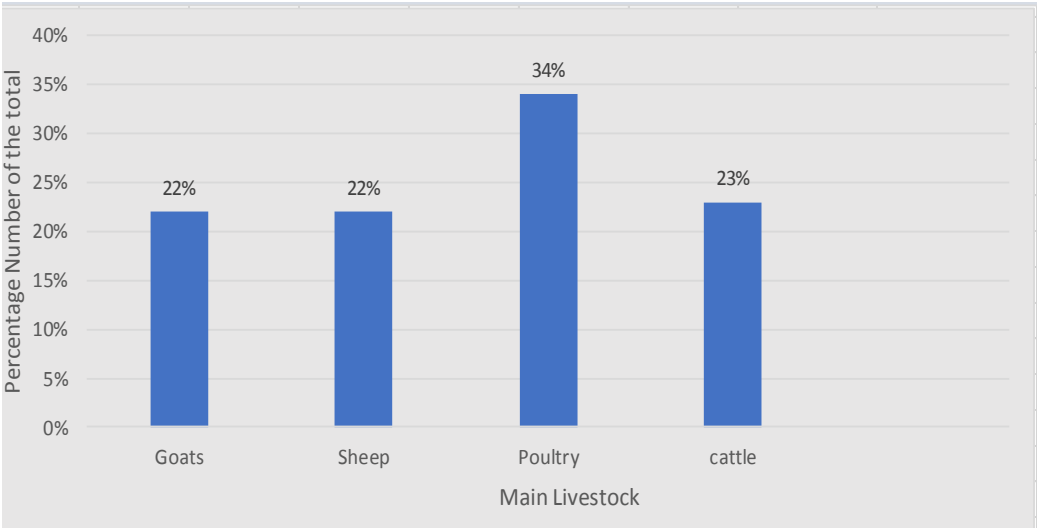


Figure 4. 4: Type of Livestock Kept

Source: Source: Author's computation based on Survey data (2021)

The livestock diversification results in Figure 4.4, indicated that the sampled smallholder farmers had diversified their livestock; smallholder farmer keeps an average of five goats, four sheep, five poultry such as chicken and turkey and four cattle, among other livestock. The most reared animals are poultry making up 34 percent of the whole number, followed by goats and sheep up to 22 percent each and cattle which is 23 percent. Most of the smallholders keep the poultry for eggs and meat, goats and sheep are kept for milk and for meat, cattle are kept mainly for milk aside from oxen and bulls that are also partly used for cultivation. Additionally, the smallholders used manure from the livestock as fertilizer. In cases where animals are sold, it was mainly in emergencies, and the frequency of selling the livestock was low, most especially when an emergency arises.

This is consistent with FAO (2015) report which documented that most smallholders kept more poultry and other smaller livestock like sheep and goats compared to cattle

since cattle is more costly to buy and maintain whereas the smaller animals are more convenient to sell quickly when in need. Additionally, poultry and smaller animals breed faster and can often thrive on harsher terrain. For many smallholders' "backyard" poultry production is the least costly and offers the highest return on investment. The following table shows livestock units owned per hectare.

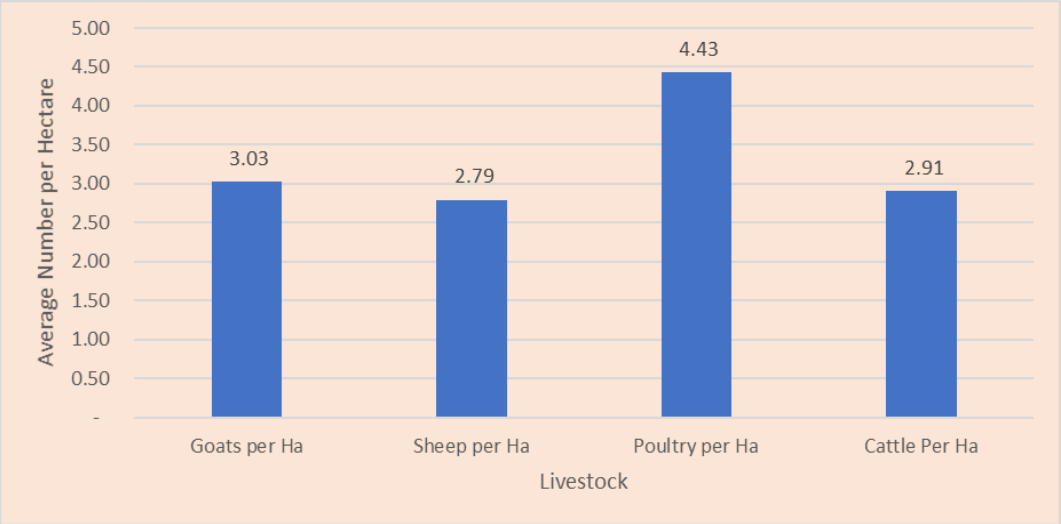


Figure 4.1 Livestock Units Owned per Hectare

Source: Source: Author's computation based on Survey data (2021)

The results (Figure 4.5) indicated that on average, the smallholders reared 3.03 goats per Hectare, 2.79 sheep per Hectare, 4.43 Poultry per Hectare, and 2.91 Cattle per Hectare. A FAO (2015) report indicated that on average, a smallholder in Bangladesh, owns 0.69 livestock per 0.24 Hectares of farm size. In Nicaragua, a farmer owns an average of 4.7 livestock per Hectare.

4.2.2 Descriptive Statistics of Categorical Variables

This section presents the results of descriptive statistics that were undertaken to describe the characteristics of small-holder farmers in Nigeria with regard to

categorical variables. Frequencies and percentages were used for categorical data, which included sex, marital status, level of education, primary source of household income, range of household monthly income, hiring additional workers for agricultural work, access to information about agricultural activity, source of agricultural information, credit access, lending institution, utilization, whether the farmer had ever needed agricultural credit, whether they had applied for a loan from a bank, and whether they had ever used the credit from that source. Table 4.2 provides a summary of the descriptive statistics for categorical variables.

Table 4.2: Descriptive Statistics Categorical Variables

Variable	Category (Measurement)	Frequency	Percent (%)
Sex	Male	259	64.9
	Female	140	35.1
Marital Status	Single	18	4.5
	Married	320	80.2
	Divorced	11	2.8
	Separated	12	3
	Widow / Widower	38	9.5
Main Source of Household Income	Farm Income Only	260	65.2
	Farming and Employment	50	12.5
	Farming and Business	89	22.3
Range of Household Monthly Income	Less than I Million Naira	103	25.8
	Between 1 and 2 million Naira	117	29.3
	More than 2 million Naira	179	44.9
Engaging Other workers in agricultural activities	No.	265	66.4
	Yes	134	33.6
Access to Information about Agricultural Credit	No	243	60.9
	Yes	156	39.1
Source of agricultural Information	No Access to information	243	60.9
	Television	41	10.3
	Radio	42	10.5
	New Paper	37	9.3
	Others (CBOs, church, mosque, friends)	36	9
Credit Access	No	318	79.7
	Yes	81	20.3
Lending Institution	Didn't Access	318	79.7
	Banks	12	3
	Agriculture Credit Scheme	39	9.7
	Cooperatives	23	5.8
	Others (Women groups and CBOs)	7	1.8
Utilization	Didn't Access	318	79.7
	Not Utilized on Agricultural Activities	22	5.5
	Partially Utilized on Agricultural Activities	50	12.5
	Fully Utilized on Agricultural Activities	9	2.3
Whether the farmer has ever been in need of agricultural credit	No	151	37.8
	Yes	248	62.2
The type of Agricultural Activity Engaged in	Crop Production	90	22.6
	Livestock Production	82	20.6
	Mixed Farming	227	56.8
Access to extension services	Yes	33	8
	No	366	92
Motorized Equipment	No	58	14.5
	Yes	341	85.5
Total Sample Size (n) = 399			

Source: Author's computation based on Survey data (2021)

According to the findings (Table 4.2), there were 259 (64.9 per cent) men and 140 (35.1 per cent) women among the small-holder farmers sampled for the study. Since that the sample process was random it can be said that small holdings in Nigeria's Plateau State are predominately dominated by men. The majority of HH heads in Plateau State, Nigeria were likely men, or it is safe to assume that most households in Nigeria were headed by men, since the small-holder farmers who were the subject of the study were the HH heads.

Related findings were also revealed by the National Survey and Segmentation of Smallholder Households in Nigeria report by the FGN, which found that nearly nine out of ten smallholder households (88 per cent) in the Nigerian North Central region, which also includes Plateau and other states, are headed by men, and in cases where the HH heads were female, they were typically widowers. Similar to this, Yusuf *et al.* (2016) discovered that up to 82.5 percent of the small holder agricultural households in Nigeria were headed by men.

The findings (Table 4.2) also showed that 320 (80.2 percent) of the study's sample of small-holder farmers were married. There were only 18 single people (4.5 per cent), compared to 11 divorced people (2.8 percent). Also, only 38 of the small-scale farmers included in the study were widows or widowers, compared to 12 (3 per cent) separated small-scale farmers (9.5 percent). In general, it can be said that the majority of small-holder farmers in the Plateau State, Nigeria region, are married. These results are comparable to those of the National Agriculture and Food Security Strategy (NAFSS) (2010-2020) report by the Federal Republic of Nigeria Ministry of

Agriculture and Rural Development, which showed that the majority (over 85 per cent) of smallholder household heads in Nigeria are married or cohabiting and that only about a tenth are separated, divorced, or widowed.

The study examined the primary sources of household income for the studied small-holder farmers. It was determined that 260 of them, or 65.2 per cent, relied on revenue from farming operations as their primary source of support. On the other hand, to augment their income, 89 (22.3 per cent) and 50 (12.5 per cent) of them also worked outside of the farm in businesses and jobs, respectively. According to the results, the majority of the small-holder farmers in Nigeria's Plateau State who participated in the study's sample come from households that primarily depend on the farm for their income. To a lesser level, they have also diversified their income sources to include jobs and business, nevertheless. This is in line with the results of a study by Adeoye (2019), which found that farming activities accounted for up to 52.9 per cent of the HH income among rural small holders in Nigeria.

Furthermore, Rizwan et al. (2017) similarly showed that the majority of small holders also earned money from jobs outside the home as part of their self-insuring plan to increase the household's overall income. A FAO (2015) report also revealed that small holders were attempting to diversify their sources of income at the time, looking for wage or self-employment opportunities in the rural non-farm sector to supplement their income. Yet, given that the majority have low educational levels, the additional positions taken were mostly poorly skilled.

As shown in Table 4.2, the study's sample of smallholder farmers' HH income ranges were also determined. It was shown that 179 (44.9 per cent) of the smallholder farmers sampled in the survey had an HH income of more than 2 million Naira, which is the majority of the smallholder farmers (4,856 USD). 117 (29.3 per cent) of the HH population had an annual household income of between 1 million Naira (2,428 USD) and 2 million Naira (4,856 USD), while 103 (25.8 per cent) had an annual household income of less than 1 million Naira (2,428 USD). The HH income was independent of any economic activity, including farming and other non-agricultural activities like business and employment. It may be proven that most small-holder farmers in Nigeria's Plateau State earn more than 2 million Naira (4,856 USD) annually. The results are in line with a study by Dan-Azumi (2011), which found that, depending on the activities they engage in outside of farming, a small holder farmer in Nigeria's shared HH income ranges from 2.2 million Naira (16,272 USD) to 2.2 million Naira (16,272 USD).

The study investigated whether the small-holder farmers sampled in the study employed additional laborers for farming tasks. The findings in Table 4.2 showed that up to 265 (66.4 percent) of the small holder farmers did not use additional personnel for farming tasks. Only 134 (33.6%) of the studied small holder farmers accomplished this. In general, the results showed that few small-holder farmers in Plateau State, Nigeria, used additional laborers for farming tasks other than when needed. On their farms, the majority of the households engaged the HH members in farming activities. Similar conclusions were drawn from a research by Dan-Azumi (2011), who found that while the majority of smallholder farmers in Nigeria were unable to hire more

workers, 23 per cent of them had to keep the number of workers they hired to 2 to 5 and only sporadically throughout the farming season.

The study determined the percentage of sampled small-holder farmers who had access to information regarding agricultural loans. Table 4.2 shows that as many as 243 (60.9 percent) of the small-holder farmers lacked access to information regarding agricultural loans. Just 156 (39.1 percent) of the tested smallholder farmers had any prior exposure to agricultural financing information. In general, it can be said that there was a lack of knowledge regarding agricultural loans among smallholder farmers in Plateau State, Nigeria. Access to information on agricultural loans was limited for smallholder farmers. This is in line with the results of a survey conducted in 2016 by Mgbenka, Mbah, and Ezeano, which showed that smallholder farmers in Nigeria lacked a high level of awareness and could not easily access information on their access to financing or agricultural activities. It was also discovered that researchers and policymakers are the primary audiences for the majority of the information, with smallholder farmers receiving less of it.

The sources of information on agricultural finance among individuals who indicated they would use it were further established and are shown in Table 4.2. The majority of the small holder farmers in the study's sample were illiterate, so radio was by far the most common source of information about agricultural credit, according to 42 (10.5 per cent) of the households. Radio was followed by television and newspapers, each with a respective share of 41 (10.3 per cent) and 37 (9.3 per cent) of the sample. In addition to CBOs, churches, mosques, field visits by extension agents, and friends or

fellow farmers, 36 (9 per cent) of the small-holder farmers used these sources for information. The results suggest that smallholder farmers in Nigeria had access to a variety of information sources about agricultural credit, with radio and television being the most popular and CBOs, churches, and mosques being the least used. Extension officers also conducted field visits and friends or other farmers or smallholders were the least likely sources of information.

Mgbenka, Mbah, and Ezeano (2016) found that radio and television were the main sources of agricultural information for small-scale farmers in Nigeria. In a similar vein, Dan-Azumi (2011) found that among small-holder farmers in central Nigeria, extension officers and field visits were the least utilised sources of agricultural information, with the majority of the farmers relying on information from the radio and television. At least 70 per cent of the farmers were found to have no contact with field officers, which is amazing.

The study's general goal was to determine whether or not small-scale farmers in Nigeria's Plateau State had ever needed agricultural credit. It was discovered that 248 of them, or 62.2 percent, had a need for agricultural loan, while 151 of them, or 37.8 percent, said they had never had a need for it. Further research revealed that although there was a strong demand for agricultural loans, the majority of small-scale farmers, 318 (79.7 per cent), did not use it to support their agricultural endeavors. Of them, just 81 (20.3 per cent) had used agricultural financing. Notwithstanding the high demand rate, these data revealed a low rate of credit availability (20.3 per cent) among small-scale farmers in Plateau State, Nigeria.

Similar results were found in a research by Obisesan (2013), who found that just 29 per cent of the smallholder cassava farming households in South West, Nigeria, were able to get agricultural finance. Accordingly, a report by FAO (2015) on the profile of smallholding among a few countries around the world revealed that in Kenya, about 33 per cent of smallholder households have access to credit, while in the United Republic of Tanzania (URT), only a small percentage of smallholders (17 per cent) were able to access credit for agricultural activities. According to the survey, small holders often receive credit at a rate of between 8 per cent and 35 per cent.

The majority of the lending institutions were agricultural credit schemes, which lent to 39 (9.7 per cent) of the small-holder farmers, followed by cooperatives, which lent to 23 (5.8 per cent). 12 small-scale farmers, or 3 percent, were the fewest to do so. 7 (1.8 per cent) of the farmers favored alternative forms of funding through CBOs and women's organisations. This suggests that the majority of smallholder farmers in Plateau State, Nigeria, choose semi-formal means of finance (cooperatives) as well as informal sources of financing like women groups and CBOs over official sources of funding like commercial banks.

This is so because the Federal Government of Nigeria (FGN), realizing that small-scale farmers needed access to credit, established a number of lending programs known as Agricultural Credit Guarantee Schemes (ACGS) to provide them with agricultural credit products (Enhancing Financial Innovations and Access (EFInA)) (2018). The results are likewise in line with those of Okojie et al. (2010), who found that the majority of Nigeria's rural small-holder farmers had limited access to

financial services from the official lending institutions like commercial banks have turned to unofficial lending groups and schemes. The majority of small holders preferred to borrow from informal institutions, according to an FAO report from 2015 on the status of small holdings worldwide, as commercial banks are frequently hesitant to lend to them due to inadequate collateral and a lack of knowledge about their risky credit behavior.

Additionally, the study determined how small-holder farmers used their credit to finance their agricultural activities (Table 4.2). The study's findings showed that 50 (12.5 percent) of individuals who had obtained credit had primarily utilized it for other purposes while also using some of it for agricultural purposes. There were 9 (2.3 per cent) people who used the credit entirely for agricultural purposes, as opposed to 22 people who used it in any way (5.5 percent). In light of this, it can be said that while some small-scale farmers in Nigeria's Plateau State do have access to credit, the majority of them only use it in part for agricultural activities. Only a small percentage of small proprietors devote the entire sum to agricultural pursuits.

In a study by Danso-Abbeam, Ansah, and Ehiakpor (2014), who evaluated agricultural credit utilization among farmers in Bole district of Northern region, Ghana, it was found that the majority of small holders (at least 80 per cent) who had accessed agricultural credit utilized it partially. Their findings were in line with our previous research. Similarly, Nosiru (2010) found that small-holder farmers in Ghana who used microcredit for agricultural purposes did not fully utilize it for that purpose but instead diverted most of it to other unrelated activities.

In Nigeria's Plateau State, it was also determined what specific agricultural operations small-holder farmers engaged in (Table 4.2). According to the findings, 227 farmers (56.9 per cent of all farmers) were involved in mixed farming, which included both crop and livestock production. Only crop farming was done by 90 people (22.6 percent). Moreover, just 82 (20.6 percent) of the small holder farmers were solely involved in cattle rearing. The results showed that mixed farming makes up the majority of small holding activities in Nigeria's Plateau State. This shows that the majority of small-scale farmers in Plateau State, Nigeria, are not dependent on just one kind of business.

According to the Federal Republic of Nigeria Ministry of Agriculture and Rural Development's National Agriculture and Food Security Strategy (NAFSS) (2010-2020), over half of Nigeria's small-holder farmers raise livestock for both consumption and income, making up a large majority of the country's small-holder farmers (67 per cent), who grow both crops and livestock. It was also mentioned that the typical smallholder household intercrops six different types of crops, meaning that they are not dependent on a single crop for food or revenue. Also, an FAO (2015) analysis found that smallholders in Bolivia's Plurinational State cultivate more than 13 different crops on farms with an average size of 0.89 hectares, just like the smallholders in Nigeria's Plateau State.

The research found that only 33 (8 percent) of the tested small holdings were able to use extension services the previous season. 366 people (92 per cent) in the majority did not. This demonstrates how little access small-scale farmers in Nigeria had to

extension services. Only 6 per cent of Nigeria's small holders had access to extension assistance, according to an FAO (2019) assessment. According to the survey, just 58 (14.5 per cent) of the selected small holdings used motorized equipment the previous season. 341 people (85.5 per cent) did not, making up the majority. This demonstrates that smallholders in Nigeria used motorized equipment at very low rates. In Nigeria, smallholder farmers' access to extension services was extremely limited. Only 16.2 per cent of Nigeria's small holdings, according to an FAO (2019) assessment, were able to employ motorized equipment.

4.2.3 Credit Access and Selected Categorical Demographic Variables (Cross Tabulation)

In order to describe the demographic profile of small-holder farmers in relation to various categorical demographic factors, including gender, marital status, highest level of education, range of HH Monthly Income, main source of HH Income, engaging other workers in agricultural activities, access to information about agricultural activity, source of agricultural information, and agribusiness, a cross-tabulation of credit access and some categorical demographic factors was conducted. Table 4.3 presents the findings.

Table 4. 3: Cross Tabulation of Credit Access and Selected Demographic Factors

Variable	Measurement	Credit Access		Total
		No (0)	Yes (1)	
	Male	203	56	259
	Female	115	25	140
Sex	Total	318	81	399
	Single	11	7	18
	Married	253	67	320
	Divorced	8	3	11
	Separated	11	1	12
	Widow / Widower	35	3	38
Marital Status	Total	318	81	399
	Less than I Million Naira	94	9	103
	Between 1 and 2 million Naira	100	17	117
	More than 2 million Naira	124	55	179
Range of HH Monthly Income	Total	318	81	399
	Farming	222	38	260
	Farming and Employment	32	18	50
	Farming and Business	64	25	89
Main Source HH Income	Total	318	81	399
	No	222	43	265
	Yes	96	38	134
Employing Extra Labour in agricultural activities	Total	318	81	399
	No	243	.	243
	Yes	75	81	156
Access to Information about Agricultural Credit	Total	318	81	399
	Didn't Access	318	.	318
	Banks	.	12	12
	Agriculture Credit Scheme	.	39	39
	Cooperatives	.	23	23
	Others (Women groups and CBOs)	.	7	7
Lending Institution	Total	318	81	399
	Crop Farming	81	9	90
	Livestock Rearing	74	8	82
	Mixed Farming (Both crop farming and livestock rearing)	163	64	227
Agricultural Activity Engaged in	Total	318	81	399

Source: Source: Author's computation based on Survey data (2021)

The results of the study, which characterized credit access based on the gender of the households, are shown in Table 4.3. It was found that of the tested small holder

farmers, men (56) accessed agricultural credit more frequently than women (25) did. Similar conclusions were drawn from a study by Lemessa and Gemechu (2016), which examined the variables influencing smallholder farmers' access to formal credit in Ethiopia's Jibat District and found that men were more likely than women to use credit. Men have greater access to resources than women, which is consistent with resource ownership, and this affects loan availability because collateral is readily available.

The study contrasted small-holder farmers who used credit with those who did not based on their marital status. According to the data, the majority (67) of small-scale farmers who used credit were married, followed by single people (seven), divorcees (three), widows (three), and then separated people (three) (1). In essence, the findings showed that married small-holder farmers accessed loans at a higher rate than other categories of marital status. The results suggested that widowed small-scale farmers did not use credit as frequently as other small-scale farmers. Similar results were found in a study by Assogba et al. (2017) on the factors influencing smallholder farmers' access to credit in North-East Benin, which showed that married smallholder farmers accessed credit more frequently than other groups.

The HH income of those who used credit was described. According to Table 4.3's findings, the majority of small-holder farmers with HH incomes of more than 2 million Naira (4,856 USD) sought loan (55) before those with incomes of between 1 million and 2 million Naira (2,428 USD) (17). Those with less than 1 million acres were the group of small-holder farmers that obtained agricultural loans the least

(2,428 USD). According to these data, the majority of small-holder farmers who used agricultural finance had HH income levels that were higher than those of individuals with lower income levels, totaling more than 2 million Naira (4,856 USD).

Since it is believed that individuals with higher income levels have a stronger ability compared to those with lower income levels, this can be explained by their capacity to repay the loans. The results are in line with research by Kosgey (2013), which examined grain farmers' access to agricultural finance in Kenya's Uasin-Gishu County and found that farmers with higher HH income levels had a higher likelihood of doing so than those with lower incomes.

For small-holder farmers who had loan access or not, the study also described the sources of HH income for them. The results in (Table 4.3) showed that the majority of small-holder farmers who used agricultural loan (38) were only involved in farming activities, followed by those small-holder farmers who were involved in both farming and business activities (25). Those who practiced farming and were also employed (18) had the lowest access to agricultural loans, likely because they were able to fund their endeavors through the profits from their jobs and their own companies.

According to the results, small-scale farmers with a variety of non-farming sources of income had a lower desire for borrowing. In their study, Lemessa and Gemechu (2016) examined the variables influencing smallholder farmers' access to formal credit in Ethiopia's Jibat District and found that loan demands were higher among smallholder farmers with lower non-farming income.

The study also discussed Nigerian small-holder farmers' choices about the use of additional labor in agricultural pursuits in relation to their ability to obtain agricultural finance. According to Table 4.3's findings, the majority of the households (43) that used agricultural financing did not necessarily add extra labor to their agricultural operations. Only those who had acquired agricultural financing and used additional labor in agricultural operations (38). These results suggest that small-holder farmers did not always borrow more money after hiring more workers. In a similar vein, a study by Bakhshoodeh and Karami (2008) found that access to finance for Iranian small-holder farmers was not significantly influenced by hiring additional staff.

In Table 4.3, the availability of agricultural finance was also compared to the availability of agricultural credit information. It was determined that every single one of the eighty-one small-scale farmers who had obtained financing had done so after finding out about agricultural lending. No farmer who had not obtained information regarding agricultural financing sought for or was granted agricultural credit. Therefore, it was inferred that small-holder farmers in Nigeria's Plateau State had a major advantage in obtaining agricultural finance: access to knowledge on agricultural financing. A further finding by Kausar (2013) was that the availability of information affected the demand for microcredit among Pakistan's small-scale farmers.

The study classified the major organizations that lend on agricultural loans. Table 4.3's findings showed that just 12 farmers sought out agricultural loans from commercial banks, whereas the bulk of farmers (39), who received credit, did so through credit schemes, 23 did so through cooperatives, and 23 did so directly from

banks. As a result, it was clear that small-scale farmers in Plateau State, Nigeria, favoured agricultural loan schemes above cooperatives and commercial banks, the last of which was their favorite source. Similar conclusions were made by Okojie et al. (2010) who stated that the majority of Nigeria's rural small-holder farmers have limited access to financial services from official lending institutions like commercial banks and instead turn to informal lending schemes and organizations.

Based on the agricultural activities they conducted, the study described the farmers who had accessed financing. The findings in Table 4.3 showed that, in contrast to primarily crop farming (9) and solely livestock rearing (24), the majority of small-holder farmers who accessed finance (64) were engaged in mixed farming (8). The results showed that small-holder farmers who had both crops and livestock had higher loan demands than those who just raised one of each. This could be as a result of the fact that mixed farming made up the majority of the smallholder farmers who took part in the study. Mixed farming was a technique for small farmers to spread their risks and raise their income, which increased their chances of obtaining financing (Adeniyi, 2019).

4.2.4 A comparison between small-scale farmers who used credit and those who did not use credit

To determine whether there was a statistically significant difference between the small holder farmers who accessed finance and those who did not, independent sample t-tests were also utilized. The Independent Samples t-test was necessary to compare the means of the two independent groups to see if there was statistical

evidence that the associated population means differed significantly in terms of age (years), education (years of schooling), farm size (ha), farm size under cultivation (ha), amount of HH income, household size, Household members who work on the farm, the number of additional workers hired, the distance to the nearest bank (kilometers), the distance to the nearest cooperative (kilometers), the total value of agricultural production (naira), and the total value of agricultural production per hectare. Independent sample t-tests, according to Mukasa, Simpasa, and Salami (2017), are an effective test for determining whether there are statistical differences between small holder farmers who received loans and those who did not. The findings were shown in Table 4.4

Table 4. 4: Independent Sample T-test for Equal Means between farmers who did not access credit (1) and Farmers who accessed credit (0)

	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference (0 –1)		95% Confidence Interval of the Difference	
						Lower	Upper
Age (Years)	Equal variances assumed	397	0.440	1.61	2.09	(2.49)	5.71
Education (Years of Schooling)	Equal variances assumed	397	**0.010**	(2.80)	1.00	(4.76)	(0.84)
Farm Size (Ha)	Equal variances assumed	397	**0.000**	(0.96)	0.13	(1.22)	(0.70)
Farm Size Under Cultivation (Ha)	Equal variances assumed	397	**0.000**	(0.61)	0.11	(0.83)	(0.39)
Amount of HH Income	Equal variances assumed	397	**0.000**	(11,626,279.76)	1,677,981.75	(4,925,120.44)	(8,327,439.07)
Household Size	Equal variances assumed	397	**0.000**	(1.66)	0.22	(2.09)	(1.22)
Household members working on the farm	Equal variances assumed	397	0.150	0.21	0.15	(0.08)	0.50
Number of Extra Workers employed	Equal variances assumed	397	0.090	(0.30)	0.18	(0.66)	0.05
Distance to the Nearest Bank (KMs)	Equal variances assumed	397	0.200	0.32	0.25	(0.17)	0.81
Distance to the Nearest Scheme (KMs)	Equal variances assumed	397	**0.000**	1.09	0.29	0.52	1.66
Distance to the Nearest Cooperative(KMs)	Equal variances assumed	397	**0.010**	0.74	0.27	0.21	1.26
Total value of Agricultural Production (Naira)	Equal variances assumed	397	**0.000**	159, 227.373	158,569.54	251,961.07	1189251.95
Total value of Agricultural Production Per Hectare		397	**0.000**	720, 606.52	238,380.26	430,664.71	1010548.31

Source: Source: Author's computation based on Survey data (2021)

According to the study's findings, there were no significant differences in terms of age, the number of household members who worked on the farm, the number of additional workers hired, or the distance to the nearest bank. This suggests that credit access was not significantly influenced by these factors. The number of years of

education between those who accessed credit and those who did not, however, varied significantly. The average education level of small-holder farmers who used loan was higher than that of those who did not (Mean Difference < 0). These results suggest that more years spent in school and greater levels of education boost a small farmer's likelihood of obtaining loans. This is due to the fact that, in accordance with Assogba et al., people with higher levels of education had greater exposure to, awareness of, and access to print media information (2017).

Furthermore, it was determined that there was a big difference between those who used credit and those who didn't in terms of farm size and farm size under cultivation. The size of the farms was larger on average for small-holder farmers who used finance as opposed to those who did not (Mean Difference < 0). When compared to smallholder farmers with smaller plots of land, those with larger farms were more likely to have access to credit because larger farms required more labor and agricultural inputs, which increased credit needs, and they also served as collateral for obtaining formal credit in rural areas. The results of a study by Kadri, Bunyaminu, and Bashiru (2013), which revealed that farmers with big farms utilized them as collateral to receive financing from financial institutions, are consistent with this.

The findings also showed that those who used credit had significantly higher HH income than those who did not. In general, small-holder farmers who used credit earned more than those who did not (Mean Difference < 0). The implication is that small-holder farmers with higher earnings had a higher chance of obtaining financing than those with lower HH incomes because they have a higher likelihood of repaying

it. The results are congruent with those of Adeniyi (2019), who found that higher HH income was linked to greater credit worthiness since the farmers could repay the credit.

The findings also showed a substantial difference in the size of the HH between individuals who accessed credit and those who did not. Small-holder farmers with financial access often had larger HH sizes than those without it (Mean Difference < 0). This suggests that small-holder farmers with larger HH sizes had a higher chance of obtaining credit than those with smaller HH sizes, perhaps as a result of the strain that larger HH sizes put on the household, which primarily manifested itself through an increased likelihood of borrowing. The results, however, are at odds with those of Sekyi (2017), who found that households' size had a negative and significant impact on the likelihood of accessing credit in rural Ghana, claiming that higher HH size decreased.

The distance to the closest cooperative and scheme between individuals who accessed credit and those who did not was also shown to be significantly different. Smallholder farmers who used credit traveled to the nearest cooperative and scheme on average less quickly than those who did not (Mean Difference > 0). According to the results, there is a higher likelihood of a small holder receiving credit if they are closer to a credit scheme or cooperative. This is mostly due to the fact that borrowing is deterred by small holders' inability to afford the transaction's time and financial expenses, particularly transportation costs, which rise with distance between the lender and

borrower. The results support Hussien's (2007) contention that households are deterred from taking out loans.

The outcomes also showed a substantial difference between those who accessed credit and those who did not in terms of the overall value of agricultural production (Naira) as well as the total value of agricultural production per hectare. The total value of agricultural production (measured in naira) and the total value of agricultural production per hectare were, on average, higher for small-scale farmers who had access to financing than for those who did not (Mean Difference > 0). This suggests that greater production per hectare and overall production were related to increased credit access. Smallholders who had access to finance were able to automate their operations, pay for their labor expenses, and use improved seed varieties, among other things. This may result in a rise in output per hectare. According to FAO (2018), having access to financing assists smallholder farmers to increase production by automating tasks, paying for input prices, and utilizing improved seed varieties. Several studies, like those by Marr et al. (2016) (SSA), Nosiru (2010) (Nigeria), and Obisesan (2013) (Nigeria), also found that smallholders' access to credit helped them increase their output per unit of land size.

4.3 Determinants of Agricultural Credit Access by Smallholder Farmers

In order to understand how smallholder farmers in Plateau State might obtain loans, the study's first objective was to examine the factors that influence this access. A probit model was used to evaluate this goal. However the study first performed diagnostic tests to determine whether the model could be used before estimating it.

4.3.1 Diagnostics Tests Results

Before estimating, diagnostic tests were performed to make sure the regression assumption was followed. The diagnostic tests carried out in this study comprised the tests for heteroskedasticity, Hosmer-Lemeshow (H-L) test, link test, and multicollinearity.

a) Multicollinearity Test Results

Using the Variance Inflation Factor (VIF), it was possible to determine whether the estimated model contained multicollinearity. The correlation between the regressors is identified, together with the strength of that correlation, by the VIF, which has a range from 1 to 10. Generally speaking, if a variable's VIF is greater than 10, multicollinearity is assumed to be present (Field, 2000). The absence of multicollinearity was demonstrated by the multicollinearity test findings, which are shown in Table A1 of Appendix II. This is because all of the variables employed in the Probit model had a VIF of less than 10. The absence of multicollinearity among the variables employed in the Probit model was further demonstrated by the mean value of 1.41 of VIF.

b) Link Test Results

When one or more variables are left out of the model or when unnecessary variables are added, the model may be misspecified. The common variance shared by the variables included may be improperly attributed to those variables, inflating the error term, if pertinent variables are mistakenly removed (Obebo, 2018). Model

misspecification typically has a significant impact on estimations of the regression coefficients. Link test was performed to determine if the model was appropriately stated (Obebo, 2018).

The test is based on the theory that any new independent variables may only be discovered by accident if a model is correctly described. The prediction variable (hat) and the squared prediction variable are two new variables introduced by the link test (hatsq). The prediction variable (hat) should be significant for a well-defined model, but hatsq shouldn't be. The findings in Table A2 of Appendix II demonstrated that the prediction variable (hat), with a p-value of 0.000, was statistically significant, whereas hatsq, with a p-value of 0.167, was not. As a result, the model's specifications were accurate.

c) Hosmer-Lemeshow (H-L) Test Results

Using the Hosmer-Lemeshow (H-L) test, the fitted probit model's goodness of fit was determined. The test examined if binary answers that were observed were consistent with predictions when they were conditional on a vector of covariates (confounding factors). If the number of outcomes in the regression corresponds to the number of outcomes that were actually seen in the data. The probability value of H-L is statistically insignificant when the predictions in the model closely match the data. The data were found to match the model well since Table A3 of Appendix II's p-value for the test was insignificant (0.9841).

d) Breusch-Pagan Test of Heteroskedasticity

The model was tested for heteroskedasticity using the Breusch-Pagan approach. The alternative, that the error variances are a multiplicative function of one or more variables, was the null hypothesis, which stated that the error variances are constant (homoscedastic) (heteroscedasticity). The probability value of the Breusch-Pagantest statistic was 0.0000, as shown in Table A4 of Appendix II. Due to the rejection of the homoscedasticity null hypothesis, heteroskedasticity was found in the data. In order to solve this issue, heteroskedastic probit was used (Alvarez & Brehm, 1995). The heteroskedastic model has been extensively utilized to examine diverse decisions and actions.

4.3.2 Probit Model Results

Heteroskedastic probit model estimation was done to determine the factors that influence smallholder farmers' access to agricultural loans and the results are shown in Appendix III Table A5. Age, gender, marital status, level of education, farm size, sources of income, HH income, household size, hiring additional workers, credit information, distance to the bank, distance to the scheme, distance to the cooperative, and the type of agricultural activity are all included in Table 4.4's summary of the Probit model results.

Table 4. 5: Marginal Effects of Determinants of Credit Access of Smallholder farmers

	Number of Observation	399
	LR Chi2 (2)	138.01
	Prob > Chi^2	0.000
	Pseudo R^2	0.5492
	Log Likelihood	-90.749

Credit Access	**Dydx**	**Robust Std Error**	**P>|z|**
Age	0.001	0.006	0.459
Sex	- 0.036	0.224	0.199
Marital Status	- 0.028	0.180	0.212
Level of Education	0.040***	0.063	0.000
Farm Size	0.067***	0.155	0.001
Sources of Income	0.030*	0.127	0.061
HH Income	0.000	0.000	0.375
Household Size	0.049***	0.063	0.000
Engaging Extra Workers	- 0.009	0.253	0.774
Credit Information	0.215***	0.231	0.000
Distance to the Bank	- 0.000	0.046	0.980
Distance to the Scheme	- 0.013***	0.041	0.009
Distance to the Cooperative	- 0.011**	0.040	0.033
Type of Agricultural Activity	0.078***	0.213	0.003
Constant	- 3.570	1.001	0.000

Significance: * (Significant at 1%); ** (Significant at 5%); *(Significant at 10%)**

Source: Author's computation based on Survey data (2021).

The estimated links between several variables (independent variables) and the likelihood or degree of credit access for smallholder farmers are essentially shown in Table 4.5. The marginal effects shed light on how these variables affect credit access while taking other model variables into account. These tables are used by researchers to determine which factors have a substantial impact on credit access as well as the direction of those impacts.

The findings indicated that the Probit model developed was reliable and a good fit, having a log-likelihood value of -90.749 and LR Chi^2 (2) of 138.01 with a corresponding significant p-value (0.000). The Pseudo R^2 value was 0.5492, indicating that the 14 factors were responsible for up to 54.92 percent of the variation

in loan access. Based on the importance of the model's coefficients, it can be inferred that education level, farm size, source of income, household size, credit knowledge, distance from the credit scheme, distance from the cooperative, and type of agricultural activity are the main determinants of smallholder farmers' access to agricultural credit. Age, sex, marital status, home size, hiring extra workers, and distance to the bank are among the factors that are not significant.

e) Level of education

At the 1 per cent level, the coefficient for educational attainment was statistically significant. The results showed that education level had a 4 per cent impact on the likelihood of obtaining agricultural credit. This suggests that having more education (more years in school) increases a small holder farmer's likelihood of obtaining financing. Compared to their counterparts with less years of education, smallholder farmers with more years of education are less likely to have loan constraints. This is due to the fact that those with higher levels of education had greater exposure to, awareness of, and access to information in print media. The results are in line with research by Hananu, Abdul-Hanan, and Zakaria (2015), Adeniyi (2019), and Assogba et al. (2017), which found that the level of education is a significant factor in credit accessibility.

f) Farm size

At the 1 per cent level, the farm size coefficient was statistically significant and positive. The results showed that the likelihood of obtaining agricultural finance was 6.7 per cent influenced by the size of the farm. This suggests that a larger farm size

boosts a small holder farmer's likelihood of obtaining loans. Smallholder farmers with larger farms had a higher likelihood of using loans than those with smaller plots of land. The need for more labor and agricultural supplies due to an increase in farm size is believed to result in increased loan needs. In rural areas, agricultural land is also seen as a key kind of collateral for formal loans. So, having a larger farm enhances the likelihood of getting credit.

These findings are in line with a study by Saqib, Ahmad, and Panezai (2016), which found that the size of the landholding had a substantial impact on the small-holder farmer's ability to receive finance. Similar to this, Moahid and Maharjan (2020) found that access to finance was significantly influenced by the size of a landowner's holdings in rural Afghanistan. These results corroborated those of Kadri et al. (2013), who discovered that farmers with sizable farms used them as security for loans from financial institutions.

g) Sources of income

The farm size coefficient was statistically significant at the 10% level and positive. The likelihood of obtaining agricultural financing was shown to be 3 percent more likely when there were additional sources of income. Research demonstrates that compared to smallholder farmers who had no additional sources of income, those who did were more likely to get financing. Farm revenue and non-farm income are typically combined for most smallholder farmers. Since farming is the major occupation for smallholder farmers, as proposed by Mishra and Goodwin, an increase in non-farm income is intended to boost farm revenue (1997)

h) Household size

At the 1 per cent level, the coefficient for household size was statistically significant and positive. The results revealed that household size had a 6.7 per cent impact on the likelihood of obtaining agricultural finance. This suggests that small-holder farmers who had larger HH sizes had a better probability of obtaining credit than those who had smaller HH sizes. This conclusion could be explained by the fact that a larger HH places more financial strain on the household, which is primarily represented in a higher likelihood of borrowing. Bigger households exhibited higher levels of spending, which was related to households' need for additional income to support their desired level of consumption. The results do not agree with those of Sekyi (2017), who found that household size had a negative and significant impact on the likelihood of accessing credit in rural Ghana. Sekyi (2017) cited that larger HH size decreased the chances of credit accessibility because of increased responsibilities which decreased the chances of loan repayment. Similar discrepancies exist between the results and those of a study by Ha (2001) that found that household size has a negative impact on the likelihood of borrowing and receiving credit.

i) Credit information

At the 1 per cent level, the credit information coefficient was statistically significant and positive. The results demonstrated that credit information had a 21.5 percent influence on the likelihood of obtaining agricultural credit. Research suggests that small-scale farmers were more likely to get financing if they had access to credit information compared to those who did not. The likelihood of a small-holder farmer obtaining credit improved when they had access to information regarding credit, such

as repayment conditions, interest rates, and where to get favorable loan arrangements. The likelihood of obtaining credit was lower for those who did not have access to such information.

The results are in line with those of a study by Kausar (2013), who found that access to information on lending rates, payment terms, and the best lending institutions to approach was one of the factors influencing small-holder farmers' demand for microcredit in Pakistan. The results corroborated those of Asom and Ijirshar (2017), who suggested that farmers who were adequately informed and made use of the agricultural credit information had access to agricultural financing for agricultural reasons.

j) Distance to the scheme

At the 1 per cent level, the distance coefficient to the scheme was statistically significant and negative. The results showed that proximity to the scheme had a 1.3 percent impact on the likelihood of obtaining agricultural loans. According to the results, a small holder has a higher chance of obtaining credit if they are closer to a scheme. This finding indicates that the likelihood of receiving credit dramatically lowers for every incremental kilometer traveled by rural families to the closest credit institution (schemes) to obtain credit. This is mostly due to the fact that distance between the lender and borrower increases the transaction's financial and temporal expenses, particularly transportation costs, which deters small holders from borrowing. The results support the claim made by Hussien (2007) that households are less likely to borrow money from credit institutions if they are farther away

k) Distance to cooperative

At the 1 per cent level, the distance coefficient from the cooperative was negative and statistically significant. The results showed that the likelihood of obtaining agricultural finance was 1.1 percent more likely when one was closer to the cooperative. The findings imply that the farther one travels from the research region to the nearest cooperative, the more likely one is to get loan services. In order to provide credit services to the public, particularly in rural areas, action must be taken. The findings of this study support those of Hussien (2007), who asserted that smallholder farmers are frequently deterred from borrowing when credit providers are located distant from their agricultural operations. Furthermore, Johnson and Morduch (2007) reported that smallholder farmers that are closer to the finance sources have higher yields.

l) Type of agricultural activity

A positive and statistically significant coefficient for the type of agricultural activity existed at the 1percent level. According to the results, proximity to the scheme had a 7.8 percent impact on the likelihood that an applicant would be approved for agricultural loan. The results suggest that, in comparison to mixed farming, the odds of obtaining credit were only slightly decreased by either crop farming or animal rearing. Small farmers might diversify their risks and boost their income by practicing mixed farming (FAO, 2015), which improved their chances of obtaining finance (Adeniyi, 2019).

4.4 Effect of access to Agricultural Credit on Agricultural Output

The study's second objective was to ascertain the impact of smallholder farmers' access to agricultural financing on agricultural output in Nigeria's Plateau State. A PSM strategy was chosen. The binary probit model was used to determine the propensity scores that were employed in the matching process as the likelihood of obtaining agricultural credit or not (Rosenbaum & Rubin, 1983; Ateka, 2018). According to Garrido et al. (2012), a logit or probit regression is frequently used as the initial step to build a propensity score, with the treatment (in this example, access to agricultural finance) serving as the outcome variable and the potential confounders serving as the explanatory variables. The output from the PSM's probit regression model that is shown in Table A6 was used in this study.

The selection of the covariates to be included is a crucial stage in the calculation of propensity scores (Brookhart *et al.* 2006). According to Austin 2011a; Garrido, Deb, Burgess, and Penrod (2012), the covariates employed in the model are expected to be those that are connected to both the treatment (in this example, credit availability) and the result (in this case, agricultural output). In a similar vein, Heckman, Ichimura, and Todd (1997) demonstrated that only variables that influence both the decision to participate and the result variable should be included. According to Brookhart et al. (2006), including a variable in the propensity score should reduce bias if it is believed to be related to the outcome (in this example, agricultural output) but not the treatment (credit availability).

These explanations led to the conclusion that the covariates associated to the treatment (access to agricultural financing), which was made in the paragraph that follows, were by default related to the outcome (agricultural production), and were therefore included in the estimation of propensity scores. Education, the amount of farmed land, the number of additional workers hired, the amount of fertilizer and seeds utilized, the use of motorized equipment, and the accessibility of extension services were all factors that were included in the model. Individual small-holder farmers with similar characteristics (education, size of cultivated land, number of additional workers engaged, amount of fertilizer used, amount of seeds used, adoption of motorized equipment, and accessibility to extension services) in the treatment and comparison groups are compared through propensity matching, then compressed into pertinent single scores.

These seven covariates are justified based on a variety of related empirical investigations that address the same general topic. When it comes to education, it has been demonstrated by Hananu, Abdul-Hanan, and Zakaria (2015), Adeniyi (2019), and Assogba et al. (2017) that the degree of education has a significant impact on both credit availability and agricultural output. Saqib, Ahmad, and Panezai (2016) found that the amount of cultivated land has a substantial impact on a small holder farmer's ability to get financing and, ultimately, the amount of agricultural output. Similar to this, Moahid and Maharjan (2020) found that the size of a landholding significantly influenced both agricultural productivity and loan availability.

Based on the claim made by Bidogeza *et al.* (2015), who claimed that borrowing credit was an option to supplement insufficient cash in order to finance factor inputs such as seeds and hired labor, it was decided to include the number of additional workers employed as a covariate. This implied that the higher the cost of labor, the greater the likelihood of accessing credit and agricultural output. According to the justification that the agricultural production function represents the relationship between physical output quantities and input quantities such as land, labor, capital, and amounts of other inputs (such as water, fertilizer, and pesticides), the other covariates, which are the quantity of fertilizer used, quantity of seeds used, adoption of motorized equipment, and availability of extension services, were included (Iqbal et al. 2003; Saleem & Jan, 2011).

To support the claim made by Garrido *et al.* (2012) that the covariates used in the PSM model should be those related to both treatment and outcome, Sial *et al.* (2011) added that agricultural credit is used to provide inputs and new technologies used to increase agricultural production. As a result, the choice of these covariates is justified. A popular first step is to employ a logit or probit regression with the therapy as the outcome variable and the potential confounders as the explanatory variables to generate a propensity score. The closest neighbor matching (NNM) technique, which is frequently used in PSM investigations, was used to match the farm family groups after the determination of the propensity scores. Stratification, Radius matching, and Kernel matching are just a few of the various matching techniques that are available.

According to Garrido *et al.* (2014), when estimating ATET in a situation where there are more than three times as many control (in this case, the number of small holder farmers who did not access credit) than those who did, the Nearest Neighbor Matching (NNM) is the best method due to its simplicity and estimation performance. However, alternative matching techniques can be used to estimate ATE (Abadie & Imbens, 2012). NNM was used because there were more small holders in this study who did not access credit than did, relative to those who did. This approach was chosen since previous research like Obebo (2018) and Ateka (2018) had used the NNM method to estimate ATET in their investigations.

4.4.1 Test Results for Diagnostics

After each observation has a propensity score assigned to it, it is necessary to check for overlap between the propensity scores assigned to the treatment and control groups (referred to as "common support"). In order to determine whether or not the matching was successful in balancing the distribution of important variables in both groups, a balancing test is also carried out to determine whether the differences in the means of the covariates for the two groups (those who accessed credit versus those who did not) are insignificant. The subsections provide further information on these two tests, which are a part of the diagnostic tests.

A) Propensity Score Matching with Common Support

Once a propensity score has been determined for each observation, it is necessary to confirm that the range of propensity scores between the treatment and comparison groups overlaps (this is known as “common support”) (Brooks & Ohsfeldt, 2013). For

a treated person for whom there is no comparison person with a similar propensity score, no conclusions about the effects of the treatment may be drawn. Examining a graph of propensity ratings between treatment and comparison groups allows for the subjective evaluation of common support (Peprah, Oteng & Sebu, 2020). This presumption makes the assumption that a certain amount of randomness is necessary to ensure that farm households with the same characteristics can be seen in both states, i.e., credit access and non-access. Hence, after the matching procedure, the density distribution of the propensity scores was examined visually, as shown in figure 4.6 and 4.7, to ensure it was correct.

Figure 4.2 Common Support for Propensity Scores of effect of Agricultural Credit Access (a)

Source: Author's computation based on Survey data (2021).

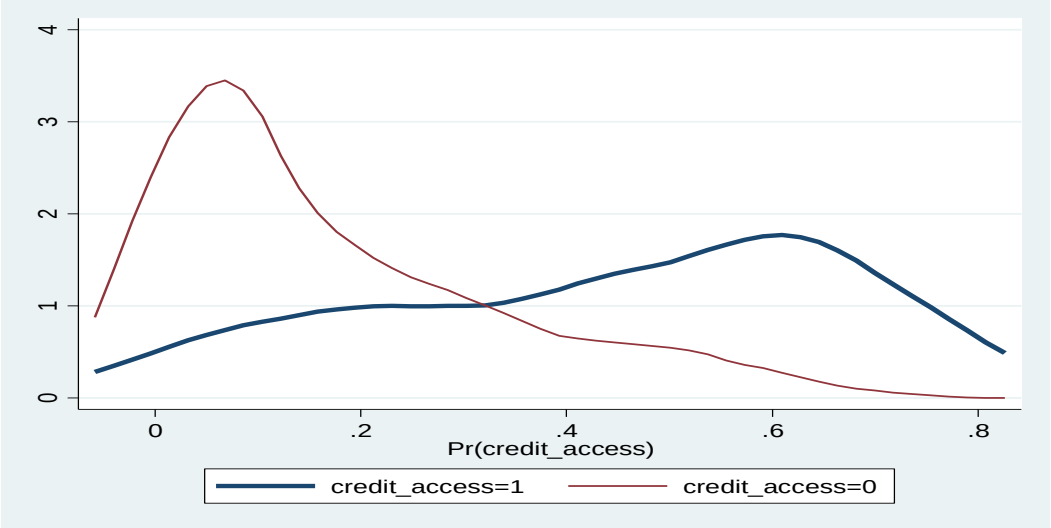


Figure 4.3 Common Support for Propensity Scores of effects of Agricultural Credit Access (b)

Source: Author's computation based on Survey data (2021).

The findings show that the distribution of propensity scores for both small holders who accessed credit and those who did not overlapped significantly. As a result, it was determined that the common support condition had been met because there was sufficient randomness to ensure that farm households with the same characteristics could be seen in both states, i.e., credit access and non-credit access (Baffour, Rahaman & Mohammed, 2020).

Thus, it can be proven that the model balances the coefficients. As a result, in the matched samples, the distribution of the conditioning confounding factors is the same in both the treatment group and the control group. This demonstrates that small-holder farmers who obtained loans and those who did not did not have different pretreatments.

b) Balancing test of Covariates across Treatment and Comparison Groups within Blocks of the Propensity Score

According to Peprah, Oteng, and Sebu (2020) and Ateka (2018), another prerequisite for employing PSM is that the differences between the means of the covariates for the two groups should not be statistically significant after matching. The absence of differences suggests that the distribution of pertinent variables (covariates) in both groups has been balanced by the matching process. Table 4.6 lists the outcomes of the balance test.

Table 4.6: Matched Groups Balancing Test for effect of access to Agricultural Credit

	Mean		t-test	
Variable	**Accessed Credit**	**Did not Access Credit**	**t**	**p >|t|**
Education	4.94	5.16	(0.800)	0.423
Size of Farm under Cultivation	2.43	2.31	0.790	0.430
Extra Workers Engaged (Labor)	0.92	0.76	0.760	0.448
Quantity of Fertilizer (Kgs)	885.82	758.69	1.670	0.298
Quantity of Seeds (Kgs)	2,670.00	2,628.30	0.380	0.707
Motorized Equipment	0.27	0.35	(0.960)	0.338
Extension Services	0.06	0.06	0	1

Source: Author's computation based on Survey data (2021).

The findings indicate that neither the small holder farmers who used credit nor those who did not use credit had any appreciable variations in the covariate means. So, after accounting for all the variables, the results showed that the differences had been significantly minimized. As a result, it can be inferred that the propensity score specification was successful in balancing the distribution of covariates between the

two matched groups and that the PSM method was adequate for the estimate of the credit access effects.

4.4.2 Effect of access to Agricultural Credit on Agricultural Output

The PSM procedure was justified after it was shown that the propensity scores balanced the distribution of variables between the two matched groups and that the assumption of shared support was true. The difference in average agricultural output between the two matched groups was then used to calculate the impact of smallholder farmers' access to finance on agricultural output. In Table 4.7, the findings are presented as the average treatment effects for the treated (ATET).

Table 4. 7: Effect of Access to Agricultural Credit on Agricultural Output from PSM

Estimator	Outcome	Effect	Coef.	AI Robust Std. Err.	P-Value
NNM	Agricultural Output	ATET	58409.26***	18,216.36	0.002

Source: Source: Author's computation based on Survey data (2021)

*AI robust standard errors are used to generate heteroskedastic –robust variance estimators to correct for potential heteroskedasticity (Abadie & Imbens, 2002; Ateka (2018).

According to Table 4.7, there was a positive and significant ATET for the impact of access to agricultural financing on agricultural output. It appears from this that having access to agricultural loans can greatly raise agricultural output by 58,409.26 Naira (USD. 142.9). This suggests that small-holder farmers may benefit from accessing loans for agricultural activities if the borrowed money is used for its intended purpose.

When borrowed agricultural credit has a higher marginal utility in agriculturally related activities and a lower marginal utility in non-agriculturally related activities like consumption, short-term investments in rival businesses, and long-term investments like education, it can have a significant impact on agricultural activity (Mghenyi, 2015).

If, as suggested by Siddiqi et al. (2009), the flow of credit to farmers increases the demand for inputs to increase crop production in terms of the number of tractors, use of chemical fertilizer, size of cultivated land, and pesticides, the amount of credit accessed may occasionally fail to have a significant impact on output. When credit is not obtained in a sufficient amount, the influence of such a high input demand on production costs may be felt.

However, having access to loans may encourage farmers to use mechanized farming techniques like using tractors or fertilizers, which may increase output (Siddiqi et al. 2009). On the other hand, Anyiro and Oriaku (2011) found that small-holder farmers in Abia State, Nigeria, did not significantly benefit from access to microcredit in terms of their agricultural output. This was primarily caused by the fact that most farmers used their agricultural credit for unrelated, non-agricultural purposes.

4.5 Effect of Credit Utilisation Behaviour on Agricultural Output

Investigating the effect of smallholder farmers' credit utilisation behavior on agricultural output in Nigeria's Plateau State was the third objective of the study. Similar to that, a PSM technique was utilised, but in this instance, the analysis only

included individuals who had access to credit (81). The binary probit model was used to determine the propensity scores that were employed in the matching procedure as the likelihood of either fully using the credit (1), partially using the credit (1), or not using the credit at all (0). (Rosenbaum & Rubin, 1983; Ateka, 2018).

Using a logit or probit regression with treatment (in this case, credit use behavior) as the outcome variable and potential confounders as explanatory variables is a common first step, according to Garrido et al. (2012), to produce a propensity score. The results of the probit regression model in PSM as shown in Table A7 were used in this study. The selection of the covariates to be included was an essential stage in this estimation of propensity scores. The covariates utilized in the model are therefore expected to be those that are connected to both the treatment (credit utilization behavior) and the result (in this case, agricultural output) (Austin, 2011a; Garrido et al., 2012). If a factor is believed to be connected to the result (such as agricultural output in this case).

Based on these explanations, factors relevant to the outcome (agricultural output), previously developed under section 4.3, were automatically associated to the treatment and were therefore included in computing propensity scores (credit utilization behaviour). Education, the amount of farmed land, the number of additional workers hired, the amount of fertilizer and seeds utilized, the use of motorized equipment, and the accessibility of extension services were all factors that were included in the model. Individual small-holder farmers with similar characteristics (education, size of cultivated land, number of additional workers

engaged, amount of fertilizer used, amount of seeds used, adoption of motorized equipment, and accessibility to extension services) in the treatment and comparison groups are compared through propensity matching, then compressed into pertinent single scores.

These explanations led to the covariates linked to the outcome (agricultural production), previously specified under section 4.3, and by default, those connected to the treatment, being included in the estimation of propensity scores (credit utilisation behaviour). As a result, the model's covariates included factors including education, the amount of farmed area, the number of additional people employed, the amount of fertilizer and seeds utilised, the use of motorized equipment, and the availability of extension services. Individual small-holder farmers in the treatment and comparison groups who share similar characteristics (education, size of cultivated land, number of additional workers employed, amount of fertilizer used, amount of seeds used, adoption of motorized equipment, and availability of extension services) are compared using propensity matching, then the results are compressed into pertinent single scores. Thereafter, individuals in the comparison and treatment groups are contrasted based on propensity scores.

Additionally, the choice of the variables can be justified by empirical studies like Danso-Abbeam, Ansah, and Ehiakpor's (2014) claim that agricultural credit utilization among farmers in Bole district of Northern region, Ghana is correlated with the small holder farmer's level of education, size of cultivated land, labor workforce, and quantity of inputs. A subsequent study by Nosiru (2010) found that credit was mostly

used for agriculture inputs like increasing the amount of land under cultivation, purchasing fertilizer, seeds, and extension services, as well as labor and mechanized equipment.

The propensity scores were generated using a probit regression with treatment as the outcome variable and potential confounders as the explanatory variables. The farm household groups were matched using the closest neighbor matching (NNM) technique, which is frequently used in PSM investigations as indicated in section 4.3.1 above, once the propensity scores had been estimated.

4.5.1 Diagnostic Test Results

The range of propensity scores for the treatment and comparison groups must overlap once each observation's propensity score has been determined (this is known as "common support"). Additionally, a balancing test is carried out to determine whether or not the differences in the covariate means for the two groups—those who accessed credit and those who did not—are unimportant in order to determine whether or not the matching was successful in balancing the distribution of important variables in both groups. The subsections of this section provide descriptions of these two tests, which are a part of the diagnostic tests.

a) Propensity Score Matching with Common Support

Common support was then ostensibly evaluated after a propensity score had been computed by looking at a graph of propensity scores between the treatment and control groups (Figure 4.4). This stipulation makes the assumption that a certain

amount of randomness is necessary to ensure that farm households with the same characteristics can be observed in both states, pitting those who used agricultural credit against those who only used it in part or not at all. Because of this, the density distribution of the propensity scores following the matching process was examined visually, as in Figures 4.8 and 4.9.

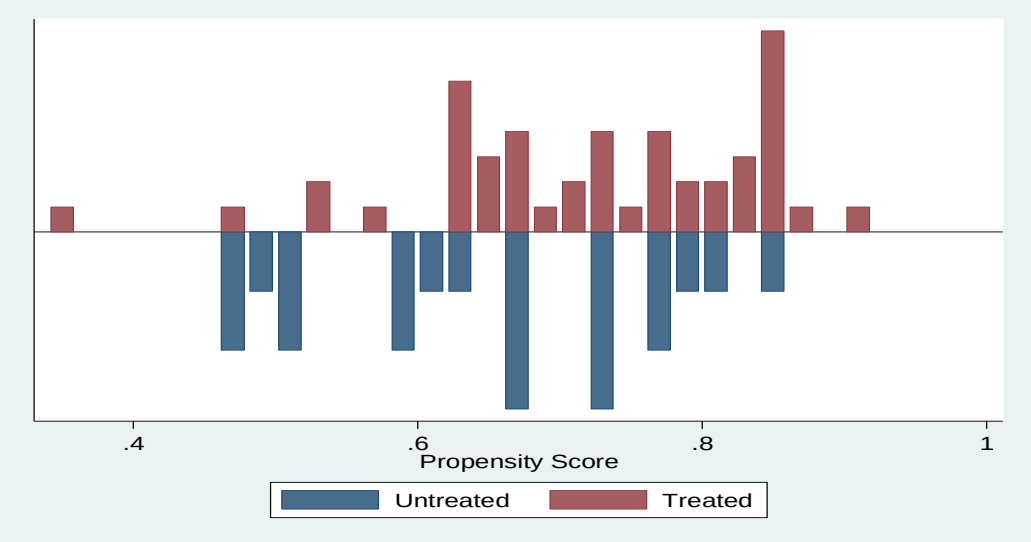


Figure 4.1 Common Support for Propensity Scores for effect of Agricultural Credit Utilization (a)

Source: Author's computation based on Survey data (2021).

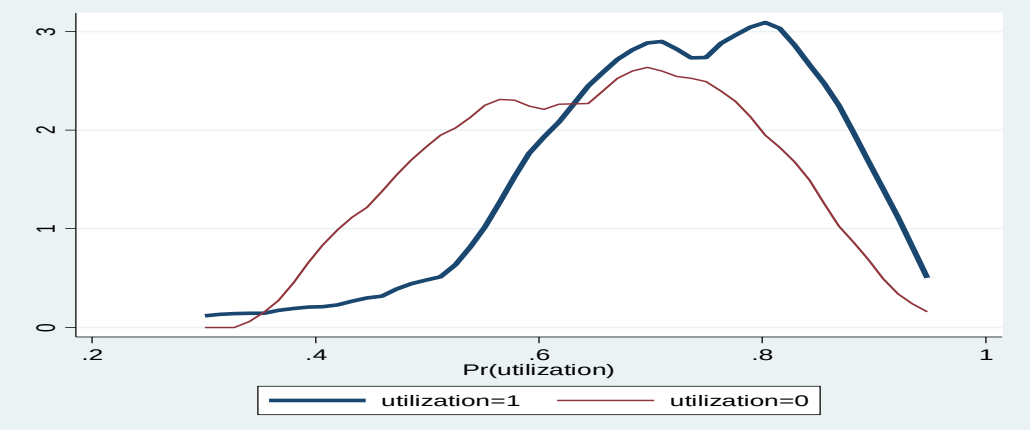


Figure 4.2 Common Support for Propensity Scores for effect of Agricultural Credit Utilization (b)

Source: Author's computation based on Survey data (2021).

The findings showed that the distribution of propensity scores for small holders who used agricultural credit fully and those who only used it partially or not at all overlapped significantly. This led researchers to the conclusion that the common support condition was satisfied because there was sufficient randomness to ensure that farm households with the same characteristics could be seen in both states, whether they were fully utilizing agricultural credit or not using it at all, and whether they were using it either partially or not at all. (Baffour, Rahman, & Mohammed, 2020).

It can be proven that the model balances the coefficients. As a result, in the matched samples, the distribution of the conditioning confounding factors is the same in both the treatment group and the control group. In other words, the self-selection bias has been eliminated, satisfying the matching requirement for computing treatment effects. This demonstrates that there are no pretreatment differences between small holder farmers who fully utilized agricultural credit and those who either partially or didn't use agricultural credit at all.

b) Balancing test of Covariates across Treatment and Comparison Groups within Blocks of the Propensity Score

Another requirement for utilizing PSM is that, following matching, the differences in the means of the covariates for the two groups should not be statistically significant. The absence of differences suggests that the distribution of pertinent variables (covariates) in both groups has been balanced by the matching process. Table 4.8 summarizes the findings of the balancing test.

Table 4. 8: Balancing Test of Matched Groups for effect of Credit Utilization Behaviour

	Mean		t-test	
Variable	**(Fully utilized)**	**(Partially Utilized or didn't utilize)**	**t-test**	**p>|t|**
Education	5.348	6.022	(2.340)	0.321
Size of Farm under Cultivation	2.435	2.365	0.470	0.641
Extra Workers Engaged (Labour)	0.348	0.261	0.670	0.507
Quantity of Fertilizer (Kgs)	1,002.500	1,069.800	(1.350)	0.181
Quantity of Seeds (Kgs)	2,811.300	2,792.400	0.170	0.862
Motorized Equipment	0.304	0.304	- 0.000	1.000
Extension Services	0.087	0.087	0.000	1.000

Source: Author's computation based on Survey data (2021).

The findings demonstrate that there were no significant changes in the means of the variables, with the exception of education level, for smallholder farmers who fully utilized agricultural loan as well as those who did so either partially or not at all. In light of these findings, it can be shown that after accounting for all variables other than education, differences were significantly reduced. So, it can be concluded that the propensity score specification was reasonably successful in balancing the distribution of covariates between the two matched groups and that the PSM procedure was appropriate for the estimate of the credit utilization effects.

4.5.2 Effect of Credit Utilisation Behaviour on Agricultural Output

The PSM procedure was justified after it was shown that the propensity scores balanced the distribution of variables between the two matched groups and that the assumption of shared support was true. The difference in average agricultural output between the two matched groups was then used to calculate the impact of credit

utilization behavior on agricultural output. In Table 4.9, the findings are presented as the average treatment effects for the treated (ATET)

Table 4. 9: Effect of Credit Utilization Behavior on Agricultural Output from PSM

Estimator	Outcome	Effect	Coef.	AI Robust Std. Err.	P>|z|
NNM	Agricultural Output	ATET	(73951.5)	29349.19	0.004

Source: Source: Author's computation based on Survey data (2021)

*AI robust standard errors are used to generate heteroskedastic –robust variance estimators to correct for potential heteroskedasticity (Abadie & Imbens, 2012; Ateka (2018).

According to Table 4.9, the ATET coefficient was negative (73951.5) and significant to 5 per cent (P-Value = 0.004). This suggests that poor credit usage behavior, as demonstrated among the study's small-holder farmers sample, where only 9 of the 81 people who received credit fully utilized the credit accessed, negatively and significantly reduces agricultural output. Access to agricultural credit, it can be argued, is linked to an increase in the demand for adult labour, which replaces child labour from households, the use of mechanized equipment, the use of organic fertilizer, and the use of high-quality hybrid seeds, all of which increase the cost of agricultural production. Poor loan use, however, causes the value of agricultural products to decline. So, it may be argued that even when access to agricultural finance pushes production costs above the value of incremental output, poor credit utilization behavior makes the situation worse. A higher interest rate on the agricultural credit accessed would also have a detrimental effect on the value of the agricultural produce. In that sense, it can be argued that these findings are consistent with earlier research, and the distinctive findings for Plateau State are that it is not simply about having

access to agricultural finance; rather, it is about using the credit wisely in order to have a substantial beneficial impact.

According to a related study by Nosiru (2010), the improper use of or diversion of secured credit away from the intended farm operations caused credit use in Ogun State, Nigeria, to have a negative impact on the level of agricultural productivity. Similar findings from other studies suggest that in rural developing nations, low credit utilization practices have negative consequences on agricultural output (Feder *et al.*, 1990; Sial and Carter, 1996) and farm investment (Carter, 1989)

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

5.1 Introduction

The study's summary, conclusion, key findings, study's contribution to and potential areas for additional research are all presented in this chapter. The study's goals and findings are summarized in Section 5.2; its conclusions are presented in Section 5.3, and its policy implications are discussed in Section 5.4. In light of the outcomes of this study, 5.6 suggest areas for additional investigation and 5.5 presents a contribution to knowledge.

5.2 Summary of the Study

The study was motivated by the government of Nigeria's efforts to increase smallholder farmers' access to credit in Nigeria since independence. Based on research done in Plateau State, Nigeria, the study discovered that education level, farm size, sources of income, household size, credit information, distance to scheme, distance to cooperative, and type of agricultural activity were the major determinants of credit access. Also, it was discovered from the study that only 81 of the 399 smallholder farmers that were examined used credit, while the other 318 did not. Only 9 of the 81 smallholder farmers that got financing, according to the study, used it to its full potential.

The results of past studies on agricultural credit did not take into account agricultural credit accessibility and its consequences on the output of smallholder farmers in

Plateau State, Nigeria, where the farmers' usage behavior was also taken into consideration. By examining the impacts of agricultural credit accessibility on the productivity of smallholder farmers in Nigeria's Plateau State, the study filled this knowledge vacuum.

The study's main objective was to examine the availability of agricultural financing and how it affected smallholder farmers' yields in Nigeria's Plateau State. Analysis of the factors influencing smallholder farmers' ability to acquire agricultural finance in Nigeria's Plateau State was one of the project's main objectives. Another was to ascertain how access to credit affected smallholder farmers' ability to produce agricultural products. The smallholder farmers served as the study's major source of primary data. Each of the chosen smallholder farmers received a questionnaire, which was used to gather the primary data.

The first objective was to analyse the determinants of agricultural credit access by smallholder farmers in Plateau State, Nigeria. The study discovered that smallholder farmers' access to credit in Plateau State, Nigeria, was influenced by their level of education, farm size, source of income, household size, credit information, distance from the scheme, distance from the cooperative, and kind of agricultural activity.

The second objective was to determine the effect of access to agricultural credit on agricultural output by smallholder farmers in Plateau State, Nigeria. The study found that the coefficient for ATET was positive and significant. The third objective was to

investigate the effect of credit utilization behaviour of smallholder farmers on agricultural output in Plateau State, Nigeria. The study found that the coefficient for ATET was negative and significant.

5.3 Conclusion

Three conclusions about the study's findings were drawn. Firstly, a few important criteria influenced how smallholder farmers could receive loans. Second, having access to agricultural loans can significantly enhance agricultural output by 58,409.26 Naira (USD 142.9). This goes against the claim that borrowing money for agricultural purposes can only be advantageous if the money is used for what it was intended to be used for. If the money is used carelessly or is diverted to purposes other than the intended farm enterprises, the impact on agricultural output will be deemed to be insignificant.

Thirdly, the study discovered that inadequate loan utilisation practices have a negative but significant impact on agricultural output. Among the smallholder farmers sampled for the study, only 9 of the 81 fully utilized the credit they had acquired. This is in line with the claim that having access to agricultural credit is linked to an increase in the demand for adult labor, which replaces child labor from households, the use of mechanised equipment, the use of organic fertilizer, and the use of high-quality hybrid seeds, all of which raise the costs of agricultural production and lead to poor credit usage behavior, which lowers the value of agricultural produce. This is also consistent with earlier research and the specific findings for Plateau State, which show that using credit responsibly is more important than simply being able to get agricultural finance

in order to have a large positive impact. According to another research, the improper use of agricultural credit or the diversion of obtained funds to purposes other than the intended farm operations prevented credit use in Ogun State, Nigeria, from positively impacting agricultural productivity. The findings were in line with prior research that showed that inefficient credit usage practices had a negative impact on agricultural output in rural parts of developing nations.

5.4 Policy Implications

Smallholder farmers are more likely to receive finance if they have better education levels (more years in school). Given the critical role that education plays in enabling farmers to access more credit for their agricultural activities, it is expected that the government of Plateau State, working in conjunction with the federal government, should increase the opportunities for farmers to enroll in school. By doing so, they will be able to potentially obtain credit and run their agricultural practices effectively and efficiently, increasing the output of their crops. The likelihood that a smallholder farmer will be able to acquire loans is higher for those with larger farms. Smallholder farmers should be allowed to acquire agricultural loans from both the state and federal governments of Nigeria in order to improve their farming methods and, as a result, their productivity. Compared to smallholder farmers who had no other sources of income, they were more likely to have access to loans. In this situation, the government should develop educational programs, similar to the empowerment programs, to help smallholder farmers develop entrepreneurial skills so they can engage in off-farm endeavors in order to boost their income.

When compared to smallholder farmers who don't, those who have obtained credit information are more inclined to do so. The government ought to devise methods by which farmers can gain access to information regarding loans, such as the conditions of repayment, the interest rates, and where to find amiable lending arrangements. Hence, a smallholder farmer may have a better chance of obtaining loans. The likelihood that a smallholder farmer will not be able to receive loans can increase for those who live closer to a program. In order to reduce the amount of money farmers spend on transportation and the amount of time they spend traveling to credit schemes to source agricultural financing, the government is urged to establish credit schemes close to the farmers. Access to financial facilities is more likely for smallholder farmers who are closer to their cooperative. This enables the government to organize various cooperatives since the distance between the lender and borrower increases the transaction's financial and temporal costs, particularly transportation costs, which deters smallholder borrowers. Smallholder farmers that practice mixed farming typically see an increase in their Monthly income, which allows them to seek out loans because they have the means to repay them. To make it simple for farmers to use mixed farming techniques, the government should train them in the process and put the required infrastructure in place.

Smallholder farmers can only benefit from obtaining credit for agricultural purposes if they use the money they borrow for that purpose. This is especially true in the case of agricultural loan access. Given that the agricultural output coefficient was positive and significant, it is clear that the agricultural credit that farmers in Plateau State have access to is essential to their ability to carry out their agricultural activities. As a

result, the government must establish more effective credit facilities so that smallholder farmers can easily access credit.

This coefficient was negative and significant for the behaviour of using agricultural finance. The cause of this is that smallholder farmers use agricultural loans to upgrade their agricultural operations, such as switching from manual labor to mechanized farming methods, and to purchase expensive agricultural working instruments. The price of producing food is increased as a result. A monitoring team should be established by the government so that it may periodically visit smallholder farmers to evaluate how the funds were spent.

5.5 Contribution to Knowledge

In terms of the study's contribution, none of the research has examined the effects of agricultural credit accessibility on the output of smallholder farmers in Nigeria's Plateau State.

A majority of the research either concentrated on crop farming or animal farming as the main types of farming. The two methods of farming which are animal production and crop production are simultaneously the subject of this investigation. The study has found that Plateau State engages in both agricultural production and animal production types of farming.

5.6 Areas for Further Research

Further studies can concentrate on areas like the link between credit accessibility and smallholder farmers' agricultural performance in Plateau State, Nigeria, the link between credit accessibility and smallholder farmers' welfare, and the link between credit accessibility and smallholder farmers' profitability in order to better understand this relationship.

REFERENCES

Abadie A., & Imbens G., (2012). "Matching on the Estimated Propensity Score." National Bureau of Economic Research Working Paper No. 15301

Ateka, J., M., (2018). Effects of Farm Size and Greenleaf Marketing Arrangements on Smallholder Tea Production Efficiency in Selected Counties In Kenya.

Adekoya, O.A. (2014). The Pattern and Determinants of Agricultural Credit Use Among Farm Household in Oyo State, Nigeria. *Asian Economic and Financial Review 4(10): 1290-1297*. https://doi.org/10.55493/5002.v13i1.4681

Adeoye, D.O., (2016). Challenges of Urban Housing Quality: Insights and Experiences of Akure, Nigeria. Proc. Soc. Behav. Sci., 216: 260-268. *https://doi.org*/10.1016/j.sbspro.2015.12.036

Agba, Adewara, Nwanji, Yusuf, & Ojipkong (2018). Reducing Small Scale FarmersPoverty through Credit Access in Kwara State Nigeria.

Ahmad, N. (2011). Impact of institutional credit on agricultural output: A case study of Pakistan. *RePEc:agr:journl:v:10(563):y:2011:i:10(563):p:99-120*

Ajakaiye, M.B. (1998). Financing Agricultural Programmes In Nigeria. The Role of the Nigeria Agricultural and Cooperative Bank Limited, Pp. 4-9. *https://doi.org*/10.1080/09718923.2008.11892634

Akinade, J. O. (2002). Agricultural credit management in Union Bank of Nigeria, Abeokuta Branch. Unpublished M.Sc thesis submitted to the Department of Agricultural Economics, University of Ibadan, Nigeria

Alvarez, R. M., Brehm, J. (1995). American Ambivalence Towards Abortion Policy: Development of a Heteroskedastic Probit model of competing values, *American Journal of Political Science*, 39, (4) 1055- 1082. https://www.jstor.org/stable/2111669

Ammani, A. A. (2012). An Investigation into the Relationship between Agricultural Production and Formal Credit Supply in Nigeria. *International Journal of Agriculture and Forestry 2(1), 46-52.* Ammani, A. A. (2012). DOI: 10.5923/j.ijaf.20120201.08.

Anyiro C, Oriaku B (2011). Access to and investment of formal micro credit by small holder farmers in Abia State, Nigeria. A case study of Absu Micro Finance Bank, Uturu. J. Agric. Sci. 6(2):69-76. https://doi.org/ 10.5897/JDAE2017.0814

Arene, C.J. (2002). Loan repayment and technical assistance among smallholder maize farmers in Nigeria. African Review of Money Finance and Banking .*A supplement of Savings and Development Journal, 1(3),* 64-72.

Asom, S. T., & Ijirshar, V. U. (2017). An Assessment of Credit Accessibility of Rural Farmers in Benue State: A case study of Bank of Agriculture (BOA).

Assogba, P.N., HarollKokoye, S.E., Yegbemey R.N., Djenontin J.A., Tassou Z., Pardoe, J., & Yabi, J.A., (2017). Determinants of Credit Access by Smallholder Farmers in North-East Benin. Journal of Development and

Agricultural Economics 9(8):210-216. https:// doi.org/ 10.1111/1475-6773.12182 Augurzky, B., & Schmidt, C., (2001). The propensity score: A means to an end. Discussion Paper 271, Institute for the Study of Labor (IZA). : *http://www.jstor.org/stable/*41058994

Austin, P.C. A (2011a). Tutorial and Case Study in Propensity Score Analysis: An Application to Estimating the Effect of In-Hospital Smoking Cessation Counseling on Mortality. *Multivariate Behavioral Research.* 2011a; 46:119–51. https:// *doi.org*/ 10.1111/1475-6773.12182

Avinash R. & Mitchell-Ryan, T. (2009).An Assessment of the Impact of The sectoral Distribution of Commercial Bank credit on Economic Growth and Development in Trinidad and Tobago. Central Bank of Trinidad and Tobago.*CBB Working Paper*, 2010.

Awotide, B. A. Abdoulaye, T. Alene, A. & Manyong, V. M. (2015). Impact of Access to Credit on Agricultural Productivity: Evidence from Smallholder Cassava Farmers in Nigeria. *African Journal of Economy and Society*, *2*(1), 10-42.

Awotide, D. O., Aihonsu, J. O. Y., & Adekoya, A. H. (2012). Cooperative societies' effectiveness in credit delivery for agricultural enterprises in Ogun State, Southwest Nigeria. *Asian J. Bus. Manage. Sci*. *2*(3), 74-79.

Baffoe G. Matsuda H. Masafumi N. & Akiyama T.(2015). The Dynamics of Rural Credit and its Impacts on Agricultural Production: An Empirical Study in RuralGhana.*http://www.ssrn.com/link/OIDA-Intl-Journal-Sustainable-Dev.html*

Baffoe, G., Matsuda, H., Nagao, M., & Akiyama, T. (2015). The dynamics of rural credit and its impacts on agricultural productivity: An empirical study in rural Ghana. *OIDA International Journal of Sustainable Development*, 7(5), 19-34. http://www.ssrn.com/link/OIDA-Intl-Journal-Sustainable-Dev.html

Baffoe, Matsuda, Nagao and Akiyama (2014). The Dynamics of Rural Credit And Its Impacts On Agricultural Productivity: An Empirical Study In Rural Ghana.

Baffour, Rahaman & Mohammed, (2020). Impact of Mobile Money Access on Internal Remittances, Consumption Expenditure and Household Welfare in Ghana.

Bashir, M. K., Mehmood, Y., & Hassan, S. (2010). Impact of agricultural credit on productivity of wheat crop: Evidence from Lahore, Punjab, Pakistan. *Pakistan Journal of Agricultural Science*, *47*(4), 405-409.

Bakhshoodeh M., & Karami, A,, (2008). Determinants of poor accessibility to microcredits in rural Iran. International Conference on Applied Economics – ICOAE 2008.

Bidogeza, J. C., Afari-sefa, V., Djoumessi, Y., .F.. & Kamdem, C. .B. (2015). Determinants of Smallholder Vegetable Farmers Credit Access and Demand in Southwest region, Cameroon. Economics Bulletin, ISSN 1545-2921, Accessecon LLC, s.l., 38 (2) 1231-1240.

Biyase, M. & Fisher, B. (2017). Determinants of Access to Formal Credit by the Poor Households Studia Universitatis Babes-Bolyai Econmica : *62, (1) 2017, 50-60.*

Brookhart, M., A., Schneeweiss, S., Rothman, K.J., Glynn, R.J., Avorn, J., & Stürmer,T.,(2006).Variable Selection for Propensity Score Models. *Am J Epidemiol. 2006 Jun 15; 163(12): 1149–1156.*

Brooks, J. M., & Ohsfeldt R. L., (2013). Squeezing the Balloon: Propensity Scores and Unmeasured Covariate Balance. *Health Services Research.* 2013;48 (4):1487–507 (2013).

Browne R., H., (1995). On the use of a pilot sample for sample size determination. *Stat Med* 1995; 14: 1933–1940

Carter, M. & Olinto, P., (2003). "Getting Institutions "Right" for Whom? Credit Constraits and the Impact of Property Rights on the Quantity and Composition of Investment." *American Journal of Agricultural Economics 85 (1): 173-186.*

Caviglia-Harris J. L. (2003). Sustainable Agricultural Practices in Rondônia, Brazil: Do Local Farmer Organizations Affect Adoption Rates? *Economic Development and Cultural Change, 52(1), 23-49.*

Central Bank of Nigeria (CBN) (2007). Agricultural Credit Guarantee Scheme Fund of Nigeria (ACGSF): An impact assessment. A study conducted by Centre for Resource Analysis and Management for Central Bank of Nigeria, Abuja: 15-6.

Central Bank of Nigeria (2010). CBN Annual Report. https://www.cbn.gov.ng/out/2011/publications/reports/rsd/ar2010/annual%20report%202010.html

Central Bank of Nigeria (2016). Developments in the External Sector. *External Sector Committee Reports, Quarter 3, Issue 1 No.3,*P. 6.

Chambers, R. G. (1988), *"Applied production analysis, a dual approach"*, Cambridge: Cambridge University Press, xv 4–331. *https://doi.org/*10.2307/1241630

Chandio, A. A., Magsi, H., Rehman, A., & Sahito, J. G. M. (2017). Types, sources and importance of agricultural credits in Pakistan. *Journal of Applied Environmental and Biological Sciences, 7*(3), 144-149.

Chavas, J. P. and M. T. Holt. 1990. "Economic Behavior under Uncertainty: A Joint Analysis of Risk Preferences and Technology." *The Review of Economics and Statistics* 78(2): 329-35.

Chena, T.A. Maria, A.G. & Tenor, M.N. (2018). Determinants of Access to Credit and Performance of Smallholder Farmers in Kumba Municipality, South West Region of Cameroon.

Chidambaram K & Ganesan S. (2002). Overdues in Primary Agricultural Cooperative Banks in Madurai district: A case study. Cooperative Perspective. 37(3): 57

Chisasa, J. (2014). An empirical study of the impact of bank credit on agricultural output in South Africa (PHD Thesis, University of Lagos).

Chisasa, J., & Makina, D. (2015). Bank credit and agricultural output in South Africa: Cointegration, Short run Dynamics and Causality. *Journal of Applied Business Research (JABR), 31*(2), 489-500. *https://doi.org/*10.19030/jabr.v31i2.9148

Collender, R. N. & Zilberman, D.(1985). Land Allocation under Uncertainty for Alternative Specifications of Return Distributions. *American Journal of Agricultural Economics* 67: 779-86. *https://doi.org*/10.2307/1241817

Conning, J., (1996). Group lending, moral hazard and the creation of social collateral. Working Paper. *Journal of Development Economics 60,(1) 3-25. https://doi.org/*10.1016/S0304-3878 (99)00034-6

Consultative Group to Assist the Poor (CGAP) (2017). Advancing Financial Inclusion to Improve the Lives of the Poor.

Dan-Azumi, J.J. (2011). Agricultural Sustainability of Smallholder Floodplain Agricultural Systems: A Case Study of Areas In North- Central Nigeria. A Thesis Submitted In Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Development Planning and Administration. Development Planning Unit/Bartlett Faculty of the Built Environment University College London.

Danso-Abbeam, G., Ansah, I.G.K., & Ehiakpor, D.S. (2014). Microfinance and Micro-Small-Medium Scale Enterprises (MSME's) in Kasoa Municipality, Ghana. British Journal of Economics, Management and Trade, 4(12), 1939 - 1956. DOI *http://dx.doi.org/*10.18551/rjoas.2016-03.07.

Dawang, C., (2018). Impact of Fishery Regulatory Innovation on Income and Nutrition of Smallholder Households in Plateau State, Nigeria. https://Doi.org/ ageconsearch.umn.edu/record/277174.

Dehejia, R. & Wahba, S. (2002). Propensity Score-Matching Methods for Nonexperimental Causal Studies. *Review Economics and Statistics, 84, 151-161*.
*https://doi.org/*10.1162/003465302317331982.

Egwu, P. N. (2016). Impact of Agricultural Financing on Agricultural Output, Economic Growth and Poverty Alleviation in Nigeria. *Journal of Biology, Agriculture and Healthcare*, 6 (2), 2016. 25–40.

Ehikioya, I.& Mohammed, I. (2013). Commercial bank credit accessibility and sectoral output performance in a deregulated financial market economy: empirical evidence from Nigeria. *Journal of Finance and Bank Management*, *1*(2), 36-59.

Ejembi, E. P., Omoregbee , F.E., & Ejembi,S. A., (2006). Farmers' Assessment Of The Training And Visit Extension System In Central Nigeria: Evidence From Barkin Ladi, Plateau State Journal Of Social Sciences 12 (3). *https://doi.org/*10.1080/09718923.2006.11978393

Ellis, F. (1992) *Agricultural policies in developing countries.* Cambridge University Press

Enhancing Financial Innovations and Access (EFInA), (2018). Estimating the Effects of Financial Access on Poor Farmers in Rural Northern Nigeria

Enilolobo, O. S., & Ode-Omenka, L. C. (2018). The impact of credits on agricultural output in Nigeria. *International Journal of Economics, Commerce and Management, 6(12), 23-34.*

Enu, P., & Attah-Obeng, P. (2013). Which macro factors influence agricultural production in Ghana? Academic Research International, 4(5), 333.

Enweze, C. (2006). *Between Food Security, Economic Growth and National Development, Economics and Politics*: the Nigeria Business.com. Accessed November 2013, available at http://www.- the Nigeria business.com,

Eswaram, M., & Kotwal, A., (1990). *Implications of Credit Constraints for Risk Behavior in Less- developed Countries.* Oxford Economics working Papers 42, Oxford University Press.

Eyo, E., (1985). The Agricultural Credit Guarantee Scheme (ACGS) CBN Bullion Vol 11 (1): 37 –41.

Food and Agricultural Organisation, (FAO) (2011). Assessing and responding to land tenure issues in disaster risk management. *http://www.fao.org/docrep*/014/i2115e/i2115e00.pdf

Food and Agricultural Organisation (FAO) (2015): Farming System and Poverty: Improving Farmers Livelihood a Changing World Federal Ministry of Agriculture, Water Resources and Rural Development (FMA) (1984) planning for ad

Food and Agricultural Organisation FAO (2009). Improving Rural Financial Markets for Developing Microenterprises. Food and Agriculture Organization of the United Nation (FAO), Rome, Italy, retrieved at: www.fao.org/docrep/007/, 15th September 2022.

Food and Agricultural Organisation (FAO), (2018). Pastoralism in Africa's drylands: reducing risks, addressing vulnerability and enhancing resilience. Food and Agriculture Organization of the United Nations, Rome.

Food and Agricultural Organisation (FAO). (2019). The State of the World's Aquatic Genetic Resources for Food and Agriculture. FAO Commission on Genetic Resources for Food and Agriculture assessments. Rome. 290 pp. (also available at www.fao. org/3/CA5256EN/CA5256EN.pdf) FAO (2019

Feder G. (1980). Farm Size, Risk Aversion and the Adoption of New Technology under Uncertainty. Oxford Economic Papers 32: 263-83.

Garrido, M.M., Deb, P., Burgess, J.F., & Penrod, J,D.(2012). Choosing Models for Cost Analyses: Issues of Nonlinearity and Endogeneity. *Health Services Research.*47(6): 2377–97.

Garvelink, .J. Wedding, K. & Hanson, S. (2012): Smallholder Agriculture: *A Critical Factor in Poverty Reduction and Food Security in Africa.* Centre for Strategic and International Studies, Washington, D.C.

Gertler, P. J., Martinez, S., Premand, P., Rawlings, L. B. and Vermeersch C. M. J.(2011) . Impact Evaluation in Practice. The International Bank for

Reconstruction and Development / The World Bank. 1818 H Street NW. *Washington DC 20433. Pp. 3, 7, 107-110.*

Glosow, P.A. (2005). *Fundamentals of Survey Research Methodology.* Washington C3 Center McLean, Virginia.

Green, S. L. (2003), Rational Choice Theory: An Overview, Baylor University

Greene, W. H. (2018). *Econometric Analysis*, Pearson Education, New Jersey.

Grune-Yanoff, T. (2010). *Rational Choice Theory and Bounded Rationality. In: Religion, Economy, and Evolution*. Pyysiäinen, I. (Ed.). Berlin: de Gruyter, Pp. 61-81.

Ha, V.T. T. (2001). Determinants of Rural Households' Borrowing from the Formal Financial Sector: A study of the rural credit market in Red river delta region.

Hananu B, Abdul-Hanan A, Zakaria H (2015). Factors influencing agricultural credit demand in Northern Ghana. African Journal of Agricultural Research 10(7):645-652. https:// doi.org/ 10.1111/1475-6773.12182

Harder, V.S., Stuart, E.A.,& Anthony, J., C., (2010). Propensity score techniques and the assessment of measured covariate balance to test causal associations in psychological research.

Harikumar, S. (1991). *Utilization and repayment of agricultural loans of regional rural banks: a case study, Agricultural Banker*, October/December, 13-16.

Heckman, J.J, Ichimura H., Todd, P.E., (1997). Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme. *ReviewofEconomi*,10681080.https://doi.org/10.5897/AJAR2020.15382.

Heinrich, C., Maffioli, A., & Vazquez, G. (2010).A primer for applying propensity-score matching.Inter-American Development Bank.

Hennessy, D., B. Babcock, A., & Hayes, D.J. (1998). Budgetary and Producer Welfare Effects of Revenue Insurance." *American Journal of Agricultural Economics* 79 (3): 1024-34. *https://doi.org*/10.2307/1244441

Hussain, A., & Taqi, M. (2014). Impact of agricultural credit on agricultural productivity in Pakistan: An empirical analysis. *International Journal of Advanced Research in Management and Social Sciences*, *3*(4), 125-139.

Hussain, A. & Thapa, G.B. (2012). Factors determining subsistence farmers' access to agricultural credit in flood-prone areas of Pakistan. Kasetsart Journal of Social Sciences 39 (2,) 262-26. *https://doi.org/*10.1016/j.kjss.2017.06.001

Hussien, H., (2007). Farm Household Economic Behaviour in Imperfect Financial Markets, Doctorial Thesis, Swedish University of Agricultural Sciences, Uppsala

Ibe, S, O. (2014). Impact of Banks' and Public Sector's financing Activities on Agricultural Output in Nigeria. *Journal of Agriculture and Environmental Sciences*, 3 (2), 129-143.

Ifeanyi, A. O., & Blessing, C. O., (2012).Economic analysis of loan repayment capacity of small-holder cooperative farmers in Yewa North Local Government Area of Ogun State, Nigeria. *African Journal of Agricultural Research 7(13), 2051-2062* .

Iheancho, A.C. (2006). Determining and Managing Appropriate Agricultural Policy Variables for Rural Poverty Reduction in Nigeria. *Journal of Agriculture Science, **2**(3), 1813–2235*

Ihegboro, I. (2014). The Impact Of Agricultural Credit On Agricultural Productivity In Nigeria (Doctoral dissertation, Department of Banking And Finance, Faculty of Business Administration, University of Nigeria, Enugu Campus).

Imbens, G. (2004). Nonparametric Estimation of Average Treatment under Erogeneity: A Review. *The Review of Economics and Statistics*, 86(1), 4-29.

International Finance Corporation (IFC) (2014). *International Finance Corporation (IFC) annual report 2014: big challenges, big solutions (Vol. 2) : IFC financials and projects2014(English).* Washington, D.C.: World Bank Group.

Iqbal, M., Ahmad, M., Abbas, K.,(2003). The Impact of Institutional Credit on Agricultural Production in Pakistan. http://mpra.ub.uni-muenchen.de/3673/ mpra paper no. 3673.

Isaga, N. (2018). Access to bank credit by smallholder farmers in Tanzania: a case study. *Afrika Focus*, 31(1).

Isitor, S. U., Babalola D. A. & Obaniyi, K. S.(2014). An Analysis of Credit Utilization and Farm Income of Arable Crop Farmers in Kwara State, Nigeria. *Double Blind Peer Reviewed International Research Journal Publisher: Global Journals Inc. (USA) Online ISSN: 2249-4626.*

Jehle, G.A. & Reny, P.J. (2000). *Advanced Microeconomic Theory,* 2nd edition, Addison Wesley, New York.

Jodha, N. S. (1986). *Common Property Resources and Dynamics of Rural Poverty*.Field Evidence from Dry Regions of India.

Robert, C.,Asil, D., & Morduch, J., (2007). Financial Performance And Outreach: A Global Analysis Of Leading Micro Banks. *The Economic Journal 3(2). https://doi.org/*10.1111/j.1468-0297.2007.02017.x

Kadri, A. Y., Bunyaminu, A., & Bashiru, S. (2013). Assessing rural banks effectiveness in Ghana. International Research, 6.

Kausar, A., (2013). "Factors Affect Microcredit's Demand in Pakistan," *International Journal of Academic Research in Accounting, Finance and Management Sciences*, Human Resource Management Academic Research Society, *International Journal of Academic Research in Accounting, Finance and ManagementSciences.3(4),11-17.*

Key, N., Sadoulet, E., & de Janvry, A. (2000). Transactions costs and agricultural household supply response. American Journal of Agricultural Economics, 82, 245–259. *http://dx.doi.org/*10.1111/ajae.2000.82.issue-2

Khandker, R. & Faruqee, P. (2003) .The impact of farm credit in Pakistan. *Agricultural Economics, 28 (3) (2003), pp. 197-213. https://doi.org/*10.1111/j.1574-0862.2003.tb00138.x

Kiplimo, J. C. (2013). *Determinants of access to credit by small-holder farmers in Eastern and Western Kenya*. Masters Dissertation, Strathmore University.

Kiratu, N. M. (2014). An Assessment of the Impact of Kilomo plus Subsidy Programme on Smallholder farmers' Food Security and Income in Nakuru North District, Kenya.

Korir K.G. (2013). *Factors Affecting Access to Credit by the Small Business Producer Groups in Trans-Nzoia.* Research Project Submitted in Partial Fulfilment of the Requirements for the Master Degree in Master of Science Entrepreneurship and Innovation Management, School of Business, University of Nairobi.

Korir L. K. (2011). Risk Management among Agricultural Households and the Role of off-Farm Investments in Uasin Gishu County, Kenya. M.Sc. Thesis Moi University

Kosgey, Y.K.K. (2013). Agricultural credit access by grain growers in Uasin-Gishu County, Kenya IOSR *Journal of Economics and Finance, 2 (3) 36-52.*

Laha, A. (2013). Technical Efficiency in Agricultural Production and Access to Credit in West Bengal, India: A Stochastic Frontier Approach. *International Journal of Food and Agricultural Economics, 53-64.*

Lawal, J. & Muyiwa, A. (2009). Food security and socioeconomic characteristics of cocoa farming households in Nigeria: support through agricultural biotechnology. Proceedings of the 2nd International e-Conference on Agricultural Bio-Sciences.

Lemessa, K., & Gemechu, F., (2016). Effect Of Climate Change On Agricultural Production And Community Response In Daro Lebu & Mieso District, West Hararghe Zone, Oromia Region National State, Ethiopia. Journal Of Natural Sciences Research www.iiste.Org issn 2224-3186 (Paper) Issn 2225-0921 (Online).6 (24).

Maddala, G.S., (1983). *Limited-dependent and qualitative variables in econometrics Cambridge University Pres. https://doi.org/*10.1017/CBO9780511810176

Maffioli & Vasquez (2010). The effect of prison-based college education programs on recidivism: Propensity Score Matching approach. *https://doi.org/*10.1016/j.jcrimjus.2013.03.001

Mafimisebi, T. E. Oguntade, A. E. & Mafimisebi, O. E. (2009). *A Perspective on Partial Credit Guarantee Schemes in Developing Countries:* The Case of the Nigerian Agricultural Credit Guarantee Scheme Fund (ACGSF). A paper presented at a World Bank conference at Washington D.C from March 13-14: 2-4.

Maher, J.R. K., Toomse-Smith, M., Kiss, Z., Pollard, E., Williams, M., Hillage, J., Green, M., Huxley, C., & Hunt, W. (2018). Student Income and Expenditure Survey 2014 To 2015 English

Manyong, V. M., Ikpi, J. K., Olayemi, S. A., Yusuf., R., Omonona, & F. S. Idachaba (2003*). Agriculture in Nigeria: Identifying Opportunities for Increased Commercialization and Investment.* Main report from International Institute of Tropical Agriculture and University of Ibadan for USAID/Nigeria.

Marr, A., & Schmied, J., (2016). Financial Inclusion and Poverty: The Case of Peru Schmied, Julian and Marr, Ana (2016) Financial inclusion and poverty: The case of Peru. Regional and Sectoral Economic Studies, 16.

Meier,G.,,(1989) Inflation and Its Effects on Economic Development (A Review of Meier ,Gerald. Leading Issues in Economic Devpt,1989, Part IV- 169-193)

Mendola, (2007). Agricultural Technology Adoption And Poverty Reduction: A Propensity-Score Matching Analysis For Rural Bangladesh. Elsevier Journal of Food Policy 32(3) 372-393. *https://doi.org*/10.1016/j.foodpol.2006.07.003

Mgbebu, E. S. & Achike, I. A., (2017). Analysis of Loan Acquisition and Repayment among Small Scale Rice Farmers in Ebonyi State, Nigeria: Implication for Effective Credit Delivery. *Journal of Economics and Finance 3(I) 20-26. https://doi.org*/10.9790/5933-0803012026.

Mgbenka, R.N. Mbah, E.N. & Ezeano, C.I.(2016). A Review of Small holder Farming in Nigeria: Need for Transformation. *Agricultural Engineering Research Journal 5(2): 19-26.*

Mghenyi,E., (2015). The Impact of Agricultural Credit on Demand for Factors of Production, Farm Output, and Profitability in Kenya. *Journal of Business and Social Review in Emerging Economies 6 (3).*

Miller, L.F.(1977), Agricultural Credit and Finance in Africa. The Rockfeller Foundation. 56 Mushunje A, Belete A and Fraser G, (2003). Technical Efficiency of Resettlement Farmers of Zimbabwe.

Mishra, A.K. & Goodwin, B.K. (1997) Farm Income Variability and the Off-Farm Labor Supply. American. *Journal of Agricultural Economics, 79, 880-887. https://doi.org*/10.2307/1244429

Moahid, M., & Maharjan, K., (2020). Factors Affecting Farmers' Access To Formal And Informal Credit: Evidence From Rural Afghanistan. *https://doi.org*/10.3390/su12031268

Mohamad, M. M., Sulaiman, N. L., Sern, L. C., & Salleh, K. M. (2015). Measuring The Validity And Reliability Of Research Instruments. Procedia: Social and Behavioral Sciences, 204, 164-171.

Mugenda, A., & Mugenda, O. (2009). *Research methods; Qualitative and quantitative Approaches*. Africa Centre for Technology (ACT), Nairobi Kenya. *Journal of Building Construction and Planning Research, 9(1).*

Muturi, W. M. (2012). Determinants of Participation in Rotating Credit and Savings Association in Urban Informal Settlement: Evidence from Mathare Slums. *Unpublished PhD Thesis, JKUAT.*

National Population Commission of Nigeria (NPA) (2006). National Population Commission (NPC) (2006) Nigeria National Census: Population Distribution

by Sex, State, LGAs and Senatorial District: 2006 Census Priority Tables (Vol. 3). http://www.population.gov.ng/index.php/publication/140-popn-distri-by-sex-state-jgas-and-senatorial-distr-2006

Neilson, W. & H. Winter, H. (2001). A Verification of the Expected Utility Calibration Theorem. *Economics Letters* 74(2002): 347-351. Department of Economics, Texas A&M University, College Station, TX 77843, USA b Department of Economics, Ohio University, Athens, OH 45701, USA. https://web.utk.edu/~wneilson/EcLett-Calibration.pdf

Njuguna, A., E., (2019). The effect of collective action on smallholder income and asset holdings in Kenya. World Development Perspectives 14 (100099). *https://doi.org*/10.1016/j.wdp.2019.02.010

Nguyen, C.H. (2007). *Access to credit and borrowing behaviour of rural households in a transition*, paper presented at International Conference on Rural Finance Research Moving Results into Policies and Practices, 19-21 March, Rome.

Njoku, J.E. (1997). Determinants of loan repayment under the special emergency loan scheme (SEALS) in Niger: a case study in Imo state, *African Review of Money Finance and Banking,* 1, 39-51.

Nosiru, M., O., (2010)/ Micro credits and agricultural productivity in Ogun State, Nigeria. *World Journal of Agricultural Sciences 6 (3) 290-296, 1817-3047.*

Nto, P. O. & Mbanasor J. A.(2008).Analysis of Credit Repayment among Arable Crops Farmers under Rural Banking Scheme in Abia State, Nigeria.*Inter. Journal of Agriculture and. Rural Dev. 11(1).*

Nwachukwu, E.U. (2008) Determination of Efficiency of Resource Use in Swamp and Upland Rice Production System in Ebonyi State. An Unpublished M.Sc Thesis Submitted to the Department of Agricultural Economics University of Nigeria, Nsukka,

Nwachukwu, I.(2008).*Empirical Assessment of Nigeria's Agricultural Export and Economic Welfare. MPRA.* Munich Personal RePEcArchive.

Nwagbo, E. C. (1993).*"Credit Access and Use in Agriculture" Paper delivered on Agricultural Finance*: Problems and Prospects. Agric. Exhibition, University of Nigeria, Nsukka.

Nwaru, J.C. & Onuoha, R.E. (2010). Credit Use and Technical Change in Smallholder Food Crop Production in Imo State of Nigeria, New York Science Journal 3(11), 144-152.

Nweze N.J.(1991). The Role of Women Traditional Savings and Credit Co-operative in Smallholder Farm Development in: *Ogits, C.A (eds) Issues in Africa Rural Development,pp 234-236.*

Nwosu, F. O., Oguoma, N. N. O., Ben-Chendo& Henry-Ukoha, A. (2010) .The Agricultural Credit Guarantee Scheme: Its Role, Problems and Prospects in Nigeria's Quest for Agricultural Development. Researchers; 2 (2)

Nyaga, J. (2017). Strategic Factors Affecting Access to Credit Facilities by Smallholder Dairy Farmers in Githunguri Sub-County Kiambu County, Kenya. *Strategic Journal of Business and Change Management* 4, (2) 1-19

Obebo, F. M., Wawire, N. H. W., & Muniu, J. M. (2018). Effects of Participation of Micro and Small Enterprises in Microfinance on Their Performance in Kenya. *International Journal of Economics and Finance*, *10*(7), 78. *https://doi.org*/10.5539/ijef.v10n7p78

Obilor, S. I. (2013). The impact of commercial banks' credit to agriculture on agricultural development in Nigeria: An econometric analysis. *International Journal of Business, Humanities and Technology, 3(1), 85-94.*

Obisesan, A., (2013). Credit Accessibility among small holder cassava farming households in south west Nigeria, Greener *Journal of Agricultural Science. 3(2): 120–127:* http://dx.doi.org/10.4314/gjass.v16i1.6

Oguoma N. N. O. (2002). An Evaluation of the Agricultural Credit Guarantee Scheme in Imo State, Nigeria. Unpublished Ph.D. thesis, Department of Agricultural Economics, Federal University of Technology, Owerri.

Ojo, M.O. (1998). Some Implications of Government Economic Policies for The Financingand Development of Agriculture in Nigeria, 16-24 in *Readings in Agricultural Finance*, Okorie, A., & Ijere, M.O., (Eds). Lagos: Longman.

Okojie, C., A. Monye-Emina, K.. Eghafona, G.. Osaghae, and J.O., Ehiakhamen. (2010). Institutional environment and access to microfinance by self-employed women in the rural areas of Edo State. NSSP Brief No. 14. Washington. D.C.: International Food Policy Research Institute.

Okorie, A. (1998). *The Agricultural Credit Guarantee Scheme Fund and Credit Administration in Nigeria:* Problems and Prospects. In M. O. Ijere and A. Okorie (Eds.) Readings in Agricultural Finance. Longman Publisher, Ikeja, Nigeria.38-40.

Okurut, N., A. Schoombee & S. Van dar Berg (2004*). Credit Demand and rationing in the Informal Financial Sector in Uganda.* Paper on the DPRU/Tips/Cornell Conference on African Development and Poverty Reduction.

Oladeebo J. O. & Oladeebo O. E.(2008). Determinants of Loan Repayment among Smallholder Farmers in Ogbomoso Agricultural Zone of Oyo State, *Nigeria J. Soc.Sci., 17(1): 59-62. https://doi.org/*10.1080/09718923.2008.11892634

Oladeebo, O.E. (2003). *Socio- Economic Factors* .Influencing Loan Repayment Among Small *Scale Farmers in Ogbomoso Agricultural Zone of Oyo State, Nigeria.* Full Professional Diploma Project (unpublished), Department of Management Science, Ladoke Akintola University of Technology, Ogbomoso.

Olaitan, M. A. (2006). Finance for Small and Medium Enterprises: Nigeria's Agricultural Credit Guarantee Scheme Fund. J*ournal of Finance and Accounting*., 4 (1) 1-10

Onono, P.A., Wawire, N.W.H. & Ombuki, C. (2013). The Response of Maize Production in Kenya to Economic Incentives", International Journal of Development and Sustainability, 2(2), 530-543.

Oriaku, B.N. (2010). *Access to and Investment of Formal Micro credit by small holder farmers in Abia State, Nigeria. A case study of ABSU micro finance bank, Uturu.".B. Agric. Thesis*. Dept. of Agricultural Economics and Extension, Abia State University Uturu.

Osabohien, R., Adeleye, N., & De Alwis, T. (2020). Agro-financing and food production in Nigeria. *Heliyon, 6*(5) 1-16.

Osabohien, R., Osuagwu, E., Osabuohien, E., Eseosa, U., Ekhator-Mobayode, and Gershon, O. (2020). *South African Journal of Economics and Management Sciences,* 23, (1) 1-19.

Osuntogun A. & Adewunmi W., (2003). *Rural Banking in Nigeria:* Nigerian Institute of Bankers. Prentice Hall Press;

Peprah, J.A., Oteng, C., & Sebu, J., (2020). Mobile Money, Output and Welfare Among Smallholder Farmers In Ghana. *Sage Journal https://doi.org/*10.1177/2158244020931114

Quach, M. H. Mullineux, A. W. & Murinde, V. (2005). Access to credit and household poverty reduction in rural Vietnam: a cross-sectional study. *The Birmingham Business School, The University of Birmingham Edgbaston*, 1-40.

Qureshi, S., Nabi, I. and Faaruquee, R., (1996). Rural Finance for Growth and Poverty Alleviation, World Bank Policy Re-search Working Paper No 1593, Washington DC: World Bank. Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Rabin M. (2000). Risk Aversion and Expected-Utility Theory: A Calibration Theorem. *Econometrica* 68(5): 1281-1292. *https://doi.org/*10.1111/1468-0262.00158.

Rahman, A. Hussain, M. &Taqi, W. (2014).Impact of agricultural credit on agricultural productivity in Pakistan: An empirical analysis. *International Journal of Advanced Research in Management and Social Sciences, 3 (4) 125-139.*

Ramaswami, B. (1992). Production risk and Optimal Input Decisions. *American Journal of Agricultural Economics* 74: 860-69. *https://doi.org/*10.31274/rtd-180813-17059

Rambabu, P.D. & Eswaran, Y. P. (1994). *Factors influencing attitude of the farmers towards farm credit. Agricultural Banker* October/ December, 25.

Rao, P.,P., (1987). *A case study of credit utilization pattern, repayment performance and profitability of crop loans of small and marginal farmers under Chaitanya Grameena Bank of Andhra Pradesh. M.Sc.(Ag.).* Thesis Submitted to Andhra Pradesh Agricultural University, Rajendranagar, Hyderabad.

Reyes, A., Lensink, R., Kuyvenhoven, A., & Moll, H. (2012). Impact of access to credit on farm productivity of fruit and vegetable growers in Chile (No. 1007-2016-79549).

Rizwan M., Ali S, Qayyum MF, Ok YS, Adrees M, Ibrahim M, Zia-ur-Rehman M, Farid M, & Abbas, F., (2017). Effect of metal and metal oxide nanoparticles

on growth and physiology of globally important food crops: A critical review. J Hazard Mater 322:2–16

Rosenbaum, P. & Rubin, D. (1983). The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika*, 70 (1), 41-55.

Rubin, D.M. (2004) A Simple Autocorrelation Algorithm for Determining Grain Size from Digital Images of Sediment. *Journal of Sedimentary Research*.

Ryan, T. (2009). Sample Size Determination and Power. John Wiley and Sons. Smith, K., (2008).An entrepreneurial perspective on the firm-environment relationship. *Strategic Entrepreneurship Journal,6(4), 329–344.*

Sadoulet, E. & de Janvry, A. (1995).Quantitative Development Policy Analysis Baltimore: John Hopkins University Press. Finance In Bangladesh. *Studies in Business and Economics, 10(2), 145-159.*

Sapkal, S. B., Kumbhar, J. S. & Shinde, H.R.(2010): "Borrowing and Utilization pattern of Cooperative Credit in Satara District of Maharashtra", *Cooperative Sugar*, 42(4): 45-49. *http://dx.doi.org*/10.21511/bbs. 14 (1).2019.16

Saqib, S.E., Kuwornu, J.K.M., Ahmad, M.M. and Panezai, S. (2018), "Subsistence farmers' access to agricultural credit and its adequacy: Some empirical evidences from Pakistan", *International Journal of Social Economics*, 45(4)644-660. *https://doi.org/*10.1108/IJSE-12-2016-0347

Sarker, S., Ghosh, S. K., & Palit, M. (2015). Role Of Banking-Sector To Inclusive Growth. Through inclusive development. *Development in Practice 26(8) https://doi.org/*10.1080/09614524.2016.1227301

Sekyi (2017). Sekyi, S. (2017). Rural Households' Credit Access and Loan Amount in Wa Municipality, Ghana. *International Journal of Economics and Financial Issues*, 7(1), 506-514.

Sial, M., H., Awan, M., S. & Waqas, M., (2011), "Role of institutional credit on agricultural production: a time series analysis of Pakistan*", International Journal of Economics and Finance, 3 (2) 126-132.*

Siddiqi, M.W. & Baluch, K.N. (2009), "Institutional credit: a policy tool for enhancement of agricultural income of Pakistan", *International Research Journal of Arts & Humanities (IRJAH), 37(2) 158-174.*

Singh I., Squire L., & Strauss J., (1986). *Agricultural Household Models: Extensions, Applications, and Policy*. Johns Hopkins University Press; Baltimore.

Stiglitz,J.E. & Weiss, A. (1981).Credit Rationing in Markets with Imperfect Information. *The American Economic Review, 71(3) 393-410.*

Suresh, K., & Chandrashekara, S., (2012). Sample Size Estimation And Power Analysis For Clinical Research Studies. *Journal of Human reproductive Sciences*, 5(1) 7- 13.

Ukoha, O.O., Majeed, R.O., & Ntee, N.I.(2007). Determinants of Farmers Welfare in Ebonyi State, Nigeria. *Pakistan Journal of Social Sciences 4(3) 351-354*.

Varian H. R. (2010).Intermediate Microeconomics: A Modern Approach. 8th edition. New York: W.W. Norton and Company. 2010. 223-224.

Verbeek, M. (2012).*A Guide to Modern Econometrics 4th eds.* West Sussex: John Wiley and Sons.

Walker, T. & Jodha, N., (1986), "How Small Farmers Adapt to Risk", in Hazell, P. Pomareda, C. and Valdez, A., eds., *Crop Insurance for Agricultural Development* , JohnsHopkins, Chap.

Were, M. Nzomoi, J. & Rutto, N. (2012). Assessing the Impact of Private Sector Credit on Economic Performance. Evidence From Sectoral Panel Data for Kenya. *International Journal Of Economics and Finance*, *4*(3), 182- 185.

Winters, P., Salazar, L., & Maffioli, A. (2010). Designing impact evaluations for agricultural projects. *Inter-American Development Bank, Washington, DC*, *14*, 2012.

Wooldridge, J. M. (2002). Inverse probability weighted M-estimators for sample selection, attrition, and stratification. Portuguese *Economic Journal, 1(2), 117–139*.

World Bank (2014). Nigeria – Agriculture and Rural poverty: A policy note, February 2014 Poverty Reduction and Economic Management, Africa Region, Report No 78364 - NG

World Bank (2019). Global Economic Prospects; Heightened tensions, subdues investments. International Bank for Reconstruction and Development / The World Bank. Washington D.C. USA.

Yamane, T., (1967). Statistical Approach to the Link between Internal Service Quality and Employee Job Satisfaction: A Case Study. *American Journal of Applied Mathematics and Statistics*, pp 178-184.

Yusuf, T. M, Ballogun, O.L & Tiamiyu, S.A., (2016). Transforming Smallholder Farming sin Nigeria through Off-Farm Employment. http://ageconsearch.umn.edu

APPENDICES

Appendix I: Questionnaire

Sunday Baba

Kenyatta University

P.O Box 43844-00100, GPO

Nairobi-Kenya

Good morning/afternoon/evening.

Dear Valued Respondent,

My name is SUNDAY BABA, a PhD student in Kenyatta University, Nairobi Kenya carrying out an important research on "**Agricultural Credit Accessibility and Its Effects on Output of Smallholder Farmers in Plateau State, Nigeria**''. This is in partial fulfillment of the requirement for the award of the degree of Doctor of Philosophy in Economics of Kenyatta University, Kenya.

This household has been selected randomly to represent others in this area. The information obtained in this research will help the government of Nigeria and other organizations know how they can bring better service delivery on agricultural credit access to you. All the information you give me will not be reported at household level and the report will not mention this household. In addition, all information given in the questionnaire will be treated with strict confidentiality and will only be used for the purpose of this research. Your cooperation will highly be appreciated.

I would like to talk to the head of the household or the person who has the most information about this household. Could I please talk to that person now?

I will ask you a number of questions

QUESTIONNAIRES

Demographics of Smallholder Farmer

1. Age of the household head…….
2. Sex of the head of the household
   a) Male [ ]
   b) Female [ ]
3. Marital Status of the head of the household
   a) Single **[ ]**
   b) Married **[ ]**
   c) Divorced **[ ]**
   d) Separated **[ ]**
   e) Widowed/Widower **[ ]**
4. Level of education of the smallholder farmer
   a) No formal education **[ ]**
   b) Primary **[ ]**
   c) Junior secondary **[ ]**
   d) Senior secondary **[ ]**

Tertiary

e) Diploma [ ]
f) National Certificate of Education (N.C.E) [ ]
g) Degree [ ]

Farm Information

5. a) Approximately, what is the size of your farm in Hectares?

.....

b) Approximately, how many hectares are under cultivation?

.....

c) What is your main source of income?

a) Farm income **[ ]**

b) Employment **[ ]**

c) Other source, specify

…….

d) a) What is your range of annual income?

i. Below 1 Million Naira [ ]

ii. Between 1 M- 2 M [ ]

iii. Above 2 M [ ]

b) Approximately, how much income do you get in a year?

.....

8. a) What is the total number of members in your household?

.....

..

b) How many of those members are engaged in the farm activities?

…….

9. a) Do your engage other farm workers in your agricultural activities?

Yes **[ ]**

No **[ ]**

b) If yes, how many do you engage per month?

……..……

Agricultural Credit Information

10. a) Do you have information about agricultural credit?

Yes [ ]

No [ ]

b) If yes to 9a) what are your sources of agricultural credit information?

Television [ ]

Radio [ ]

Newspaper [ ]

Others [ ]

11. Have you taken a loan in the past one year to finance your agricultural sactivities?

Yes [ ]

No [ ]

12. If yes, to question 10, where did you get the loan from?

Banks [ ]

Agricultural credit scheme **[ ]**

Cooperatives **[ ]**

Others [ ]

Please state……..

13. If loan is from Bank, which bank?

……..

14. If agricultural scheme, which agricultural scheme? .....

15. If cooperative, which cooperative? ……

16. What is the total amount of credit that was accessed (in '000 Naira)

……

17. Please state the proportion of credit utilized to fund agricultural activities

Fully utilized on agricultural activities **[ ]**

Partially utilized on agricultural credit **[ ]**

Not utilized on agricultural activities **[ ]**

18. If small holder farmer has not accessed credit, how do you mainly fund your agricultural activities? …….

19. What is the distance from your home to the following credit providers in km?

Bank ……..

Agricultural credit scheme ……

Cooperatives ……

20. Who are the major credit providers to smallholder farmers in Plateau State? ……..

21. Have you ever been in need of a loan to fund your agricultural activities?

Yes **[ ]**

No **[ ]**

Agricultural Output by the smallholder farmers:

22. What agricultural activities are you engaged in?

Crop production [ ]

Livestock production [ ]

Both crop and livestock [ ]

Others [ ]

23. What quantity (Kgs) of the following do you use on your land annually?

Fertilizer [ ]

Seeds (Planting Materials) [ ]

24. Do you use Motorized equipment?

Yes **[ ]**

No **[ ]**

25. Do you benefit from government agricultural agent's extension services?

Yes **[ ]**

No **[ ]**

26. If you are a mixed or crop farmer, please indicate kilograms (Kgs) produced for each of these crops annually

CROPS	**Kilograms produced**
Guinea corn	
Sorghum	
Cabbages	
Pepper	
Onions	
Tomatoes	

	Sweet Potatoes	
	Millet	
	Hungry rice	
	Beans	
	Others 1..... 2..... 3..... 4.....	 ....

27. Please state the amount of each crop sold and consumed at home

CROPS	Amount in Naira	
	Crops Sold	Crop Consumed
Guinea corn		
Sorghum		
Cabbages		
Pepper		
Onions		
Tomatoes		
Sweet Potatoes		
Millet		
Hungry rice		
Beans		
Others 1..... 2..... 3..... 4.....	 …… …… …… ……..	 …… …… …… ……..

28. If livestock, please indicate the amount sold

SMALLHOLDER FARMERS OF LIVE STOCK PRODUCTION IN PLATEA STATE		
LIVESTOCI	Number of animal Sold	Amount Sold in Naira
Goats		
Sheep		
Chickens		
Cows		
Turkey		
Dugs		
Others 1..... 2..... 3..... 4.....	 …… …… …… ……..	 …… …… …… ……..

29. State the prices of the following livestock:

LIVESTOCK	PRICES OF LIVESTOCK AT THE PREVAILING MARKET PRICE
Goats	
Sheep	
Chickens	
Cows	
Turkey	

Dugs	
Others	....

THANK YOU FOR PARTICIPATION

Appendix II: Tables and Figures

Table A1: Multicollinearity Test from Probit Model

Variable	VIF	1/VIF
Farm Size	3.17	0.32
Type of Agricultural Activity	2.96	0.34
Access to Credit Information	1.52	0.66
Amount of HH Income	1.39	0.72
Engaging Extra Workers	1.30	0.77
Distance to the Scheme	1.08	0.92
Sources of Income	1.08	0.93
Level of Education	1.06	0.94
HH Size	1.06	0.94
Distance to the Cooperative	1.05	0.95
Age	1.05	0.96
Marital Status	1.04	0.96
Distance to the Bank	1.02	0.98
Gender	1.02	0.98
Mean	**1.41**	

Source: Author's computation based on Survey data (2021)

Table A2: Link Test Results of the Probit Model

				Number of Observation	399	
				LR Chi2 (2)	223.22	
				Prob > Chi^2	0.000	
				Pseudo R^2	0.5544	
				Log Likelihood	-90.749	
Credit Access	**Coef.**	**Std. Err.**		**P>|z|**	**[95% Conf.**	**nterval]**
Hat	.932	.115	.090	0.000	0.706	.157
Hatsq	.126	.091	(1.380)	0.167	(0.305)	.053
Cons	.110	.136	.810	0.415	(0.155)	.376

Source: Author's computation based on Survey data (2021)

Table A 3: Hosmer-Lemeshow Test of Goodness of fit of the Probit Model

Number of Observations	399
Number of Groups	10
Hosmer-Lemeshow $Chi^2(8)$	1.89
Prob>Chi^2	0.9841

Source: Author's computation based on Survey data (2021)

Table A 4: Breusch-Pagan/Cook-Weisberg test of Heteroskedasticity

Ho: Constant Variance
Variables: Fitted Values of Credit Access
$Chi^2(1)$ = 124.52
Prob>Chi^2 = 0.0000

Source: Author's computation based on Survey data (2021)

Table A 5: Probit Regression Results for Determinants of Credit Accessibility

		Number of Observations			399	
		LR Chi2 (2)			138.01	
		Prob > Chi^2			0.000	
		Pseudo R^2			0.5492	
		Log Likelihood			-90.749	
Credit Access	**Coefficient**	**Robust Std Error**	**Z**	**>|Z|**	**[95% Confidence Interval**	
Age	0.005	0.006	.740	.459	(0.007)	0.017
Gender	(0.287)	0.224	(1.280)	0.199	(0.726)	0.152
Marital Status	(0.225)	0.180	(1.250)	0.212	(0.579)	0.128
Level of Education	0.323	0.063	5.170	0.000	0.200	0.445
Farm Size	0.536	0.155	3.460	0.001	0.232	0.841
Sources of Income	0.237	0.127	1.870	0.061	(0.011)	0.486
HH Income	0.000	0.000	0.890	0.375	(0.000)	0.000
Household Size	0.390	0.063	6.150	0.000	0.266	0.515
Engaging Extra Workers	(0.073)	0.253	(0.290)	0.774	(0.569)	0.423
Credit Information	1.726	0.231	7.460	0.000	1.273	2.180
Distance to the Bank	(0.001)	0.046	(0.030)	0.980	0.092)	0.089
Distance to the Scheme	(0.106)	0.041	(2.600)	0.009	(0.185)	(0.026)
Distance to the Cooperative	(0.085)	0.040	(2.130)	0.033	(0.164)	(0.007)
Type of Agricultural	(0.625)	0.213	(2.940)	0.003	(1.042)	(0.208)

Activity						
Constant	(3.570)	1.001	(3.570)	0.000	(5.531)	(1.609)

Source: Author's computation based on Survey data (2021)

Table A 6: Estimation Results of the PSM Probit Model on effect of Credit Access

Dependent Variable	**Credit Access**					
	Coefficient	**Std Error**	**Z Value**	**P>|z|**	**[95% Conf.**	**[Interval]**
Education	0.328***	0.054	6.090	0.000	0.222	0.434
Size of Farm under Cultivation	(0.072)	0.157	(0.460)	0.645	(0.379)	0.235
Extra Workers Engaged (Labour)	0.050	0.090	0.560	0.577	(0.126)	0.226
Quantity of Fertilizer (Kgs)	0.001**	0.000	2.240	0.025	0.000	0.001
Quantity of Seeds (Kgs)	0.001**	0.000	2.570	0.010	0.000	0.001
Motorized Equipment	0.220	0.258	0.850	0.395	(0.287)	0.726
Extension Services	(0.056)	0.425	(0.130)	0.894	(0.888)	0.776
Constant	(3.761)	0.444	(8.470)	0.000	(4.631)	(2.890)

Source: Author's computation based on Survey data (2021)

- LR Chi^2 (7) = 83.57, Prob > Chi^2 = (0.000) ; * Sig at 10%, ** Sig at 5%, *** Sig at 1%
- The default for motorized equipment is no access to motorized equipment
- The default for extension services is no access to extension services

Table A 7: Estimation Results of the PSM Probit Model on effect of credit utilization

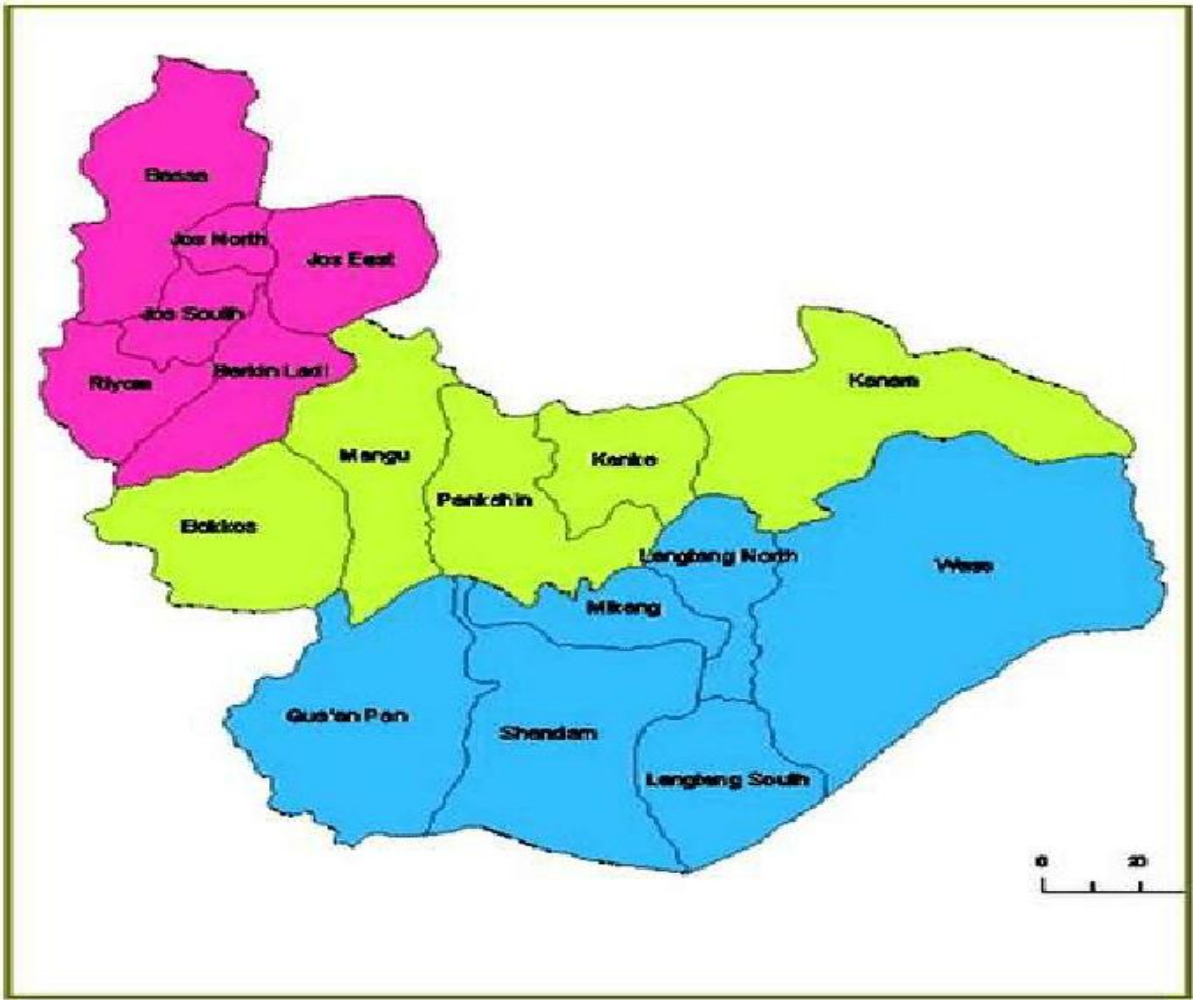
Dependent Variable	**Credit Utilization Behaviosr**					
	Coefficient	**Std Error**	**Z Value**	**P>|z|**	**[95% Conf.**	**[Interval]**
Education	0.142	0.108	1.320	0.186	(0.069)	0.353
Size of Farm under Cultivation	(0.276)	0.305	(0.900)	0.366	(0.875)	0.322
Extra Workers Engaged (Labor)	(0.041)	0.157	(0.260)	0.795	(0.349)	0.267
Quantity of Fertilizer (Kgs)	(0.001)	0.001	(0.920)	0.358	(0.002)	0.001
Quantity of Seeds (Kgs)	0.001*	0.000	1.880	0.061	(0.000)	0.002
Motorized Equipment	0.009	0.426	0.020	0.983	(0.826)	0.844
Extension Services	(0.324)	0.677	(0.480)	0.632	(1.652)	1.003

Constant	(0.864)	0.902	(0.960)	0.338	(2.632)	0.903

Source: Author's computation based on Survey data (2021)

- LR Chi^2 (7) = 4.8, Prob > Chi^2 = (0.6839) ; * Sig at 10%
- The default for motorized equipment is no access to motorized equipment
- The default for extension services is no access to extension service

Figure A 1: Map of Plateau State, Nigeria



Appendix III: Request for Research from the Ministry of Agriculture and Rural Development Plateau State

GOVERNMENT OF PLATEAU STATE, NIGERIA

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT

Joseph Gomwalk Secretariat, P.M.B. 2050, Jos, Plateau State.

Email: moaplateaustate@gmail.com

Telephones:
Commissioner's Office: 08098161641
Permanent Secretary's Office: 08098161644.

All correspondence should be addressed to the Commissioner

MANR/Infor/II/13
24th February, 2020

Sunday Baba (REG: NO:K96/CTY/28526/2013),
Department of Applied Economics
School of Economics,
Kenyatta University,
P.O. Box 43844-00100
Nairobi, Kenya

RE: REQUEST FOR RESEARCH AUTHORIZATION UNDER YOUR MINISTRY CONCERNING REGISTERED SMALL HOLDER FARMERS IN PLATEAU STATE

With reference to your letter dated 19/2/2020 on the above subject matter.

I have been directed to inform you that the ministry has approved your request, please.

Rueben Daze
Principal Executive Officer I
For: Hon. Commissioner

GOVERNMENT OF PLATEAU STATE, NIGERIA
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
Joseph Gomwalk Secretariat, P.M.B. 2050, Jos, Plateau State.
Email: moaplateaustate@gmail.com
Telephones:
Commissioner's Office: 08098161641
Permanent Secretary's Office: 08098161644.

All correspondence should be addressed to the Commissioner

MANR/Infor/II/13
24th February, 2020

Sunday Baba (REG: NO:K96/CTY/28526/2013),
Department of Applied Economics
School of Economics,
Kenyatta University,
P.O. Box 43844-00100
Nairobi, Kenya

RE: REQUEST FOR RESEARCH AUTHORIZATION UNDER YOUR MINISTRY CONCERNING REGISTERED SMALL HOLDER FARMERS IN PLATEAU STATE

With reference to your letter dated 19/2/2020 on the above subject matter.

I have been directed to inform you that the ministry has approved your request, please.

Rueben Daze
Principal Executive Officer I
For: Hon. Commissioner

Appendix IV: Research Authorization Letter from Graduate School

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

OUR REF: K96/CTY/28526/13

Date: 8th April, 2019

The Director General,
National Commission for Science, Technology & Innovation
P.O. Box 30623-00100,
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MR. SUNDAY BABA REG. NO. K96/CTY/28526/13

I write to introduce Mr. Baba who is a Postgraduate Student of this University. He is registered for Ph.D. Degree programme in the Department of Applied Economics in the School of Economics.

Mr. Baba intends to conduct research for Ph.D. Thesis entitled, "Agricultural Credit Accessibility and its Effect on Agricultural Output of Smallholder Farmers in Plateau State, Nigeria"

Any assistance given will be highly appreciated.

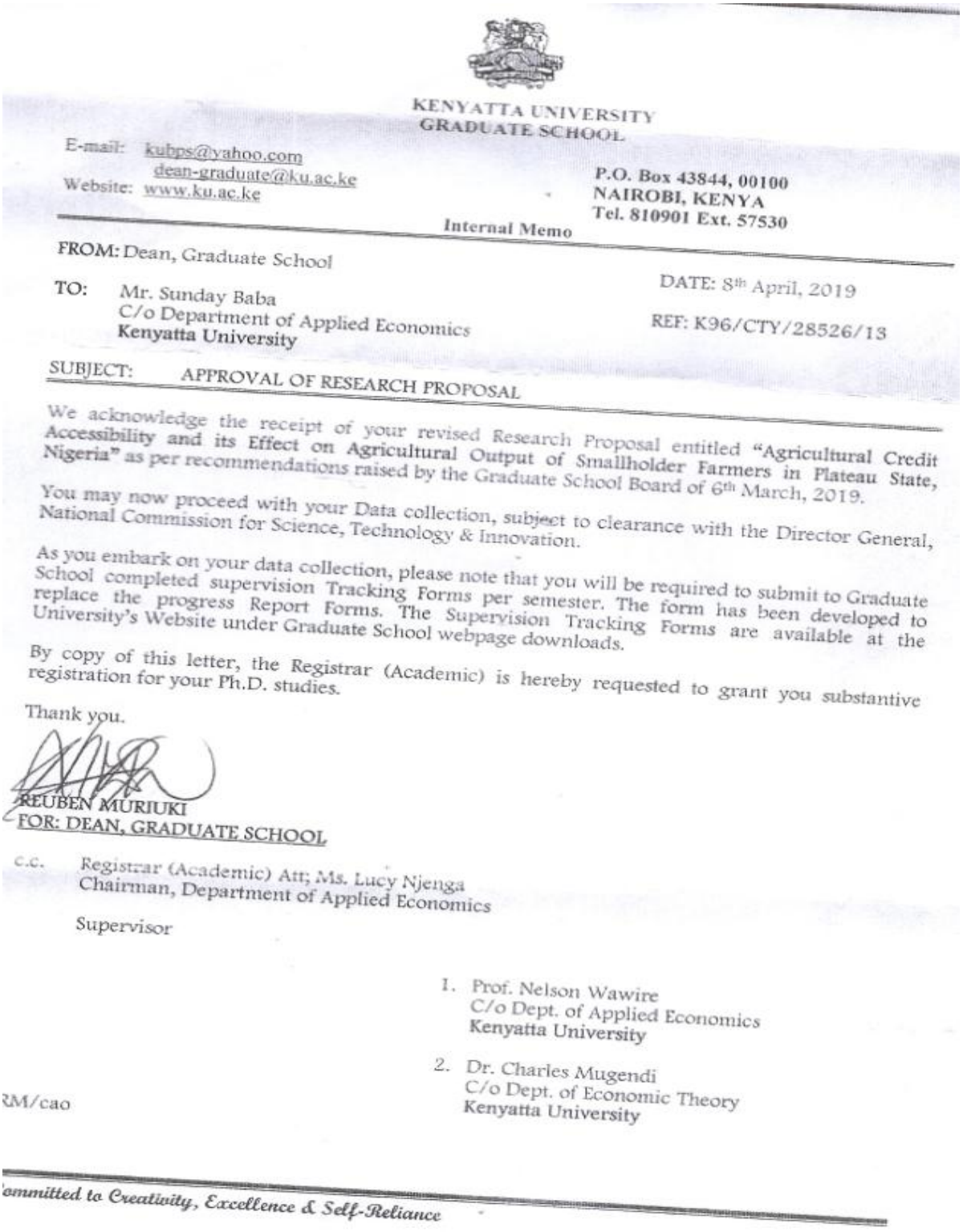
Yours faithfully,

PROF. ELISHIBA KIMANI
DEAN, GRADUATE SCHOOL

RM/cao

Committed to Creativity, Excellence & Self-Reliance

Appendix V: Research Approval Letter from Graduate School



KENYATTA UNIVERSITY
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P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School

DATE: 8th April, 2019

TO: Mr. Sunday Baba
C/o Department of Applied Economics
Kenyatta University

REF: K96/CTY/28526/13

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

We acknowledge the receipt of your revised Research Proposal entitled "Agricultural Credit Accessibility and its Effect on Agricultural Output of Smallholder Farmers in Plateau State, Nigeria" as per recommendations raised by the Graduate School Board of 6th March, 2019.

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed supervision Tracking Forms per semester. The form has been developed to replace the progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

By copy of this letter, the Registrar (Academic) is hereby requested to grant you substantive registration for your Ph.D. studies.

Thank you.

REUBEN MURIUKI
FOR: DEAN, GRADUATE SCHOOL

c.c. Registrar (Academic) Att; Ms. Lucy Njenga
Chairman, Department of Applied Economics

Supervisor

1. Prof. Nelson Wawire
C/o Dept. of Applied Economics
Kenyatta University

2. Dr. Charles Mugendi
C/o Dept. of Economic Theory
Kenyatta University

RM/cao

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