



**Financial inclusion of rural smallholder farmers in Nigeria:
measurement issues, impact on livelihood and implications for policy
interventions**

by

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DECLARATION

I, Olayinka Oladoyin Adegbite, declare that this thesis, which I hereby submit for the degree of Doctor of Philosophy (PhD) in Agricultural Economics at the University of Pretoria, is entirely my own work and has not been previously submitted by me for a degree at this or any other tertiary institution.

I acknowledge that parts of this thesis have been submitted as research articles for publication in journals.

Signature:



Date:

01/02/2021

DEDICATION

I dedicate this work firstly to God for seeing me through the PhD journey. To my loving parents, Mr and Mrs D.J. Akinyemi; my dear husband, Mr Kehinde David Adegbite; and children Oluwadarasimi Elizabeth and Obaseyitan David: thank you for your unrelenting support throughout my study period.

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The race is not for the swiftest, nor the strongest but of God that shows mercies.

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ABSTRACT

Financial inclusion is fundamental to sustainable agriculture and inclusive rural economic development. Prevailing dominant measurements of financial inclusion (FI) tend to measure the concept as access to bank services or formal account ownership. This study proposes that FI is multidimensional and access indicators alone, though required, may not provide adequate conditions for consumers such as rural smallholder farmers to sustainably meet their agricultural financial needs or cope with livelihoods. The policy commitment of the Government of Nigeria to achieve a financial inclusion rate of 80% by 2020 necessitates knowing the level of financial inclusion of rural smallholder farmers.

The study developed a multidimensional financial inclusion index specifically to determine the level of financial inclusion of rural smallholder farmers in Nigeria, and to ascertain how FI varies according to gender and geographical location. The study also determined the contribution of financial inclusion indicators to the financial inclusion of rural smallholder farmers. In order to determine the robustness of findings in informing policy interventions, the study further assessed the sensitivity of contributions of financial inclusion indicators to changes in financial inclusion adequacy. In light of the fact that, although rural smallholder farmers primarily depend on agriculture, they may also engage in other income-generating activities, the study assessed the impact of financial inclusion on their livelihood strategies when financially included, relative to when they are excluded.

This study utilised the 2016 Nigeria smallholder secondary data set prepared by the Consultative Group to Assist the Poor. A stratified two-stage sampling procedure was utilised to select a total of 2,300 rural smallholder respondents. Data analysis involved adapting the Alkire-Foster method to compute a multidimensional financial inclusion index based on the domains of financial inclusion: financial participation; financial capability; and financial well-being. The three domains cover nine financial inclusion indicators, namely access, usage, no barriers, financial literacy, consumer protection, financial planning, control over finance, financial resilience, and financial situation. Furthermore, to investigate its findings, the study employed descriptive statistics, decomposition techniques and sensitivity analysis. Ultimately, a propensity score matching model was used to determine the impact of financial inclusion on the livelihoods of rural smallholder farmers.

The results indicated that 78% of rural smallholder farmers in Nigeria were still yet to be financially included. Moreover, findings suggest that formal access to finance is significantly different from the sustainable financial inclusion required for rural smallholder farmers. Gender variations in multidimensional financial inclusion showed that male rural smallholder farmers were, to a large extent, more financially included than females were. Geographical variations demonstrated that rural smallholder farmers in the southern zones had higher levels of financial inclusion than those in the northern zones, and that females had a higher geographical disparity in the level of financial inclusion. In addition, results indicated that Nigeria's South South geopolitical zone had the highest level of FI of rural smallholder farmers, compared with the national assessment of the country's South West zone. Equally important, results showed that there are differences in the levels of financial inclusion related to specific individual and household characteristics of rural smallholder farmer subgroups. These include factors such as age, education, marital status, household size, income and poverty status. The contribution of FI indicators to levels of financial inclusion showed the highest gender gaps specifically in financial resilience, control over finance and formal access. Based on geographical location considerations, the study found that adequacies of financial inclusion indicators, namely access, usage, consumer protection and financial planning, were lowest in the North West zone. Conversely, contributions of financial resilience, financial situation, financial literacy, no barrier, and control over finance indicators were found to be lowest in the North East zone. Aggregate contribution by financial inclusion domains indicated the lowest censored headcount ratio of rural smallholder farmers in financial capability relative to financial well-being. Findings from the propensity score matching and sensitivity analysis

highlighted the point that financial inclusion significantly reduces the sole dependence of rural smallholder farmers on farm income activities relative to exclusion. However, the engagement of rural smallholder farmers in both farm and non-farm income-generating sources significantly increased with financial inclusion.

The findings suggest that, if Nigeria's policy goal is to sustainably increase financial inclusion of rural smallholder farmers, then it is important for efforts to be made to intensify interventions beyond formal account ownership. More so, if closing the gender gap is part of the goal, then the findings suggest that policy interventions to advance the financial inclusion of rural women smallholder farmers are important, with more focus on indicators such as formal access, control over finance and financial resilience. Furthermore, the results imply that policy interventions are more likely to succeed if targeted to rural smallholder farmers, based on variations in financial inclusion status across geographical location, rather than on aggregated national assessments. Finally, if financial inclusion policy aims at promoting sustainable rural livelihoods and economic development, then it is crucial that efforts to increase the financial inclusion of rural smallholder farmers be intensified, as this strengthens the integration of farm and non-farm economic sectors.

Keywords: Financial inclusion, multidimensional index, rural farmers, smallholder agriculture, Alkire-Foster method, policy interventions, livelihoods, propensity score matching, Nigeria

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ACRONYMS

ACGS	Agricultural Credit Guarantee Scheme
ADP	Agricultural Development Programme
AFI	Alliance for Financial Inclusion
AGRA	Alliance for Green Revolution in Africa
APP	Agricultural Promotion Policy
ATA	Agricultural Transformation Agenda
BVN	Bank Verification Number
CBN	Central Bank of Nigeria
CFI	Center for Financial Inclusion
CEBR	Center for Economic & Business Research
CFPB	Consumer Financial Protection Bureau
CFSI	Center for Financial Services Innovation
CGAP	Consultative Group to Assist the Poor
EFIna	Enhancing Financial Innovation and Access
FAO	Food and Agriculture Organization
FI	Financial Inclusion
FMARD	Federal Ministry of Agriculture & Rural Development
GPIFI	Global Partnership for Financial Inclusion
HLPE	Higher Level Panel of Experts
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IOM	International Organization for Migration
IPCR	Institute for Peace and Conflict Resolution
ITU	International Telecommunication Union
MFII	Multidimensional Financial Inclusion Index
MPI	Multidimensional Poverty Index
NACRDB	National Agricultural Cooperative & Rural Development Bank
NAIC	National Agricultural Insurance Corporation
NBS	National Bureau of Statistics
NFIS	National Financial Inclusion Strategy
OECD	Organisation for Economic Co-operation & Development

PPI	Progress Out of Poverty Index
PSM	Propensity Score Matching
SDGs	Sustainable Development Goals
UN	United Nations
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WEF	World Economic Forum
WEAI	Women Empowerment in Agricultural Index

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

This chapter comprises five sections which collectively introduce the study. Section 1.2 presents the background of the study by providing an overview of smallholder agriculture and financial service supply in Nigeria. In addition, the need for financial inclusion of rural smallholder farmers and Nigeria's efforts to promote financial inclusion are discussed. Section 1.3 discusses the problem statement, while section 1.4 provides the objectives of the study. Section 1.5 presents the hypotheses of the study. The final section of the chapter outlines how the rest of the chapters in the thesis are organised.

1.2 BACKGROUND

1.2.1 Overview of smallholder agriculture and supply of financial services in Nigeria

Nigeria's position in Africa is crucial in terms of the size of its economy, geography and population. The country's economy, which is the largest in Africa, was recently valued at 448.12 billion USD (World Bank, 2019a). Nigeria occupies a complete land area of 92.4 million hectares, capable of supporting the production of a diverse range of agricultural products (FMARD, 2010). Its large geographical size has made it necessary to divide the country into six geopolitical zones: South West, South East, South South, North Central, North East and North West. This enables the efficient planning and allocation of resources in the country. Nigeria has an estimated population of 202 million people, which is the highest in Africa (World Bank, 2019b). About 63% of the population live in rural areas, while over 70% of the population rely on agriculture for livelihood (Adelaja et al., 2019; FMARD, 2017). Activities in the agricultural sector are driven mainly by smallholder farmers, constituting 80% of all farmers, and producing over 90% of overall national agricultural production (Mgbenka and Mbah, 2016). These agricultural activities contribute about 22% to Nigeria's gross domestic product (World Bank, 2020).

Despite the importance of smallholder agriculture in Nigeria, it has no standard definition. However, smallholder agriculture is often described in relation to characteristics such as greater dependence on rain-fed agriculture with little or no irrigation, subsistence farming and minimal use of farm mechanisation, poor land tenure systems, and limited access to finance, inputs, technologies and markets (World Bank, 2020; AGRA, 2017; 2016). Over 70% of smallholder farmers in Nigeria live in poverty, owning a mean size of approximately 2 hectares of land (Anderson et al., 2017). The majority of the rural small-scale farmers mainly rely on farming as a means of livelihood, while also engaging in other income-generating sources (Rapsomanikis, 2015). There are five major productive resources considered essential for sustainable development, namely human, physical, natural, social, and financial resources (Serrat, 2017). Of these, financial resources are found to be one of the least available to smallholder farmers, despite them constituting the bedrock in most agricultural value chains (IFC, 2013).

While sources of finance for smallholder farmers range from informal to formal, the majority of them rely on informal sources such as money-lenders within their communities (World Bank, 2017a). Moreover, the informal sources are not regulated, and majority focus on credit allocation, which is often limited and inefficient to meet the agricultural and financial needs of small-scale farmers (Ayegba, 2013). Conversely, formal financial sources such as banking institutions are regulated by government with emphasis placed on the allocation of a broad range of financial services and products beyond credits, like savings, insurance, remittances and transfers (Demirgüç-Kunt and Klapper, 2013). Despite this, rural smallholder farmers are often financially marginalised (Triki and Faye, 2013). Some of the reasons are related to the demand for financial services, including low levels of formal education and financial literacy, high interest rates, transaction costs, and information asymmetry (Divya, 2014; Diniz et al., 2012). In addition, rural small-farm families often lack formal documentation, assets and well-defined property rights that could serve as collateral to guarantee the provision of formal financial services (Norton et al., 2014). While some perceive they are too poor to own or use a formal account, others may be discouraged by the long distances to the nearest formal financial institutions (Demirgüç-Kunt and Klapper, 2013; Anderson et al., 2017). As a result, the supply of financial service in the rural areas is dominated by the unregulated activities of informal service providers, which are considered less sustainable for meeting the investment requirements for transforming agriculture (Ayegba, 2013).

From the supply perspective, most formal service providers consider rural smallholder households to be risky clients due to the seasonality of agricultural activities, which might increase default rates in repaying loans (Amadhila, 2016). Moreover, demand for formal financial services by rural households is usually small compared with the high transaction costs incurred on the supply side (De Klerk et al., 2013). Therefore, most formal financial institutions prefer to serve urban dwellers rather than rural residents (Mujeri, 2015). Moreover, due to a lack of credit histories and the imperfect documented information of most rural households, the formal institutions are unable to guarantee or discern borrowers' characteristics or actions (Kringlen, 2016). While the banks sometimes charge a high-risk premium in order to break even, smallholder farmers who are not willing to take risks do not seek formal financial services (National Bank of Belgium, 2017). As a result, rural smallholder farmers face various challenges that constrain their participation in formal financial systems.

1.2.2 The need for financial inclusion of rural smallholder farmers and Nigeria's efforts to promote financial inclusion

Financial inclusion (FI) is described as the access to and use of a broad range of formal financial services and products at affordable cost by all population groups, while ensuring that those who are marginalised financially are included (World Bank, 2017a). Sustainable financial inclusion is recognised as a crucial strategy to alleviate poverty and to improve income, socio-economic status and welfare, especially among the poor or rural populations (Oji, 2015). Furthermore, FI facilitates the modernisation of smallholder agriculture, which is indispensable for agricultural transformation (IFC, 2013; Fan et al., 2013). Ensuring the sustainable financial inclusion of rural smallholder farmers is vital because access to and use of financial services, such as credit, savings, insurance and payments, facilitate several potential opportunities. These include consumption smoothening, savings and capital accumulation, better risk management, investment in profitable business opportunities, and human and physical capital development (Demirgüç-Kunt and Klapper, 2013; Ellis et al., 2010). While the financial inclusion of smallholder farmers could result in better investments and advancement towards achieving Sustainable Development Goal (SDG) 2, which is to “*end hunger, achieve food security, improved nutrition and promote sustainable agriculture*”, efforts aimed at achieving SDG 2 would have a positive multiplier effect on other SDGs (FAO, 2017; Klapper et al., 2016). However, despite the fact that rural smallholder farmers comprise the principal agents in

agriculture, with positive demand for the above-stated financial services to enhance their productivity, most of their financial needs are largely unmet (Cuevas and Anderson, 2016).

In 2011, Nigeria made a commitment towards achieving financial inclusion, aimed at decreasing the financially marginalised populations from 46.3% in 2010 to 20% by 2020 (CBN, 2012). These policy targets are clearly indicated in the country's National Financial Inclusion Strategy (NFIS) of 2012. Since then, various efforts have got underway. For instance, according to Global Findex (2014), although Nigeria's overall FI increased from 30% in 2011 to 44% in 2014, it decreased by 4% in 2017. This was partly attributed to the bank verification exercise undertaken in Nigeria during the period in order to limit corruption; an initiative that also led to reduced formal account ownership. In 2018, the revised national financial inclusion strategy was launched with the aim to address the lapses of previous NFIS, as well as to address new policy developments in financial inclusion (CBN, 2018). Given the need for Nigeria to re-diversify its economy to agriculture and the crucial role of rural smallholder farmers (FMARD, 2017), there is need to intensify efforts to ensure FI makes significant impacts in agriculture, rural livelihood and economic growth (Sharma and Kukreja, 2013). However, due to Nigeria's large geographic size, efforts aimed at achieving FI without ensuring equality among population subgroups may lead to disparities, especially among regions and between genders. According to Sophia (2016), government and partners' efforts aimed at financial inclusion should give rural areas a topmost priority because this constitutes an operative approach to equity and sustainable development. Therefore, evaluating the level of FI in rural Nigeria at multiple levels, such as national, geographical locations and gender, is crucial for efficient planning, an inclusive financial system, and development.

Efforts committed to using agricultural and rural finance as a catalyst for rural agricultural economic development in Nigeria are not new. The efforts of previous governments to promote inclusive rural finance have evolved from schemes to programmes and to institutions (Eze et al., 2010). Notable among the schemes is the Agricultural Credit Guarantee Scheme (ACGS) formed in 1977 (FAO, 2013). The following are also worth mentioning: the World Bank-assisted Agricultural Development Programme in Nigeria, rural community banking, microfinance programmes and the National Fadama Development Project (World Bank, 2008a; Kama and Adigun, 2013; Ike, 2012). The specific efforts aimed at financial institutional development, which were all directed at providing formal financial services to the poor and rural households, include: the National Agricultural Cooperative and Rural Development Bank,

established in 1972; the National Agricultural Insurance Corporation, created in 1987; the People's Bank of Nigeria, formed in 1990; and the National Agricultural Land Development Authority, established in 1991 (Eze et al., 2010). However, the previous efforts to ensure inclusive rural finance suffered setbacks partly due to high levels of loan non-repayment among borrowers, despite loans being offered at lower interest rates (World Bank, 2008b). Furthermore, the failures could also be attributed to high levels of financial illiteracy, unstable policy environment, lack of skilled human resources, inadequate infrastructure, and poorly developed administrative rural financial systems (Aina and Omonona, 2012; Kama and Adigun, 2013).

Nevertheless, with the revised Nigeria financial inclusion agenda in place until its target year in 2020, failure to assess the extent of the financial inclusion of rural smallholder farmers and indicators for policy interventions may leave little room for improvement. In addition, not evaluating the impact of FI on the livelihoods of rural smallholder farmers may undermine the role of their financial inclusion in influencing the rural farm and/or non-farm economies. Hence, evidence from this study will suggest policy interventions to enhance the financial inclusion of Nigerian rural smallholder farmers. Furthermore, evaluating the impact of FI on their livelihoods provides insights into understanding how financial inclusion influences the livelihoods of rural smallholder farmers.

1.3 PROBLEM STATEMENT

Despite the fact that financial inclusion is a highly prioritised global goal, there is no universally accepted standard measure (Tita, 2017). The lack of standardisation has made quantifying progress in FI difficult, and adequate measures are necessary to monitor progress and also inform areas for policy interventions. According to ShahulHameedu (2014), the challenges in measuring FI may be attributed to the evolution of various concepts and policies, which requires the need for constant adaptation of measures to current issues. Besides such developments, the challenges may be due to the inadequate integration of consumers' perspectives into methods of measurement. This latter aspect is crucial if FI is focused on specific target groups who are more likely to be marginalised, rather than on emphasising aggregates. Similarly, ongoing arguments on FI indicate the need to shift from measuring FI based on headline indicators, such as access or formal account ownership, to incorporating indicators that address sustainable development outcomes and consumer targets in financial

inclusion (WEF, 2018). Despite the existence of an array of FI indicators, most studies have placed emphasis on the access and/or usage indicators (Demirgüç-Kunt et al., 2018; Migap et al., 2015; Okpara, 2013). The study notes that measures relying on these indicators are not less important, but could provide insights towards the first steps to inclusion in a regulated financial system. However, they only constitute a part of the financial participation dimension in FI, while leaving out other important measurements (Hall, 2014). Furthermore, emphasis on such indicators only tends to present a diminutive coverage of the entire financial inclusion concept, thereby narrowing the relevance of such metrics in informing policy decisions.

Due to the multidimensional nature of financial inclusion, no single indicator or dimension is able to effectively measure FI (Gupte et al., 2012). Most previous multidimensional approaches have used various approaches, including the distance-based approach (Sarma, 2008; 2015; Gupte et al., 2012; Yorulmaz, 2013; Sethy, 2016), the axiomatic approach (Chakravarty and Pal, 2010), the two-step principal component analysis (Camara and Tuesta, 2014; Yorulmaz, 2018) or a combination of the distance-based approach and the two-step principal component analysis (Park and Mercado, 2018). While these approaches constitute important developments in measuring financial inclusion, the distance-based approach has been considered less appropriate in informing policy decisions due to the non-decomposability property of the index (Chakravarty and Pal, 2010). Most of the approach's applications were evaluated at the macro level using supply-side data, which may not be truly inclusive of the poor populations. This necessitates advancing methods of FI from just measuring indicators, like access and/or usage, to integrating consumer target indicators, such as financial literacy, consumer protection and financial well-being (CBN, 2012). Such indicators inform the extent of consumer capabilities in achieving the outcomes they desire from participating in financial inclusion (Insight2impact, 2017; WEF, 2018). The majority of the poor such as rural smallholder farmers find it easier to access and use informal sources. However, the basic motivation for previously financially excluded people to participate in financial inclusion and/or develop capabilities would be to enhance their financial well-being (GPFI, 2017). Therefore, it is essential to incorporate appropriate indicators in measures of multidimensional financial inclusion for the utmost realisation of policy goals. Although Camara and Tuesta (2014) used the two-stage principal component analysis and utilised data from both the supply and demand-side perspectives, Sarma (2015) argued that principal component approaches may not adequately account for important properties desired in a development index, such as monotonicity. Furthermore, the approaches address the second moment of the contribution made by dimensions to the

computed financial inclusion index, rather than the first moment which is more relevant in measuring financial inclusion. Therefore, principal component approaches have been considered less appropriate in measuring multidimensional financial inclusion.

At a country level, both the initial and revised Nigeria financial inclusion strategy have identified key financial inclusion targets for clients to extend beyond access and usage (CBN, 2012; 2018). Furthermore, improved financial participation, capability and well-being are identified as important prospects for FI in rural areas. However, no study has been known to integrate such indicators into multidimensional measures of FI. While most studies have reported global- and country-level financial inclusion, limited evidence exists of the extent of inclusive financing of rural smallholder farmers. Various population subgroups may require different policy interventions, depending on their situation. Moreover, a comprehensive knowledge of FI is better delivered through advanced measures that integrate key indicators of various dimensions that could inform policy intervention across different population subgroups (Beck, 2016). In Nigeria, a few studies, such as that by Okpara (2013), have used an average of ratio index to compute a financial inclusion index. Although the index was computed at the country level over three periods (1985, 1988 and 2003), it relied only on bank data and thus utilised bank indicators. A further attempt to evaluate financial inclusion in Nigeria, carried out by Kalu et al. (2018), computed adequacy gap and timeliness gap indices to investigate how formal financial institutions have been able to meet the credit needs of farmers. The adequacy gap index was expressed as a proportion of the difference between the amount of credit supplied and the amount of credit requested. On the other hand, the timeliness gap index was expressed as a proportion of the difference in periods between when credit was supplied, and when the credit was requested. Although the approach provides insights into credit rationing by banking institutions, it weakens the concept of FI. Credit is only a type of financial product and its generalisation to a range of financial products may not be adequate. Likewise, neither bank financial services nor credit access is synonymous with financial inclusion.

This study proposes to make a significant methodological contribution by adapting the Alkire-Foster Method in constructing a multidimensional financial inclusion index (MFII) for rural smallholder farmers in Nigeria. The aim is to address the identified gaps in previous studies and to inform better FI policy approaches. In previous studies, the method has been applied in developing the Multidimensional Poverty Index (Alkire and Foster, 2011; Alkire and Santos, 2010) and adapted to develop the Women Empowerment in Agriculture Index (Alkire et al.,

2013). Results of these studies have informed policy interventions aimed towards attaining some of the SDGs. Adapting the method for this study would enable evidence to inform the extent of multidimensional financial inclusion of rural smallholder farming population subgroups in terms of region, gender, and indicators requiring policy interventions. In addition, results would also inform the incidence and intensity of multidimensional financial inclusion. The MFII developed in this study is a survey-based tool that could be used in baseline surveys and also for monitoring advancements, over time. As a result, this study would be a first effort in computing a multidimensional financial inclusion index for rural smallholder farmers. The MFII is found adequate to investigate the objectives of this study because it satisfies the properties of a development index such as decomposability and monotonicity (Alkire and Foster, 2011). The decomposability property facilitates the targeting a specific group, gender, region or indicators for policy interventions. Similarly, the monotonicity property of the proposed index makes it flexible in increasing or decreasing the number of dimensions or indicators that can be adapted to different contexts.

On the other hand, despite rural smallholder farmers depending on agriculture for their livelihoods and also engaging in non-agricultural economic opportunities, a research gap exists on how FI affects the rural livelihoods of smallholder farmers in Nigeria. While most studies focus on the determinants of livelihood diversification, only a few studies (Ousmane et al., 2017; Ulwodi, 2017; Adebowale and Dimova, 2017) have investigated the impacts of FI on welfare in general, although without addressing any population group or sector. Given that the involvement of rural families in non-farm income sources complements the farm economy (HLPE, 2013; Babatunde, 2015), this study seeks to establish the pathway through which FI affects the livelihoods of rural smallholder farmers by using the propensity score matching model. This model is used to address the counterfactual problem of what the impact of FI would be on livelihoods if those who are financially included were to be excluded. By using the model, this study accounts for the impact of FI while also controlling for financial exclusion, which addresses selection bias and the problem of assessing impact in isolation. Therefore, the research question to be answered by this study is: To what extent are rural smallholder farmers financially included and what is the impact of financial inclusion on their livelihoods in Nigeria?

1.4 OBJECTIVES OF THE STUDY

The overall objective of this study was to determine the level of financial inclusion of rural smallholder farmers in Nigeria by developing a measure of FI that takes into consideration its multidimensional nature, and thus to assess the impact of FI on their livelihoods.

The specific objectives were as follows:

1. to construct a multidimensional index for measuring financial inclusion of rural smallholder farmers;
2. to determine the level of financial inclusion of rural smallholder farmers and its determinants, specifically how it varies according to gender and region in terms of geographical location;
3. to determine the contribution of indicators of financial inclusion, namely access, usage, no barrier, financial literacy, financial planning, consumer protection, control over finance, financial resilience and financial situation to the financial inclusion of rural smallholder farmers;
4. to determine the sensitivity and robustness of the contribution of financial inclusion indicators to changes in financial inclusion adequacy; and
5. to assess the impact of financial inclusion on the income sources of rural smallholder farmers.

1.5 HYPOTHESES

The hypotheses of the study are as follows:

1. *Male rural smallholder farmers have a higher level of financial inclusion than female rural smallholder farmers.*

This hypothesis is motivated by the fact that women inexplicably face barriers that constrain them in economic participation and financial inclusion, as compared with men (World Bank, 2017a; Triki and Faye, 2013). Empirical evidence from previous studies (Reynolds et al., 2017; Soumare et al., 2016) has indicated that gender significantly influences formal financial access.

According to Abdu et al. (2015), being a female decreases the likelihood of owning a formal banking account. The Nigeria-Global Findex of the years 2011, 2014 and 2017 revealed that although formal account ownership among males and females increased over the years, females persistently lagged behind (Adegbite and Machethe, 2020). Lower levels of financial inclusion among females have often been associated with poor socio-economic characteristics, such as education, literacy, employment, access to productive resources and assets, as compared with males (World Bank, 2017a; Reynolds et al., 2017). Furthermore, women's involvement in house chores, child care and food preparation limit their time usage for paid activities and visits to bank branches in order to access formal financial services (FAO, 2011). However, given the need to address FI measurement issues in rural smallholder agriculture, this study hypothesises that male rural smallholder farmers in Nigeria would still have a higher level of financial inclusion than females do.

2. *Rural smallholder farmers in the southern geopolitical zones (South West, South East and South South) have a higher level of financial inclusion than rural smallholder farmers in the northern geopolitical zones (North West, North East and North Central).*

Past empirical evidence has revealed that although financial inclusion facilitates equitable access to and use of financial resources, which in turn enhances inclusive economic growth and development (Madichie et al., 2014; Demirgüç-Kunt and Klapper, 2013; Honohan, 2008), variations exist across and within country regions. These variations are largely attributed to country-level socio-economic development and individual-level socio-economic characteristics (Deléchat et al., 2018). While high levels of financial inclusion are found in high-income economies or regions with low poverty levels, the opposite is the case for low- and middle-income countries or regions with high poverty levels (Demirgüç-Kunt et al., 2018). Aro-Gordon (2017) investigated the performance of the national financial inclusion strategy in Nigeria and found that the south western region had the lowest rate of 18% financial exclusion as at 2016, while the North West region had the highest exclusion rate. Furthermore, geographical locations in the urban areas were often found to be more financially included than those in the rural areas were (Masiyandima et al., 2017; Yubing and Geng, 2018). However, Obayelu (2014) decomposed rural poverty in Nigeria and found that the northern zones were associated with the highest poverty levels, while the South West zone had the lowest levels. Although Anderson et al. (2017) reported that higher numbers of smallholders in Nigeria were

located in the northern zones, this study hypothesises that the southern regions in Nigeria would have higher levels of financial inclusion of rural smallholder farmers.

3. Financial inclusion has a positive relationship with income diversification between farm and non-farm income sources of rural smallholder farmers.

This hypothesis is based on the finance-growth positive relationship assumption, following Levine (2005), which is rooted in the ability of the efficient functioning of financial systems to enhance an inclusive economic growth. Further studies have revealed that financial inclusion has a positive multiplying impact on the economy, including welfare (Tita, 2017; Demirguc-Kunt et al., 2017; Ellis et al., 2010). According to Villarreal (2017), financial inclusion could enhance the better allocation and diversification of productive resources, which facilitates income generation from various sources. The reasons for income diversification could be categorised into push (survival led) or pull (opportunity led) factors (Loison, 2015). The former is often associated with negative events and uncertainties that force poor households to diversify livelihoods in order to survive. Contrariwise, the latter is associated with positive factors that enable rural households to diversify income sources in order to take advantage of economic opportunities. These include factors such as access to productive resources and market commercialisation.

Studies by Sayinzoga et al. (2016) and Beck et al. (2009) have also found that formal financial access and literacy may influence the ability to generate income from various sources due to enhanced capabilities to save, borrow credits, accumulate assets and mitigate risks, leading to widened entrepreneurial abilities and exploration of further economic opportunities. In addition, Hernandez et al. (2018) reported that it was more likely for rich male smallholders to partake in both farm and non-farm activities due to higher financial inclusion, unlike their female counterparts with less access to economic opportunities. Most smallholder farmers depend on agriculture for their livelihoods, but may also earn income from other sources (Anderson et al., 2017; Rapsomanikis, 2015). Moreover, this hypothesis is justified by the fact that the engagement of rural households in farm and non-farm activities consolidates one another in Nigeria (Babatunde, 2015).

1.6 THESIS OUTLINE

The rest of the thesis after the introduction consists of six chapters. Chapter 2 provides the review of literature relevant to the purpose of the study. The chapter essentially maps out previous related literature in order to identify existing research gaps that are filled in by the present study. Chapter 3 unpacks the concepts used in the study and further outlines the conceptual framework. Chapter 4 discusses the methods and procedures employed to achieve the objectives of the study. This includes the study area, type and source of data, sampling procedure, and method of data analysis. Chapter 5 reports the results from computing the multidimensional financial inclusion index to determine the financial inclusion of rural smallholder farmers. This includes findings on the contribution of population subgroups and FI indicators to the multidimensional financial inclusion of rural smallholder farmers in Nigeria and the results of sensitivity analysis. Furthermore, implications for policy interventions are also presented in Chapter 5. Chapter 6 discusses results of the impact of FI on the income sources of rural smallholder farmers in Nigeria. Lastly, Chapter 7 summarises the study by explaining its major findings, conclusions and implications for policy interventions, and suggests recommendations for future research work.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews previous literature related to this study. As stated in Chapter 1, the general aim of this study is to develop a measure of financial inclusion that takes into consideration its multidimensional nature to determine the level of financial inclusion of rural smallholder farmers in Nigeria and to assess the impact of FI on their livelihood. To contextualise the study, this section reviews literature relevant for understanding what has been done and, in the process, will identify the research gaps addressed by the study and its contribution to knowledge. In order to do this, reviews addressing related subject matters are grouped into six separate sections. Section 2.2 reviews the extent of financial inclusion and variations. Section 2.3 starts with broadly reviewing the methods of measuring FI, and is then divided into sub-sections analysing keys approaches, such as simple methods, complex methods and other approaches to measurement. Section 2.4 examines the factors affecting FI, while Section 2.5 presents the relevance of financial inclusion in agricultural and economic development. The impact of FI on welfare and livelihood outcomes is discussed in Section 2.6. Finally, Section 2.7 recaps the chapter.

2.2 EXTENT OF FINANCIAL INCLUSION AND VARIATIONS

The majority of recent estimates on the extent of FI and variations over time have been largely contributed by the World Bank's Global Financial Inclusion Database (Global Findex). With the first survey being initiated in 2011, followed by the second in 2014 and the latest in 2017, results showed that 69% of adults in the world owned registered accounts in a regulated financial institution as at 2017 (Figure 2.1) compared with 62% and 51% in 2014 and 2011, respectively (Demirgüç-Kunt et al., 2018). Furthermore, while the majority had accounts with banks, the World Bank study indicated that almost 50% of the world's 1.7 billion unbanked adult population resided in seven countries, including Nigeria. Before then, Honohan (2008) investigated household access to financial services over 160 countries by using a composite indicator based on factors including the number of bank accounts, microfinance institutions, banking depth, and gross domestic product. The study found that Africa and developing

countries in Eastern Europe and Central Asia had the lowest formal financial access. Furthermore, nations with better access to financial services were positively correlated with high mobile phone penetrations and good governance, although the reverse was found with their association with higher shares of agricultural production, population density and age dependency. Demirgüç-Kunt and Klapper (2013) investigated the disparity in the usage of financial services across and within 148 countries and found that the level of income and economic development drive varied across and within countries. A study by Masiyandima et al. (2017), which accounted for geographical differences within a country, concurred with this view as it found that living in an urban area was likely to increase access to and use of financial services by 160%, as compared with residing in the rural areas.

Today, 69 percent of adults around the world have an account
 Adults with an account (%), 2017

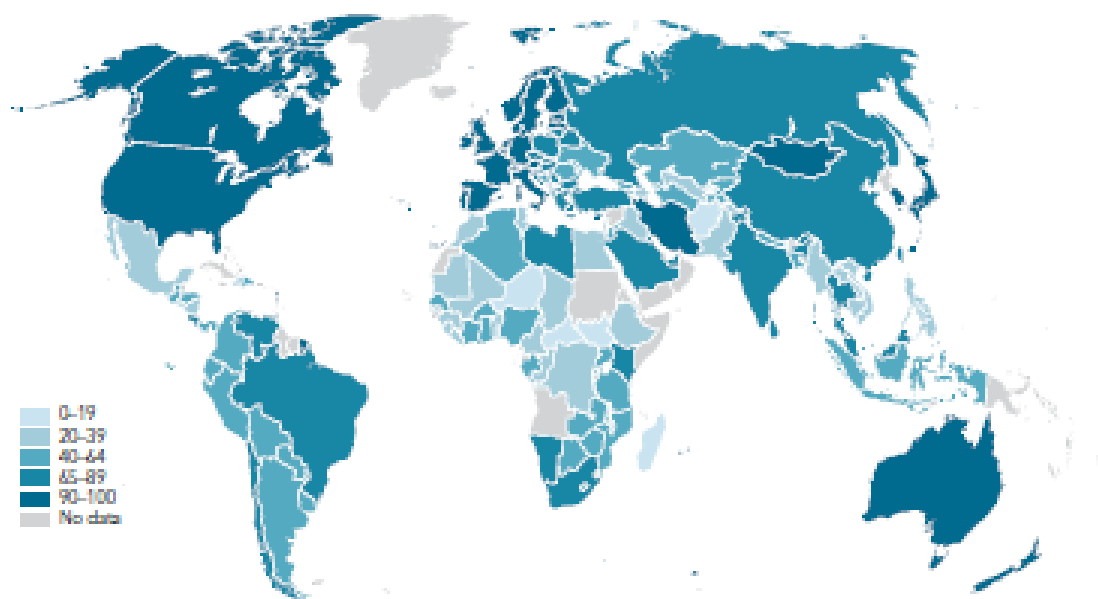


Figure 2.1: Map showing the percentage shares of adults with bank accounts around the world, 2017

Source: Demirgüç-Kunt et al. (2018)

Specifically, in Nigeria, Aro-Gordon (2017) analysed the status of financial inclusion between 2008 and 2016 by using secondary data from various sources including the World Bank 2014 Global Findex database and the Central Bank of Nigeria, as well as data from Enhancing Financial Innovation and Access (EFIna). He found that Nigeria, in respect of the nine key performance indicators investigated to implement the NFIS, had the highest attainment in increasing physical bank branches and agent banking penetration, as at 2016. Furthermore, the

South West had the highest rate (82%) of financial inclusion, while the North West region had the lowest (30%). However, Adelaja et al. (2019) summarised Nigeria’s financial inclusion data sets from 2008 to 2018 found in three major sources: World Bank (2011, 2014 and 2017); EFIna (2008, 2010, 2012, 2014, 2016 & 2018) and Intermedia (2013–2017) and found that over 10 years (Figure 2.2), the country had a mean of 42.9%, 15.4% and 41.7% for banked, under-banked and unbanked populations, respectively. However, changes in the banked population over the years had not been too constant as occasional increases, decreases and no changes were observed. Part of the reasons for the decreases or no changes could be attributed to the country’s Bank Verification Number (BVN) exercise, which reduced the banked population with multiple accounts.

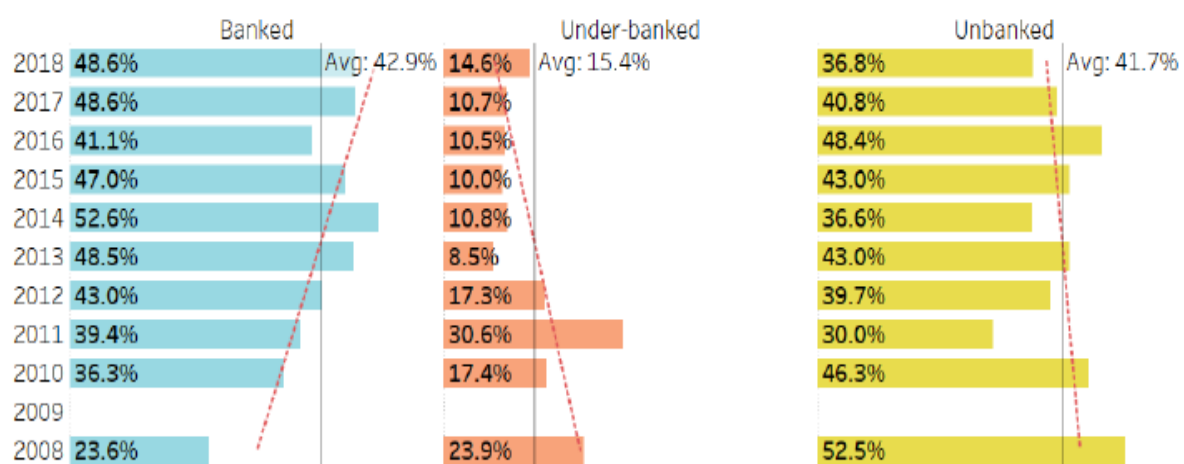


Figure 2.2: Summary of national financial inclusion in Nigeria (2008–2018)

Source: Adelaja et al. (2019)

Regarding the smallholders, most of the studies (there are only a few) that do provide insights into their demands for financial services are contributed by the Consultative Group to Assist the Poor (CGAP) (Anderson et al., 2017; Riquet et al., 2017; Anderson and Ahmed, 2016; Anderson and Learch, 2016; Anderson et al., 2016a; 2016b; 2016c). Based on the access indicator, the scholars found that less than 50% of smallholders were financially included in Bangladesh (45.5%), Côte d'Ivoire (28.8%), Uganda (26.4%), Nigeria (26.3%) and Mozambique (7.4%). Only Tanzania (49.5%) had approximately half of its smallholder population financially included. However, Anderson and Ahmed (2016) found that the smallholders in Pakistan used the highest number of financial tools (18) when compared with the smallholders in Tanzania (12) and Mozambique (3). In South Africa, De Klerk et al. (2013)

found that 56.1% of smallholder farmers were financially included, with 49.9% having a formal bank account and 6.2% using non-bank financial institutions.

Although many studies were investigated at the national level, very few studies examined whether variations exist among the population subgroups of rural households. One such study found that investigated geopolitical variations in rural Nigeria was that by Obayelu (2014), who analysed spatial variations in rural poverty, using the shapely decomposition approach. The study found that the northern geopolitical zones (North East, North West and North Central) accounted for 73.1% of rural poverty, while the South West region had the least poverty. Moreover, the mean income was the major driver of spatial differences in rural poverty. Therefore, given the potentials of FI in increasing incomes, it is important to investigate the level of FI among rural smallholder farmers and examine how it influences their livelihoods. While attention should be given to national estimates, it is more crucial that such evidence is decomposed by population groups, such as regions and gender, to inform targeted policy interventions aimed at inclusive agricultural and rural economic development.

2.3 METHODS OF MEASURING FINANCIAL INCLUSION

Over time, the methods of measuring financial inclusion have evolved from simple to complex approaches. On the one hand, evolution in measurement may be partly due to the multi-diverse efforts and multi-stakeholder approaches towards ensuring FI as a global development initiative (Arun and Kamath, 2015). On the other hand, the evolution may be ascribed to the increasing availability of comprehensive data, which provide better indicators for measuring FI and highlight the need to incorporate such indicators into emerging policy developments. Previous classification has generated controversy because of its main emphasis on either supply- or demand-side factors of the various dimension indicator(s) of financial inclusion. For example, the categorisations of usage as a supply-side factor by Ambarkhane et al. (2016), and as a demand side factor by Sethy (2016), pose challenges in measurement. Based on evidence of the predominance of narrow classification of FI indicators in past studies, this study therefore classified the methods of measuring financial inclusion as simple or complex (multidimensional) methods. The former is based on whether financial inclusion was measured using a one-dimensional approach, while the latter is based on measuring financial inclusion using a multidimensional approach (computing ≥ 2 dimensions or indicators into a composite

index). Such distinctions are important to helping understand how financial inclusion has evolved and what indicators are essential in developing an inclusive financial system.

2.3.1 Simple methods of measuring financial inclusion

Simple methods of measuring FI range from the use of single indicators like ownership of bank account per one thousand adults, extent of bank penetration and rate of savings, to constructing one-dimensional indices (Demirgüç-Kunt et al., 2018; Honohan, 2008). Demirgüç-Kunt et al. (2018) focused on the access indicator by measuring FI as the proportion of adults aged 15+ owning a personal formal account with a financial institution. Honohan (2008), on the other hand, measured FI by constructing a one-dimensional index using access indicators. For households with available survey data, the access indicator was measured as the share of adults having formal access to financial intermediaries. Information on the number of bank accounts and GDP per capita was employed as access indicators for those households without data on the access indicator. However, one-dimensional or single-indicator approaches have been criticised for their narrow scope in addressing emerging policy developments (Camara and Tuesta, 2014).

2.3.2 Complex methods of measuring financial inclusion

The emergence of various concepts and policy efforts in financial inclusion has influenced trends in measurement, and constant modernisation of measures to address evolving issues. While most studies have identified financial inclusion with three dimensions, various approaches have been employed to develop a multidimensional measure, which include the various approaches explained in the next sections.

2.3.2.1 The distance-based approach

A study by Sarma (2008) provided the foundation for measuring financial inclusion by using a distance-based approach to compute a multidimensional financial inclusion index. Sarma's approach shares some similarities with the United Nations Development Programme (UNDP) approach of computing development indices, particularly the Human or Gender Development Index. However, the point of divergence lies in Sarma's distance-based approach and the selection of values for the min-max transformation of each dimension. Conversely, the

UNDP's approach used a simple arithmetic averaging method, with pre-fixed values for the min-max transformation of each dimension in computing the multidimensional index. A host of studies have adapted the distance-based approach developed by Sarma to investigate the extent of FI across countries (Sarma, 2008; 2015; Sarma and Pais, 2011; Gupte et al., 2012; Sethy, 2016; AFI, 2016a). The financial inclusion index was developed by normalising the inverse Euclidean distance of the investigated dimensions from the ideal point (1, 1, 1) where the financial inclusion index ranges between zero (worst case or total financial exclusion) and one (best case or complete financial inclusion). Although the majority of studies considered three dimensions of financial inclusion over varying indicators, the number of dimensions included was subject to data availability. Sarma (2008) only investigated the extent of FI across 55 countries when the three dimensions of penetration, availability and usage were considered. However, despite this limitation, she was able to increase the sample size to 100 countries by considering the two dimensions of availability and usage. Her findings showed that the majority of the sampled countries ranked as high ($0.5 \leq FII \leq 1$) and medium ($0.3 \leq FII < 0.5$), based on their financial inclusion index categories, were OECD countries. In addition, most of the countries were associated with low levels of financial inclusion ($0 \leq FII < 0.3$). Similarly, Sethy (2016) and Yorulmaz (2013) investigated the same cited three indicators as Sarma (2008) did and found that higher levels of financial inclusion had a strong positive association with countries' levels of socio-economic growth and incomes.

Following the proliferation of the distance-based approach espoused by Sarma (2008), Gupte et al. (2012) attempted to improve on the three dimensions proposed by the scholar by including the ease and cost dimensions, and the scholars found higher levels of financial inclusion in India in 2008 and 2009, as compared with the findings by Sarma (2008). They argued that the integration of additional indicators makes results more robust, whereas the non-inclusion of relevant indicators may lead to the overestimation of results. However, regarding the cons, the added indicators varied across formal institutions and individuals; hence, indicators lacked standardisation and uniformity. Likewise, Ambarkhane et al. (2016) computed a financial inclusion index (FII) based on three dimensions, namely demand, supply, and infrastructure, and then they multiplied the FII with the drag component of population growth. Adapting the distance-based approach was considered suitable for measuring financial inclusion because it satisfied the characteristics of a development index (Sarma, 2008; Sarma, 2015; Sethy, 2016). The method was considered flexible as it could integrate more types of indicators. Furthermore, it accounted for the equal contribution of each dimension to financial inclusion by assigning

equal weights, which addressed the problems of perfect substitution (Park and Mercado, 2018). According to these authors, the major limitation of the approach was data availability, which influences the number of dimensions or indicators to be included in computing the index. However, most applications of the approach have relied on supply-side information, which may not adequately reflect the extent to which the poor have been financially included. Moreover, most of the studies used the approach to rank country- or regional-level financial inclusion, which does not reflect emerging policy initiatives for financial inclusion. Furthermore, the inability to decompose such index by domains, regions, gender or indicators renders findings from such measures less suitable for identifying areas of policy interventions or further research.

2.3.2.2 *The principal component analysis approach*

Most applications of the principal component analysis have endeavoured to improve on the distance-based approach by utilising both demand- and supply-side information. Camara and Tuesta (2014) used a two-stage principal component analysis to measure FI based on the three dimensions of access, usage and barrier. The inclusion of the barrier dimension was based on the claim that measures of financial inclusion should also include information about the financially excluded and reasons for exclusion. The first stage principal component analysis involved estimating the measure of financial inclusion using the access, usage and barrier dimensions as sub-indices. Subsequently, the second stage principal component analysis involved estimating the weight of each dimension and whole index of financial inclusion using the earlier developed sub-indices as causal variables. The approach was used to rank 137 countries in 2011 and 2014, and to further compare variations in rankings based on the countries' financial inclusion index scores. They found that higher levels of FI were strongly correlated with developed economies, while African countries were associated with low financial inclusion scores, with a few exceptions in countries like Brazil, which ranked fourth. Although the method was the first effort to incorporate information from both the financially included and excluded perspectives, the method has its limitations. Firstly, the sub-indices of financial inclusion dimensions have varying assigned weights based on the principal component analysis, which may affect results depending on the quality and availability of data. Secondly, Park and Mercado (2018) argued that measures that include ease of using financial services and barriers could be confusing due to the combination of reasons for inclusion and

exclusion. Lastly, restricting measurement of the access dimension to physical access ignores the emergence of technological advancements or digital solutions in financial inclusion.

Cabrera and Villarreal (2018) also used the two-step principal component analysis (PCA) in Mexico with the aim to compute a multidimensional index to evaluate the extent of FI based on the access and usage dimensions. Their results indicated that significant geographical differences existed among the drivers of the access and usage dimensions between rural and urban dwellers, although most variations in financial inclusion at the individual level were particularly explained by the access dimension. Other studies include that by Yorulmaz (2018) who used the PCA to compute two types of composite indices based on different surveys to investigate the level of financial access among countries. He investigated the outreach, ease, usage and cost dimensions of financial access over 10 indicators for 179 countries from 2004 to 2011 in computing the first index. For the second index, the same dimensions were investigated over 26 indicators for 58 countries from 2004 to 2005. He was able to slightly diverge from previous applications of the PCA by incorporating more indicators to expand the scope of financial inclusion measurement, maintaining that such exploration had no negative effect but would rather enhance the robustness of results. He also succeeded in classifying whether the indicators selected in computing the composite index were of primary, secondary or less relevance. Furthermore, the introduction of a time factor in his analysis helped to show how financial access has improved across countries and over the investigated periods.

Although the principal component analysis offers an alternative approach to computing a multidimensional index for financial inclusion, assigning different weights to the dimensions implies that greater power is given to one dimension than others in explaining statistical variations. This is problematic because all dimensions of financial inclusion are important, as they represent different but interrelated concepts (World Bank, 2017a). Consequently, assigning different weights to the dimensions may lead to an unbalanced structure in computing a multidimensional index (Nardo and Saisana, 2008). This position is supported by Sarma (2015) who argued that while the principal component approach accounts for the multidimensionality of financial inclusion, it does not account for the other properties desired in a development index, such as monotonicity, compactness (boundedness and closedness) and scale invariance (homogeneity). Besides, computing an index to measure the extent of FI lies more in the aim to estimate the first moment of the contribution of each domain to the overall

FI index, rather than the second moment. Yet, PCA addresses the second moment, thereby reducing its usefulness.

2.3.2.3 *Integrating the distance-based and the two-stage principal component approach*

Park and Mercado Jr. (2018) opined that the two-stage principal component analysis has inherent weaknesses and therefore attempted to build on the method by combining the distance-based approach of Sarma (2008) and the two-stage principal component analysis of Camara and Tuesta (2014). Their approach was considered as an improvement because, although the method measured financial inclusion based on the three dimensions of access, availability and usage (like its predecessors), the approach also employed indicators considering both physical and mobile financial access. While the distance-based approach was used to compute each dimension's indicator(s), the two-step PCA was used to firstly aggregate the indicators into a dimension index, and this was followed by deriving the weights for each dimension. The approach was used to rank countries based on their financial inclusion scores by using the World Bank Global Findex data (2011 and 2014), while regression models were estimated to assess differences across countries regarding the impact of FI on development goals. They found that high- and middle-high-income countries with high levels of FI were significantly correlated (1%), with high growth and low poverty rates (-0.300), whereas no significant correlation was found among the other countries, as middle-low and low-income countries generally ranked low in financial inclusion.

2.3.2.4 *Other approaches to measurement*

Other approaches to measuring the complex nature of financial inclusion include factor analysis (Amidzic et al., 2014), axiomatic measurement (Chakravarty and Pal, 2010), average of ratio index (Okpara, 2013), and adequacy gap and timeliness gap indices (Kalu et al., 2018). According to Park and Mercado Jr. (2018) and Camara and Tuesta (2014), the major weaknesses of the factor analysis approach include the underutilisation of available data, and assigning varying weights to each dimension, which renders one dimension more relevant than the other. Furthermore, the method of measurement was found to restrict the scope of financial inclusion indicators to country-level supply data. Conversely, Chakravarty and Pal (2010) used the axiomatic measurement approach to measure the extent of FI across countries and at state level in India. While significant variations exist in the levels of financial inclusion, they found

that high-income countries were associated with high levels of financial inclusion, and low-income countries associated with low financial-inclusion levels, with few exceptions in Saudi Arabia and Thailand. One important contribution of the approach was the ability to compute the percentage contribution of each dimension to the total FI score. Analysing the individual contribution of each dimension helps to inform areas for policy intervention. However, the major drawback of their approach was the computation of financial inclusion only from the banking point of view. They measured financial inclusion based on access to and use of bank services, and this especially reduces the relevance of such measures to situations where people have formal accounts with non-bank financial institutions and mobile money service providers.

It is important to further emphasise that while measuring access to and usage of financial services may be a requirement, it is not a sufficient condition to tell the complete story of financial inclusion. Furthermore, having access or use may not necessarily translate to enhanced financial capabilities or well-being of rural smallholder farmers. The majority of applications of previous methods emphasised cross-country rankings in financial access and usage, with a few exceptions addressing regional rankings. However, various population groups or regions may require different policy interventions, depending on their situation. As stated earlier in Chapter 1, the various roles of FI in the agricultural sector include consumption and production smoothing, risk mitigation, enhancement of economic growth and well-being. Despite this, there is a dearth of evidence on using a multidimensional index to measure FI among rural smallholder farmers, and accordingly this study seeks to address this research gap. The multidimensional nature of FI is receiving increasing policy attention and new approaches will continue to evolve in adaptation to policy developments. However, if appropriate consumer-oriented measures are not developed, it is most likely that population groups such as rural smallholder farmers would be forgotten. Therefore, it is important that advanced measures, aimed to identifying areas for intervention in the process of FI, reflect the extent to which rural smallholder farmers have participated and strengthened their capabilities to improve financial well-being.

2.4 FACTORS AFFECTING FINANCIAL INCLUSION

This study observes that most previous studies that analysed the factors affecting FI have used secondary data from the Global Financial Inclusion Database. Soumare et al., (2016) analysed the determinants of four indicators, particularly ownership of account, savings, borrowing and

frequency of use of financial inclusion in West and Central Africa, by using a logit regression model. They found that factors such as age, gender, education, marital status, employment, area of residence, size of household and extent of trust in formal institutions affect access to formal financial services. Allen et al. (2016) also analysed how country-level and individual characteristics affect access and usage dimensions of FI. Their method involved using a probit regression approach to assess three aspects: the determinants of formal account ownership, factors influencing the use of formal accounts to save, and frequency of use. They found that lower transaction costs of owning an account, nearness to financial institutions, and stable country policies had significant, positive influences on financial inclusion. Other factors that increased the likelihood of owning a formal account and savings at a financial institution were also found to include being rich, educated and older, and living in the urban area, as well as being employed and married. Similarly, Zins and Weill (2016) used the probit regression model to analyse the Global Findex (2014) covering 37 countries in Africa. They found that individual factors were the major determinants of financial inclusion, and that having received tertiary education had the greatest significant, positive marginal effects on account ownership, savings and borrowing in formal financial institutions by 44%, 32% and 10%, respectively.

In Nigeria, Abdu et al. (2015) also used the probit model to analyse the drivers of FI by using four indicators represented by account ownership, savings, borrowing and having a personal insurance policy. They reported that being male, being of youthful age, and having secondary and tertiary education and income increased the likelihood of owning a formal account. In terms of borrowing at a financial institution, the only significant determinant was having a tertiary education qualification. In general, having a tertiary education qualification increased the probability of having a formal account by 54.10, savings by 57.50%, and borrowing by 13.30%, whereas being in the highest income level increased the probability of having an insurance policy by 5.51%. In conclusion, evidence from the studies reviewed suggests that policy, household and individual characteristics mainly affect financial inclusion, and that having received formal education seems to play a major positive role at the micro level.

2.5 RELEVANCE OF FINANCIAL INCLUSION IN AGRICULTURAL AND ECONOMIC DEVELOPMENT

Emerging evidence reveals that financial inclusion promotes agricultural and economic development (Demirguc-Kunt et al., 2017; Evans 2017; Kim, 2016). However, differential impacts may exist, depending on the indicators of FI that are assessed. Evans (2017) utilised a time-series data approach, specifically relying on an Autoregressive Distributed Lag bounds testing procedure in order to examine the impact of FI on Nigeria's agricultural growth during the period from 1981 to 2014. The study indicated that the usage of financial services significantly influenced agricultural growth in the long and short run, while access was not significant. In the long run, a 1% increase in the usage of financial services would increase agricultural growth by 0.59%. However, Adebayo et al. (2012) assessed the impact of a micro-credit programme on smallholder farmers in Nigeria by using a Propensity Score Matching model. The scholars revealed that the micro-credit programme had no meaningful impact on food security and the agricultural productivity of farmers. This may be due to usage of micro-credit for other purposes, which would imply that unless formal financial access is backed by the right usage in Nigerian agriculture, little or no impact might be realised. On the other hand, in Bangladesh, Nusrat et al. (2016) reported in their study that credit access strengthened the efficiency of farmers by up to 12.25% and income diversification by 4.86%.

In a separate study, Kim (2016) analysed the impact of financial access on the association between income inequality and economic growth in 40 countries. A two-stage least square regression model was estimated. In the first step, they found that economic growth had no significant effect in decreasing income inequality in countries that have low incomes, but they observed otherwise in high-income countries. Nonetheless, the introduction of an FI variable in the model reduced the income inequality found in low-income countries with greater effect. In Nigeria, Onaolapo (2015) analysed the effect of FI on economic development between 1982 and 2012 by using the ordinary least square regression method. Three models were estimated to study the impact of FI on the rural well-being and economic growth of those previously excluded, as well as the impact of financial intermediation on their FI. They found that the provision of loans to rural regions and the Agricultural Credit Guarantee Scheme Fund had positive, significant effects on poverty reduction. In addition, the credit ratio to private sector to GDP had a positive, significant impact on economic development. However, loans to rural areas and loans to small-scale enterprises had significant, positive outcomes on FI by 63 percent

and 37 percent, respectively. In the same vein, Babajide et al. (2015) indicated that FI significantly enhances total factor of productivity in Nigeria and capital per worker. Therefore, a 100% increase in FI would lead to a 374% growth in Nigeria's economy, *ceteris paribus*.

2.6 IMPACT OF FINANCIAL INCLUSION ON WELFARE AND LIVELIHOOD OUTCOMES

Although viewed from different perspectives, most of the cited evidence on the welfare effects of FI showed a positive relationship. Danquah et al. (2017) evaluated the impact of formal financial service provision on the welfare of rural families in Ghana (proxied by expenditure on household consumption per adult). The scholars used ordinary least square and two-stage least square regression methods and found that the provision of financial services by rural community banks significantly enhanced the welfare of rural families by 51.7% (OLS) and 38.2% (IV), respectively. Similarly, Masiyandima et al. (2017) evaluated the effect of FI on livelihoods in Zimbabwe, using secondary data from the 2014 FinScope survey. The scholars categorised individuals into distinct socio-economic groups: vulnerable, insecure, neither, relatively secure, and secure. They then used the ordered logit regression model to assess how financial inclusion or exclusion determines the likelihood of being in any of the categories, relative to the investigated livelihood outcomes selected by the study, which were basic income, food, health and education. Their findings showed that FI has a positive influence on livelihood. It also increased the probability of being in the secure group by 31% regarding access to basic income, 47% in food, 51% in health, and 56% in education, as compared to being in the vulnerable group.

Brune et al. (2011) also provide relevant insights for understanding the impact of FI in rural settings. Their study used a random field experiment to analyse the impact of access to savings at a formal institution on the well-being of rural cash-crop smallholder farmers. They found a significant, positive impact on welfare was attained through increases in agricultural input use, output, sales, expenditures and income returns. Other studies have evaluated the impact on welfare achieved through branchless banking and digital financial inclusion. For instance, Ulwodi (2017) evaluated the impact of the adoption of mobile banking and agent banking on welfare in Kenya through using data sets available from Global Findex, FinAccess and FinScope. The study was based on an estimation of a wealth quintile regression defined on four levels: poorest 20%, second 20%, middle 20% and third 20%. The study found that financial

market segmentation is crucial if financial inclusion is to have impact on targets, as non-segmentation may result in a complete welfare loss. They also found that adopting branchless banking would have a positive, significant impacts on welfare by 62% and 83% if the third 20% and middle 20% quintile were targeted, respectively. In the same vein, Murendo (2015) indicated that adoption of mobile money by rural families in Uganda significantly enhanced financial inclusion and also had a positive impact on their welfare.

In Nigeria, Adebowale and Dimova (2017) examined the link between access to finance, household welfare (proxied by household per capita expenditure) and inequality through using the treatment effect and decomposition technique. They found that significant determinants of financial access, such as bank availability, urban areas, access to internet, level of education and formal employment, have significant, positive impacts on household welfare. Although the results revealed that access to finance increased inequality between households, financial literacy was found to reduce inequality, but not in households without access to finance. Conversely, Ousmane et al. (2017) used panel data to assess financial inclusion impact on household consumption between 2010 and 2012. Results from the fixed effect instrumental variable estimation showed that formal financial access significantly increased household consumption in Nigeria, by 123% in 2010 and by 146% in 2012. In the same way, a growing body of evidence in Nigeria (Ageme et al., 2018; Bakari et al., 2019; Ogunsakin and Fawehinmi, 2017) revealed that financial inclusion plays a significant role in poverty reduction and could enhance the financial resilience of the poor to mitigate risks, shocks or emergencies. Ageme et al. (2018) used an error correction model to confirm that a long-run equilibrium exists between FI and poverty alleviation. Moreover, it was observed that 71% of the disequilibrium in the short run would be rectified to the steady state by the speed of adjustment every quarter. However, despite this, it is widely known that most rural smallholder farmers earn income from other sources aside from agriculture, yet literature investigating how financial inclusion influences the various income sources is very limited. Based on this observation, this study therefore proposes that evidence is required to inform whether there is a need to shift from strict sectoral policy approaches in the financial inclusion of rural smallholder farmers to those that integrate both agricultural and non-agricultural sectors used in improving smallholders' livelihoods.

2.7 SUMMARY

The literature review, taken as a whole, shows that there is no universally accepted standard for evaluating the level or progress made in FI. Furthermore, the review demonstrates that previous approaches to measurement show increasing awareness of the roles of financial inclusion in development and the need to advance measures aiming to adequately inform policy decisions. While most of the measures have relied on supply data obtained from banks and aggregated at country levels, none is consumer oriented. A summary of the issues covered in the chapter on methods of measuring financial inclusion is presented in Table 2.1.

This study proposes that it is important to develop advanced measures of FI in order to bridge the existing gaps between efforts aimed at measuring headline indicators like access and the primary goal of improving the quality of life for previously excluded groups. Moreover, it is important that measures of FI move beyond ranking of country levels of FI, to targeting population subgroups for sustainable outcomes. As stated earlier, findings from the literature review bemoan the lack of evidence regarding measuring the FI of rural smallholder farmers and how different population subgroups and indicators have contributed to informing policy interventions. Such evidence is necessary to inform policy interventions. Furthermore, research gaps exist on how the individual and household characteristics of rural smallholder farmers affect their financial inclusion and whether being financially included has an impact on their rural livelihoods. It is expected that evidence from this study would inform targeted interventions aimed at inclusive agricultural and rural economic development in Nigeria.

Table 2.1: Summary of methods of measuring financial inclusion

Simple methods	Major component	Author		
Proportion of adults aged 15+ owning a sole or joint account at a financial institution or with a mobile money provider	Access	Demirgüç-Kunt et al., (2018)		
Proportion of adults having access to formal financial intermediaries while number of bank accounts and GDP per capita was used for households without survey data on the access indicator.	Access	Honohan (2018)		
Complex or multidimensional measures				
Method of measuring financial inclusion	Components in constructing the FI index	No. of dimensions	Author	
Distance-based approach	Penetration, availability and usage	Three	Sarma (2008); Sarma and Pais (2011); Yorulmaz (2013); Sarma (2015); Sethy (2016)	
	Availability and usage	Two		Sarma (2008)
	Penetration, availability, usage, ease and cost	Five		Gupte et al. (2012)
Adaptation of the distance-based approach	Demand (penetration and access); Supply (usage); Infrastructure and a drag component (population growth)	Three	Ambarkhane et al. (2016)	
Principal component analysis	Access, usage and barrier	Three	Camara and Tuesta (2014) Cabrera and Villarreal (2018)	
	Access and usage	Two		
	Outreach, usage, ease and cost. A time factor was introduced into analysis	Four		Yorulmaz (2018)
Integrating the distance-based and the two-stage PCA Factor analysis	Access, availability and usage	Three	Park and Mercado Jr. (2018)	
	Outreach and use of financial services	Two	Amidzic et al. (2014)	
Axiomatic measurement approach	Access to physical bank branches and use of banking services	Two	Chakravarty and Pal (2010)	
Average ratio approach	Access to and use of bank financial services	Two	Okpara (2013)	
Index of penetration gap (a combination of adequacy and timeliness gap indices)	Adequacy and timeliness of access to credit	One	Kalu et al. (2018)	

Source: Author's own compilation

CHAPTER 3: UNPACKING THE CONCEPTS OF FINANCIAL INCLUSION, RURAL SMALLHOLDER FARMERS AND LIVELIHOOD

3.1 INTRODUCTION

This chapter unpacks the concepts of financial inclusion, rural smallholder farmers and their livelihoods, with the aim to provide an in-depth understanding of the conceptual framework applied in this study. The various definitions of the concepts of FI as used in literature are harmonised and interpreted in order to give the study an opportunity to adopt or redefine the concepts and indicators to be used in developing the multidimensional measure of FI. According to Hannig and Jansen (2010), a reliable measure of FI should not only be able to translate concepts into operative approaches, but also be able to identify priorities and measure the progress and impact of policy outcomes. Based on this, this study therefore applies the conceptual framework (Figure 3.2) that it developed in order to provide better insights into the financial inclusion of rural smallholder farmers, the measurement issues addressed, and the pathways through which FI could impact on the livelihoods of rural smallholder farmers in Nigeria.

3.2 CONCEPT OF FINANCIAL INCLUSION

The concept of FI was traditionally borne out of the need to address various inequalities that exist across and within countries or population subgroups and hinder socio-economic inclusion (Beck et al., 2007; Nwanne, 2015). The emphasis of this study is on the financial inclusion of rural smallholder farmers, as the majority of them are poor and constrained in access, ownership, utilisation and control of productive resources (Rapsomanikis, 2015). Moreover, the lack of access and usage of financial resources constitutes a major constraint to their participation in agricultural economic opportunities (Ogunmefun and Achike, 2015). Owing to this limitation, when rural smallholder farmers are faced with financial challenges, they resort to using informal financial services that are considered more flexible, but less regulated and less sustainable for enhancing a country's economic growth (Ayegba, 2013). Although financial inclusion has no universal definition, as noted in the previous chapter, this study explored the different meanings of FI in the literature to arrive at a consensus in conceptualising the multidimensional framework for the FI of rural smallholder farmers.

3.2.1 Interpretations of financial inclusion

Financial inclusion is increasingly becoming a highly prioritised development policy strategy (Arun and Kamath, 2015). This is because it is considered as a viable tool for attaining sustainable development outcomes, like agricultural productivity, food security and poverty reduction (Adegbite and Machethe, 2020; Klapper et al., 2016). As a result, various stakeholders, like policy makers, organisations, financial institutions and researchers, have adopted different interpretations of financial inclusion.

Policy makers: According to Kama and Adigun (2013), “the government’s key goal for financial inclusion is about ensuring that everyone has access to appropriate financial services, enabling them to manage their money on a day to day basis, plan for the future and deal effectively with financial distress.” This definition suggests that policy makers perceive financial inclusion as the right of all population groups to achieve improved financial well-being by making available better economic opportunities, especially to the vulnerable groups.

Organisations: The World Bank (2017a) has defined financial inclusion as a condition where all population groups have formal access to a wide range of quality financial services, including credit, saving, insurance, remittances, money transfers, transactions and payment services. According to the institution, these financial services ought to be provided responsibly by financial institutions at affordable cost in a competitive financial market. Similarly, CGAP (2015) defined FI as “a state where both individuals and businesses have opportunities to access and use a range of financial services that are responsibly provided by financial institutions”. The Centre for Financial Inclusion (2013) defined FI as “ensuring everyone has the capability opportunity to access the financial services and products needed to participate fully in modern-day society and the economy”. Equally noteworthy is the definition of FI by the Organisation for Economic Co-operation and Development (2018) as “the process of promoting affordable, timely and adequate access to regulated financial products and services and broadening their use by all segments of society through the implementation of tailored existing and innovative approaches, including financial awareness and education, with a view to promote financial well-being as well as economic and social inclusion”.

Formal financial Institutions: While financial institutions can range from formal or semi-formal to informal, the level of formality depends on the degree of sophistication of organisational structure and government regulation. The Central Bank of Nigeria is charged with the general organisation and regulation of the financial sector policies of the Nigerian government. According to the CBN (2012), financial inclusion is realised when “adult populations (18⁺) in Nigeria have easy access to a broad range of formal financial services (payments, savings, credit, insurance and pension) designed according to needs and provided at affordable costs. The CBN (2018) later adopted a similar definition, but extended the financial services to include capital market products. Although financial inclusion is mostly perceived by bank financial institutions as existing when all population groups have access to and use financial services and products delivered by bank institutions, this definition narrows the concept of financial inclusion.

Researchers: Various researchers in development economics have defined financial inclusion based on various concepts. Sarma (2008) defined FI as a state where nobody is deprived of having access to and use of basic financial services in an economy. Conversely, Demirgüç-Kunt and Klapper (2013) defined FI as “the share of the population that uses formal financial services”. Although “financial inclusion” and “inclusive financing” are sometimes used interchangeably in literature, Camara and Tuesta (2014) defined FI as “the basic ingredient for individuals’ welfare”. Their definition presents a divergent view that perceives an inclusive financial system as one that maximises access and usage of financial resources, while reducing the involuntary exclusions that constitute barriers to using financial services in a regulated system. While having access to financial services is important, Arun and Kamath (2015) opined that the concept of FI encompasses other issues associated with developing the financial capabilities of people and ensuring better management of financial resources. In conclusion, a summary of the various interpretations of financial inclusion by stakeholders as outlined above is presented in Table 3.1.

Table 3.1: Interpretations of financial inclusion by stakeholders

Stakeholder	Definitions of financial inclusion	Source
Policy makers	It involves ensuring “everyone has access to appropriate financial services, enabling them to manage their money on a day to day basis, plan for the future and deal effectively with financial distress”.	Kama and Adigun (2013)
Organisations	A condition where all population groups, have access to wide-ranging quality financial services that are provided responsibly by formal financial institutions at affordable cost. “A state where both individuals and businesses have opportunities to access and use a range of financial services that are responsibly provided by financial institutions”.	World Bank (2017a) CGAP (2015)
	“Ensuring everyone has the capability opportunity to access the financial services and products needed to participate fully in modern-day society and the economy”	CFI (2013)
	“The process of promoting affordable, timely and adequate access to regulated financial products and services and broadening their use by all segments of society through the implementation of tailored existing and innovative approaches, including financial awareness and education, with a view to promote financial well-being as well as economic and social inclusion”.	OECD (2018)
Formal financial institutions	FI is realised when “adult populations (18+) in Nigeria have easy access to payments, savings, credit, insurance and pension designed according to needs and provided at affordable costs”	CBN (2012)
Researchers	A state where nobody is deprived of having access to and use of basic financial services in an economy “Share of the population that uses formal financial services”	Sarma (2008) Demirgüç-Kunt and Klapper (2013)
	An inclusive financial system is one that maximises access and usage of financial resources while reducing barriers in FI FI encompasses other issues related to developing the financial capabilities of people and ensuring better management of financial resources	Camara and Tuesta (2014) Arun and Kamath (2015)

Source: Author's own compilation

Financial exclusion: Financial exclusion widens inequality, and retards economic growth and its attendant gains (Beck et al., 2009). It is the reverse of FI, and financial exclusion confines the poor to limited personal savings, investment, human capital formation, business and growth opportunities (World Bank, 2008b). According to the World Bank (2014a), financial exclusion could be categorised into voluntary and involuntary exclusion. The former refers to those groups that are financially excluded, probably due to low levels of financial literacy, religious or socio-cultural beliefs, or those who feel that using formal financial services is irrelevant. The latter refers to those groups that are financially excluded due to discrimination and low incomes, or those who constitute potentially risky clients to be served by formal service providers due to imperfect information. Findings from the literature revealed women, farmers, rural dwellers, and lower income groups or regions are more vulnerable to financial exclusion.

Redefining financial inclusion: Based on the various definitions of FI cited above, the common emanating themes include a broad range of financial services and/or products, affordable cost, all population groups, access and usage, formal financial institutions, economic opportunities, financial capability, and well-being. Insights from the themes indicate that financial services extend beyond credit and that formal financial services and products are not provided only by banking institutions. Furthermore, the need for the efficient and equitable allocation of financial services to promote an all-inclusive economic opportunity for population subgroups is crucial. Based on these insights, this study defines FI as a process of ensuring equitable access and use of a broad range of formal financial services, such that those who were previously excluded (rural smallholder farmers) are financially included for better participation in economic opportunities, while also strengthening their financial capabilities and well-being needed to attain their life potentials.

3.2.2 Conceptualising the domains and indicators of financial inclusion

Many previous studies have adopted the multidimensional nature of financial inclusion (Sarma 2008; Gupte et al., 2012; Camara and Tuesta 2014; Ambarkhane et al., 2016, Park and Mercado Jr. 2018). The classification of FI as access, usage and quality (AFI, 2011) indicates that FI extends beyond just having financial access. While the access dimension represents the supply side of formal services, usage is synonymous with demand for formal financial services backed with supply, and the aspect of quality implies the segmentation of financial markets in order to provide products that address the financial needs of target clients (Triki and Faye, 2013). Triki

and Faye (2013) opined that efforts geared towards enhancing financial inclusion should ensure that the three dimensions are addressed. Furthermore, the World Bank (2017a) indicated the need to differentiate between access and usage of financial services, and this requirement reflects that they are different but equally relevant concepts in FI policy development. Therefore, efforts aimed at providing the desirable financial inclusion impact in agriculture should not stop at access, but also ensure that other important dimensions of financial inclusion are equally met.

3.2.3 The three domains of financial inclusion

Following the classification by Hall (2014) and the common themes highlighted in the definitions of financial inclusion, this study adopts three major domains of FI, which comprise financial participation, financial capability, and financial well-being.

3.2.3.1 Financial participation domain and indicators

Financial participation refers to the access and use of quality financial products and services, such as credit, savings, insurance, transfers, remittances and payments, at affordable cost. This definition integrates the Alliance for Financial Inclusion's classification (AFI, 2011). However, in the absence of data on the aspect of quality, Camara and Tuesta (2014) used the barrier dimension as a proxy, i.e. measuring the quality dimension from the perspective of the financially excluded or the challenges faced by people in gaining access to or using formal financial services. This study adopts access, usage, and barrier indicators as the metrics of the financial participation domain.

- a. Access:** Accessibility to financial services, regulated by government, used to be limited to bank-provided services. However, in this study, formal access to financial services encompasses financial services delivered by banking institutions, non-banking financial institutions, and mobile money service providers. Access in this study refers to the extent of formal account penetration, and to a situation where a rural smallholder farmer has a personal formal account, with at least any of the three types of formal financial service providers.

- b. Usage:** The usage of regulated financial services used to be limited to bank services or products. In this study, it refers to the use of formal financial services delivered by bank financial institutions, non-bank financial institutions or mobile money service providers. The concept therefore refers to a situation where a rural smallholder farmer has used a formal account to save or borrow, and make or receive payments, transfers or remittances up to 90 days. This is to account for the frequency of usage of financial services or products, which is more important in FI rather than just adoption.

- c. No barrier:** Barriers are limitations to full access and usage of formal financial services that constrain people's participation in financial inclusion (Camara and Tuesta, 2014). Such barriers may include high costs of transaction charged by formal institutions, distance, lack of formal identity documentation, or lack of information on formal account opening (Anderson et al., 2017). Although barriers faced by rural smallholder farmers constitute constraints, overcoming the barriers is a crucial goal in promoting FI. In this study, the "no barrier" indicator is adopted such that the more numbers of rural smallholder farmers there are who face no, or minimal, barriers, the higher the level of financial inclusion is.

3.2.3.2 *Financial capability domain and indicators*

Financial capability entails the financial literacy, knowledge, skills and attitudes required to make sound decisions regarding one's financial well-being (Centre for Financial Inclusion, 2013). According to Sherraden (2013), the concept of financial capability is most crucial in addressing the financial inclusion of the poor. This is because strengthening financial capability enhances the poor's participation in financial markets and overall inclusion (CBN, 2012). According to CFI (2013), the process of financial inclusion can only be termed "effective" when consumers are financially capable of making informed decisions with regard to the access and use of financial services. Furthermore, the concept of financial capability is crucial when financial innovations and tools are being developed to meet the financial needs of the previously marginalised in a bid to promote financial inclusion (GPFI, 2010). This is because FI is not just about developing finance innovations, but also about giving consumers enough confidence to adopt such innovations to meet their financial needs. Hence, financial capability refers to people's ability to effectively participate in a formal financial system by making prudent financial decisions, planning and budgeting, while being sufficiently financially

literate to adopt and use financial innovations (Abor et al., 2018). To this end, scholars such as McQuaid and Egdell (2010) identified indicators of financial capability as managing money, selecting financial products, financial planning, and financial literacy. A related view of financial capability was also advanced by the CBN (2018), which identified financial literacy and consumer protection (financial capability) as essential consumer targets in financial inclusion.

The various meanings therefore imply that fostering the emergence of financial capability is a crucial policy goal in the financial inclusion agenda that should not be overlooked (Bolaji-Adio et al., 2013). Therefore, based on evidence from literature, this study specifically adopts financial literacy, financial planning and consumer protection as indicators for measuring the financial capability of rural smallholder farmers in Nigeria.

- a. Financial literacy:** refers to the skill, knowledge and awareness required to stay informed on choices of financial products, or the knowledge required to minimise risks or maximise opportunities associated with using financial services (OECD, 2018; 2009). According to the CBN (2012), financial literacy is “a central pillar to the enhancement of financial inclusion, particularly when coupled with consumer protection”. This implies that financial literacy strengthens the capability of the poor to effectively participate in financial inclusion.
- b. Consumer protection:** refers to the institutional settings that guarantee the safety of consumers in financial market participation and inclusion (Randall et al., 2017). Consumer protection is a crucial element of FI because it builds consumers’ confidence and trust in formal financial systems (CBN, 2012; 2018). According to the OECD (2018), developing consumers’ trust in formal financial systems is a top priority for consumer protection because this activates consumers’ capability to participate in FI.
- c. Financial planning:** is the basic financial management strategy required to make effective financial decisions in addressing financial needs, and may be influenced by attitudes and behaviours (Agarwal et al., 2015). Financial planning entails having a budget plan, savings plan, credit plan, and records of incomes and expenditures to inform financial decision making.

3.2.3.3 *Financial well-being domain and indicators*

The concept of financial well-being emerged mostly through advances made in consumer finance. Often used interchangeably in literature as financial health, financial well-being could refer to the extent of financial resilience in meeting financial needs, one's financial situation, and having freedom of choice or control over finance (Abor et al., 2018; Kempson et al., 2017; Brügger et al., 2017). Despite this, very few studies have attempted to measure financial well-being; hence, there is no standard way of measuring the concept. The Consumer Finance Protection Bureau (2015) identified four indicators of financial well-being as follows: control over finance, ability to absorb financial shocks, ability to accomplish financial goals, and freedom to make financial choices to achieve life potentials. In the same vein are scholars such as Kempson et al. (2017) and the Australian & New Zealand Banking Group (2018) who identified the three indicators of financial well-being as the ability to meet financial goals, feeling comfortable, and having financial resilience. However, Muir et al. (2017) provided a different set of indicators, identified as the ability to meet expenditures with some money left behind, having control in financial decisions, and being free of financial worries.

Ladha et al. (2017) emphasised the point that, irrespective of geographical locations, socio-economic status or income levels of individuals and countries across the globe, everyone primarily aspires to having a healthier financial well-being. However, Hernandez (2019) cautioned that financial well-being should not be confused with the ultimate outcome of using financial services. Instead, it is a state of being in control of one's finances to meet financial responsibilities both now and in the future with confidence so as to maximise livelihood strategies and opportunities to accomplish life goals (CFPB, 2015; Hernandez, 2019). As stated earlier, this study maintains that the process of FI can only be termed "successful" when individuals, particularly groups often known to be marginalised, are financially better off in a regulated system. Therefore, integrating these consumer indicators into measures of FI is considered essential in developing a robust FI measure that is capable of informing better policy decisions, especially for the poor. Based on the outlined interpretations of relevant concepts in the above-cited literature, this study adopts the indicators of financial well-being set out below.

- a. **Control over finance:** refers to the ability to make decisions over the use of one's finances, both in the present and future (CEBR, 2018). It could also refer to being able to meet one's financial needs or pay bills on time. In the global framework for financial

health, the financial role indicator could be likened to having control over finance, which according to the authors, is crucial in providing insights into the extent of power that an individual has regarding his or her financial health status (Ladha et al., 2017).

- b. **Financial resilience:** refers to the ability to mitigate risks, absorb shocks and address the emergencies that affect one's financial well-being (the Australian & New Zealand Banking Group, 2018). While financial resilience could be influenced by individual financial behaviours and having financial plans, social networks like friends, families and community groups also play essential roles in meeting emergent financial needs (Anderson et al., 2017; Ladha et al., 2017).
- c. **Financial situation:** It is a subjective measure of one's financial well-being and is exclusive to each individual (Brüggen et al., 2017). In this study, the financial situation indicator reflects the subjective assessments of rural smallholder farmers to meet at least their basic financial needs and responsibilities.

3.3 CONCEPT OF SMALLHOLDER AGRICULTURE

This section describes the different concepts and interpretations of smallholder agriculture as used in literature, while also conceptualising rural smallholder farmers in Nigeria who constitute the target focus of this study. The roles of smallholders, especially in agriculture, cannot be over emphasised and as a result, various stakeholders have embraced different definitions, often linked to agricultural activities and livelihoods. Traditionally, the concept is often used interchangeably in literature to mean subsistence or peasant agriculture, which is characterised by consuming what is produced or producing just enough to meet own-consumption requirements (Rapsomanikis, 2015). Another interpretation of smallholder agriculture views it as traditional or smallholder farming, which is characterised by the dominant use of family labour to produce agricultural outputs, lower adoption and use of agricultural technologies, and low participation in markets (Murphy, 2012). The concept could also overlap with “small farms”; “family farms” or “resource-poor farmers” (World Bank, 2007; Graeub et al., 2016).

3.3.1 Descriptions of smallholder farmers

Defining smallholder farmers has over the years generated varying perspectives across the globe. This is mainly due to reasons that include lack of consistent data, the choice of the physical, social or economic criterion used to determine thresholds, and considering thresholds in relative or absolute terms. However, most concepts of smallholder farmers are related to aspects of poverty, such as having limited access to markets, investments and finance, which tend to limit their capabilities to adopt improved agricultural technologies to increase incomes. At the same time, various solutions, mostly linked to finance, are also required to improve their livelihoods, as illustrated in Figure 3.1 (AGRA, 2016).

Other definitions of smallholder farmers are described in relation to farm typology, labour input or productivity, use of family labour, socio-economic characteristics, level of access to productive resources, or a combination of different criteria (Khalil et al., 2017; Fan et al., 2013). Considerable common ground is found in defining smallholder farmers as being those subsistence farmers with limited assets and resource-base, having less than two hectares of agricultural land (World Bank, 2003). Another description by OECD (2015) relates smallholder farmers to their struggles to remain competitive in order to earn sufficient incomes to meet both individual and households' financial needs as they are left with less marketable surplus after own consumption of outputs. In order to provide insights into demand by smallholders in Nigeria for financial services and products, Anderson et al. (2017) sectioned smallholders into four groups as follows: those farming for sustenance, those battling the elements, those with options for growth, and lastly, those who are strategic entrepreneurs. However, Hazell and Rahman (2014) categorised smallholder farms in relation to their livelihood strategies and market orientation to inform targeted interventions. Based on this view, these scholars grouped smallholders into three distinct categories: commercial, transitioning and subsistence groups (AGRA, 2017).

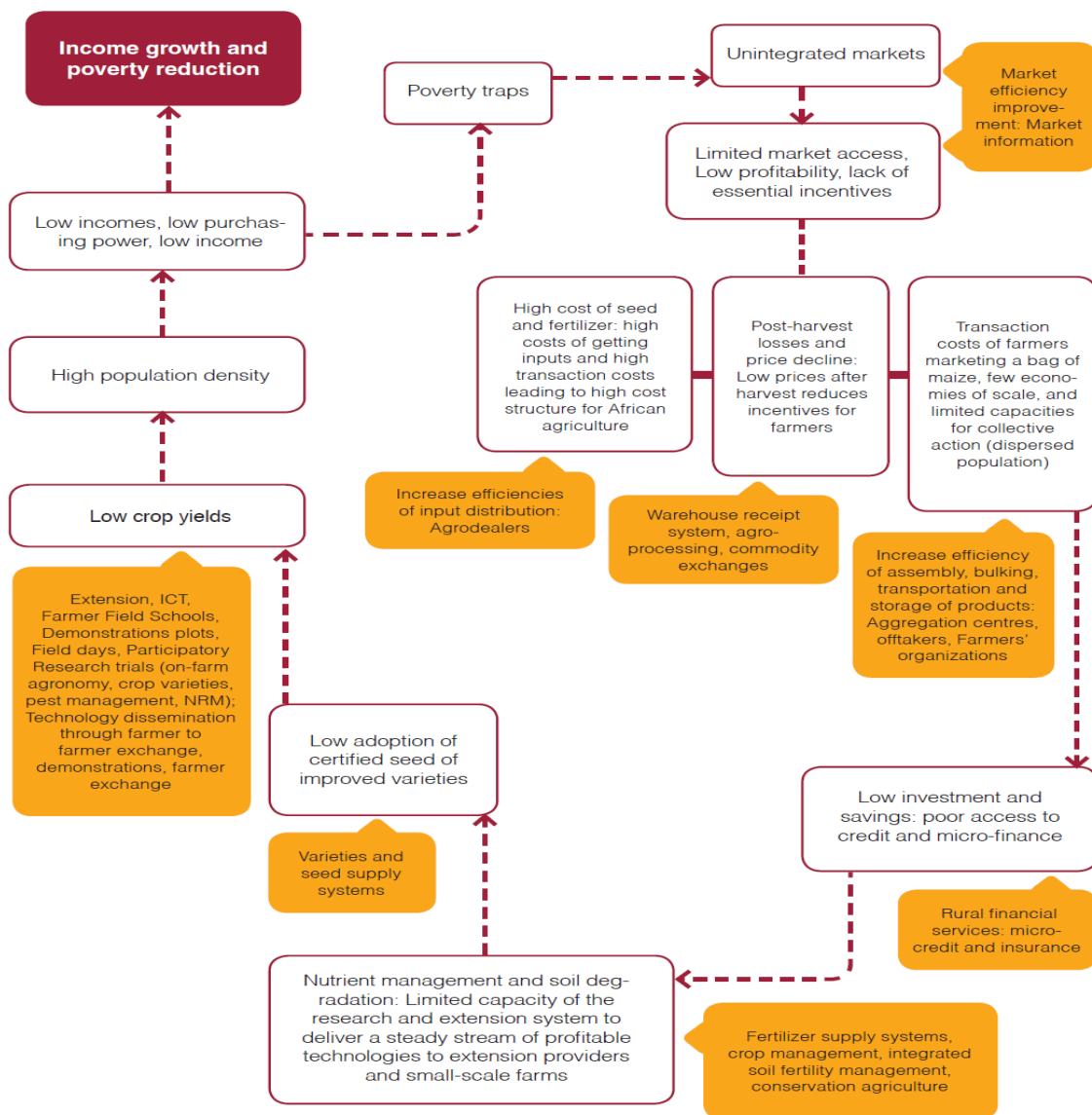


Figure 3.1: Poverty traps framework of smallholder farm households

Source: AGRA (2016)

According to Graeub et al. (2016), in the past, smallholder farmers were viewed as being “part of a hunger problem”. However, their findings revealed that small farms account for 98% of all farms across the 105 countries investigated, and that they produce about 53% of the world’s food. Thus, an increasing awareness of the roles of smallholder farmers in development necessitates rethinking approaches to policy and practice interventions for smallholder farmers.

3.3.2 Conceptualising rural smallholder farmers in Nigeria

Globally, there is no common definition of the concept of “rural smallholder farmers”. However, smallholder agriculture, which is central to most global development strategies, is typically domiciled in the rural areas. While various initiatives to advance the rural sectors are being developed, Paul et al. (2014) found that, beyond their existence on paper, most of the plans do not benefit the rural households. In Africa, rural smallholder farmers constitute vulnerable groups, mostly trapped in poverty, hence the requirement for their financial empowerment in order to meet the targets of global development policies (AGRA, 2016). In Nigeria, the rural populations could be termed as “the forgotten poor” as they are often characterised by poor socio-economic conditions such as living in remote communities that lack access to basic amenities, including electricity, to the internet, and to financial institutions or services (Nwanne, 2015; Adelaja et al., 2019). This study adopts the classification of smallholders stated by Anderson et al. (2017) and defines rural smallholder farmers in Nigeria as, first and foremost, those who reside in the rural areas, across the six geopolitical zones, and in addition to this, those who rely on agriculture to contribute significantly to their livelihoods. Furthermore, this study also views rural smallholder farmers as those who have up to five hectares of farmland, or less than 100 sheep, pigs or goats, or less than 1,000 chickens. Various studies have continued to show the increasing need to invest in rural smallholder farmers and adopt an integrated approach to upgrade their quality of livelihoods (IFAD, 2017, HLPE, 2013). Therefore, there is need to prioritise financing policies in Nigeria and specifically target their implementation to benefit rural smallholder farmers in order to attain an inclusive economic growth and to also improve individual lives.

3.4 CONCEPT OF LIVELIHOOD

This section provides a synopsis on the concepts of livelihood – when is a livelihood “sustainable” and what rural and agricultural livelihoods imply. Furthermore, the livelihood indicators of rural smallholder farmers for this study are conceptualised and utilised as the outcome variables in assessing the impact of FI on the livelihood of rural smallholder farmers in Nigeria. Chambers and Conway (1992) state that “livelihood comprises the capabilities, assets and activities required for a means of living, a livelihood is sustainable when it can cope with and recover from stresses and shocks and enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.” On the other hand, livelihood

could simply refer to a source of living or income activity. However, the type of activities engaged in or strategies employed could be determined by the level of access to productive resources (Serrat, 2017).

3.4.1 Interpretations of sustainable rural and agricultural livelihood

The sustainable rural livelihood approach identifies five basic resources (human, physical, natural, social and financial) which restrain or make available the economic opportunities required to achieve a desired livelihood outcome (HLPE, 2013). The World Bank (2007) has indicated that, although rural families are associated with three broad categories of livelihood strategies, namely farming, diversification and migration, they depend more on one of the activities as a means to sustain livelihoods. While the need to improve the quality of rural livelihoods cannot be overemphasised, the availability of financial resources has been identified as one of the least readily obtainable means of improvement for the rural poor (IFC, 2013). Yet, if smallholder agriculture is to improve the living standard of the rural populace, then inclusive financing of rural smallholder farmers is crucial for facilitating access to other resources.

Although smallholder farmers engage in farming, the majority of them earn incomes from diverse sources (Anderson et al., 2017). It is often assumed that, as poor farming households have better access to productive resources that could be facilitated through financial inclusion, they would specialise rather than diversify (Gecho, 2017). Traditionally, income diversification was regarded as the livelihood strategy employed by the poor in coping with risks (Loison, 2015). However, evidence suggests that having diverse income sources may be a response aimed at maximising economic opportunities, and could increase with wealth accumulation (USAID, 2017; Dimova and Sen, 2010). According to Loison (2015), diversification of income sources may be classified by sector; agricultural and non-agricultural; function (wage and self-wage employment); or location (on farm and off farm). There is a likelihood to assume that participation in farm and non-farm income activities by rural households may have a negative effect on agricultural productivity. However, earning income from other sources has a positive influence on the purchase of inputs and the adoption of improved technology and agricultural productivity methods, as off-farm income is likely to be invested into agricultural production (Babatunde, 2015; Dirro et al., 2015). This is supported by evidence from recent development approaches which suggests that income diversification of rural households could facilitate

agribusiness development, the better integration of farm and non-farm economic sectors and promote rural industrialisation, and could be an alternative to reducing rural–urban labour migration (FAO IFAD IOM WFP, 2018).

3.4.2 Conceptualising the livelihood indicators of rural smallholder farmers for the study

According to data from the 2016 Nigeria - CGAP smallholder household survey, rural smallholder farmers earn income from farm and other sources. The major income sources cited in the survey data were introduced into the analysis of this study as livelihood variables. The farm income sources include growing crops, fruits, vegetables and/or rearing livestock such as poultry, fish, and bees, and selling them or their by-products. Other income sources include earning wages (occasional or regular jobs), running own business (manufacturing, retail or service provision), and receiving remittances or getting money from friends and family members. Furthermore, other sources include receiving a grant, pension, stipend/allowance or subsidy, and income generation from transport services. According to USAID (2017), a stronger motivation may exist for livelihood diversification among rural farming households beyond coping with uncertainties. As demonstrated earlier, in Nigeria, rural families with a better socio-economic status were found to be more diversified than those with a lower socio-economic status were (Babatunde and Qaim, 2009). Hence, this study adopts the pull (opportunity-led) school of thought for expanding income sources, and seeks to provide insights on how financial inclusion could influence the strategies of rural smallholder farmers to cope with risks and shocks that affect their livelihoods. Given the roles played by financial inclusion in enhancing socio-economic status, economic opportunities, capital accumulation and investments, the study hypothesises that FI would increase diversification between farm and non-farm income sources of rural smallholder farmers (Figure 3.2).

3.5 SUMMARY

This chapter has provided the study’s understandings of the concepts of financial inclusion, smallholder agriculture, and rural smallholder farmers in Nigeria and their livelihoods. Furthermore, the various concepts were integrated to develop the conceptual framework applied to address the study objectives. The meaning of the concept of financial inclusion can be interpreted differently, depending on the perspectives of various stakeholders. However, the

various perspectives are often overlooked in the definitions of financial inclusion. Synthesising the common goals of FI with often overlooked subjects in its concept has given this study the opportunity to redefine financial inclusion. Moreover, it is crucial that the measures of FI are rendered more responsive to addressing emerging policy concerns of rural smallholder farmers, and that specific interventions are targeted to the vulnerable groups. Regarding the various potentials of FI in poverty alleviation, welfare and socio-economic development, this study expects that financial inclusion would improve the income sources of rural smallholder farmers in Nigeria. However, the pathway through which financial inclusion influences the livelihood strategies of rural smallholder farmers is yet to be established. Although most rural smallholder farmers depend on agriculture as a means of livelihood, they also depend on other sources for making a living and this broad view has informed the study to utilise the most-cited livelihood strategies of rural smallholder farmers as its livelihood indicators.

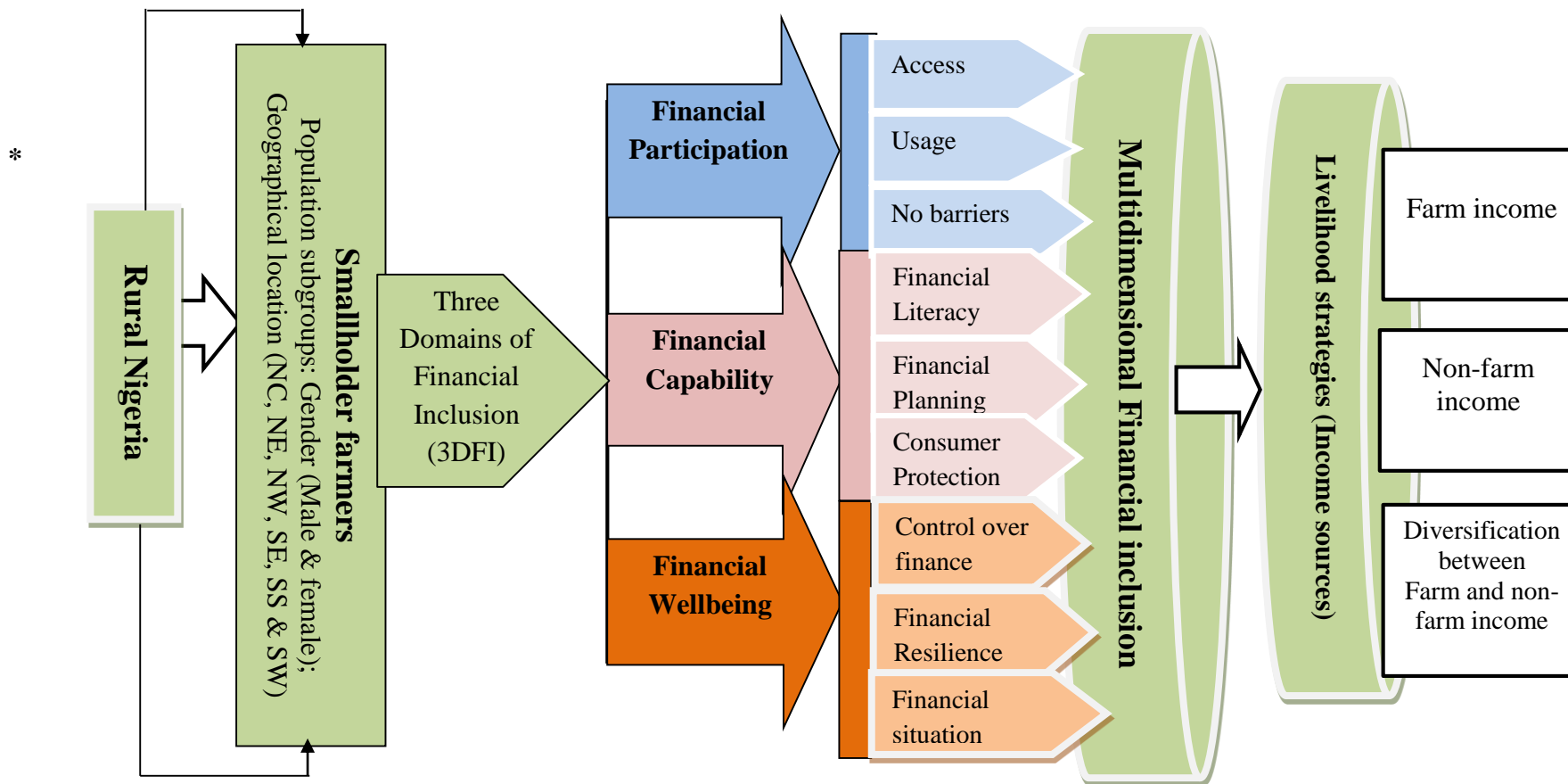


Figure 3.2: Conceptual framework for financial inclusion of rural smallholder farmers in Nigeria and impact on livelihood

Source: Author's own compilation

CHAPTER 4: METHODS AND PROCEDURES

4.1 INTRODUCTION

This chapter is organised into five sections, with the overall objective to discuss the methods and procedures of this study. Firstly, the study area is discussed in Section 4.2. Secondly, the type and source of data are described in Section 4.3. Thirdly, the sampling procedure is presented in Section 4.4. The fourth part outlines the method of analysis in Section 4.5. This section is further divided into sub-sections to provide better insights into the procedures employed to analyse the specific objectives of the study. Lastly, Section 4.6 concludes the chapter by summarising the study's methods and procedures.

4.2 STUDY AREA

The study was carried out in rural Nigeria, which comprises the rural areas in the six geopolitical zones across Nigeria. These encompass the North East, North West, North Central, South East, South West and South South zones. There is a total of 36 states, distributed across the six geopolitical zones (Figure 4.1 below). For simplicity, they could be grouped into northern and southern geopolitical zones.

Northern Geopolitical zones: The northern geopolitical zones and states in Nigeria comprise:

- North East: Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe
- North West: Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto and Zamfara
- North Central: Federal Capital Territory (FCT), Kogi, Kwara, Nasarawa, Niger, and Plateau.

Southern geopolitical zones: The southern geopolitical zones and states in Nigeria comprise:

- South East: Abia, Anambra, Ebonyi, Enugu, and Imo
- South West: Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo
- South South: Akwa Ibom, Bayelsa, Cross River, Delta, Edo and Rivers.



Figure 4.1: Map of Nigeria showing geopolitical zones and states

Source: National Bureau of Statistics (2018)

Nigeria is a highly diverse country in terms of economic activities, ethnicity and languages. Though English is the official language, about 250 languages are spoken across 400 ethnic groups (Ayenbi, 2014). The major socio-cultural groups are the Hausa, Yoruba and Igbo, and the majority of the afore-mentioned groups reside in the northern zones, South West and South East regions respectively (Ayenbi, 2014). The rural areas across the six geopolitical zones in Nigeria represent the areas where most agricultural activities are carried out, and where a greater percentage of the poor reside. The major occupation in rural Nigeria is smallholder farming, and crop production accounts for a significant part of rural income (Rapsomanikis, 2015). Although most agricultural households in rural Nigeria have positive demand for financial services, the majority have less access to and use of financial services than those in the urban areas do (Akinlo, 2014). Moreover, agricultural households in rural Nigeria are mostly headed by males, and are characterised by large household sizes and associated with poor socio-economic status (World Bank, 2014b). The target respondents of this study were rural smallholder farmers in Nigeria.

4.3 TYPE AND SOURCE OF DATA

The study utilised secondary data from the CGAP Smallholder Household survey in Nigeria, collected from 11 November to 9 December 2016. The data, which was collected by Ipsos Nigeria in collaboration with Intermedia's local field partner across the six geopolitical zones in Nigeria, used structured questionnaires that were translated into local languages for accuracy and consistency (Anderson, 2016).

4.3.1 Trade-offs between demand- and supply-side financial inclusion data

The collection or availability of comprehensive data is crucial for financial inclusion analysis. Most data could be categorised into supply- or demand-side data sets, and the majority are collected by regulatory bodies like central banks. Other data collectors may include supervisory organisations, or donor agencies interested in monitoring FI or providing information on the financial lives or needs of some special groups of interest. Such bodies are able to cope with the high budget requirements related to collecting all-inclusive, quality data, without which data collection could be constrained by the limited budget of an individual researcher, especially if getting to know the extent of FI in a country or a target group is required. As a result, it is necessary for individual researchers to further explore comprehensive secondary data sets in addressing research problems on financial inclusion.

The major distinction between using a supply- or a demand-side data set to address research gaps in financial inclusion lies in whether such data have been gathered from the financial service providers' perspectives or the end users' perspectives. According to Triki and Faye (2013), secondary data sourced from the former may be subjective, and may not account for the actual extent to which the poor have been financially included or account for variations in FI. While such data comprise mostly national aggregates of the level of bank financial service provision, the study argues that the bank institution is only a type of formal financial service provider. As a result, the data may not be a true representation or provide detailed understanding of how people, especially the vulnerable groups, have been financially included (Klapper and Singer, 2017).

On the other hand, data sourced from consumers of financial services could be more robust, as they provide better insights regarding the extent of FI from the end users' perspective. Most

household surveys carried out previously did not capture information on the financial lives and needs of households. However, ongoing developments, such as increased policy commitment to financial inclusion, and consumer-oriented finance and outcomes in addition to evolving policy goals to reach the poor, have necessitated the need to source data from the consumer perspective (Insight2impact, 2017). Therefore, this study utilised information from the perspective of rural smallholder farmers in Nigeria, who constitute clients, while at the same time incorporating supply and demand indicators in measuring financial inclusion. The following financial service providers (Table 4.1) were covered during the CGAP survey.

Table 4.1: Types of formal financial service providers covered during survey

Bank Financial Institutions	Non-Bank Financial Institutions	Mobile Money Providers
Access Bank	Microfinance institutions	Access Bank (Access mobile)
Citibank Nigeria Limited	Savings and Credit Cooperative Society (SACCO)	Airtel Money
Diamond Bank	Cooperative	Cellulant Nigeria (Cellulant)
Eco Bank Nigeria	Village Saving and Lending Associations (VSLAs)	Chams Mobile
Enterprise Bank	Post Office Bank	Diamond/MTN Y’ello
Fidelity Bank		Eartholeum Networks (QikQik)
First City Monument Bank		Ecobank (Ecobank Mobile Money)
Guaranty Trust Bank		Etisalat Easywallet
Key Stone Bank		ETranzact (Pocket moni)
Main Street Bank		FETS Solution (Mywallet)
Skye Bank		Fidelity Bank (Quick-Pay)
Stanbic IBTC Bank Ltd.		Fortis Microfinance bank (Fortis Mobile Money)
Standard Chartered Bank Nigeria Ltd.		FCMB Flash Me Cash
Sterling Bank		Glo Mobile Money
SunTrust Bank Nigeria Limited		GT Bank (GT Mobile Money)
Union Bank of Nigeria		Hedonmark Management Services (Click n Pay)
United Bank for Africa		MKudi (Mimo)
Unity Bank		Pagatech (Paga)
Wema Bank		
Zenith Bank		
Heritage Banking Comp. Ltd.		
First Bank of Nigeria Ltd		

Source: Author’s compilation from Nigeria - CGAP Smallholder Household Survey (2016)

4.4 SAMPLING PROCEDURE

In order to carry out the CGAP smallholder survey, a stratified multistage sampling procedure was used to obtain data from respondents. The sample was selected independently from each state across the six geopolitical zones. The first stage included the purposive selection of enumeration areas, with smallholder households from the country's enumeration areas, by using the National Integrated Survey of Households sample frame. This process resulted in the selection of a total of 215 Agricultural Enumeration Areas (AEAs). The second stage involved selecting smallholder households across the geopolitical zones in proportion to the number of AEAs. The third stage involved the selection of smallholder households from states in each zone, based on proportion to their number of AEAs. Therefore, a total of 17 smallholders' households were chosen from each AEA, where possible, and less than 17 were selected where it was not possible. During the survey, three types of questionnaires – household, multiple and individual questionnaires – were used to elicit information from smallholder farmers, and these questionnaires corresponded to totals of 3,026, 5,128 and 2,773 respondents, respectively.

For the purpose of this study, a stratified two-stage sampling procedure was used to select respondents from the secondary data set (Table 4.2 below). The first stage involved the stratification of respondents into rural and urban residents. The second stage involved selecting all sampled rural respondents from all the states across the geopolitical zones. The survey carried across the household, multiple and single respondent completed questionnaires, comprising totals of 2,471, 4,511 and 2,690 interviews, respectively. The information contained in the single-respondent data set was mainly provided by the head of the household, and where the head was not available, the spouse or a well-informed adult who contributed significantly to household incomes or agricultural activities provided the information. The multiple-respondent data set was an extension of the previous data set, which could be linked using a unique household member identification number. It contained the information of other household members who also contributed to household economic activities, including the interviewed household member in the single questionnaire. Likewise, the household data set was an extension of the previous two data sets that contained information regarding the household characteristics of the respondents. This information could also be linked to other data sets, based on the household identification number.

The purpose of sectioning the questionnaires used in collecting the data sets was to be able to obtain comprehensive information that could capture the complex livelihoods and financial lives of the smallholder farmers. Another consideration was that compiling all sections into a single questionnaire may reduce the response rate attributable to completing a lengthy questionnaire. Data points collected included: individual characteristics, household characteristics, agricultural activities and farm characteristics, livelihood and income sources, access and use of financial services, the barriers encountered in the formal financial system, and other relevant information regarding the financial lives of rural smallholder farmers. The need to utilise information across the three data sets necessitated merging them into a single file, based on the unique member and household identification number of rural smallholder farmers, by using Stata 15 software.

Table 4.2: Summary of smallholder farmers' questionnaires

	Household Questionnaire	Multiple Respondent Questionnaire	Individual Respondent Questionnaire
CGAP Survey			
Target respondents	Household head, spouse, or a well-informed adult	All household members (+15years) who contributed to household income or participated in agricultural activities, including the individual respondent	Household head, spouse, or a well-informed adult
Subjects Covered	<ul style="list-style-type: none"> • Basic Information on all household members • Information about household characteristics and livelihood 	<ul style="list-style-type: none"> • Demographics • Agricultural activities • Household economics and income sources 	<ul style="list-style-type: none"> • Agricultural activities • Household economics • Mobile phones • Formal and informal financial tools
Overall completed Interviews during CGAP survey	3,026	5,128	2,773
For the purpose of this study			
Stratified interviews completed for the rural smallholders	2,690	4,511	2,471
Sample size for study	2,300 rural smallholders (number of respondents whose information details were successfully merged across the data sets corresponding to questionnaires)		

Source: Adapted from Anderson et al. (2017)

Based on the number of smallholder farmers whose information was completely merged across the three rural data sets, a total of 2,300 rural respondents were utilised for the study. Furthermore, the need to ensure financial inclusion of individual rural smallholder farmers,

rather than that of households, was a measure that informed the decision made on the unit of analysis and the utilisation of the individual sample weight in the survey data.

4.5 METHOD OF DATA ANALYSIS

This section discusses the methods employed to analyse the study's specific objectives and to further explain the techniques used to test the hypotheses. The first part of this section is aimed at constructing a multidimensional index that is then used to determine the level of FI of rural smallholder farmers, and the variations across gender and geographical locations. Furthermore, the contributions of the various FI indicators to the financial inclusion of rural smallholder farmers are investigated from the developed multidimensional index. A sensitivity analysis is performed to ascertain the extent to which the estimates of the developed index remain valid in informing policy interventions. Four key observations provide the basis for the index construction. These are as follows: the identified measurement gaps, the identified key targets for consumers in Nigeria's financial inclusion agenda, the need to focus on a target group such as the rural smallholder farmers, and the need to monitor the extent to which a country's financial inclusion process has integrated the marginalised groups. This study therefore adapted the Alkire-Foster Method (Alkire and Foster, 2011; Alkire and Santos, 2010) to develop a multidimensional financial inclusion Index (MFII) for smallholder farmers in rural Nigeria. The second part of this section specifies the propensity score matching model and estimation strategy employed to assess the impact of FI on the livelihoods of rural smallholder farmers.

4.5.1 Choice of domains, indicators, adequacy and weighting

The multidimensional financial inclusion index was developed from three domains of financial inclusion (3DFI): financial participation, financial capability, and financial well-being. The domains for financial participation specifically comprised the access, usage and no barrier indicators, while financial capability domains included financial literacy, financial planning, and consumer protection indicators. The financial well-being domain comprised control over finance, financial resilience and financial situation indicators.

1. Financial participation domain: This domain was constructed based on three indicators, namely access, usage and no barrier.

Access: The access indicator was constructed considering whether a respondent has a personal formal account with a bank financial institution, a non-bank financial institution, or mobile money service provider. A sub-indicator was further developed that considers whether such a respondent has adequate access in the indicator or not. A respondent would be considered adequate (i.e. having adequate access) if he or she had a personal formal account with at least one formal service provider.

Usage: The usage indicator was constructed based on whether a rural smallholder farmer has used a personal formal account, or that of or someone else, to perform at least one financial activity with a bank financial institution, non-bank financial institution, or mobile money service provider. A sub-indicator was developed that considers whether a respondent is adequate in the usage indicator or not. To account for the frequent usage of financial services, rather than just adoption, a respondent would be considered to have adequate usage if he or she used a formal account for a financial activity with at least one of the formal sources for up to 90 days.

No-barrier: The no-barrier indicator examines the constraints faced by a respondent in having access to or using a formal account. The fewer barriers, or no barriers, reported by a rural smallholder, the greater the possibility of financial participation and inclusion in the formal financial system would be. Therefore, the study focused on the major barriers common among rural smallholder farmers. These included high transaction cost/registration fees, physical distance, lack of formal identification, and lack of information on formal account opening or use. A respondent would be considered adequate in this indicator, if no barrier was reported among the barriers addressed in the study.

2. Financial capability domain: This domain was constructed from three indicators, namely financial literacy, financial planning, and consumer protection.

Financial literacy: The financial literacy indicator was constructed based on the following key survey questions: Does a respondent know at least one of the financial services offered by the financial institution used? What types of financial activities can a rural smallholder farmer use mobile money for? Can a rural smallholder farmer recall at least one name of a mobile money provider without aid? A rural smallholder farmer would be considered as having adequate achievement in financial literacy if he or she knew at least one of the services offered by the

formal financial institution, had used or knew at least one type of financial activity mobile money could be used for, or at least recalled one name of any mobile money provider, without aid.

While formal education is often used as a proxy for financial literacy, and it is further argued that having formal education could increase the likelihood of FI, recent studies have found that the levels of formal education of smallholder farmers in Nigeria are generally low (Abdu et al., 2015; Anderson et al., 2017). Rather than suggesting that additional formal education of rural smallholder farmers is necessary for financial inclusion, the study proposes that knowledge of financial products and services could be increased through training and awareness programmes. This view is supported by Nigeria's national financial inclusion strategy (CBN, 2018), which indicates the need to achieve 50 percent level of consumer awareness in financial products. Therefore, it is imperative to clearly observe how FI is associated with having adequate achievements in other indicators, aside from formal education, within the context of rural smallholder farmers.

Financial planning: The financial planning indicator was constructed from two key survey questions: Does a respondent have any of the following: a savings plan, investment, living will, retirement plan or an insurance plan? Secondly, does a respondent currently have any of the following products: a credit plan for school fees, a goal savings plan or contractual savings plan for school fees, a savings plan for inputs such as seeds, fertilisers or pesticides, or a payment plan for inputs? These two indicators were selected to explore adequate information on the extent of financial planning of rural smallholder farmers. A respondent would be adequate in the financial planning indicator if he or she had attained an achievement in at least one of the plans.

Consumer protection: The consumer protection indicator was constructed by using consumers' (rural smallholder farmers) trust in formal financial sources as a proxy indicator. The trust indicator was found ideal due to consensus in the literature that consumer trust in the formal financial system is highly prioritised in consumer protection. Furthermore, trust facilitates transparency and builds consumers' confidence in a formal financial system. Therefore, consumer protection is captured by the extent to which a respondent trusted each of the following formal service providers: banks, bank agents, savings groups, microfinance institutions, mobile money agents, and mobile money providers.

In the survey questionnaire, the answer scale for consumer trust in formal sources was 1 = fully distrust; 2 = somewhat distrust; 3 = neither trust nor distrust; 4 = somewhat trust; 5 = fully trust, and 98 = don't know. A sub-indicator was developed for each formal source, which considers whether a respondent is adequate in the consumer protection indicator or not. A respondent would be considered to have adequate consumer protection if he or she fully trusted or somewhat trusted at least one of the formal financial sources.

3. Financial well-being domain: The financial well-being domain was constructed from three indicators, namely control over finance, financial resilience, and financial situation.

Control over finance: The control over finance indicator was constructed by developing two sub-indicators from the survey questions: Does a respondent make a sole, joint, or does not make decisions regarding daily expenses? And, how often was a respondent able to pay bills on time? The sub-indicators were adopted to avoid neglecting vital information on the control over the finance indicator. The first sub-indicator reflects the decision-making ability of a rural smallholder farmer, or extent of input in making decisions regarding finance. Conversely, the second sub-indicator reflects the ability of a rural smallholder farmer to meet ends or financial needs.

The answer scale for the first sub-indicator (whether respondent makes sole, joint or does not make decisions regarding daily expenses) was: 1 = do not make decisions regarding daily expenses; 2 = make decisions regarding daily expenses, together with someone else in my household (joint); 3 = I make decisions regarding daily expenses on my own (sole); and 98 = don't know. Adequacy in this sub-indicator is determined by whether a respondent makes either sole or joint decisions regarding daily expenses. On the other hand, the answer scale for the second sub-indicator was: 1 = always; 2 = sometimes; 3 = rarely; 4 = never; and 98 = don't know. Adequacy in this sub-indicator is determined by whether a respondent is able to pay bills, either always or sometimes. Overall adequacy in the control over finance indicator is determined by whether a respondent is adequate in any of the sub-indicators.

Financial resilience: The financial resilience indicator was constructed using proxy measures as sub-indicators. The first sub-indicator was constructed from a survey question regarding whether it is possible for a respondent to come up with 100,000 naira if there is an emergency and she or he needs to pay. The answer scale was: 1 = very possible; 2 = somewhat possible; 3

= not possible; and 98 = don't know. A respondent would be considered adequate in this indicator if it was very possible or somewhat possible to come up with 100,000 naira to pay for the emergency. The second sub-indicator was constructed from a survey question regarding whether a respondent has an emergency fund to cover unplanned expenses. The answer scale was: 1 = always; 2 = sometimes; 3 = rarely; 4 = never; and 98 = don't know. Adequacy in this sub-indicator is determined by whether a respondent is able to come up with emergency funds to meet unplanned expenses, either always or sometimes. Overall adequacy in the financial resilience indicator is therefore determined by whether a rural smallholder farmer has attained adequate achievement in any of the sub-indicators.

Financial situation: To determine whether a rural smallholder farmer is adequate in his or her financial situation, the survey question was based on a self-assessment of a respondent household's current financial situation. The answer scale was: 1 = we do not have enough money for food; 2 = we have enough money for food and clothes only; 3 = we have enough money for food and clothes and can save a bit; 4 = we can afford to buy certain expensive goods; and 5 = don't know. Adequacy in this indicator is determined by a rural smallholder farmer belonging to a household having at least enough money for food and clothes only, and at most being able to afford certain expensive goods. The minimum benchmark indicates the need for rural smallholder farmers to be able to meet their basic needs. This is especially crucial, as those who cannot afford to buy at least food could never be satisfied with their financial situation.

A summary of the financial inclusion domains, indicators, adequacy, and the weighting scheme employed in the construction of the multidimensional financial inclusion index is presented in Table 4.3.

Table 4.3: Summary of financial inclusion domains, indicators, adequacy and weighting

Domain	Indicator	Adequacy threshold	Rel. Weight
Financial participation	1. Access	Adequate if a rural smallholder farmer has a personal formal account with bank financial institution, non-bank financial institution or mobile money service provider.	1/9
	2. Usage	Adequate if a rural smallholder farmer has used a formal account with at least one financial service provider up to 90 days.	1/9
	3. No barrier	Adequate if no barrier is reported by a rural smallholder farmer among the investigated barriers.	1/9
Financial capability	1. Financial literacy	Adequate if a rural smallholder farmer is able to indicate at least one of the financial services offered by the formal institution used; OR indicates at least one type of financial activity he or she can use mobile money for; OR at least recalls one name of any mobile money provider, without aid.	1/9
	2. Financial planning	Adequate if a rural smallholder farmer has at least one of the following: a savings plan, investment plan, living will, retirement plan, insurance plan; OR currently has: a credit plan, goal savings plan or contractual savings plan for school fees, a savings or payment plan for agricultural inputs.	1/9
	3. Consumer protection	Adequate if a rural smallholder farmer fully trusts or somewhat trusts at least one formal financial source.	1/9
Financial well-being	1. Control over finance	Adequate if a rural smallholder farmer makes either sole or joint decisions regarding daily expenses; OR is able to always or sometimes pay bills.	1/9
	2. Financial resilience	Adequate if it is very possible or somewhat possible for a rural smallholder farmer to come up with 100,000 naira to pay for an emergency within the next month; OR always or sometimes has emergency funds to cover unplanned expenses.	1/9
	3. Financial situation	Adequate if a rural smallholder farmer is from a household with at least enough money for food and clothes only, and at most, is able to afford certain expensive goods.	1/9

Source: Author

4.5.2 Constructing the multidimensional financial inclusion index

This subsection outlines the procedures used to analyse Objective 1: to construct a multidimensional index for measuring financial inclusion of rural smallholder farmers. The steps included:

1. Coding: Respondents were coded as adequate or not adequate in each of the nine domain indicators, based on whether or not they are able to meet the minimum benchmark described above for the sub-indicators of each FI indicator. A respondent is coded as 1 if adequate in an FI indicator, and 0 if inadequate (Table 4.3 above).
2. Computing the adequacy score (a_i): An adequacy score was constructed for each respondent, based on the weighted total of the respondent's adequate achievements across the nine indicators. An equal weighting system was assigned to the domains and distributed across the number of indicators in each domain. The essence is to reflect the equal relevance of each dimension in ensuring a complete realisation of financial inclusion and the need for policy efforts to avoid substituting success in one dimension with failures in another. The adequacy score increases as the number of adequate achievements increases, such that a_i ranges between 0 and 1 ($a_i = 1$ if respondent is adequate in all nine indicators, and $a_i = 0$ if respondent has no adequate achievement in any indicator). The adequacy score is represented as follows:

$$a_i = w_1X_1 + w_2X_2 + w_3X_3 + \dots + w_9X_9 \quad (1)$$

where a_i = Adequacy score for each respondent

X_i = Indicator i ($i = 1, 2, \dots, 9$) such that $X_i \in \{0, 1\}$

$X_i = 1$ if a rural smallholder is adequate in the i^{th} indicator, and 0 otherwise.

w_i = Attached weight to indicator i with $\sum_{i=1}^9 w_i = 1$

3. Determining the financial adequacy cut off (f_k): The financial adequacy cut off, denoted by f_k , is the threshold required to be attained by rural smallholder farmers in order to be classified as financially adequate. It is the proportion of the weighted adequacies a respondent must have across all nine indicators, with or without adequacy

in the access indicator. A rural smallholder farmer is considered financially adequate if he or she has an adequacy score greater than or equal to the financial adequacy cut-off: ($a_i \geq f_k$).

A previous application of the Alkire-Foster method in computing the multidimensional poverty index (Alkire and Foster, 2011) set the poverty cut off at 0.33. This implies that an individual is multidimensionally poor if he or she is deprived in at least one-third of the weighted indicators, but otherwise for those not having deprivations in up to 2/3 of the weighted indicators. Another application of the Alkire-Foster method in computing the women empowerment in agriculture index (Alkire et al., 2013) categorised a person as empowered if such an individual has achieved adequacy in at least 0.80 of the weighted indicators. This implies that any individual with an empowerment score of 0.20 or below is classed as disempowered. While choosing a threshold may require making some normative decisions, Nigeria has a national target to increase the rate of financial inclusion from 53.7% in 2010 to 80% by 2020 (CBN, 2012; 2018). These figures are used to establish the lower and upper bound adequacy thresholds later in the section on sensitivity analysis.

Considering the characteristics of rural smallholder farmers in Nigeria and the year of survey data collection, setting a high f_k would imply that very few rural smallholder farmers would be categorised as adequate in financial inclusion. Conversely, a low f_k would imply that many rural smallholder farmers would be categorised as adequate in financial inclusion. Therefore, based on a number of indicators and domains developed to compute the multidimensional financial inclusion index, this study set the adequacy cut-off (f_k) at 0.66. This implies that a rural smallholder farmer is considered financially adequate if he or she has achieved adequacy in a combination of weighted indicators that sum up at least two-thirds of the three domains of financial inclusion.

4. Censoring the financial adequacies of rural smallholder farmers: Censoring entailed differentiating respondents whose adequacy scores was greater than or equal to the financial adequacy cut off ($a_i \geq f_k$), with or without adequacy in the access indicator. The censored adequacy score is denoted by $a_i(k)$, which represents the financial

adequacy score of rural smallholder farmers. Respondents with adequacy scores less than the financial adequacy threshold ($a_i < f_k$) are classified as $a_i(k) = 0$, while those with $a_i \geq f_k$ are classified as $a_i(k) = a_i$ (Alkire and Foster, 2011; Alkire et al., 2013).

5. Determining the financial inclusion cut off (fi_k): The financial inclusion cut off, denoted by fi_k , is the cut off required to be attained by a rural smallholder farmer in order to be classified as financially included or excluded. It is the proportion of the weighted adequacies that a rural smallholder farmer must have, across all nine indicators, including adequacy in the access indicator. A rural smallholder farmer is considered financially included if he or she has an adequacy score greater than or equal to the financial inclusion cut-off ($a_i \geq fi_k$). That is, if the adequacy score is greater than or equal to the financial adequacy cut off ($a_i \geq f_k$) with adequacy in the access indicator.
6. Censoring the financially included: This entailed differentiating the respondents whose adequacy score was greater than or equal to the financial inclusion threshold ($a_i \geq fi_k$). The censored adequacy score of the financially included is denoted by $fi(k)$, while the notation of the initial adequacy score remains unchanged (a_i). Therefore, respondents with adequacy scores greater than or equal to the financial inclusion cut-off ($a_i \geq fi_k$) are classified as $a_i(k) = a_i$, whereas those with adequacy scores less than the financial inclusion cut-off ($a_i < fi_k$) are classified as $a_i(k) = 0$.
7. Constructing the censored headcount ratio of the financially included: This is the first component of the multidimensional financial inclusion index. It is the proportion of rural smallholder farmers who are financially included to the total population (n). This component measures the incidence of multidimensional financial inclusion of rural smallholder farmers. It is denoted as follows:

$$Ch_{FI} = \frac{FI}{n} \quad (2)$$

where Ch_{FI} = censored headcount ratio of the financially included

FI = number of rural smallholders who are financially included

n = pooled sample size of rural smallholders

8. Computing the average adequacy score of the financially included: This is the second component of the multidimensional financial inclusion index. It is the average adequacy score of the financially included and measures the intensity of multidimensional financial inclusion of the rural smallholder farmers. It is denoted as follows:

$$A_{FI} = \frac{\sum_{i=1}^n fi(k)}{FI} \quad (3)$$

9. Evaluating the multidimensional financial inclusion index: The multidimensional financial inclusion index is determined by multiplying the incidence (Ch_{FI}) and intensity (A_{FI}) of the multidimensional financial inclusion of rural smallholder farmers, following Alkire and Foster (2011). The multidimensional financial inclusion index is expressed as follows:

$$MFII = Ch_{FI} \times A_{FI} \quad (4)$$

The multidimensional financial inclusion index (MFII) therefore reflects the incidence and intensity of rural smallholder farmers having met the financial inclusion threshold at ≥ 0.66 . In other words, the financially included are those rural smallholder farmers who have access to formal services and are financially adequate in at least two-thirds of the domains of financial inclusion. Table 4.4 presents a summary of the interpretations of the multidimensional financial inclusion index estimates.

Table 4.4: Summary of interpretations of MFII estimates

Indicators	Interpretation
Formal access	proportion of rural smallholder farmers to the total population who were adequate only in the access indicator
Adequacy score	Weighted sum of a rural smallholder farmer's adequate achievements across the nine indicators of the 3DFI, with adequacy score ranging between zero and one.
Financial adequacy	Having adequate achievements in at least two-thirds of the 3DFI
Financial inclusion	Having adequate achievements in at least two-thirds of the 3DFI, with adequacy in formal access
Incidence of financial inclusion	Multidimensional financial inclusion head count ratio
Intensity of financial inclusion	Average adequacy score of multidimensional financial inclusion
MFII	Multidimensional financial inclusion index (Incidence * intensity)
1 – MFII	Index of multidimensional financial exclusion

Source: Author

4.5.3 Determining the levels of financial inclusion and variations by population subgroups

Estimates obtained from computing the multidimensional financial inclusion index provided the basis for evaluating Objective 2: to determine the level of FI of rural smallholder farmers and its determinants, specifically how it varies according to gender and region (geographical location). Determining whether or not significant variations existed between the levels of FI of rural smallholder farmers by gender and geographical location was first assessed using cross-tabulations and the Pearson chi-square test. The approach was used to test the first and second hypotheses of the study, which are stated as follows:

1. *Male rural smallholder farmers have a higher level of financial inclusion than female rural smallholder farmers.*
2. *Rural smallholder farmers in the southern geopolitical zones (South West, South East and South South) have a higher level of financial inclusion than rural smallholder farmers in the northern geopolitical zones (North West, North East and North Central).*

Findings from the tested hypotheses were validated by decomposing the multidimensional financial inclusion index by gender and geographical location. The statistical significance of the association between the levels of financial inclusion of population subgroups (gender and geographical locations) and specific determinants (individual and household characteristics) were examined by using the Pearson chi-square test. The individual characteristics examined included age, marital status and educational levels, while the household characteristics included household income, household size and poverty status.

4.5.3.1 *Decomposing the multidimensional financial inclusion index by gender*

One important feature of the multidimensional financial inclusion index is its decomposability property which facilitates targeting a specific population subgroup or indicators for policy interventions. This decomposability property was further used to confirm the test of hypotheses regarding gender variations in the level of FI and implications for policy interventions. The overall multidimensional financial inclusion index of rural smallholder farmers was decomposed by gender of rural smallholder farmers. This was followed by assigning a corresponding weight, represented as the share of rural male or female smallholder farmers to the total population. The overall MFII is therefore the weighted sum of both male and female MFII, which is represented as follows:

$$MFII = \frac{n_m}{n} MFII_m + \frac{n_f}{n} MFII_f \quad (5)$$

where:

n_m = number of rural male smallholder farmers

n_f = number of rural female smallholder farmers

n = total number rural smallholder farmers (sample size).

The percentage contribution of each gender to multidimensional financial inclusion is therefore calculated as follows:

$$\% \text{ Contribution of each gender to } MFII = \frac{\frac{n_G MFII_G}{n}}{MFII} \times 100 \quad (6)$$

Accordingly, where G represents each gender, the sum of both male and female contribution should add up to 100%. The groups requiring greater policy interventions were identified as those whose contribution was less than their corresponding weight was, as these groups are associated with lower censored headcount ratios in multidimensional financial inclusion.

4.5.3.2 *Decomposing the multidimensional financial inclusion index by region*

To confirm the hypothesis regarding the variation in the level of FI by geographical location and to identify regions for policy interventions, the overall multidimensional financial inclusion index of rural smallholder farmers was decomposed by the six geopolitical zones in Nigeria. This was followed by assigning a regional weight for each geopolitical zone, represented as the proportion of rural smallholder farmers in each geopolitical zone to the total population. Variations in the levels of FI among the geopolitical zones are therefore compared through using the regional MFII. The overall multidimensional financial inclusion index of rural smallholder farmers in Nigeria is therefore the weighted sum of all regional MFII, which is represented as:

$$MFII = \frac{n_{NW}}{n} MFII_{NW} + \frac{n_{NE}}{n} MFII_{NE} + \frac{n_{NC}}{n} MFII_{NC} + \frac{n_{SW}}{n} MFII_{SW} + \frac{n_{SE}}{n} MFII_{SE} + \frac{n_{SS}}{n} MFII_{SS} \quad (7)$$

where the number of rural smallholder farmers in the six geopolitical zones was represented as follows:

n_{NW} = number of rural smallholder farmers in the North West

n_{NE} = number of rural smallholder farmers in the North East

n_{NC} = number of rural smallholder farmers in the North Central

n_{SW} = number of rural smallholder farmers in the South West

n_{SE} = number of rural smallholder farmers in the South East

n_{SS} = number of rural smallholder farmers in the South South

n = total number smallholders in rural Nigeria (sample size)

$$n = \frac{n_{NW}}{n} + \frac{n_{NE}}{n} + \frac{n_{NC}}{n} + \frac{n_{SW}}{n} + \frac{n_{SE}}{n} + \frac{n_{SS}}{n} \quad (8)$$

The percentage contribution of each rural region to the multidimensional financial inclusion of rural smallholder farmers is therefore calculated as:

$$\% \text{ Contribution of each region to } MFII = \frac{n_R MFII_R}{MFII} \times 100 \quad (9)$$

Accordingly, where R represents each region, the sum of all regional contribution should add up to 100%. The regions requiring urgent policy interventions are therefore identified as those areas whose contribution is less than their regional weight is.

4.5.4 Decomposing the multidimensional financial inclusion index by censored financial inclusion indicators

The third objective was to determine the contribution of the various indicators of FI (access, usage, no barrier, financial literacy, financial planning, consumer protection, control over finance, financial resilience and financial situation) to the financial inclusion of rural smallholder farmers. This was analysed by decomposing the multidimensional financial inclusion index by the censored domain indicators. The proportion of the censored headcount was evaluated by dividing the sum of rural smallholder farmers who were adequate in each indicator by the total number of rural smallholder farmers in the sample. The weighted sum of the proportion of censored headcount of rural smallholder farmers in all nine indicators should therefore be equivalent to the overall multidimensional financial inclusion index, which is represented as follows:

$$MFII = w_1 ChX_1 + w_2 ChX_2 + w_3 ChX_3 + \dots + w_9 ChX_9 \quad (10)$$

where X_i = indicator i ($i = 1, 2, \dots, 9$) such that $X_i \in \{0, 1\}$

ChX_i = the proportion of censored headcount in indicator i

w_i = attached weight to indicator i with $\sum_{i=1}^d w_i = 1$

To identify the indicators for policy interventions, each indicator's contribution to the multidimensional financial inclusion index is calculated as $w_i ChX_i$ with the percentage contribution expressed as follows:

$$\% \text{ Contribution of each indicator to } MFII = \frac{w_1 ChX_i}{MFII} \times 100 \quad (11)$$

The contribution of any FI indicator less than the corresponding weight implies a relatively low adequacy in the FI indicator regarding the sample of rural smallholder farmers investigated. Therefore, the financial inclusion indicators with lower censored head count ratios represent the indicators for interventions.

4.5.5 Sensitivity and robustness check

The fourth objective of the study was to determine the sensitivity and robustness of the contribution of FI indicators to changes in financial inclusion adequacy, at $a_i \geq 0.66 \pm 0.11$. The study examined how variations in the adequacy cut off influence the robustness of results. Following the construction of the MFII at the base adequacy threshold of ≥ 0.66 , the same process was repeated to construct two other MFII, at an adequacy threshold of ≥ 0.77 (upper bound) and ≥ 0.55 (lower bound). The alternate indices were first decomposed by gender, region and FI indicators at $a_i = 0.66 \pm 0.11$, such that contributions to financial inclusion were ranked at the different thresholds and compared with the initial. The robustness of the contribution of financial inclusion indicators was compared by using Kendall's tau rank correlation analysis, represented as follows:

$$R^\tau = (CP - DP) / (n(n - 1)/2) \quad (12)$$

where CP = number of concordant pairs; DP = number of discordant pairs; and n = number of compared pairwise observations. Following Alkire et al. (2015), a paired observation (P, P') is "concordant" in this study if the rank order compared between the base and alternate adequacy thresholds both have same rank direction, either higher or lower, but not necessarily of the same position. Such pairwise comparison is termed "robust". However, a pairwise comparison is "non-robust" if a paired observation between the base and alternative adequacy threshold is discordant. That is, the rank orders compared at different adequacy thresholds have altered directions. The Kendall tau coefficient ranges between 0 and 1, which could be positive or negative, such that a value of 0 implies no association between the ranks compared, 1 implies a perfect positive association (100% robust pairwise comparisons), and -1 implies a perfect negative association (100% non-robust comparison). While a positive rank coefficient indicates

that the number of robust pairwise comparisons (concordant pairs) is greater than the number of non-robust comparisons (discordant pairs), the closer it is to 1, the higher the robustness of the result will be to variations in adequacy cut-offs.

4.5.6 Propensity score matching model specification

The study utilised the propensity score matching (PSM) model to analyse the fifth objective: to assess the impact of FI on the income sources of rural smallholder farmers. The model involves estimating propensity scores through using a non-linear binary model (logit), choosing the most appropriate PSM algorithm, testing for overlap and common support, evaluating the matching quality, and analysing the treatment effect and its sensitivity (Haji and Legesse, 2017). The basic idea is to find from a set of those who are financially excluded (control group) having similar pre-treatment observable characteristics with those who are financially included (treatment group). Using the PSM relaxes randomisation and helps to address the counterfactual problem of what the effect would have been if those financially included were to have been excluded. Therefore, the model is found useful to assess the impact of FI on the income sources of the rural smallholder farmers, while also controlling for financial exclusion, which addresses the problem of assessing impact in isolation. The propensity score is therefore defined as the conditional probability of being in the treatment group, given a set of pre-treatment observable covariates (Michalek, 2012).

$$P(X_i) = \Pr(Z_i = 1|X_i) = E(Z_i|X_i) \quad (13)$$

where Z_i = the indicator variable of the treatment such that:

$$\begin{cases} Z_i = 1 \text{ for the treated group} \\ Z_i = 0 \text{ for the control group} \end{cases}$$

The group of rural smallholder farmers having adequate achievements in two-thirds and above of the three domains of financial inclusion constitutes the treated group, and if otherwise, the control group. X_i is the set of covariates to estimate propensity scores. These factors were selected based on a literature review, theoretical justifications, and data availability. They included gender, marital status, membership of an association, primary education, secondary education, university education, ownership of a mobile phone, geographical location, age,

household size, and farm size (Table 4.5). While age and household size remain unaltered from the original survey, other pre-treatment characteristics are recoded for analysis.

Table 4.5: Description of covariates

Variables	Description	Codes from original survey
Gender	Male = 1; Female = 0	Male = 1; Female = 2
Age	Age of individual respondent in years	Age of individual respondent in years
Marital status	Married/cohabiting = 1; otherwise = 0	Single/never married = 1; Married = 2; Divorced/separated = 3; Widowed = 4; living together/cohabiting = 5; Don't know = 98
Primary education	Yes = 1 if respondent completed primary education; No = 0	Yes = 1; No = 2
Secondary education	Yes = 1 if respondent completed secondary education; No = 0	Yes = 1; No = 2
University education	Yes = 1 if respondent completed university education; No = 0	Yes = 1; No = 2
Membership of association	Yes = 1 (a respondent is recoded as 1 if he or she belongs to at least any of the associations asked during original survey); No = 0	Yes = 1 (for each listed group/association a respondent belongs); No = 2
Mobile phone ownership	Yes = 1 if respondent has a personal mobile phone; No = 0	Yes = 1; No = 2
Geographical location	Southern zones = 1 (if a respondent is located in the SE, SS or SW zone; Northern zone = 0 (if a respondent is located in the NC, NE or NW zone)	Zone = 1 if respondent is located in NC; 2 = NE; 3 = NW; SE = 4, SS = 5 & SW = 6
Household size	Total number of household members	Total number of household members
Farm size (ha)	Size of agricultural land owned (hectares). Responses in ha, acre and plots were multiplied by 1; 0.4 and 0.7, respectively, to standardise to ha	Size of agricultural land owned were originally reported in varying units of hectares, acres, plots

Source: Author

To avoid comparing the incomparable, such that the common support assumption is satisfied, three PSM algorithms (nearest neighbour, kernel, and radius), which are often used in literature

to estimate propensity scores, were tested (Haji and Legesse, 2017; Michalek, 2012). They included the nearest neighbour matching without replacement (1 to 1; 1 to 2; and 1 to 4 matches); the kernel matching at bandwidths 0.8, 0.1, 0.25 and 0.5; and the caliper matching at radiuses 0.1, 0.2, 0.25 and 0.5. The suitability of the matching techniques in yielding consistent estimates is based on two underlying assumptions that conditional on observable covariates (X_i), the expected outcome (Y_i) is independent of treatment assignment Z_i (Rosenbaum and Rubin, 1983).

$$\text{Conditional Independence: } Y_i(1), Y_i(0) \perp Z_i \setminus X_i \quad (14)$$

Where $Y_i(1)$ is the expected outcome for observation i if assigned to treated group, $Y_i(0)$ is the expected outcome for observation i if assigned to the control group, and \perp symbolises independence. Secondly, the common support assumption implies that a positive probability exists of being allocated into the treated or control group, for each observable characteristic of covariates (X_i). The assumption rules out the perfect prediction of Z_i by X_i such that matching is only done within the common support area where the observable characteristics of covariates (X_i) overlap between the treated and control groups (Caliendo and Kopeinig, 2008).

$$\text{Overlap: } 0 < P(Z_i = 1|X_i) < 1 \quad (15)$$

Furthermore, the matching quality was assessed by comparing the before and after matching estimates to ascertain whether matching was successful after conditioning on the propensity scores using the mean standardised bias, t-test, pseudo R^2 and joint significance. However, to assess the impact of financial inclusion on the income sources of rural smallholder farmers, the study adopted the more policy-related assessment of the average treatment effect on the treated, which is defined as follows:

$$ATT = E(Y_1 - Y_0|D = 1) = E(Y_1|Z_i = 1) - E(Y_0|Z_i = 1) \quad (16)$$

Given that $E(Y_1|Z_i = 1)$ denotes the expected outcome of the treated group and $E(Y_0|Z_i = 1)$, the expected outcome of the comparison non-treated group. The difference in outcomes between the treated (financially included) and control (financially excluded) groups after matching is then attributed to the average impact of FI on the income sources of rural

smallholder farmers, which is evaluated statistically. This study hypothesises that FI would have a positive relationship with diversification between the farm and non-farm income sources of rural smallholder farmers in Nigeria. While some studies have either adopted the nearest neighbour matching technique (Shehu and Sidique, 2014) or the Rosenbaum bounds test (Michalek, 2012) to analyse the sensitivity of results in propensity score matching analysis, a few studies (Efobi et al., 2016) have utilised both approaches. In this study, both approaches are used to assess whether inferences arising from the estimated impact of the ATT are insensitive to another matching algorithm and to hidden bias, respectively. The Rosenbaum bounds (rbounds) test is used to determine the levels of hidden bias (γ) that could alter the conclusions made due to unobserved variables affecting the assignment into treatment and the outcome indicators (Rosenbaum, 2005; Caliendo and Kopeinig, 2008).

4.6 SUMMARY

This chapter has presented the relevant methods and procedures used by the study to determine the level of financial inclusion of rural smallholder farmers in Nigeria. It achieved this by demonstrating how various approaches were used in developing a measure of FI that takes into consideration its multidimensional nature and can assess the impact of FI on smallholders' livelihoods. The target focus comprised rural smallholder farmers, distributed across the six geopolitical zones in Nigeria. This study utilised a secondary rural data set derived from the CGAP smallholder national household survey in Nigeria, which was found to be the most comprehensive data specific to smallholder farmers' financial lives. A two-stage sampling procedure was used to select the rural respondents who were considered in the study analyses. Thereafter, the rest of the chapter provided detailed discussion on how the study objectives were evaluated. It is expected that this study's findings would address the shortcomings of previous methods of measuring financial inclusion, especially for rural smallholder farmers, and would also inform policy interventions in enhancing smallholders' financial inclusion. Furthermore, it is expected that these findings would provide insights regarding the pathways through which FI influences the livelihoods of rural smallholder farmers in Nigeria. All analyses and results presentations are based on the author's estimations from the survey data.

CHAPTER 5: THE MULTIDIMENSIONAL FINANCIAL INCLUSION OF RURAL SMALLHOLDER FARMERS IN NIGERIA

5.1 INTRODUCTION

Financial inclusion is a key development strategy in Nigeria and the country intended to reduce the financial exclusion rate to 20% by 2020 (CBN, 2018). A question yet unanswered comprehensively remains: What is the status of rural smallholder farmers in Nigeria's financial inclusion agenda? The country's crucial ambitions to transform agriculture in order to strengthen Nigeria's economy and to increase productivity to feed the ever-growing population, in addition to sustaining livelihoods, suggest the need to financially include the drivers of the sector (rural smallholder farmers). Determining the level of financial inclusion of rural smallholder farmers requires a measure that recognises the multidimensional nature of financial inclusion. Therefore, this chapter develops and uses a multidimensional financial inclusion index (MFII), adapted from the Alkire-Foster method (Alkire et al., 2013), to measure the FI of rural smallholder farmers in Nigeria. The MFII is composed of three domains of financial inclusion, namely financial *participation*, financial *capability*, and financial *well-being*. The three domains are investigated across nine indicators of financial inclusion (access, usage, no barrier, financial literacy, financial planning, consumer protection, control over finance, financial resilience, and financial situation). The MFII is developed based on the need to bridge the gap between using headline indicators like "access" as measures of FI and the importance of integrating indicators that matter to poor consumers like rural smallholder farmers. In addition, this approach can advance measures beyond just ranking countries' levels of FI to informing better policy decisions for inclusive development and measuring progress over time.

This chapter also examines the variations in the levels of FI among rural smallholder farmers by gender and geographical location, and the relationships with specific individual and household characteristics. The contributions of FI indicators to the levels of financial inclusion of rural smallholder farmers are assessed and the sensitivity to changes in financial inclusion adequacy. Finally, the implications of findings and suggestions for financial inclusion policy interventions for rural smallholder farmers in Nigeria are discussed.

5.2 THE MULTIDIMENSIONAL FINANCIAL INCLUSION OF RURAL SMALLHOLDER FARMERS

This section presents findings derived from developing the multidimensional financial inclusion index. To begin with, findings from the descriptive analysis of rural smallholder farmers according to the sub-indicators of the three domains of FI – financial *participation*, financial *capability* and financial *well-being* – are presented. The following subsection presents the assessed adequacy of rural smallholder farmers across financial inclusion indicators. The final subsection discusses the estimates of the multidimensional financial inclusion index.

5.2.1 Description of rural smallholder farmers by sub-indicators of the financial participation domain

The results regarding the financial participation domain (Figure 5.1) indicate that 21.59% of rural smallholder farmers had access to banks. Only 8.53% had access to non-bank financial institutions, and 0.17% to mobile money services. Similarly, the usage indicator was driven by the use of bank (20.3%) and non-bank financial services (7.8%). The findings suggest that few of the rural smallholder farmers who do own personal accounts at these financial institutions use them frequently to save, borrow, make or receive payments. At the time of survey, the findings showed that fewer rural smallholder farmers used mobile money services (0.34%) but only in the sub-indicator was usage found to be double that of access. This suggests that increased usage could be promoted as long as those without registered mobile money accounts are granted access to use the services through the personal accounts of the few registered mobile money account holders. This assertion supports Adelaja et al. (2019), who established that, while there was still a need to intensify the awareness of mobile money to translate into an effective use of the services, there was increasing acceptance of mobile money services among registered and unregistered users in Nigeria. Therefore, the results of this study suggest that mobile money services have the prospect of enhancing the access to and use of financial services among rural smallholder farmers in Nigeria.

Further findings show that the major barriers faced by rural smallholder farmers were high transaction costs (23.34%), lack of formal identification (15.12%), and distance (14.92%). This conforms to the findings of Olomola (1992) who found that smallholders in Nigeria, who were mostly based in rural areas, did not want to participate in formal financial systems because of

the associated high transaction costs, and that such trends would persist, if not addressed. Nigeria has adopted various innovations in *know your customer* (KYC) regulations, such as the three-tiered KYC categorisation, biometric bank verification number (BVN) and national identification number (NIN), to ease the challenges faced in formal financial participation (Alliance for Financial Inclusion, 2019). Nonetheless, it is still difficult to enrol rural populations and farmers due to distance and poor infrastructure, which increases the costs of linking up the innovative programmes with agricultural operations (ITU, 2016). The findings suggest that continued efforts to reduce these barriers faced by rural smallholder farmers may be necessary to promote their financial participation.

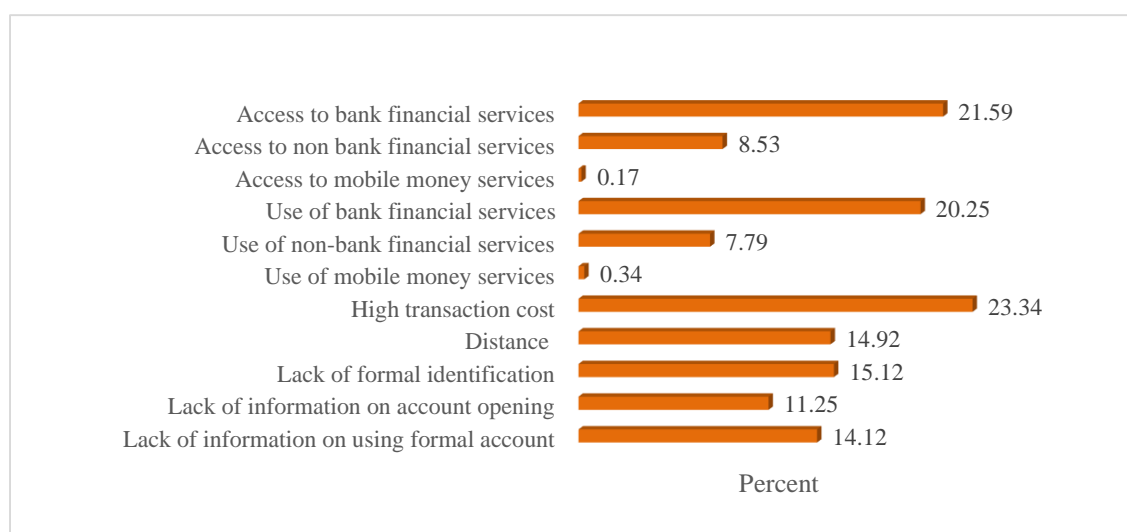


Figure 5.1: Sub-indicators of the financial participation domain

Source: Author

5.2.2 Description of rural smallholder farmers by sub-indicators of the financial capability domain

The results regarding the financial capability domain (Figure 5.2) show that about 25.39% of rural smallholders had knowledge on at least one type of financial service offered by the formal institution used. Only 2.15% could recall at least one name of a mobile money service provider, without aid, while 1.32% knew at least one type of financial activity that mobile money service could execute. Regarding the financial planning indicator, the common financial management strategy of rural smallholder farmers was to have a general savings plan (26.4%), or a savings plan specific to agricultural needs (10.82%), or an investment plan (10.09%). Approximately 1% of rural smallholder farmers had an insurance plan (0.57%), which is a limitation on

mitigating agricultural risks through formal financial mechanisms. According to CGAP (2018), the acceptance of innovative insurance products among smallholder farmers is challenged by the high costs of products related to coordinating multifaceted processes to deliver services. Findings from the sub-indicators of consumer protection reveal that most rural smallholder farmers trusted formal sources, in the following order: banks (51.62%), savings groups (38.71%), bank agents (34.1%), microfinance (28.43%), mobile money providers (14.2%), and mobile money agents (12.68%). The high level of trust that rural smallholder farmers have in formal financial systems may exist because Nigeria recognises consumer protection as an essential part of financial inclusion. This is evidenced by the country’s high prioritisation of the need to protect consumers in formal financial systems, since the launch of its initial National Financial Inclusion Strategy in 2012 and the Consumer Protection Framework in 2016. In addition, the World Bank (2017b) has reiterated that, for a country like Nigeria, consumer trust in formal financial systems is essential for improving the levels of FI. However, despite the consumer protection, a low level of knowledge and management skills needed to make informed choices regarding financial services could be detrimental to the financial capability of rural smallholder farmers.

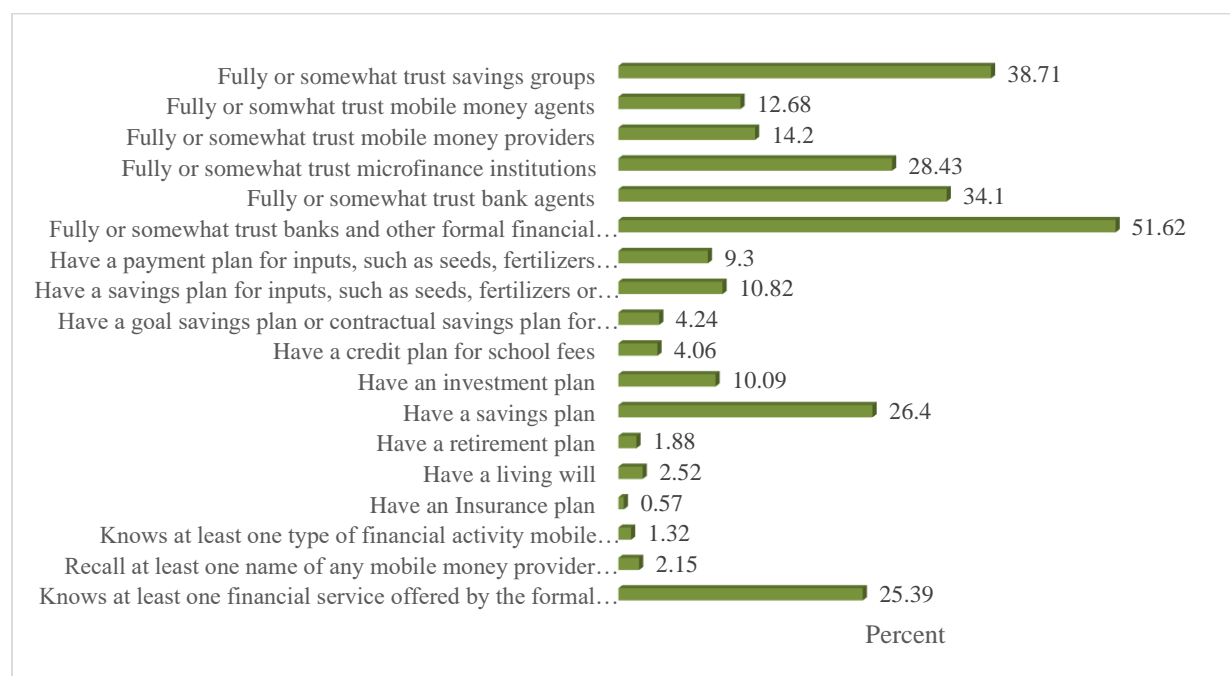


Figure 5.2: Sub-indicators of the financial capability domain

Source: Author

5.2.3 Description of rural smallholder farmers by sub-indicators of the financial well-being domain

Results regarding the financial well-being domain (Figure 5.3) show that the majority of rural smallholder farmers in Nigeria (63.44%) had input in making financial decisions regarding daily expenses, and were sometimes able to pay bills (44.61%). However, less than one-fifth (17.61%) were able to solely make financial decisions or always pay bills (16.44%). Although most rural smallholder farmers in Nigeria indicated experiencing joint roles in financial decision making, there is a higher likelihood that males also dominate joint decision making, as traditions expect women to mostly go with whatever decisions are made by the males (Adegbite and Machethe, 2020). In terms of financial resilience, less than half of the rural smallholder farmer population had an emergency fund, either sometimes (41.30%) or always (9.8%), to cover for unplanned expenses. About 32.88% found it somewhat or very (20.96%) possible to come up with 100,000 naira to meet an emergent financial need. Furthermore, the results show that the majority had sufficient money just for food and clothes (54.11%), while fewer respondents could save a little in addition to having enough money for food and clothes (24.36%). Moreover, only a few (7.26%) could afford luxury goods.

The inability of most rural smallholder farmers in Nigeria to save beyond meeting basic needs could be detrimental to their ability to successfully respond to economic shocks, such as their responses in mitigating the impacts of the current global Covid-19 pandemic. This is because formal savings can promote self-insurance, which in turn can complement taking up insurance products to manage risks and economic shocks compared to informal approaches (Moore et al., 2019). An example of such informal approaches is investing in livestock, a practice which is common among smallholder farmers in Nigeria (Anderson et al., 2017). However, it is important to note that the latter approach could be less sustainable, as the animals are also exposed to risks, diseases and pandemics, and the death of such animals would only contribute more to economic losses for a rural smallholder farmer with livestock as investments.

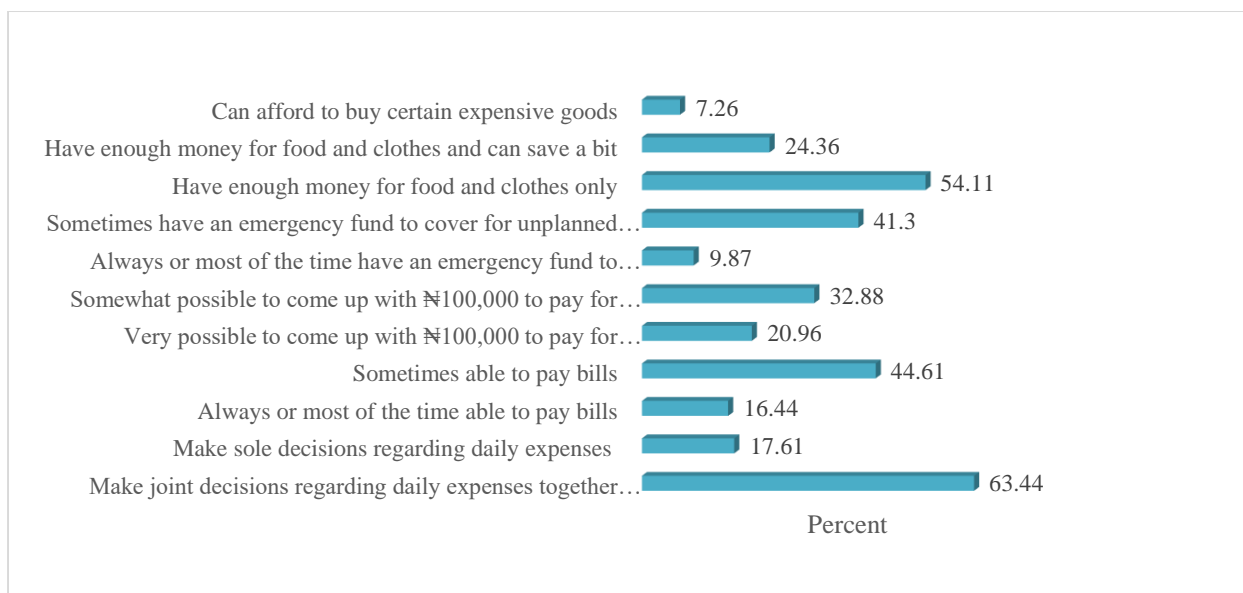


Figure 5.3: Sub-indicators of the financial well-being domain

Source: Author

5.2.4 Adequacy of rural smallholder farmers across financial inclusion indicators

This section discusses the pertinent adequacy of rural smallholder farmers across the nine indicators of the three domains of financial inclusion. The results (Table 5.1) reveal that, in the financial participation domain, less than one-third (27.07%) of rural smallholder farmers in Nigeria had access to formal financial services. Only a quarter (25.43%) of the rural smallholder farmers had used formal financial services. Furthermore, 30.93% of rural smallholder farmers reported not facing barriers to access to or use of formal financial services. In the financial capability domain, the results reveal that only 26% of the rural smallholder farmers were financially literate, while 39.33% were adequate regarding the financial planning indicator, and 66.80% on the consumer protection indicator. Further analysis of the financial well-being domain shows that most rural smallholder farmers in Nigeria (92.06%) had control over finance, 72.27% were adequate in financial resilience, and 85.74% in financial situation. The results imply that rural smallholder farmers in Nigeria have the highest raw (uncensored) headcount ratio in control over finance, compared with financial literacy (26.0%) and use of formal financial services (25.43%). While Nigeria established a financial literacy framework in 2013 (Central Bank of Nigeria, 2015a), evidence from this study suggests that financial education programmes are yet to adequately reach rural smallholder farmers in Nigeria.

Table 5.1: Adequacy of rural smallholder farmers across financial inclusion indicators

Domain	Indicator	Frequency	Percent
Financial participation	Access	621	27.07
	Usage	585	25.43
	No barrier	711	30.93
Financial capability	Financial literacy	598	26.00
	Financial planning	905	39.33
	Consumer protection	1,515	65.80
Financial wellbeing	Control over finance	2,117	92.06
	Financial resilience	1,662	72.27
	Financial situation	1,972	85.74

Source: Author

5.2.5 Estimates of the multidimensional financial inclusion index

Findings derived from constructing the multidimensional financial inclusion index show that, while 27.07% of rural smallholder farmers had formal access to financial services, a slightly higher proportion (29.90%) had attained adequate achievements in at least two-thirds of domains of FI (Table 5.2). This implies that not all rural smallholder farmers in Nigeria who have access to formal services are financially adequate. However, the findings show that rural smallholder farmers had a multidimensional financial inclusion headcount ratio (incidence) of 25.65% and, on average, had attained adequate achievements (intensity) in 85.50% of the three domains of financial inclusion. Thus, the overall MFII, which determines the level of financial inclusion of rural smallholder farmers, had a value of 0.2193. The findings imply that rural smallholder farmers in Nigeria are characterised by a low level of FI, a situation which this study suggests may not be able to sustainably transform smallholder agriculture in Nigeria.

Furthermore, Anderson et al. (2017) reported that 26% of smallholder farmers in Nigeria were financially included, as defined by the proportion of those having a personal formal account. However, the findings from this study suggest that rural smallholder farmers who only own a formal account for accessing financial services are significantly different, at 1%, from those who have achieved financial adequacy in at least two-thirds of the 3DFI with formal access. Therefore, this study establishes the point that formal access to finance does not equally translate to the financial inclusion of rural smallholder farmers in Nigeria, a position which therefore validates the construction of the MFII.

Table 5.2: Estimates of the multidimensional financial inclusion index

Indicators	Estimates at adequacy threshold ($f_k \geq 0.66$)
Formal access	0.2707
Financial adequacy	0.2990
Incidence of financial inclusion	0.2565
Intensity of financial inclusion	0.8550
MFII	0.2193
1 – MFII	0.7807
Pearson X^2 test	p-value
H ₀ : formal access = financial adequacy	0.000
H ₀ : formal access = financial inclusion	0.000

Source: Author

5.3 VARIATIONS IN THE LEVELS OF FINANCIAL INCLUSION AND ASSOCIATION WITH SPECIFIC SOCIO-ECONOMIC CHARACTERISTICS

While previous studies have shown that socio-economic characteristics affect the levels of financial inclusion, gender and geographical location remain germane issues that often generate debate about FI interventions (Zins and Weill, 2016; Abdu et al., 2015). This section provides insights on how these factors affect the levels of FI of rural smallholder farmers in Nigeria. Determining whether or not significant variations exist between the levels of rural smallholder farmers' FI by gender and geographical location is first assessed by using cross-tabulations and the Pearson chi-square test. Secondly, the multidimensional financial inclusion index is decomposed by gender and geographical location to examine the extent of variations. Lastly, the statistical significance of the association between the levels of FI of population subgroups (gender and geographical location) and their specific individual and household characteristics is examined.

5.3.1 Variations in the level of financial inclusion by gender and geographical location of rural smallholder farmers

The results noted in Table 5.3 show that the level of FI represented by the multidimensional financial inclusion headcount ratio of rural smallholder farmers was significantly different

between males and females, at 1%. Moreover, males constituted a greater proportion (70.52%) of the financially included rural smallholder farmers than females did (29.48%). Similarly, the levels of FI were significantly different across the six geopolitical locations in Nigeria. The results show that rural smallholder farmers in the southern geopolitical zones constituted a greater proportion (60.50%) of the financially included, as compared with the 38.98% in the northern zones. This implies that the levels of FI among rural smallholder farmers in Nigeria significantly vary by gender and geographical locations, at 1%. A cross-tabulation between gender and geographical location in the levels of FI (Appendix 1) indicates that rural male smallholder farmers in the South were significantly more financially included (56.91%) than those in the North were (43.35%). Similarly, rural female smallholder farmers in the South were significantly more financially included (69.09%) than those in the North were (30.91%). However, females had a higher geographical disparity (38.18%) in the level of financial inclusion, compared with the males (14.56%). This suggests that, even in the northern region with a lower level of FI, rural female smallholder farmers are more financially excluded than their male counterparts are.

Table 5.3: Levels of financial inclusion of rural smallholder farmers by gender and geographical location

Population groups	Frequency	Level of financial inclusion (Percent)
Gender		
Male	416	70.52
Female	174	29.48
Pearson X^2 statistic	29.84	
P-value	0.000	
Geographical location		
North central	153	25.93
North east	32	5.35
North west	48	8.22
South east	84	14.30
South south	220	37.25
South west	53	8.95
Pearson X^2 statistic	257.90	
P-value	0.000	

Source: Author

5.3.2 Analysis of the multidimensional financial inclusion index by gender and region

This subsection discusses the results obtained from the decomposition analysis of the multidimensional financial inclusion index by gender and geographical location of rural smallholder farmers, with the aim to validate the hypotheses regarding the variations in the levels of financial inclusion. This feature facilitates further investigation into how specific population subgroups of rural smallholder farmers in Nigeria, such as those categorised by gender and geographical location, are associated with varying levels of FI.

5.3.2.1 Gender variations in multidimensional financial inclusion

The results obtained from decomposing the multidimensional financial inclusion index by gender (Figure 5.4) reveal that rural male smallholder farmers in Nigeria had a higher MFII value (0.26) than their female counterparts had (0.16). Moreover, rural male smallholder farmers had an incidence value of 0.30 and, on average, had attained adequate achievements in

85.38% of the three domains of financial inclusion. Conversely, female rural smallholder farmers had an incidence value of 0.19 and, on average, had attained adequate achievements in 85.77% of the 3DFI. The findings indicate that, while a significant gender variation in the levels of financial inclusion exists, male rural smallholder farmers have a higher level of FI than the females do. This supports earlier studies which argued that, despite female farmers participating in similar activities to males, gender inequality persists in Nigerian agriculture (Oseni et al., 2013). Moreover, Adegbite and Machethe (2020) have proposed that, while gender inequality persists in access to and use of financial resources in smallholder agriculture, closing the gap is vital to achieving sustainable development outcomes.

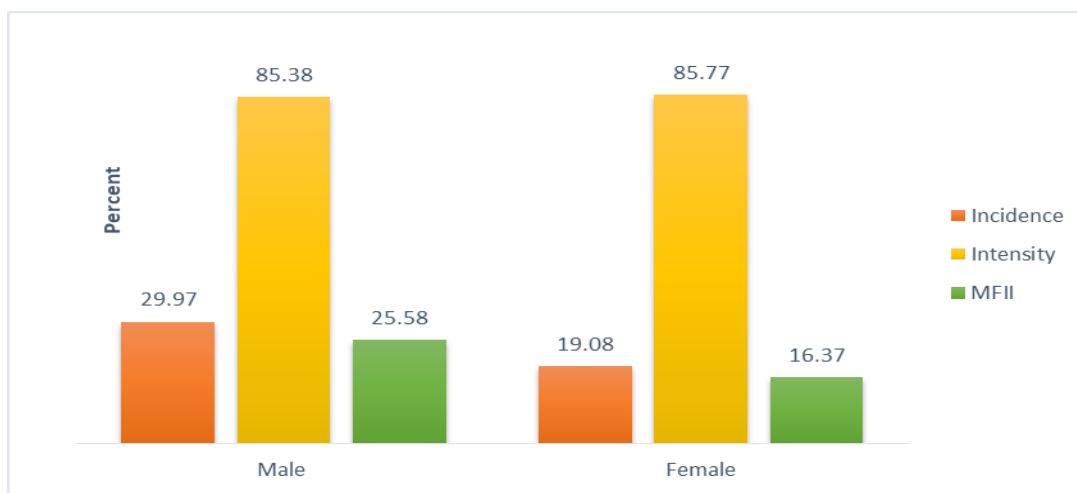


Figure 5.4: Multidimensional financial inclusion of rural smallholder farmers in Nigeria

Source: Author

5.3.2.2 Geographical variations in multidimensional financial inclusion

The results obtained from decomposing the multidimensional financial inclusion index by geographical location (Figure 5.5) reveal higher MFII values of 0.45, 0.28 and 0.22 in the SS, SE and SW geographical locations, respectively. On the contrary, the MFII values of rural smallholder farmers in the NC (0.20), NW (0.09) and NE (0.09) geographical zones indicate lower levels of financial inclusion. In addition, rural smallholder farmers in the SS (0.53), SE (0.32) and SW (0.27) had higher incidence values and, on average, had adequate achievements in 84.28%, 87.74% and 82% of the 3DFI, respectively (Appendix 2). However, lower incidence values were observed in the NC (0.23), NE (0.11) and NW (0.10), with adequate achievements in 86.03%, 82.74% and 91.04% of the three domains of FI, respectively.

The lower levels of financial inclusion in the North could exist because of the region's association with a higher level of rural poverty, and it is important to note that 67% of smallholder families in Nigeria are located in this region (Obayelu, 2014; Anderson et al., 2017). The findings from this study mean that the northern region, notwithstanding having a higher proportion of rural smallholder farmers, is the region with a lower level of FI of rural smallholder farmers. Furthermore, while the North East and the North West regions are the zones most affected by the insurgency of the “*Boko Haram*” sect, the North Central region has also been affected by the recurring conflicts over land and environmental resources between farmers and herders (Azad et al., 2018; IPCC, 2017). Although the situation in the northern zones may seem more overwhelming to manage, compared with the southern zones, this study proposes that the northern rural smallholder farmers should not be financially marginalised, as these zones are also the most susceptible to climate change (Haider, 2019). Failure to cope with climate change effects because of limited financial resources would negatively affect agricultural productivity and food security of Nigerians (Adegbite and Machethe, 2020).

This study has established the points that significant geographical variations exist in the levels of FI among rural smallholder farmers in Nigeria, and that higher levels are found in the SS, SE and SW regions, respectively. Previous evidence reported in studies such as those by Aro-Gordon (2017) and CBN (2018) indicated that the South West was the only region that had achieved the national target of 80% FI rate and, as a result, it had the highest level of FI in Nigeria, while the North West had the lowest. However, the findings from this study suggest that certain rural smallholder farmers in Nigeria may be omitted from targeted interventions if those interventions are informed by aggregated national assessments, as the South South was found to have the highest level of FI, while the North East had the lowest (Figure 5.5).

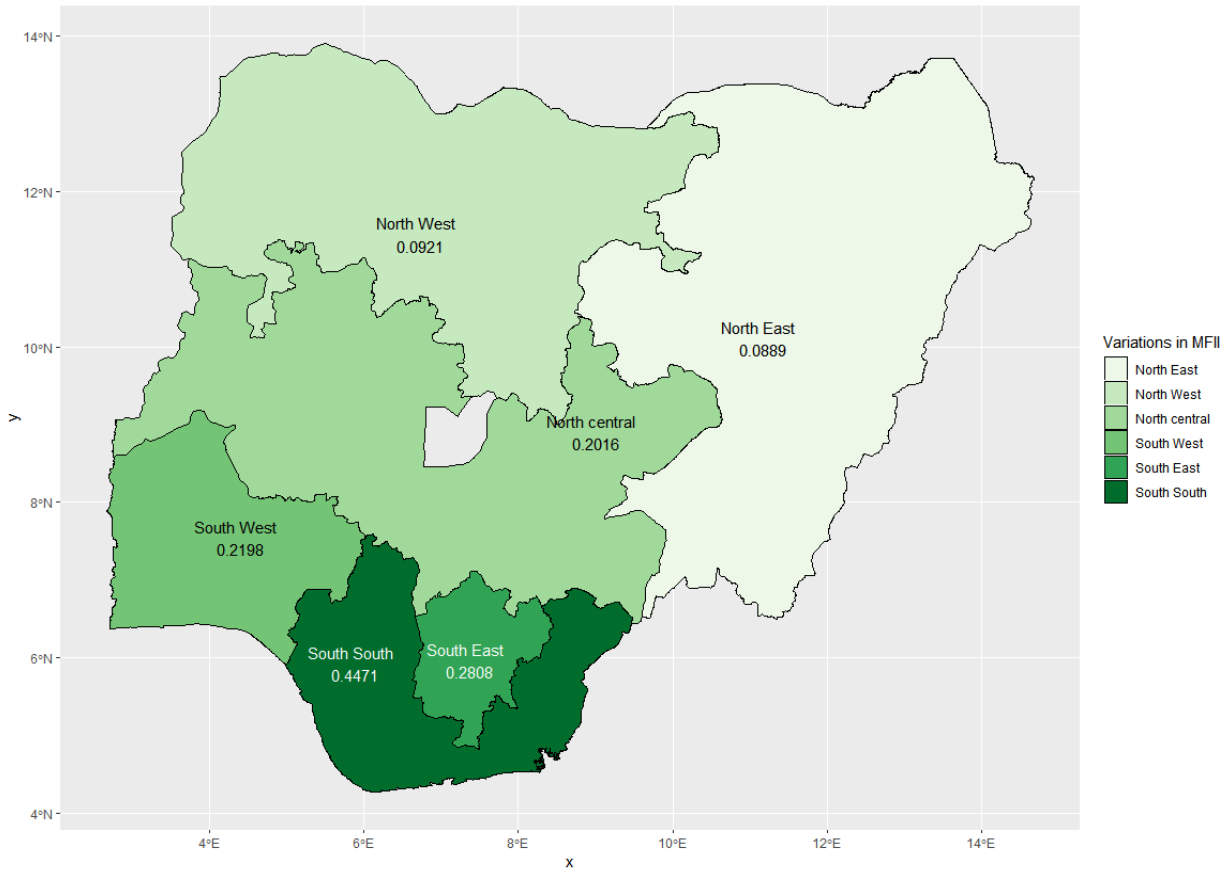


Figure 5.5: Map of Nigeria showing geographical variations in the multidimensional financial inclusion of rural smallholder farmers

Source: Author

5.3.3 Association between the levels of financial inclusion of rural smallholder farmers' population subgroups and their individual and household characteristics

This subsection discusses how the different levels of FI between gender and the geographical location of rural smallholder farmers in Nigeria relate to specific individual and household characteristics. The individual characteristics include age, marital status and educational levels, while the household characteristics include household income, household size and poverty status. The results shown in Table 5.4 reveal that age was significantly associated with the levels of financial inclusion of rural male smallholder farmers, at 1%, but no strong association was found for their female counterparts. If early interpretations from the literature on control are to be considered, men's age is often used to signify men's control in relation to women

(Alkire et al., 2013). Therefore, these findings may reflect the greater control of rural male smallholder farmers in financial inclusion, as compared with the females, in Nigeria.

Table 5.4: Levels of financial inclusion and age of rural smallholder farmers

Age Category (years)	Gender (%)		Geographical location (%)					
	Males	Females	NC	NE	NW	SE	SS	SW
15 – 29	33.23 (142)	40.53 (68)	24.72 (24)	24.67 (9)	19.54 (11)	26.54 (27)	56.37 (107)	13.97 (12)
30 – 44	33.43 (143)	31.92 (53)	40.64 (40)	35.30 (13)	36.66 (20)	25.57 (26)	26.25 (50)	45.92 (40)
45 – 59	24.67 (105)	17.77 (30)	28.07 (28)	31.89 (12)	32.62 (18)	35.85 (36)	10.76 (20)	20.54 (18)
≥ 60	8.67 (37)	9.79 (16)	6.58 (6)	8.13 (3)	11.18 (6)	12.05 (12)	6.62 (13)	19.58 (17)
Total	29.97 (427)	19.08 (167)	23.44 (98)	10.74 (37)	10.12 (55)	32.01 (101)	54.05 (190)	26.80 (87)
Pearson X^2 statistic	12.74	3.44	17.65	4.96	8.43	4.96	8.68	2.58
P-value	0.005	0.329	0.001	0.174	0.038	0.175	0.034	0.461

Source: Author

Note: Figures in parentheses are weighted frequencies

Almost the same proportion of the financially included rural males were between the ages of 15 – 29 years (33.23%) and 30 – 44 years (33.43%). Conversely, the levels of financial inclusion decreased among higher age groups in the case of rural female smallholder farmers, as a greater proportion aged 15 – 29 years (40.53%) were financially included. This supports the finding made by Abdu et al. (2015) that being of a younger age increases the probability of financial inclusion in Nigeria, while older age and being a female reduces the probability. However, this contradicts Adelaja et al. (2019) who found that younger women in Nigeria, aged 18 to 34 years, were the most excluded from financial services, although in this case the share of banked adults was considered as the measure of financial inclusion. Other studies (Efobi et al., 2014; Soumare et al., 2016; Zins and Weill, 2016) found a non-linear association between age and FI, indicating that although it was more likely for FI to increase with higher age groups, the probability diminished after a certain threshold. Zins and Weill (2016) and Efobi et al. (2014) indicated that older people had more bank accounts, compared with younger people, but a negative relationship was found with the use of bank financial services. These

findings therefore suggest that sustainable financial inclusion of population groups is important and that the measure of financial inclusion or indicators used can influence the association between individual characteristics like age and FI.

Findings from comparing the regions indicate a statistically significant relationship between age and the levels of FI in the NC, NW and SS, but an insignificant association was observed in the NE, SE and SW. While most of the financially included rural smallholders were between the ages 30 – 34 years, an exception was the SE zone where the majority of the financially included were aged 45 – 59 years. This suggests that the majority of the financially included rural smallholder farmers were still within their early (15 – 24) and prime (25 – 54) working age in Nigeria. It is indispensable to note that the South South region, with the highest level of FI of rural smallholder farmers in Nigeria, was also the region that had the highest share of the financially included rural smallholders aged 15 – 29 years (56.37%). This implies that the financial inclusion of rural youth smallholder farmers has the potential to drive higher levels of FI in Nigeria's smallholder agriculture, and if theory holds, their inclusion could help to transform the sector through the adoption of innovative technologies (Trendov et al., 2019). This assertion is based on the new age classification (15 – 29 years) for Nigerian youths, compared with the previous classification of 18 – 35 years, as indicated in Nigeria's National Youth Policy 2019. Moreover, it has been observed that the youth in agriculture are more likely to adopt technologies to digitise agricultural activities than older farmers are (Trendov et al., 2019). However, if stakeholders want to avoid the widening of gender gaps, then these results suggest that they must ensure that both a conducive policy environment and relevant infrastructure are equally created to support the development and adoption of innovative financial technologies for both men and women (BMGF, 2019).

Results of the association between the levels of financial inclusion by population subgroups (gender and geographical locations) and marital status are presented in Table 5.5. Considering the gender of the rural smallholder farmers, the findings show that 66.84% of the financially included males were married, while 79.53% of the financially included females were married. This finding agrees with the finding by Depew and Price (2018) that the financial health of women could improve with marriage, especially for those with adult children, due to the positive correlation with family income and lower likelihood to live in poverty, unlike unmarried women. Similarly, Fry and Cohen (2010) indicated that the economic benefits and asset base of adults were likely to increase with marriage. However, given that it is more likely

for family assets like land to be transferred to male adults rather than females in Nigeria (Adegbite and Macheche, 2020), females without assets could benefit through marriage to such male adults with inherited assets. This could enhance access to finance, as it might be easier for a married male with higher socio-economic status to act as a guarantor for his wife in her gaining to access credit, unlike unmarried women. Similarly, a significant association was observed across geographical location, although an insignificant relationship ($p > 0.10$) was found in the North West and South West regions. Nonetheless, a greater multidimensional financial inclusion headcount ratio was found for all married sub-populations of the rural smallholder farmers in Nigeria.

Table 5.5: Levels of financial inclusion and marital status of rural smallholder farmers

Marital status	Gender (%)		Geographical location (%)					
	Male	Female	NC	NE	NW	SE	SS	SW
Single	30.64 (131)	13.16 (22)	8.44 (9)	0.93 (1)	11.53 (6)	26.98 (27)	47.08 (90)	10.14 (9)
Married	66.84 (285)	79.53 (133)	88.21 (74)	79.03 (29)	85.38 (47)	67.42 (68)	51.65 (98)	84.75 (74)
Divorced	1.50 (6)	0.90 (1)	1.86 (1)	11.39 (4)	0.00 -	0.58 (1)	0.00 -	1.67 (1)
Widowed	0.33 (1)	6.41 (11)	1.49 (3)	4.95 (2)	3.10 (2)	3.03 (3)	1.27 (2)	3.44 (3)
Living together	0.28 (1)	0.00 -	0.00 -	3.71 (1)	0.00 -	0.00 -	0.00 -	0.00 -
Don't know	0.40 (2)	0.00 -	0.00 -	0.00 -	0.00 -	1.98 (2)	0.00 -	0.00 -
Total	29.97 (427)	19.08 (167)	23.44 (98)	10.74 (37)	10.12 (55)	32.01 (101)	53.05 (190)	26.80 (87)
Pearson X^2 statistic	16.28	6.71	13.82	20.60	1.15	15.22	10.33	4.19
P-value	0.006	0.082	0.008	0.000	0.562	0.004	0.016	0.241

Source: Author

Note: Figures in parentheses are weighted frequencies

Table 5.6 reflects the relationships between the levels of FI and education of rural smallholder farmers. The findings indicate that a statistically significant relationship existed for all the population subgroups investigated, with multidimensional financial inclusion head count ratios

rising for those who had completed secondary education, across the subgroups. However, there were a few exceptions in the North East region where a majority (34.30%) had completed primary education, and in the North West where a majority had completed university education (21.10%). Besides secondary education, the results show that a greater proportion of the financially included males had received some level of university education (13.29%) or had completed it (6.25%), compared with the 7.94% and 2.75% of females, respectively. This supports the assertion by Reynolds et al. (2017) that, although most Nigerians had some level of secondary education, more women were without formal education than men were. Furthermore, Abdu et al. (2015) indicated that over 60% of the gap in FI between males and females in Nigeria could be attributed to differences in secondary education. However, it is generally observed that a low level of education existed across all groups of rural smallholder farmers in Nigeria.

Table 5.6: Levels of financial inclusion and education of rural smallholder farmers

Education	Gender (%)		Geographical location (%)					
	Male	Female	NC	NE	NW	SE	SS	SW
No formal education	10.34 (44)	14.19 (24)	20.45 (20)	19.71 (7)	19.76 (10)	2.11 2	3.78 (7)	19.96 (17)
Informal education only	0.23 (1)	0.22 -	0.00 -	0.39 -	1.35 (1)	0.00 -	0.00 -	1.09 (1)
Some primary	2.10 (9)	0.86 (1)	2.17 2	3.06 (1)	4.73 (2)	0.86 (1)	0.33 -	4.14 (4)
Completed primary	11.53 (49)	15.05 (25)	16.78 (16)	34.30 (12.57)	8.39 (5)	12.74 (13)	3.71 (7)	27.82 (24)
Some secondary	8.77 (37)	9.43 (16)	8.87 (9)	12.69 (4.65)	8.41 (5)	23.66 (24)	3.19 (6)	8.11 (7)
Completed secondary	35.81 (153)	36.37 (61)	24.19 (24)	16.22 (5.94)	14.39 (8)	29.03 (29)	56.95 (108)	29.92 (26)
Post-secondary qualifications	11.17 (48)	13.19 (22)	22.64 (22)	3.83 (1)	12.25 (7)	8.13 (8)	8.16 (16)	3.46 (3)
Some university	13.29 (57)	7.94 (13)	2.64 (3)	9.80 (4)	21.10 (12)	13.81 (14)	19.41 (37)	3.27 (3)
Completed university	6.25 (27)	2.75 (5)	1.24 (1)	0.00 -	9.62 (5)	9.07 (9)	4.47 (9)	2.23 (2)
Post-graduate	0.50 (1)	0.00 -	1.03 (1)	0.00 -	0.00 -	0.58 (1)	0.00 -	0.00 -
Total	29.97 (427)	19.08 (167)	23.44 (98)	10.74 (37)	10.12 (55)	32.01 (101)	53.05 (190)	26.80 (87)
Pearson X^2 statistic	369.57	165.95	102.14	42.54	206.83	59.96	151.31	11.37
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001

Source: Author

Note: Figures in parentheses are weighted frequencies

Regarding the association between the levels of FI and income of rural smallholder households, the results (Table 5.7) indicate a significant relationship existed, at 1%, for both male and female rural smallholder farmers. However, according to Abraham (2018), rural women farmers in northern Nigeria have a greater likelihood of being in the lowest income group, compared with the higher likelihood of the rural men farmers belonging to the richest income quintile. Similarly, in this study, a significant association was observed between the levels of financial inclusion and household income across the regions, except in the North Central and North East. However, most of the financially included rural smallholders across the population subgroups belonged to households having an average monthly income of less than ₦50, 000. Only the South South (SS) region (the same region with the highest level of FI) had a higher proportion of financially included rural smallholder farmers, with a mean monthly household income ranging between ₦50, 000 and ₦99, 999.

Table 5.7: Levels of financial inclusion and household income of rural smallholder farmers

Household income (Naira)	Gender (%)		Geographical location (%)					
	Male	Female	NC	NE	NW	SE	SS	SW
≤ 49,999	52.73 (225)	64.72 (108)	70.89 (70)	80.31 (29)	48.25 (26)	79.46 (80)	38.20 (73)	44.98 (39)
50,000 – 99,999	28.32 (121)	28.57 (48)	19.50 (19)	19.69 (7)	32.10 (18)	13.46 (14)	41.49 (79)	25.35 (22)
100,000 – 299,999	17.78 (76)	6.04 (10)	6.61 (9)	0.00 -	19.65 (11)	6.41 (6)	19.56 (37)	22.44 (20)
300,000 – 49,999	0.37 (2)	0.67 (1)	0.00 -	0.00 -	0.00 -	0.66 (1)	0.75 (1)	0.91 (1)
≥ 500,000	0.80 (3)	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 (-)	6.32 (5)
Total	29.97 (427)	19.08 (167)	23.44 (98)	10.74 (37)	10.12 (55)	32.01 (101)	54.33 (190)	26.80 (87)
Pearson X^2 statistic	52.26	12.47	3.74	1.25	14.24	7.66	38.10	11.06
P-value	0.000	0.006	0.291	0.741	0.003	0.054	0.000	0.026

Source: Author

Note: Figures in parentheses are weighted frequencies

The results obtained from examining the association between the levels of FI by gender, geographical location and household size of rural smallholder farmers are presented in Table

5.8. The findings reveal that the household size of rural male and female smallholder farmers was statistically associated with their levels of financial inclusion, at 1%. The majority of financially included rural male smallholder farmers belonged to households having between six to 10 persons (48.12%). Conversely, the levels of FI decreased with a higher household size for rural female smallholder farmers. A higher percentage of the financially included females (59.85%) belonged to households having between one to five persons. This could imply that the financial inclusion of rural female smallholders may be challenged in households having large family sizes. The limitation could be attributed to the probability that the home care responsibilities for women may increase with large family sizes, which limit the time available for financial participation, unlike in the case of males (Grassi et al. 2015). This finding is in line with the observation made by the World Bank (2014b) that rural families with larger household sizes in Nigeria had a higher likelihood of being poor. Likewise, a significant association between the levels of FI and household size was found across the regions, except for the South East and South South zones. Most of the financially included rural smallholder farmers in the North East, North West and South South zones were associated with household sizes of 6 to 10 persons. Conversely, the levels of FI decreased with higher household sizes in the North Central, South West and South East.

Table 5.8: Levels of financial inclusion and household size

Household size	Gender (%)		Geographical location (%)					
	Male	Female	NC	NE	NW	SE	SS	SW
1 – 5	45.94 (196)	59.85 (100)	65.04 (64)	25.71 (9)	21.49 (12)	65.57 (66)	40.77 (78)	61.08 (53)
6 – 10	48.12 (206)	39.21 (65)	31.85 (31)	63.80 (24)	42.06 (23)	33.67 (34)	59.23 (113)	38.92 (34)
11 – 15	4.02 (17)	0.94 (2)	1.75 (2)	10.49 (4)	24.22 (13)	0.75 (1)	0.00 -	0.00 -
16 – 20	1.92 (8)	0.00 -	1.36 (1)	0.00 -	12.22 (7)	0.00 -	0.00 -	0.00 -
Total	29.97 (427)	19.08 (167)	23.44 (98)	10.74 (37)	10.12 (55)	32.01 (101)	54.33 (190)	26.80 (87)
Pearson X^2 statistic	12.90	25.43	20.36	6.52	8.62	3.04	1.65	4.80
P-value	0.005	0.000	0.000	0.089	0.035	0.219	0.437	0.091

Source: Author

Note: Figures in parentheses are weighted frequencies

Further examination of the association between the level of FI and the poverty status of the households of rural smallholder farmers indicates that a significant relationship existed, at 1%, for both males and females (Table 5.9). The poverty status measured by the progress out of poverty index classifies a smallholder farmer as being above or below the poverty line (Anderson et al. 2017). Findings from this study showed that approximately 50% of the rural male smallholder farmers who were financially included comprised both those who were above (49.59%) and those who were below (50.43%) the poverty line. Conversely, a higher proportion of financially included rural female smallholders (55.89%) were above the poverty line, as compared with those below (48.96%). Similarly, the findings show that a significant relationship existed across geographical locations, except in the South West region where the financially included rural smallholders above the poverty line were not significantly different from those below the poverty line. This may be because, despite most rural smallholder farmers being susceptible to greater incidences of poverty, the South West region had the lowest level of poverty in rural Nigeria (Cuevas and Anderson, 2016; Obayelu, 2014). Further findings show that the NE had the highest share of its financially included population below the poverty line, while the SE zone had the highest proportion of its financially included above the poverty line. This suggests that zones with lower levels of poverty are significantly related with higher levels of FI.

Table 5.9: Levels of financial inclusion and household poverty status

Household poverty status	Gender (%)		Geographical location (%)					
	Male	Female	NC	NE	NW	SE	SS	SW
Above poverty	49.59 (212)	55.89 (93)	51.04 (50)	23.36 (9)	51.00 (28)	67.14 (68)	55.18 (105)	29.10 (25)
Below poverty	50.43 (215)	44.11 (74)	48.96 (48)	76.64 (28)	49.00 (27)	32.86 (33)	44.82 (85)	70.90 (62)
Total	29.97 (147)	19.08 (167)	23.44 (98)	10.74 (37)	10.12 (55)	32.01 (101)	54.33 (190)	26.80 (87)
Pearson X^2 statistic	161.42	65.08	65.26	4.08	105.34	8.27	10.75	1.14
P-value	0.000	0.000	0.000	0.043	0.000	0.004	0.001	0.286

Source: Author

Note: Figures in parentheses are weighted frequencies

5.4 CONTRIBUTION OF RURAL SMALLHOLDER FARMER POPULATION SUBGROUPS TO FINANCIAL INCLUSION

This section presents further findings on how the relationship between gender and geographical location in Nigeria contributes to the overall multidimensional financial inclusion of rural smallholder farmers. This study identifies the need to consider the population share weights of subgroups of rural smallholder farmers in Nigeria, if the policy goal is to be aimed at addressing disparity in financial inclusion. The results reflected in Table 5.10 indicate that male rural smallholder farmers, whose population share weight is 60.36%, accounted for 70.42% of the gender contribution to the multidimensional financial inclusion index. On the contrary, female rural smallholder farmers had a population share weight of 39.64%, but contributed only 29.59%. This implies that rural female smallholder farmers in Nigeria are associated with lower adequacies in multidimensional financial inclusion than their male counterparts, given that their contribution to the multidimensional financial inclusion index is less than their population share weight (29.59% < 39.64%).

The population share weights of rural smallholder farmers across geographical location show the following order: North Central (28.37%) > North West (20.81%) > South South (18.01%) > North East (12.77%) > South East (11.46%) and South West (8.57%). The results (Table 5.10) reveal that the South South zone had the highest contribution (36.72%) towards the overall MFII of rural smallholder farmers, followed by the North Central (26.09%), South East (14.68%), North West (8.74%), South West (8.59%), and North East (5.18%) zones. Based on these findings, the geographical locations requiring greater policy FI interventions are defined as those regions whose contribution to MFII is less than their population share weight is. These include the North West (-12.07), the North East (-7.59), and the North Central (-2.28) zones. Regarding the southern zones, only the South South and the South East had their contributions as greater than the population share weights, by 18.71 and 3.22, respectively. Although the South West zone breaks even (0.02), the results imply that the zone is neither better nor worse off in receiving targeted interventions to enhance the FI of rural smallholder farmers.

Table 5.10: Contribution of rural smallholder farmer subgroups to financial inclusion

Population subgroup	Contribution to MFII	% Contribution to MFII	% Population Share weight	% contribution to MFII - % population share weight
Gender				
Male	0.1544	70.42	60.36	10.06
Female	0.0649	29.59	39.64	-10.06
Total	0.2193	100.00	100.00	0.00
Geographical location				
North central	0.0572	26.09	28.37	-2.28
North east	0.0114	5.18	12.77	-7.59
North west	0.0192	8.74	20.81	-12.07
South east	0.0322	14.68	11.46	3.22
South south	0.0805	36.72	18.01	18.71
South west	0.0188	8.59	8.57	0.02
Total	0.2193	100.00	100.00	0.00

Source: Author

It is crucial to note that the implications of these findings do not translate into side-lining other subgroups of rural smallholder farmers with at least positive differences between their contributions and population share weight. This study suggests that evidence could be used to guide the prioritisation of FI policy interventions, especially in situations where resources are scarce. Failure to prioritise FI policy interventions for rural smallholder farmers by subgroup could widen disparities and constitute a drawback for efforts aimed at inclusive economic development.

5.5 CONTRIBUTION OF FINANCIAL INCLUSION INDICATORS TO THE FINANCIAL INCLUSION OF RURAL SMALLHOLDER FARMERS

Previously, much emphasis was placed on the access indicator as being the main measure of financial inclusion. However, from a rural smallholder farmer's perspective, two key questions arise: Would having a formal account imply he or she is financially better off than a counterpart outside the formal system? Moreover, how can the process of FI add value to the lives of rural smallholder farmers to the point of making them shift from their traditional financial arrangements? It has been established that financial inclusion is a veritable means to achieve

sustainable desired outcomes (Klapper et al., 2016; Adegbite and Machethe, 2020). However, this assertion also depends on defining what specifically is measured as financial inclusion, especially for the rural poor. Therefore, this section discusses the findings on how the various indicators of financial inclusion (access, usage, no barrier, financial literacy, financial planning, consumer protection, control over finance, financial resilience and financial situation) contribute to the multidimensional financial inclusion of rural smallholder farmers in Nigeria. The results reflected in Figure 5.6 show that the financial inclusion indicators contributed to the aggregate multidimensional financial inclusion of rural smallholder farmers in the following order: access (13.00%), control over finance (12.82%), financial situation (12.07%), usage (11.71%), financial resilience (11.00%), financial literacy (10.70%), consumer protection (10.05%), no barrier (9.74%), and financial planning (8.92%). Although the results show a relatively low adequacy across the indicators of FI, the indicators requiring more policy attention, based on their contributions less indicator weights, are financial planning, removing barriers like high transaction costs, consumer protection, and financial literacy.

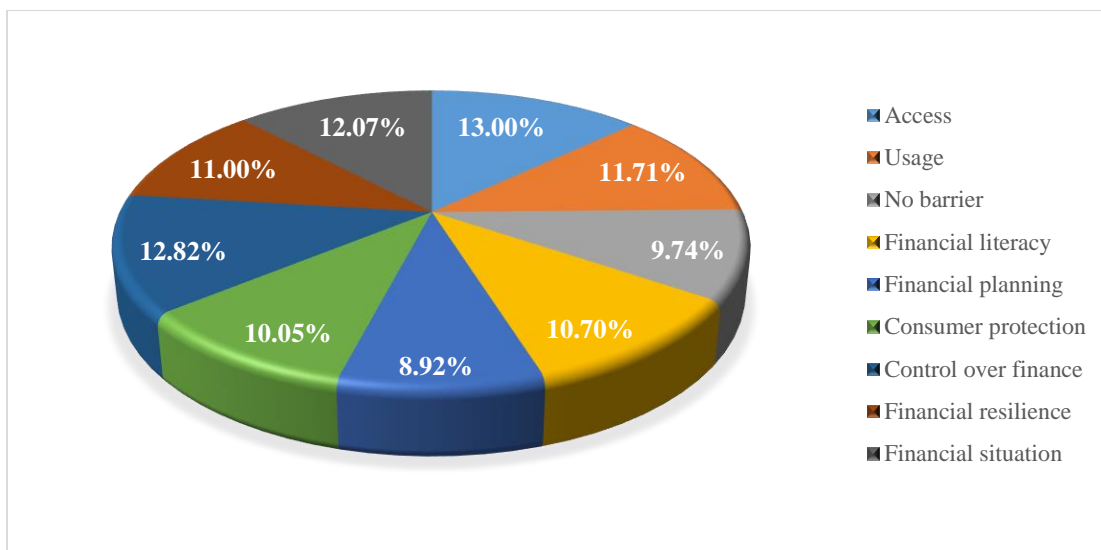


Figure 5.6: Contribution of financial inclusion indicators to the financial inclusion of rural smallholder farmers

Source: Author

To further provide understanding of how the contributions of FI indicators influence the variations in the levels of FI among population subgroups, the study examines the contribution of FI indicators by gender and geographical location. The results indicate that rural male smallholder farmers generally display a higher contribution than females do, across the nine financial inclusion indicators investigated (Figure 5.7). Furthermore, gender differences

observed in the contribution of FI indicators were ranked in the following descending order: financial resilience, control over finance, access, financial literacy, financial situation, usage, consumer protection, no barrier, and financial planning. This implies that the highest gender differences in the contributions of FI indicators to the financial inclusion of rural smallholder farmers in Nigeria are found in financial resilience, control over finance, and formal access. This supports Kumar and Quisumbing (2014) who indicated that it is imperative that a broad range of financial tools are made accessible to women due to their higher vulnerabilities in exposure and response to economic shocks, relative to men. Moreover, Fletschner and Kenney (2011) have indicated that the inability to access financial resources could affect farmers' ability to cope with risks, and as such, ensuring that women farmers have direct control and access to financial resources is important for achieving both short- and long-term sustainable outcomes. In this study, the findings suggest that it is also essential to address the financial literacy gender gap in rural smallholder agriculture in order for affected people to make the best out of their financial choices.

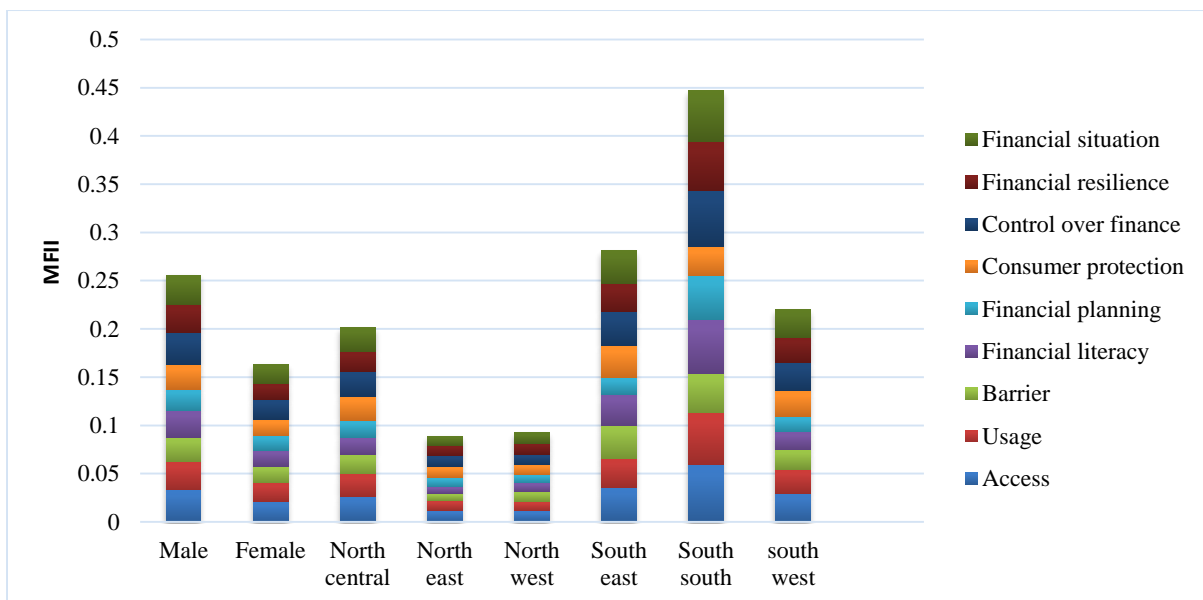


Figure 5.7: Contribution of financial inclusion indicators by population subgroups

Source: Author

Conversely, results obtained from the contributions of FI indicators by geographical location (Figure 5.7 above) show that the contributions of the access, usage and consumer protection indicators had similar rankings, in the following order: SS > SE > SW > NC > NE >NW. Although the contributions of the financial resilience, financial situation, financial literacy, no

barrier, and control over finance indicators followed a similar trend, the North East zone was displaced to the lowest position by the North West zone ($SS > SE > SW > NC > NW > NE$). This implies that the South South, South East, South West and North Central zones consistently ranked first, second, third and fourth, respectively, regarding the contributions of eight out of nine FI indicators. While the contributions of access to formal financial services, usage and consumer protection were the lowest in the North West zone, the contributions of financial resilience, financial situation, financial literacy, no barrier and control over finance were the lowest in the North East zone.

Lastly, the contribution of the financial planning indicator, across the zones, shows the following order: $SS > NC > SE > SW > NE > NW$. This implies that, except in the South South zone, financial planning contributed more to the levels of FI in the North Central than the South East or South West zones, as compared with previous trends, but contributed the least in the North West zone. Adelaja et al. (2019) also reported related trends indicating that formal financial access could be a struggle in the north eastern and north western zones in Nigeria. However, studies by Aro-Gordon (2017) and CBN (2018) have shown that the South West region in Nigeria was the only region that had been able to meet the country's target of an 80% FI rate. Findings from this study imply that, although country-level FI estimates are of leading importance in informing development policy decisions, caution should be taken with interventions based on aggregations. This is because aggregated national estimates may not reflect the true situation of different rural smallholder farmers, and consequently, the common interventions may have the potential to further widen disparities.

5.6 CONTRIBUTION OF FINANCIAL INCLUSION DOMAINS TO THE FINANCIAL INCLUSION OF RURAL SMALLHOLDER FARMERS

This section discusses the results (Figure 5.8) obtained from aggregating the contributions of the FI indicators across the three domains of financial inclusion (financial participation, capability and well-being). The findings show that the financial well-being domain contributed the most (35.89%) to the levels of financial inclusion among the rural smallholder farmers, followed by financial participation (34.45%), and financial capability (29.66%). This implies that rural smallholder farmers in Nigeria are the least financially capable of making informed choices about the formal financial services or products they need, which could make them even worse off if they were to be provided with innovative financial services. According to Bolaji-

Adio et al. (2013), financial capability is an essential policy strategy in financial inclusion because it can influence the extent of an individual’s financial well-being and/or financial participation. Although the financial capability of individuals is often substituted with financial literacy (ANZ, 2018), this study suggests that the latter is only a component of financial capability. Moreover, it is important to note that rural smallholder farmers in Nigeria not only have knowledge about financial services, but are also able to develop capabilities to interact with the formal financial systems and manage financial resources effectively.

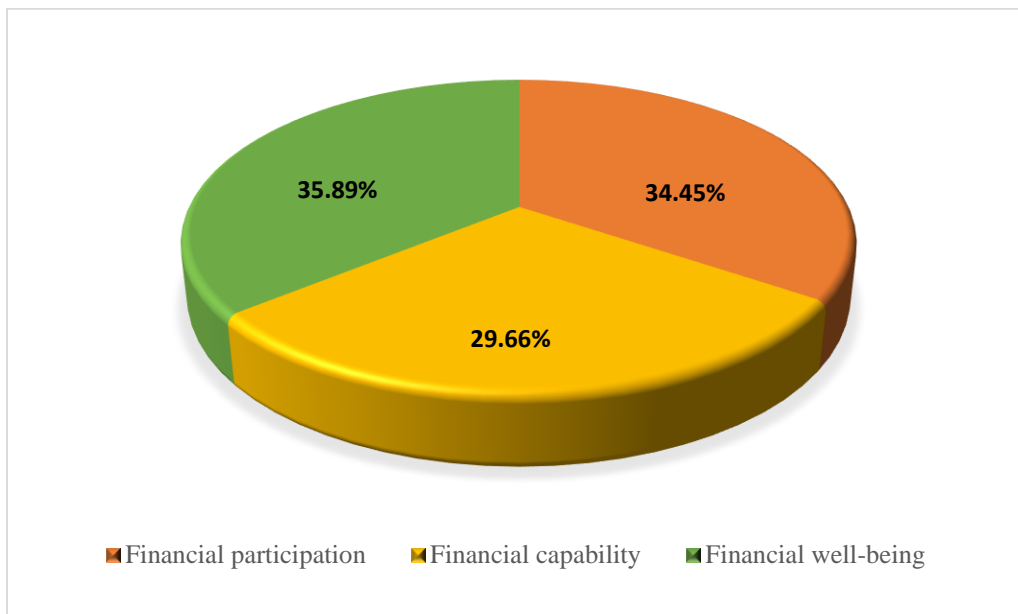


Figure 5.8: Contribution of financial inclusion domains to the financial inclusion of rural smallholder farmers

Source: Author

The results obtained from decomposing the financial inclusion domains by gender and region (Figure 5.9) show that while financial well-being contributed the most (36.25%) to the males’ level of FI, financial participation contributed the most (35.27%) for the females. Similarly, even though financial well-being contributed the most, across the regions, an exception was the South East zone, where financial participation contributed the most (35.71%). The main similarity between gender and geographical location was that financial capability contributed the least to the level of FI. However, regional differences in the contributions of the three domains of FI show that average contributions of financial capability in the northern zones (30.73%) were greater than in the southern zones (28.87%). Conversely, the average contributions of the financial participation and financial well-being domains were higher in the

southern zones (34.69% and 36.45%) than in the northern zones (33.78% and 35.49%), respectively.

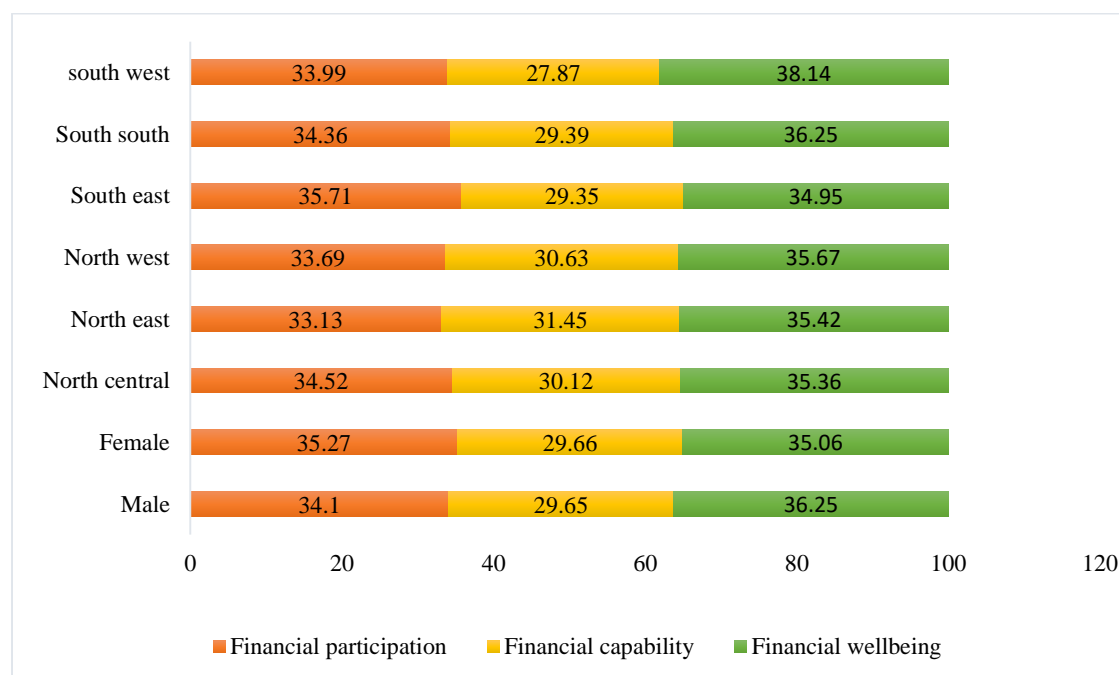


Figure 5.9: Contribution of the financial inclusion domains by population subgroups

Source: Author

5.7 ESTIMATES OF THE MULTIDIMENSIONAL FINANCIAL INCLUSION INDEX AT ALTERNATIVE ADEQUACY THRESHOLDS

This section presents the results obtained from constructing the multidimensional financial inclusion index at alternative adequacy thresholds $f_k \geq 0.55$ (lower bound) and $f_k \geq 0.77$ (upper bound). The results reflected in Table 5.11 show that although less than one-third (27.07%) of rural smallholder farmers had access to formal services, a greater proportion (41.56%) were financially adequate at the lower bound, compared with 22.08% at the upper bound. Furthermore, rural smallholder farmers who were financially included had an incidence of 26.52% and intensity of 84.47% at lower bound. At the upper bound, financially included rural smallholder farmers had an incidence of 21.15% and, on average, had attained adequate achievements in 89.50% of the 3DFI. This implies that, for rural smallholder farmers who had adequate achievements in at least 55% of the weighted FI indicators, the majority were financially adequate, but had less access to formal services. It is also further implied that, for those who had adequate achievements in at least 77% of the weighted FI indicators, a larger proportion had access to formal services, but were less financially adequate. However, the

upper and lower bound estimates indicate that rural smallholder farmers had MFII values ranging from 0.19 to 0.22, whereas those financially excluded had values ranging from 0.78 to 0.81, respectively. This implies that rural smallholder farmers in Nigeria consistently have a high financial exclusion rate, irrespective of changes in adequacy thresholds.

Table 5.11: Estimates of the multidimensional financial inclusion index at alternative adequacy thresholds

Indicators	Lower bound estimates	Upper bound estimates
Formal access	0.2707	0.2707
Financial adequacy	0.4156	0.2208
Incidence of financial inclusion	0.2656	0.2115
Intensity of financial inclusion	0.8447	0.8950
MFII	0.2243	0.1893
1 – MFII	0.7757	0.8107

Source: Author

5.7.1 Sensitivity of the levels of financial inclusion to changes in financial inclusion adequacy

This section presents the results regarding the sensitivity of levels of financial inclusion of rural smallholder farmers to alterations in financial inclusion adequacy at $f_k \geq 0.55$ and $f_k \geq 0.77$. These results are compared with the initial adequacy threshold at $f_k \geq 0.66$. The results (Table 5.12) show that rural male smallholder farmers had a censored financial inclusion headcount ratio (Ch_{FI}) of 31%, with an average adequacy score (A_{FI}) of 85%, thereby gaining a multidimensional financial inclusion index of 0.26. However, at the upper bound, the males had a censored financial inclusion head count ratio of 24%, with an average adequacy score of 90%, thereby gaining an MFII value of 0.22. Conversely, rural female smallholder farmers had a censored financial inclusion headcount ratio of 20%, with an average adequacy score of 84% at the lower adequacy threshold, and Ch_{FI} of 16% and A_{FI} of 89% at the upper adequacy threshold. As a result, the MFII values of the female rural smallholders were 0.17 and 0.15 at the upper and lower bounds, respectively.

Table 5.12: Sensitivity of the levels of financial inclusion to changes in financial inclusion adequacy

Gender	$f_k \geq 0.55$					$f_k \geq 0.66$					$f_k \geq 0.77$				
	MFII	Rank	Ch_{FI}	A_{FI}	C_MFII	MFII	Rank	Ch_{FI}	A_{FI}	C_MFII	MFII	Rank	Ch_{FI}	A_{FI}	C_MFII
Male	0.261	1	0.31	0.85	0.157	0.256	1	0.30	0.85	0.154	0.218	1	0.24	0.90	0.132
Female	0.169	2	0.20	0.84	0.067	0.164	2	0.19	0.86	0.065	0.145	2	0.16	0.89	0.058
Region															
NC	0.206	4	0.24	0.85	0.058	0.202	4	0.23	0.86	0.057	0.178	3	0.20	0.90	0.050
NE	0.091	6	0.11	0.82	0.012	0.089	6	0.11	0.83	0.011	0.081	6	0.10	0.85	0.010
NW	0.092	5	0.10	0.91	0.019	0.092	5	0.10	0.91	0.019	0.083	5	0.09	0.95	0.017
SE	0.290	2	0.34	0.86	0.033	0.281	2	0.32	0.88	0.032	0.250	2	0.27	0.91	0.029
SS	0.455	1	0.54	0.84	0.082	0.447	1	0.53	0.84	0.081	0.380	1	0.43	0.88	0.068
SW	0.233	3	0.29	0.80	0.020	0.220	3	0.27	0.82	0.019	0.166	4	0.19	0.89	0.014
Pooled MFII			0.2243			0.2193			0.1893						

Source: Author

Comparing the results across the three adequacy thresholds (including the base threshold) indicates that rural male smallholder farmers consistently had a higher level of FI and contribution to the aggregate multidimensional financial inclusion index (C_MFII) than their female counterparts did, as rankings were unaltered. As stated earlier, a result from a sensitivity analysis is termed “robust” if the rankings at alternative thresholds remain unchanged (Alkire and Santos, 2010; Ryan and Leibbrandt, 2015). These findings therefore imply that the MFII estimates indicating the levels of FI by gender are robust to changes in adequacy thresholds. This further validates the tested hypothesis of this study that male rural smallholder farmers have higher levels of financial inclusion compared with females. Results from decomposing the MFII by the six geographical location indicate that rankings remained unchanged when estimates of the lower bound ($f_k \geq 0.55$) were compared with the base threshold ($f_k \geq 0.66$). Similarly, the rankings remained unaltered for most comparisons between the base threshold and upper bound ($f_k \geq 0.77$) estimates, except for the South West and the North Central region that switched ranks at 3rd and 4th positions by a difference of 0.012 in MFII values. The results imply that one population subgroup of the rural smallholder farmers was not ambiguously more or less financially included than the other, irrespective of changes in adequacy at $f_k \geq 0.55$; ≥ 0.66 and ≥ 0.77 .

5.7.2 Sensitivity of the contributions of financial inclusion indicators to changes in financial inclusion adequacy

The sensitivity of the contributions of FI indicators to changes in financial inclusion adequacy is further assessed at adequacy thresholds $f_k \geq 0.55$; ≥ 0.66 and ≥ 0.77 . The MFII's computed at the lower and upper bounds were decomposed by computing the censored headcount ratio of the FI indicators and contributions to the levels of FI. The results (Table 5.13) were compared with those obtained at $f_k \geq 0.66$, which is the base adequacy threshold for this study. The findings (Table 5.13) show that the censored head count ratio (Ch_{FI}) for each FI indicator and contributions to MFII (C_MFII) decreased with higher adequacy thresholds. The proportion of financially included rural smallholder farmers who were adequate in the financial participation domain ranged from 26.56% to 21.15% for formal access, 23.64% to 19.81% for usage, and 19.73% to 17.48% for those who did not encounter barriers.

Table 5.13: Sensitivity of the contributions of financial inclusion indicators to changes in financial inclusion adequacy

Domains of FI	Indicators	$f_k \geq 0.55$			$f_k \geq 0.66$			$f_k \geq 0.77$		
		Ch_{FI}	C_MFII	Rank	Ch_{FI}	C_MFII	Rank	Ch_{FI}	C_MFII	Rank
Financial participation	Access	0.2656	0.0295	1	0.2565	0.0285	1	0.2115	0.0235	1
	Usage	0.2364	0.0263	4	0.2311	0.0257	4	0.1981	0.0220	4
	No barrier	0.1973	0.0219	8	0.1923	0.0214	8	0.1748	0.0194	7
Financial capability	Financial literacy	0.2119	0.0235	6	0.2111	0.0235	6	0.1883	0.0209	5
	Financial planning	0.1770	0.0197	9	0.1760	0.0196	9	0.165	0.0183	9
	Consumer protection	0.2026	0.0225	7	0.1983	0.0220	7	0.1746	0.0194	7
Financial wellbeing	Control over finance	0.2622	0.0291	2	0.2530	0.0281	2	0.2101	0.0233	2
	Financial resilience	0.2212	0.0246	5	0.2171	0.0241	5	0.1825	0.0203	6
	Financial situation	0.2453	0.0273	3	0.2383	0.0265	3	0.1989	0.0221	3
	Pooled MFII		0.2243			0.2193			0.1893	

Source: Author

Furthermore, the financially included rural smallholder farmers had a censored head count ratio ranging from 21.19% to 18.83% for financial literacy, 17.70% to 16.50% for financial planning, and 20.26% to 17.46% for consumer protection in the financial capability domain. For the financial well-being domain, the censored head count ratio of rural smallholder farmers ranged from 26.22% to 21.01% for control over finance, 22.12% to 18.25% for financial resilience, and 24.53% to 19.89% for financial situation. However, the censored headcount ratio across the alternative adequacy thresholds reveals that having access to financial services, followed by control over finance, contributed a greater proportion to the levels of FI of the rural smallholder farmers, while the financial planning indicator contributed the least. Furthermore, the rankings of the nine FI indicators remained unchanged when comparing the lower bound ($f_k \geq 0.55$) with the base threshold ($f_k \geq 0.66$). However, the results obtained from comparing the base threshold with $f_k \geq 0.77$ reveal that the rankings also remained unchanged for most comparisons, except for a change of positions among three indicators. The rank of financial resilience changed from 5th to 6th, that of no barrier changed from 8th to 7th, and the rank of financial literacy changed from 5th to 6th.

5.7.3 Rank robustness check of the sensitivity of financial inclusion indicator estimates

The results of the Kendall tau-b rank correlation coefficients (Table 5.14), obtained from comparing the base threshold with the lower bound ($f_k \geq 0.66$ vs. $f_k \geq 0.55$), show that rank coefficients ranged from 0.96 to 0.99 for all nine FI indicators. However, the coefficients ranged from 0.90 to 0.96 for all nine FI indicators when the base threshold was compared with the upper bound ($f_k \geq 0.66$ vs. $f_k \geq 0.77$). Although the results show that higher rank coefficients were obtained in the former comparison case than in the latter, not less than 0.90 was obtained across alternative thresholds. While a rank coefficient of one indicates a perfect positive relationship between the ranks obtained at the alternative adequacy thresholds, Alkire et al. (2015) opined that rank coefficients estimated from alternate thresholds should be steady enough not to deviate too far from the value of one. Therefore, this study concludes that the results obtained from computing the MFII are stable enough to inform policy interventions in enhancing the FI of rural smallholder farmers in Nigeria.

Table 5.14: Rank robustness check of the sensitivity of financial inclusion indicator estimates

Domains of FI	Indicators	Kendall Tau-b rank coefficient	
		$fI_k \geq 0.66$	$fI_k \geq 0.66$
		Vs.	Vs.
		$fI_k \geq 0.55$	$fI_k \geq 0.77$
Financial participation	Access	0.9602	0.8972
	Usage	0.9727	0.9302
	No barrier	0.9774	0.9385
Financial capability	Financial literacy	0.9940	0.9592
	Financial planning	0.9929	0.9568
	Consumer protection	0.9799	0.9073
Financial well-being	Control over finance	0.9596	0.9007
	Financial resilience	0.9806	0.9196
	Financial situation	0.9659	0.9132

Source: Author

5.8 POLICY IMPLICATIONS OF FINDINGS

The financial inclusion of rural smallholder farmers is important for promoting inclusive agricultural and rural economic development. However, as emphasised earlier, this study suggests that defining what is specifically measured as FI is also crucial for accurately informing policy intended to optimise the potential of FI. Estimates of the multidimensional financial inclusion index provide insights into understanding the state of the FI of rural smallholder farmers in Nigeria, and further indicate areas for policy interventions. This section therefore discusses the policy implications of the findings obtained from constructing the multidimensional financial inclusion index.

- 1. If the policy goal is to increase financial inclusion of rural smallholder farmers in Nigeria, then findings suggest it is important that FI policy efforts ensure that in addition to having access, rural smallholder farmers are financially adequate.**

Estimates of the multidimensional inclusion index (MFII) indicate that rural smallholder farmers in Nigeria have a low financial inclusion rate. Moreover, not all rural smallholders who have access to finance in a regulated system are financially

adequate. The findings in this study suggest that having formal access to finance is not significantly the same as having financial inclusion. Therefore, if the policy goal is to optimise the financial inclusion of rural smallholder farmers, then the results of this study indicate that it is important that policy interventions be made to address the gaps between formal access and financial adequacy of rural smallholders in a regulated financial system. The findings further suggest that it is important that FI stakeholders do not conclude too quickly that rural smallholder farmers are financially better off once they own a formal account to access financial services. Instead, the results suggest the need for FI policy efforts to be made to ensure that rural smallholder farmers are financially adequate for achieving their potentials, in addition to having access.

- 2. If the policy goal is aimed at closing disparity in financial inclusion for inclusive development, then results suggest that reliance on aggregated country level financial inclusion estimates and common policy interventions could be misleading and widen gender and regional disparities.**

National aggregate estimates are of leading importance in informing development policy decisions. However, the results suggest that policy interventions, based on aggregates, could widen disparities if subgroups are not targeted. The findings show that significant gender and geographical variations exist in the levels of FI of rural smallholder farmers. Rural male smallholder farmers have a higher level of FI than their female counterparts do. Despite the current National Financial Inclusion strategy in Nigeria having identified gender and regional gaps, among others, for policy attention, there are no differentiated targets for smallholder farmers by gender or region. If the policy goal is aimed at closing FI gender disparity, then the results suggest the need to implement gender-differentiated policy interventions with greater emphasis on enhancing the financial inclusion of rural women smallholder farmers. The findings suggest the need to focus more on enhancing the adequacy of rural women smallholder farmers in FI indicators, such as formal access to finance, financial literacy, control over finance, and financial resilience. In addition, there is a need to increase gender awareness on the part of the males who play supportive roles in female financial inclusion and control over finance.

In addition, the country-level estimates in the national financial inclusion strategy, based on the access metric, indicated that the South West region had the highest financial inclusion rate of 82%. As a result, the region had realised the country's target of 80% inclusion rate. This contradicts the results from this study, which indicate that the South West had the lowest level of FI of rural smallholder farmers in the southern geopolitical zone. Likewise, the South South region, with the highest level of financial inclusion of rural smallholder farmers, is yet to achieve the nation's target of 80% financial inclusion. Therefore, if the goal is to achieve regional parity, then it is important that policy interventions should consider sub-national estimates of the FI state of rural smallholder farmers that are more accurate. In addition, findings suggest targeted interventions in promoting financial inclusion of rural smallholder farmers in the northern zones is due to lower adequacies in financial inclusion indicators.

- 3. If the policy goal is to modernise rural smallholder agriculture in Nigeria, then findings suggest the need for policy promoting rural youth's financial inclusion and participation in smallholder agriculture.**

The findings indicate that the South South region had the highest level of FI of rural smallholder farmers in Nigeria, also had with the highest share of the financially included rural smallholder farmers aged 15–29 years. Theory suggests that the youth are quicker to adopt innovative technologies, as compared with the older generations. The findings also indicate that the youth constitute an important segment for driving higher levels of FI among the rural smallholder farmers in Nigeria. Therefore, if theory holds, a policy for the promotion of the FI of the rural youth and their participation in smallholder agriculture would present an opportunity to transform the sector through the adoption of innovative financial services and technologies that could improve agricultural productivity.

- 4. If the policy aim is to minimise barriers faced by rural smallholder farmers in financial inclusion, then findings suggest that affordable mobile financial services have the potential to increase access to and usage of formal services.**

Evidence suggests that access to and usage of formal financial services among rural smallholder farmers in Nigeria is driven more by physical banks than by mobile money

services. However, it was observed in this study that the proportion of rural smallholder farmers who frequently use mobile money services was double the proportion of those who own a personal mobile money account. This may be because of the distances and costs of transportation faced by rural smallholder farmers in visiting physical bank branches. If so, the results suggest that mobile financial solutions may increase the usage of financial services through lower transaction costs for rural smallholder farmers in Nigeria, as compared with the costs of physical banks. Therefore, if the policy goal is to promote digital financial inclusion, the findings suggest that it is important that mobile finance solutions should be equally responsive to the needs of rural smallholder farmer subgroups so that gaps such as gender and financial literacy are addressed.

- 5. If the policy goal is aimed at sustainable multidimensional financial inclusion of rural smallholder farmers, findings suggest it is important for policy interventions to promote not only participation in formal financial systems but also strengthening financial capability and well-being in Nigeria.**

The findings show that formal access to finance, in addition to other indicators of FI (usage, consumer protection, financial literacy, no barrier, control over finance, financial planning, financial resilience and financial situation), contributed to multidimensional financial inclusion. However, the highest inadequacies of rural smallholder farmers were found in the financial planning, no barrier, consumer protection, and financial literacy indicators. Furthermore, while rural smallholder farmers in the southern zone had the highest inadequacy of FI indicators in the financial capability domain, those in the northern zone had highest inadequacies in the financial participation and financial well-being domains. Therefore, if the policy goal is to sustain the multidimensional financial inclusion of rural smallholder farmers, this study recommend that policy interventions should equally strengthen the financial *participation*, financial *capability*, and financial *well-being* of rural smallholder farmers in Nigeria.

5.9 SUMMARY

This chapter has presented the findings derived from developing a multidimensional financial inclusion index by adapting the Alkire-Foster method to measure the FI of rural smallholder farmers in Nigeria. The findings show that while bank financial institutions drive access to and use of formal services among rural smallholder farmers, the potential of mobile money service channels to enhance FI is yet to be fully tapped. Furthermore, the findings indicate that the major barriers faced by rural smallholder farmers in financial participation were high transaction costs, lack of formal identification, and distance. The results show that, although rural smallholder farmers exhibited a higher adequacy in the consumer protection indicator, poor adequacies in financial literacy and financial planning could impede the financial capability to participate in a regulated system. The findings show that the financial well-being of rural smallholder farmers is driven by a higher adequacy in control over finance, and also that lower adequacy in financial resilience could increase the vulnerability of rural smallholder farmers in Nigeria to risks and uncertainties.

The evidence noted in this study shows that rural smallholder farmers who owned only formal accounts were significantly different from those who were financially adequate. Furthermore, only 22% of rural smallholder farmers were financially included. In addition, the results indicate that significant gender and regional variations existed in the levels of financial inclusion, at 1%. The results indicate that male rural smallholder farmers have a higher level of FI than their female counterparts do. In addition, rural smallholder farmers in the SS, SE and SW zones had higher levels of financial inclusion than those in the NC, NW and NE zones. The findings show that variations in the levels of FI among population subgroups are related to specific characteristics at individual and household levels. At household level, key personal characteristics influencing variations in the levels of FI encompassed age, education and marital status, while household income, household size and poverty status also had influences at household level. The majority of the financially included rural smallholder farmers were within their active working age, and so could contribute significantly to Nigeria's economy through participation in smallholder agriculture. In addition, a higher proportion of the financially included rural female smallholders were young, married, above the poverty line, and belonged to households with smaller family sizes (1–5 persons). Compared with other characteristics, the significant association between the level of FI and education of rural

smallholder farmers in Nigeria cuts across all population groups. Moreover, the South South region, with the highest level of FI, also had the highest proportion of financially included rural smallholder farmers who had attained secondary or university education, and were mostly youths.

Findings from the aggregate contributions of financial inclusion indicators show that the highest inadequacies of rural smallholder farmers were found in the results relating to the financial planning, no barriers, consumer protection and financial literacy indicators. However, the highest gender differences were found in financial resilience, control over finance, and formal access. Regarding the contribution of the FI indicators by geographical location, the findings show that the contributions of the access, usage, consumer protection and financial planning indicators were lowest in the North West zone. However, the contributions of financial resilience, financial situation, financial literacy, no barrier and control over finance indicators were lowest in the North East zone. Furthermore, the SS, SE, SW and NC zones consistently ranked first, second, third and fourth, respectively, in the contributions of eight out of nine FI indicators. Except in the South South zone, the financial planning indicator contributed more to the levels of FI in the North Central zone, relative to the South East or South West zones. The aggregated result of the three domains of FI show that financial capability made the lowest contribution to the financial inclusion of rural smallholder farmers in Nigeria. The results of the sensitivity analysis to changes in financial inclusion adequacy show that the MFII estimates are robust in informing FI policy interventions for rural smallholder farmers in Nigeria.

In conclusion, this study notes that the major policy implications of the findings indicate that owning a formal account is only one of the integral components of financial inclusion, among other components, and should not be seen as a substitute for other FI indicators in policy interventions. If the policy goal is to increase and sustain the FI of rural smallholder farmers in Nigeria, then it is important that policy interventions should promote not only participation in formal financial systems, but also the strengthening of financial capabilities and financial well-being. Furthermore, if the policy goal is to address gender disparity, then it is important that policy interventions should promote the FI of rural women smallholder farmers. Moreover, if the policy goal is to address regional disparity, then the findings suggest that targeted interventions are more likely to succeed if they are based on the true FI state of rural

smallholders in each region, rather than being common interventions based on aggregated national assessments. The findings suggest that policy interventions which promote rural youth FI and participation in smallholder agriculture could drive higher levels of FI in Nigeria's smallholder agriculture, and help to transform the sector through the adoption of innovative technologies. Moreover, affordable digital financial solutions have the potential to minimise the barriers faced by rural smallholder farmers in Nigeria's financial inclusion.

CHAPTER 6: IMPACT OF FINANCIAL INCLUSION ON THE LIVELIHOODS OF RURAL SMALLHOLDER FARMERS IN NIGERIA

6.1 INTRODUCTION

This chapter discusses findings from the impact analysis of financial inclusion on the livelihood strategies of rural smallholder farmers in Nigeria by using a propensity score matching model. To this effect, the chapter is organised into seven sections. The next section presents findings derived from comparing the pre-treatment characteristics of the treatment group (financially included) and control group (financially excluded) of rural smallholder farmers. Section 6.3 then proceeds to present findings from the descriptive analysis of rural smallholder farmers by livelihood strategies. Section 6.4 presents the propensity score estimates obtained by using the logit regression model. This is followed by a description of findings on the selection of the most appropriate algorithm to match the treated and control groups, based on similar pre-treatment characteristics, through using the estimated propensity scores. Results of the matching quality, based on the mean standardised bias, pseudo R^2 , t-test and joint significance, are also presented. The chapter then presents a description of the impacts of FI, based on findings derived from estimating the average treatment effect on the treated (ATT), in addition to the sensitivity and robustness of the significant estimated impact. Finally, the chapter concludes by summarising findings from the impact analysis and further discusses their implications for policy interventions aimed at improving the livelihoods of rural smallholder farmers in Nigeria. The study hypothesises that financial inclusion increases diversification among rural smallholder farmers in Nigeria through engagement in both farm and non-farm income sources.

6.2 DESCRIPTION OF RURAL SMALLHOLDER FARMERS BY PRE-TREATMENT CHARACTERISTICS

This section presents the results of the descriptive analysis of rural smallholder farmers by pre-treatment characteristics. The findings (Table 6.1) indicate that males constituted a higher proportion (60.36%) of rural smallholder farmers than females did (39.64%).

Table 6.1: Description of rural smallholder farmers by pre-treatment characteristics

Variables	Financially included	Financially excluded	X² statistic	P – values	Pooled sample
Categorical variables					
Gender (male = 1; female = 0)	29.97 (416)	70.03 (972)	9.29***	0.002	60.36 (1,388)
Marital status (married and cohabiting = 1; 0 = otherwise)	24.57 (417)	75.43 (1,282)	0.47	0.492	73.88 (1,699)
Primary education (1 = yes; 0 = no)	21.92 (74)	78.08 (264)	1.27	0.259	14.71 (338)
Secondary education (1 = yes; 0 = no)	43.50 (212)	56.50 (276)	20.52***	0.000	21.21 (488)
University education (1 = yes; 0 = no)	86.24 (31)	13.76 (5)	53.12***	0.000	1.55 (36)
Membership of association (1 = yes; 0 = no)	27.21 (563)	72.79 (1,508)	15.28***	0.000	90.06 (2,071)
Ownership of mobile phone (1 = yes; 0 = no)	36.88 (523)	63.12 (895)	99.68***	0.000	61.68 (1,418)
Geographical location (1 = southern zones; 0 = northern zones)	40.80 (357)	59.20 (518)	44.29***	0.000	38.04 (875)
Continuous variables			T-test		
Age (years)	38.06 (1,789)	37.76 (511)	0.30	0.831	37.84 (2,300)
Household size (number)	6.01 (1,789)	6.35 (511)	-0.34	0.364	6.26 (2,300)
Farm size owned (hectares)	1.68 (1,789)	1.62 (511)	0.06	0.655	1.64 (2,300)

Source: Author

Notes: Values indicated for categorical variables are the weighted percent and pooled sample size of respondents, having a value of one. Values indicated for continuous variables are the weighted mean and pooled sample size of all respondents in the study. Figures in parentheses are the number of observations.

, ** and * indicate significance levels at 10%, 5% and 1% respectively.*

Moreover, the majority of the males (90.06%) were found to be members of at least one association, which implies the existence of strong social networks among rural smallholder farmers in Nigeria. According to Matuschke (2008), social networking can influence learning

and the adoption and usage of innovations among groups in the rural areas. In terms of educational level, the study found that about 14.71% of rural smallholder farmers had completed primary education, while a higher percentage (21.21%) had completed secondary education, and only 1.55% had completed university education.

The Central Bank of Nigeria (2015b) has indicated that about 40% of Nigerians, belonging to the segment with the lowest financial capability score, participated mostly in smallholder agriculture. The findings from this study now suggest that the poor educational levels of rural smallholder farmers in Nigeria, coupled with low levels of financial literacy, may affect their financial capability in the process of attaining financial inclusion. The findings also indicate that more than half of the sampled population of rural smallholder farmers owned mobile phones (61.68%), and about 38.04% were located in the southern geographical zones. Furthermore, findings from this study indicate that rural smallholder farmers in Nigeria had an average age of 38 years, with a mean household size of six persons and ownership of an average size of approximately two hectares of farmland. A comparison of the treated and control groups shows that those rural smallholder farmers who were financially included were not statistically different from those financially excluded, with regard to marital status, primary education, age, household size and farm size. However, significant differences were observed in the following characteristics: gender, membership of association, secondary and university education, ownership of mobile phone, and geographical locations, at 1%. The results imply that although the two groups of rural smallholder farmers exhibited similarities across certain characteristics, some initial bias may exist across other pre-treatment variables, with significant differences before matching.

6.3 DESCRIPTION OF RURAL SMALLHOLDER FARMERS BY LIVELIHOOD STRATEGIES

The results (Table 6.2) show that the major livelihood strategies of rural smallholder farmers in Nigeria involved engagement in crops (78.34%), livestock (37.94%), running own business (26.47%), and remittances (23.87). However, income generation from earning wages (15.20%), receiving a grant, pension, allowances or subsidy (0.96%), and transportation (0.30%) constituted the lowest ranked of their livelihood strategies.

Table 6.2: Description of rural smallholder farmers by income sources

Income sources	Variable description	Frequency	Percent
Crop income Source	Income generation from producing crops, fruits or vegetables and selling the produce	1,802	78.34
Livestock income source	Income generation from livestock, poultry, fish, or bee production and selling the same or by-products	873	37.94
Earning wages	Income generation from earning wages or salaries from regular jobs, occasional jobs or irregular paid jobs or labour for hire	350	15.20
Running own business	Running own business in retail, manufacturing or service provision	609	26.47
Remittances	Receiving money from friends or family or income generation derived from remittances or other help from friends or family	549	23.87
Other income sources	Generating income from receiving a grant, pension, stipend/allowances or subsidy	22	0.96
	Income generation from transport / Okada	7	0.30
Household monthly income (Naira)		Mean	Std.
		45,912.53	61,310.07

Source: Author

While multiple responses about livelihood strategies of rural smallholder farmers in Nigeria are initially presented in Table 6.2, their subsequent categorisation into three income sources (Figure 6.1) indicates that specialisation in farm income constituted the highest proportion (43.5%), followed by dependence on both farm and non-farm income sources (39.20%), while only 14.42% accounted for dependence on non-farm income sources. Although reasons for generating income from sources other than farming were not provided at the time of survey, it is known that most rural smallholder farmers practise subsistence farming and are dependent on rain-fed agriculture (AGRA, 2017). This may increase their exposure to climate and economic shocks. As a result, it is possible that rural smallholder farmers might be able to earn income only from non-farm income sources during times when agricultural activities return low yields. Such situations may lead to a necessity to consume all farm outputs, with the resulting possibility that smallholder farmers would be left with almost nothing to sell to earn farm income. In support of this view, AGRA (2016) have indicated that some smallholder

farmers may partake in both farm and non-farm income sources to make the best use of economic opportunities. Furthermore, Rapsomanikis (2015) indicated that the livelihoods of rural smallholder farmers hinge on their choice of capital allocation between farm and non-farm income sources, based on their economic situation and/or challenges faced at a difficult time in making the highest possible income.

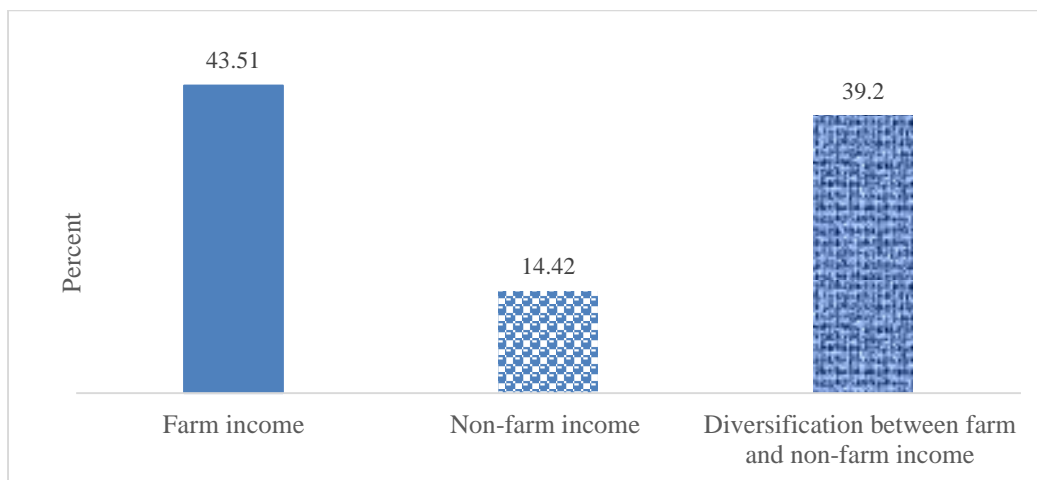


Figure 6.1: Distribution of rural smallholder farmers in Nigeria by income sources

Source: Author

6.4 ESTIMATION OF PROPENSITY SCORES USING THE LOGIT MODEL

The logit regression model was used to determine the propensity scores to match the financially included and financially excluded rural smallholder farmers. Findings from the model estimation also show the factors influencing the likelihood of financial inclusion. The results (Table 6.3) show that the estimated regression had a percent correct prediction of 80.04% of the sample of rural smallholder farmers, which indicates confirmation of the estimated model's goodness of fit. Moreover, the log likelihood ratio had a statistically significant X^2 distribution, at 1%. The results indicate that various factors, such as gender, secondary education, university education, owning a larger farm (hectares), ownership of mobile phones and geographical location, significantly influenced the likelihood of being financially included among rural smallholder farmers.

The marginal effects of gender (0.088) and farmland ownership (0.015), at 5% level of significance, suggest that the fact of being a male and owning a larger farm (in hectares) is

positively and significantly associated with the likelihood of FI. In addition, the marginal effects of secondary education (0.124), university education (0.620), ownership of mobile phones (0.234), and geographical location (0.191) show significant positive relationships with the financial inclusion of rural smallholder farmers, at 1%.

Table 6.3: Estimation of propensity score using the logit model

Variables	Coefficient	S.E.	Z	P > z	Marginal effect
Gender (1 = male; 0 = female)	0.574**	0.224	2.57	0.010	0.088
Age (years)	0.003	0.007	0.05	0.959	0.000
Marital status (1 = married; 0 = otherwise)	0.136	0.249	0.55	0.585	0.021
Primary education (1 = yes; 0 = no)	-0.068	0.259	-0.26	0.792	-0.011
Secondary education (1 = yes; 0 = no)	0.697***	0.263	2.65	0.008	0.124
University education (1 = yes; 0 = no)	2.897***	0.582	4.98	0.000	0.620
Membership of association (1 = yes; 0 = no)	0.146	0.315	0.46	0.643	0.022
Household size (number of persons)	0.005	0.033	0.14	0.887	0.001
Farm land ownership (hectare)	0.097**	0.049	1.98	0.048	0.015
Ownership of mobile phone (1 = yes; 0 = no)	1.634***	0.214	7.64	0.000	0.234
Geographical location (1 = southern zone; 0 = northern zone)	1.113***	0.238	4.67	0.000	0.191
Constant	-3.783***	0.440	-8.60	0.000	
Chi ² statistic	157.02***				
Log likelihood	-1000.74				
Pseudo R ²	0.191				
No. of obs.	2300				
% of correctly predicted sample	80.04				

Source: Author

***, **, * indicate significance levels at 1%, 5%, and 10%, respectively.

The positive significance of gender could be attributed to the fact reported by Adegbite and Machethe (2020) that male smallholder farmers in Nigeria have greater control of resources and face less institutional discrimination than females do, which enables them to gain greater access to formal financial services. Regarding education, the positive significant influence of secondary and university education could arise because, as past studies have found, education level influences financial literacy and readiness to access, adopt or use formal financial

services, which comprise a vital part of financial inclusion (Divya, 2014). Notably, the positive significance of mobile phone ownership could be accounted for by the observation made by Klapper et al. (2019) that having a mobile phone had the potential to transform the traditional ways to access and use financial services through digital financial inclusion. Despite this, Anderson et al. (2017) indicate that most smallholders are yet to fully explore the possibilities of having a mobile phone, as the greatest use (98%) was found in calling families and friends, compared with only 6% usage for financial transactions.

The positive significance of farmland ownership could arise because land ownership with tenure rights in Nigeria is considered to be the most satisfactory form of security for obtaining formal loans from financial institutions such as banks (Adegbite and Machethe, 2020). Therefore, this result is not surprising, as earlier findings from this study show that bank financial institutions are the major drivers of rural smallholder farmers' access to formal financial services. The positive significance of location in southern Nigeria could occur because the southern geopolitical zone is related with a lower level of rural poverty, compared with the northern zone (Obayelu, 2014). Equally important, Adelaja et al. (2019) have indicated that the southern region in Nigeria had higher access to infrastructure such as electricity and to digital technologies such as mobile phones and the internet, as compared with the northern region.

Other variables, such as age, marital status, membership of association, household size and primary education, were found to insignificantly predict the likelihood of the financial inclusion a rural smallholder farmer. Notwithstanding this, these factors exhibited a positive relationship, with the exception of primary education that had a negative relationship. In conclusion, the highest positive marginal effects of university education and mobile phone ownership suggest the potential of literacy and digital financial services for promoting financial inclusion among rural smallholder farmers in Nigeria. The lowest positive marginal effect in farmland ownership suggests that the importance of land alone as collateral for financial services may be dwindling as financial institutions begin to accept more diversified forms of collateral.

6.5 SELECTION OF PROPENSITY SCORE MATCHING ALGORITHM AND ASSESSMENT OF COVARIATE BALANCE

This section presents findings from testing three algorithms: nearest neighbour matching, caliper matching, and kernel matching. The essence is to allow the data to determine the most appropriate algorithm for matching the propensity scores of financially included and excluded groups of rural smallholder farmers. Doing this would help in achieving the best balancing of covariates, based on the data rather than a pre-selection of matching algorithm. Therefore, the nearest neighbour matching without replacement is specified at 1:1, 1:2 and 1:4 matches; the caliper matching is specified at radiuses 0.08, 0.1 and 0.2; and the kernel matching at bandwidths 0.08, 0.1 and 0.2.

The findings (Table 6.4) show that the kernel matching at bandwidth 0.08 yielded the best matching result between the treated and control groups of rural smallholder farmers compared to the nearest neighbour and caliper matching estimates. The selection was based on the algorithm estimates that removed all pre-existing significant differences between the financially included and excluded groups after matching. Besides, any observed residual significant difference implied matching on similar observable covariates could not be successful. Findings show that all existing significant differences between the treated and control groups were removed for all matching algorithms specified except kernel matching at bandwidth 0.2 (Appendix 3). Further criteria for selection depended on the algorithm that yielded estimates with a low pseudo R^2 , high size of matched sample, low mean standardized bias (SB) and joint insignificance after matching as compared to the before matching estimates (Caliendo and Kopeinig, 2008; Haji and Legesse, 2017).

Table 6.4: Selection of PSM algorithm and assessment of covariate balance

PSM algorithm	No of insignificant variables	Pseudo R ²	Matched Sample size	Mean SB	LR test
Nearest Neighbour matching					
NNM (1) without replacement	11	0.004	501	3.3	5.18 (0.922)
NNM (2) without replacement	11	0.002	501	2.1	2.48 (0.996)
NNM(4) without replacement	11	0.002	501	2.7	2.73 (0.994)
Caliper matching					
Radius (0.08)	11	0.004	501	3.3	5.18 (0.922)
Radius (0.1)	11	0.004	501	3.3	5.18 (0.922)
Radius (0.2)	11	0.004	501	3.3	5.18 (0.922)
Kernel matching					
Bandwidth (0.08)	11	0.001	501	2.1	1.66 (0.999)
Bandwidth (0.1)	11	0.001	501	2.2	1.91 (0.999)
Bandwidth (0.2)	10	0.008	501	4.9	11.02 (0.441)

Source: Author

Note: Figures in parentheses are the likelihood ratio (LR) chi-square p-values.

The results of the kernel matching estimates at bandwidth 0.08 show insignificant differences in all 11 observed covariates between the financially included and excluded groups after matching, as compared with the six variables found significantly different before matching.

This covariate balancing property satisfies the conditional independence assumption such that rural smallholder farmers having similar observed values have a likelihood of being both financially included and excluded, as the expected outcome is independent of treatment assignment. Furthermore, a lowest pseudo R² of 0.001, mean bias of 2.1, high matched sample (501), and joint insignificance of likelihood ratio, indicated by LR chi² value of 1.66 ($p > \chi^2 = 0.999$), was achieved with the kernel matching algorithm. The best performance of kernel matching could be attributed to the fact that the algorithm utilised the weighted mean of all control observations to construct a counterfactual outcome of a treatment unit, unlike the nearest neighbour and caliper matching. Therefore, the kernel matching utilised more

observations to balance the treated and control groups, thereby achieving a smaller variance and mean bias (Michalek, 2012). Selecting the kernel matching algorithm, at bandwidth 0.08, therefore implies that the process of matching the financially included and financially excluded rural smallholder farmers, based on propensity score estimates, is delimited to a common support region, defined by bandwidth 0.08.

A graphical presentation of the density distribution of estimated propensity scores between the treated (financially included) and untreated (financially excluded) groups, revealing the common support region, is presented in Figure 6.2.

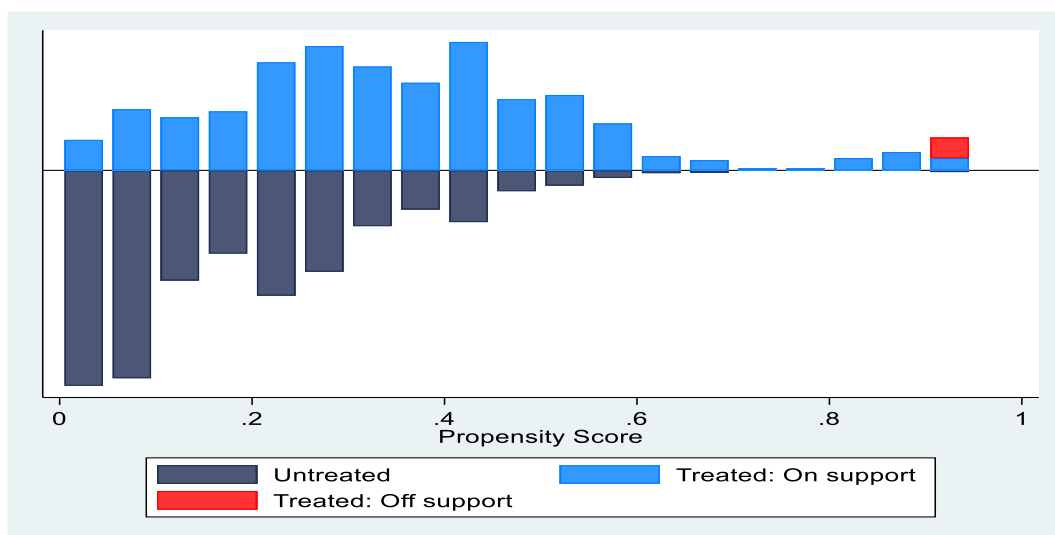


Figure 6.2: Distribution of propensity scores and common support region

Source: Author

The common support condition was achieved based on the propensity score distribution of a matched sample size of 501 rural smallholder farmers. Although a total of 2,290 out of 2,300 observations were on support, the overlap condition ensured that only the subgroup of the financially excluded (untreated) rural smallholder farmers, which was similar to those financially included (treated) in observable characteristics, was utilised to avoid estimating the impact of financial inclusion in isolation.

6.6 IMPACT OF FINANCIAL INCLUSION ON THE LIVELIHOOD STRATEGIES OF RURAL SMALLHOLDER FARMERS

This section presents findings from estimating the average treatment effect on the treated (ATT) to determine the impact of financial inclusion on the income sources of rural smallholder farmers in Nigeria. After controlling for all pre-treatment observable characteristics that are correlated with financial inclusion and the livelihood strategies of rural smallholder farmers, the difference in the ATT of the treated and control groups can be ascribed to the impact of FI. The results (Table 6.5) show that FI significantly reduced the farm income sources of the financially included rural smallholder farmers, as compared with those financially excluded, by 37.58% ($\text{ATT (Difference)} / \text{ATT (control)} \times 100$). Conversely, the non-farm income sources of those financially included increased by 34.51%, as compared with those financially excluded, at 10% significance level. This supports the findings of Davis et al. (2017) that the dependence of rural families on farm income sources in African countries like Nigeria was dwindling and being substituted with non-farm income sources. Although the previous evidence in their study was not linked with financial inclusion, Bezu and Barrett (2012) indicated that rural households with greater capabilities to borrow money and accumulate savings and capital were more likely to partake in high-value non-farm income generating sources. Further results indicate that FI exhibited a statistically significant positive influence, at 1%, on income diversification between farm and non-farm sources, as postulated by this study. Moreover, the engagement of the financially included rural smallholder farmers in both farm and non-farm income activities significantly increased by 32.45%, compared with those who were financially excluded.

Table 6.5: Impact of financial inclusion on the livelihood strategies of rural smallholder farmers

Income sources	Sample	Treated	Control	Difference	Std. Error	T-stat
Farm income	Unmatched	0.290	0.470	-0.180	0.025	-7.33***
	ATT	0.293	0.471	-0.177	0.028	-6.22***
Non-farm income	Unmatched	0.149	0.157	-0.008	0.018	-0.46
	ATT	0.152	0.113	0.039	0.022	1.80*
Diversification of farm and non-farm income	Unmatched	0.558	0.372	0.186	0.024	7.62***
	ATT	0.551	0.416	0.135	0.029	4.60***

Source: Author

Notes: ***, * indicate significance levels at 1% and 10% respectively.

It is likely to be assumed that the engagement of rural smallholder farmers in both farm and non-farm income activities in Nigeria may have a negative effect on agricultural productivity. However, Babatunde (2015) found that income diversification complemented farm income through the investment of non-farm incomes in agricultural activities. In support of this, Adjognon et al. (2017) indicated that financial services such as loans taken up by farmers were mostly used to finance non-farm start-ups, the income from which would be invested in financing agricultural activities, including purchasing farm inputs. The diversification of income sources among rural households could, therefore, facilitate agribusiness development, better integration of agricultural and non-agricultural sectors to promote rural industrialisation, and could provide an alternative to reducing rural–urban labour migration (FAO IFAD IOM WFP, 2018). According to AGRA (2016), smallholder farmers require complementary and unified investments to translate into solutions that are aimed at increasing incomes that would reduce poverty. Moreover, Daud et al. (2018) indicated that income diversification significantly increased the household income of rural farmers in Oyo state, Nigeria. Therefore, the evidence from this study suggests that increasing diversification between farm and non-farm income activities could provide a pathway through which financial inclusion would exhibit its poverty-reducing potential for improving the livelihoods of rural smallholder farmers in Nigeria, as compared with farm specialisation.

6.7 SENSITIVITY AND ROBUSTNESS ANALYSIS

This section presents the results of the sensitivity and robustness analysis that used the nearest neighbour matching (2) and Rosenbaum bounds (rbounds) test. The study adopted the NNM (2) algorithm because it gave the best matching quality next to the kernel matching estimates. The results (Table 6.6) show that the direction and significance of the impact point to the same conclusion as did the estimated ATT using the kernel matching algorithm (Table 6.5 above). The findings show that the sole dependence of financially included rural smallholder farmers on farm income activities significantly reduced, compared with those financially excluded, by 40.40%. However, financial inclusion significantly increased non-farm income sources by 46.15%, and diversification between farm and non-farm income sources by 38.44%, relative to financial exclusion. This implies that the estimated impact using kernel matching at bandwidth 0.08 was less sensitive to the NNM (2) algorithm, except that higher differences in treatment effects were observed between the treated and control groups.

Table 6.6: Estimating the average treatment effect on treated using NNM (2)

Income sources	Sample	Treated	Control	Difference	Std. Error	T-stat
Farm income	Unmatched	0.290	0.470	-0.180	0.025	-7.33***
	ATT	0.293	0.500	-0.202	0.034	-5.99***
Non-farm income	Unmatched	0.149	0.157	-0.008	0.018	-0.46
	ATT	0.152	0.104	0.048	0.023	2.09**
Diversification of farm and non-farm income	Unmatched	0.558	0.372	0.186	0.024	7.62***
	ATT	0.551	0.398	0.153	0.034	4.44***

Source: Author

Notes: ***, ** & * indicate significance levels at 1%, 5% and 10% respectively.

The results of the Rosenbaum bound test are presented in Table 6.7. While the gamma critical values were estimated from 1.0 to 3.0, the p- values for the upper bound significance level (sig+) of gamma critical values are reported because the direction of the study hypothesis is positive. Findings show that the log odds of differential assignment due to unobserved factors (gamma) ranged from 1.0 to 3.0 for farm income sources, and 1.0 to 2.8 for diversification between farm and non-farm income sources. This implies that the estimated impact of FI on

farm income sources and income diversification between farm and non-farm sources was not sensitive to a bias that would increase the odds of treatment by 300% and 280%, respectively, to render the result invalid. However, the findings show less robustness to hidden bias regarding the estimated impact of FI in increasing only non-farm income sources. In conclusion, the evidence suggests that FI would significantly promote the integration of both farm and non-farm income sources among rural smallholder farmers in Nigeria, rather than a sole dependence on farm income activity.

Table 6.7: Results of the Rosenbaum bounds sensitivity analysis

Gamma Critical Values	P – values of upper bound significance level (sig+) of income sources at gamma critical values		
	Farm income (sig+)	Non-farm income (sig+)	Diversification between farm and non-farm income (sig+)
1.0	0.051	1.000	0.000
1.2	0.039	1.000	0.000
1.4	0.001	1.000	1.1e-13
1.6	2.3e-06	1.000	3.6e-10
1.8	4.0e-09	1.000	1.3e-07
2.0	3.9e-12	1.000	1.1e-05
2.2	2.4e-15	1.000	2.8e-04
2.4	0.000	1.000	0.0032
2.6	0.000	1.000	0.0194
2.8	0.000	1.000	0.0724
3.0	0.000	1.000	0.1857

Source: Author

Notes: The Gamma critical values are the log odds of differential assignment due to unobserved factors.

6.8 SUMMARY AND POLICY IMPLICATIONS

It is commonly known that rural smallholder farmers depend on agriculture, but may also diversify income to cope with maintaining livelihoods. However, it has remained unclear in policy interventions whether being financially included would prompt a rural smallholder farmer in Nigeria to specialise in farm income sources, non-farm income activities, or integrate both income sources. Therefore, this chapter has examined the impact of financial inclusion on

the livelihoods (income sources) of rural smallholder farmers in Nigeria by using the propensity score matching model.

Descriptive analysis of the pre-treatment characteristics of the financially included (treated) and financially excluded (control) groups of rural smallholder farmers indicate that significant differences do exist. This is reflected in characteristics such as gender, membership of association, secondary education, university education, ownership of mobile phone, and geographical location. However, the treated groups were insignificantly different from the control groups in terms of marital status, primary education, age, household size and farmland ownership. Furthermore, factors like gender (being a male), having secondary and or university education, owning a larger farm (hectares), mobile phone ownership and location in the southern geographical region had significant positive relationship with financial inclusion. While rural smallholder farmers in Nigeria were found to have a mean monthly household income of ₦45,912.53, descriptive analysis by livelihood strategies showed that 43.51% of the farmers specialised in farm income activities, 39.20% diversified between farm and non-farm income sources, and only 14.42% depended on non-farm income sources. The estimated propensity scores of the treated and control groups were matched by using the kernel matching algorithm at bandwidth 0.08. The findings indicate that FI significantly increased diversification between farm and non-farm income sources among rural smallholder farmers in Nigeria, which confirms the hypothesis of the study. While it is observed that non-farm income sources also increased significantly, the sole engagement of rural smallholder farmers in farm income activities reduced significantly with FI. Findings from the sensitivity analysis indicate that the estimated impact of FI on farm income sources and diversification between farm and non-farm income sources are robust to hidden bias.

This study concludes that increasing diversification between farm and non-income activities could provide a pathway through which FI could improve the livelihoods of rural smallholder farmers in Nigeria. The implication of the findings is that if policy aims at improving rural livelihoods, then it is essential that policy efforts to increase the financial inclusion of rural smallholder farmers be intensified, as this strengthens the linkage between the farm and non-farm sectors. Strengthening such linkages has been shown to be one of the most effective ways of enhancing the growth and development of a country.

CHAPTER 7: SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

7.1 INTRODUCTION

This chapter summarises the thesis. For this purpose, the chapter is organised into four main sections. To start with, a brief recap of the study background, problem statement, objectives, methods and procedures is provided. The findings of the study are then summed up. This leads to a presentation of the policy implications suggested by the findings, and a subsequent presentation of the conclusions and recommendations made by the study. Finally, the chapter and this thesis close with a recapitulation of the contributions of this study to knowledge, and indicate areas for future research.

7.2 SUMMARY OF THE THESIS

7.2.1 Study background and problem statement

Agriculture in Nigeria is mainly driven by rural smallholder farmers who, despite being poor, are burdened with the nation's agricultural transformation for attaining food security and other sustainable goals. With over half of the country's population living in rural areas and mostly relying on agriculture as a means to survive, smallholder agriculture plays a central role in Nigeria's rural livelihood and economic development. However, limited financial resources place a major constraint upon the key resources required to achieve sustainable outcomes. Although unregulated informal financial service providers such as moneylenders are common in rural areas, most rural smallholder farmers are still unable to cope with the financial requirements to sustain agriculture and livelihoods. As a result, the majority are limited in their abilities to achieve smooth consumption, accumulate capital, manage risks, and invest in economic opportunities that could increase income to alleviate poverty. Nigeria became a signatory to the Maya Declaration in 2011, pledging to increase the rate of FI to 80% by 2020. Since then, policy plans have been and are being implemented to ensure that everyone, especially those who are financially marginalised, have equal opportunities to financial resources required to attain their life potentials in a regulated economy. Given the role of rural smallholder farmers in Nigeria's economy and the potential of FI for facilitating an inclusive

and sustainable economic development, this study develops and explores a better measure of financial inclusion of rural smallholder farmers in Nigeria.

Most previous studies have measured FI based on access to formal finance or bank account ownership, despite the increasing recognition of the multidimensional nature of FI that is currently receiving attention for policy development. The few existing advanced multidimensional measures of FI were evaluated in the past at the macro level, mostly based on data from financial service providers. Moreover, most previous analyses were not decomposed, thus obscuring variation in the true state of financial inclusion regionally, and especially for groups often known to be marginalised, such as women. This study now argues that, while owning formal accounts may be necessary, it is not an adequate condition for measuring the sustainable financial inclusion of rural smallholder farmers in Nigeria. Moreover, if consumer finance indicators are not integrated into FI multidimensional measures, it is more likely for marginalised consumers, particularly rural smallholder farmers, to be “forgotten” in FI interventions. None of the previous approaches integrated consumer target indicators, such as financial capability and well-being, which are considered as important prospects in FI measures for rural clients or small farm families. In addition, it has remained unclear as to how rural smallholder farmers cope with livelihoods when financially included, given that they may also participate in other income-generating activities, aside from farm-income sources. Failure to assess the financial inclusion of rural smallholder farmers and to identify areas for policy interventions may hinder policy efforts aimed at achieving inclusive agricultural and rural economic progress in Nigeria. In addition, not evaluating the impact of FI on the livelihood strategies of the rural smallholders may undermine the role of FI in enhancing sustainable rural livelihoods.

7.2.2 Purpose of the study

The overall objective of this study was to develop a multidimensional measure to determine the levels of FI of rural smallholder farmers in Nigeria and to assess the impact of FI on their livelihoods. Specifically, the study developed a multidimensional financial inclusion index to measure the FI of rural smallholder farmers. Variations in the levels of the FI of rural smallholder farmers, by gender and geographical location, were explored based on association with specific individual characteristics (age, educational levels and marital status), and

household characteristics (household income, household size and poverty status). The contributions of rural smallholder farmer population subgroups (segregated by gender and geographical location) to the levels of FI were determined to identify relevant areas for policy intervention. Furthermore, the contributions of FI indicators (access, usage, no barrier, financial literacy, financial planning, consumer protection, control over finance, financial resilience and financial situation) to the levels of FI of rural smallholder farmers were assessed. A sensitivity analysis of the contributions to changes in financial inclusion adequacy was conducted to assess the extent to which the findings were stable enough to inform policy interventions. Finally, the impact of FI on the livelihoods of rural smallholder farmers was assessed.

7.2.3 Methods and procedures

This study was carried out in Nigeria and the target respondents were rural smallholder farmers located across the country's six geopolitical zones (North East, North West, North Central, South East, South West and South South). The study utilised nationally representative secondary data obtained from the Nigeria – CGAP smallholder household survey undertaken in 2016. A stratified multistage sampling procedure was employed to select smallholder households independently across the states in each geopolitical zone, based on proportion to size of agricultural enumeration areas in Nigeria. At the time of the primary survey, structured household, multiple and individual questionnaires were used to obtain comprehensive information from totals of 3,026, 5,128 and 2,773 respondents, respectively.

A stratified two-stage sampling procedure was used to select rural smallholder farmers from the secondary data. The first stage involved the stratification of respondents into rural and urban groups in each of the three data sets corresponding to the questionnaires utilised in the initial survey. The second stage involved the selection of all sampled rural respondents from all the states across geopolitical zones, resulting in total selections of 2,471, 4,511 and 2,690 respondents across the household, multiple and single data sets, respectively. The single respondent questionnaire provided detailed information about individual rural smallholders, while the multiple respondent questionnaire provided further information about the individual and other members within the same household. The household data set constituted an extension of the previous two data sets, which had information regarding the household characteristics of

the respondents. The sectioned data sets were merged into a single file, based on the unique member and household identification numbers of the rural smallholders, using Stata 15 software. A total of 2,300 rural respondents was utilised, based on the number of respondents with complete information that had successfully merged across the three data sets.

The analysis of the study objectives was categorised into two main sections. The first section involved adapting the Alkire-Foster method to develop a multidimensional financial inclusion Index for rural smallholder farmers in Nigeria. The MFII was constructed based on three domains of financial inclusion (financial participation, financial capability and financial planning) across nine financial inclusion indicators. The financial participation domain was particularly constructed based on the adequacy indicators for rural smallholder farmers regarding access to formal financial services, usage, and no barrier. The financial capability domain was specifically constructed from adequacy in financial literacy, financial planning and consumer protection indicators. The financial well-being domain was constructed from adequacy control over finance, financial resilience and financial situation indicators. Further analysis involved a combination of descriptive statistics, decomposition techniques, and sensitivity checks. The second section assessed the impact of FI on the income sources of rural smallholder farmers through using the propensity score matching model to determine how FI influences rural livelihoods. The study primarily aimed to provide evidence to guide FI policy interventions for rural smallholder farmers, especially if the goal is targeted at promoting inclusive agricultural and rural economic growth.

7.3 SUMMARY OF FINDINGS

7.3.1 Multidimensional financial inclusion of rural smallholder farmers, variations and association with socio-economic characteristics

The findings derived from the study indicate that a high rate of financial exclusion (78%) persists among rural smallholder farmers in Nigeria, despite the country's target to reduce financial exclusion to 20% by 2020. Although the ability to gain access to and use bank financial services currently drives the financial participation domain, as compared with non-bank and mobile money services, the high costs of transacting pose the greatest barrier to participation in a formal financial system. This barrier is followed by a lack of formal

identification and distance to visiting physical bank branches for financial transactions. Similarly, while the financial capability of rural smallholder farmers is driven by having trust in formal financial sources, only a few have an insurance plan or knowledge of mobile money financial activities. Although those married couples who are rural smallholder farmers in Nigeria and have joint control over their financial decisions may experience a measure of benefit for their financial well-being, the majority of them do not have sufficient funds to meet emergencies and could hardly afford luxury items. Estimates of the MFII indicate that formal access to financial services by rural smallholder farmers in Nigeria is significantly different from their actual financial inclusion. The findings of this study indicate that rural smallholder farmers in Nigeria had an overall MFII value of 0.22, based on having achieved adequate achievements in at least two-thirds of the three domains of financial inclusion ($f_k \geq 0.66$), with gender and regional variations existing in the level of financial inclusion.

7.3.1.1 Gender variations in the level of financial inclusion of rural smallholder farmers

The findings indicate that the levels of FI of rural smallholder farmers in Nigeria vary significantly by gender, at 1%. Decomposing the MFII by gender indicates that rural male smallholder farmers had a financial inclusion head count ratio of 29.97% and had achieved average adequate achievements in 85.38% of the three domains of financial inclusion. With a MFII value of 0.26, rural male smallholder farmers, whose population share weight was 60.36%, accounted for 70.42% of gender contribution to MFII. Conversely, rural female smallholders had an FI head count ratio of 19.08%, with average adequate achievements in 85.77% of the weighted financial inclusion indicators, resulting in an MFII value of 0.16. With a population share weight of 39.64%, results show that rural female smallholder farmers contributed less than one third (29.59%) to the MFII. The results confirm the study hypothesis that the level of FI among male rural smallholder farmers is higher than that of their female counterparts.

7.3.1.2 Geographical variations in the levels of financial inclusion of rural smallholder farmers in Nigeria

The findings indicate that the levels of FI of rural smallholder farmers in Nigeria vary significantly ($p < 0.00$) across the country's six geopolitical zones. Findings from decomposing

the MFII by geographical location indicate that the SS, SE and SW zones had FI headcount ratios of 53.05%, 32.01% and 26.80%, respectively, with average adequate achievements in 84.28%, 87.74% and 82.00% of the 3DFI, respectively. As a result, higher MFII values were observed in the SS (0.45), SE (0.28) and SW (0.22) zones, which contradicts the country's estimates that the SW region has the highest level of financial inclusion in Nigeria. Lower MFII values were observed in the NC (0.20), NW (0.09) and NE (0.09) regions, based on FI headcount ratios of 23.44%, 10.74% and 10.12%, respectively, with average adequate achievements in 86.03%, 82.74% and 91.04% of the 3DFI, respectively. Considering that the northern zones had a higher population share weight of rural smallholder farmers than the southern zones, the regional contributions to MFII were less than population share weight only in the northern zones. The evidence confirms the study hypothesis that rural smallholder farmers in the South East, South South and South West geopolitical zones have higher levels of FI than those in the North Central, North East and North West geopolitical zones do.

7.3.1.3 Level of financial inclusion and association with specific individual and household characteristics of rural smallholder farmers in Nigeria

The association between variations in the levels of financial inclusion of rural smallholder farmers and specific socio-economic (individual and household) characteristics was analysed by gender and geographical location. The individual characteristics were age, marital status and educational levels, while the household characteristics included household income, household size and poverty status. The findings show that age is significantly associated with the level of FI of male rural smallholder farmers, although no strong association is found with the female rural smallholder farmers. However, a greater proportion of the financially included females were young (15 – 29 years), while the financially included males had almost a similar proportion between the ages of 15 – 29 years and 30 – 44 years. Furthermore, the study found a significant association between the level of FI and marital status of both male and female rural smallholder farmers. The findings show that a greater proportion of the financially included females were married, as compared with the males. However, the reverse was found in the significant relationship between educational levels and FI, as a higher level of education was found among the financially included males. The findings also indicate that the household characteristics of both male and female rural smallholder farmers in Nigeria were related

significantly to their levels of FI. For example, findings show that the females' level of FI reduced with larger household sizes, as compared with the males.

At the regional level, a statistically significant association was found between age and the level of FI in the North Central, North West and South South, but no strong association was observed in the North East, South East and South West. However, it is important to note that the South South region, which has the highest level of FI of rural smallholder farmers in Nigeria, had the highest share of the financially included rural smallholder farmers as young people. The findings also showed a strong association between education and level of FI of rural smallholder farmers in all six geopolitical zones. Furthermore, the most financially included rural smallholder farmers across regions were associated with an average monthly household income less of than ₦50, 000. Only the South South (SS) region (the region with the highest level of FI) had a higher proportion of the financially included rural smallholder farmers with a mean monthly household income ranging between ₦50, 000 and ₦99, 999. The majority of the financially included rural smallholder farmers in the NE, NW and SS zones were associated with household sizes of six to ten persons. Conversely, the level of FI decreased with higher household sizes in the NC, SW and SE zones. Regarding the association with poverty status across the regions, the SE zone had the highest proportion of its financially included above the poverty line, while the NE had the lowest.

7.3.2 Contributions of financial inclusion indicators and domains to the level of financial inclusion of rural smallholder farmers

The contributions of the financial inclusion indicators to aggregate MFII show the following, in descending order: access, control over finance, financial situation, usage, financial resilience, financial literacy, consumer protection, no barrier, and financial planning. The aggregated results across the 3DFI indicate that rural smallholder farmers in Nigeria have the lowest adequacies in the financial capability domain, which domain thus contributes the least to FI. However, the average contributions of the financial well-being and financial participation domains were higher in the southern zone than in the northern zone. Conversely, the average contribution of the financial capability domain was higher in the northern zone than in the southern zone. A sensitivity analysis of the findings, conducted at alternate adequacy

thresholds of $f_k \geq 0.55$ and $f_k \geq 0.77$, show that the evidence is robust and stable enough to inform policy discussions.

7.3.3 Impact of financial inclusion on the livelihood of rural smallholder farmers

The impact of FI on the livelihoods of rural smallholder farmers in Nigeria was assessed by using the propensity score matching model. Descriptive analysis before matching showed that rural smallholder farmers who were financially included were not significantly different from those financially excluded with regard to marital status, primary education, age, household size, and farm size. However, significant differences were found in gender, membership of association, secondary education, university education, ownership of mobile phone, and geographical location. Description by livelihood strategies shows that most rural smallholder farmers engaged in crop income activities, followed by livestock income activities, running own businesses and remittances. Income generation from earning wages, receiving a grant, pension, allowances or subsidy and transportation constituted the fewest of the activities that were engaged in. Further categorisation revealed that most rural smallholder farmers in Nigeria depended solely on farm income sources, followed by diversification between farm and non-farm income sources, while a lower proportion depended only on non-farm income activities at the time of survey. An analysis of the propensity scores using the logit regression model showed that being a male, having completed secondary or university education, higher farm size owned, owning a mobile phone, and location in the southern zone increased the likelihood of financial inclusion. The study tested three algorithms (nearest neighbour matching, caliper matching and kernel matching) to match the estimated propensity scores of the treated and control units, and the findings show that the kernel matching at bandwidth 0.08 yielded the best balancing quality.

Results of estimated impact showed that being financially included significantly decreased the sole dependence of rural smallholder farmers on farm income sources, relative to those financially excluded, at 1%. However, the non-farm income sources of those financially included increased significantly, as compared with those who were financially excluded. The findings showed that FI significantly increased diversification between farm and non-farm income sources, at 1%, which confirms the study hypothesis. Engagement in both farm and non-farm income sources among the financially included rural smallholders significantly

increased by 32.45%, relative to those who were financially excluded. Results of sensitivity analysis using the nearest neighbour matching and Rosenbaum bounds test point to the conclusion that FI significantly increases diversification between farm and non-farm income sources, but reduces the sole dependence of rural smallholder farmers on farm income activity in Nigeria.

7.4 POLICY IMPLICATIONS OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The key pressing questions regarding the issue of FI for Nigeria's policymakers are as follows: What is the status of rural smallholder farmers in Nigeria's financial inclusion? Is having just a formal account enough for the sustainable financial inclusion of rural smallholder farmers to transform agriculture? How do rural smallholder farmers in Nigeria respond to livelihood strategies when financially included? How can financial inclusion policy in Nigeria foster an inclusive rural and agricultural economic development paradigm? The analysis undertaken by this study explored the most comprehensive nationally representative data, specific to the financial lives of smallholder farmers in Nigeria, to provide insights into answering these questions. The findings of this study provide pointers for gaining a better understanding of the implications of FI and highlight requirements for improved financial inclusion policy interventions for rural smallholder farmers in Nigeria.

The findings suggest that the high rate of financial exclusion that exists among rural smallholder farmers in Nigeria could pose a threat to efforts aimed at transforming agriculture to achieve SDG 2. This study argues that having a formal account is not sufficient for providing FI from a rural smallholder farmer's perspective. If the policy goal is to promote the FI of rural smallholder farmers, then it is important that an FI strategy specific to the true state of rural smallholder farmers in Nigeria be implemented. FI is accomplished when rural smallholder farmers have access to formal services and are financially adequate in a regulated economy. If the goal of policy makers is to minimise barriers faced by rural smallholder farmers, then it is important to consider affordable mobile financial services that have the potential to reduce challenges, such as remoteness and costs of transportation to visit physical bank branches. However, it is crucial to ensure that an appropriate policy environment is enabled to allow for digital financial inclusion to thrive in rural Nigeria.

The findings suggest the need for FI interventions to be made to address gender and regional disparities in financial inclusion among rural smallholder farmers in Nigeria to allow for inclusive development to thrive. Moreover, if the goal is to modernise smallholder agriculture, then it is important that policy should promote the financial inclusion of the rural youth and their participation in Nigeria's smallholder agriculture. The results suggest that policy interventions which enhance the FI of rural women smallholder farmers, especially in indicators like access to formal financial services, control over finance, and financial resilience, would help to address gender disparities. Furthermore, if the goal is to address regional disparities, then it is essential that caution should be taken with common interventions based on national aggregations. The findings suggest that policy interventions should be prioritised in those situations where resources to facilitate implementation are scarce. The results further suggest that FI interventions for rural smallholders should be prioritised in the zones in the following order: North West, North East, North Central, South West, South East and South South, taking into consideration the regional population share weights and contributions to FI. This study recommends, in order to secure the sustainability of financial inclusion among rural smallholder farmers in Nigeria, that policy interventions should be made, not only to promote participation in formal systems, but also to strengthen financial capabilities and financial well-being.

In conclusion, the results suggest that increasing the diversification between farm and non-income activities would provide a major pathway for improving the incomes of rural smallholder farmers in Nigeria. This would empower them to break out of poverty. Moreover, if the FI policy goal is to achieve sustainable rural livelihoods and agricultural economic development, then it is important that farm activities should not be abandoned in favour of non-farm activities as rural smallholder farmers progressively become financially included. This study recommends that FI policy interventions be implemented to strengthen the integration of both the agricultural and non-agricultural sectors in rural Nigeria for achieving inclusive economic growth.

7.5 CONTRIBUTIONS OF STUDY AND AREAS FOR FUTURE RESEARCH

This study adapted the Alkire-Foster method to address multidimensional measurement issues in financial inclusion and thus ascertain how they affect rural population subgroups in

smallholder agriculture. The multidimensional financial inclusion index developed was survey-based and could be used to monitor progress in financial inclusion of rural smallholder farmers, over time. The extensive analysis undertaken by the study therefore provides both empirical and methodological contributions to the financial inclusion literature. Furthermore, the evidence from this study contributes to identifying areas for policy interventions, specifically for promoting the financial inclusion of rural smallholder farmers. This study relied on the most comprehensive, nationally representative CGAP smallholder household survey data collected in 2016, and made publicly available for research in 2017. Hence, it is desirable for future research to monitor progress in the multidimensional financial inclusion of rural smallholders, over time, as more recent data that are nationally representative become available.

This study examined gender variations in the levels of financial inclusion among rural smallholders; however, intra-household gender disparities could not be examined due to the limited data available. Therefore, this study suggests the need for future research to be undertaken to explore gender-disaggregated financial inclusion data within the same smallholder agricultural households. Such data could be integrated into computing the MFII to determine the extent to which FI has empowered women in agriculture to achieve gender parity within the same households. Future research could also explore the MFII to investigate the extent of financial inclusion of smallholders, across agricultural commodity value chains, across countries. It is believed that such research evidence would help to inform policy developments regarding the financial integration and empowerment of smallholders in transforming agricultural commodity value chains with a gender lens, especially in Africa.

This study assumes that FI is an empowerment tool for rural smallholder farmers to achieve financial resources that could influence their responses to livelihood strategies, or enhance income activities engaged in to improve livelihoods. However, responses on the income sources of rural smallholder farmers were captured as binary variables in the secondary data utilised, rather than as the proportion of income shares to total income. It would be desirable for future research to utilise data with the income sources of rural smallholder farmers expressed as a proportion of their income shares to total income, and to examine whether a bi-directional causality exists between FI and their income sources. Nevertheless, the broad analysis undertaken by this study addresses the research gaps regarding the financial inclusion of rural smallholder farmers and describes how this inclusion influences their engagement in

income activities relative to financial exclusion. Evidence suggests that policy recommendations should be implemented to enhance the FI of rural smallholder farmers in Nigeria in order to secure sustainable agriculture, rural livelihoods, and integrated economic development.

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APPENDICES

Appendix 1: Cross-tabulation analysis between gender and geographical location of rural smallholder farmers in the level of financial inclusion

Table A1: Cross-tabulation between gender and geographical location of rural smallholder farmers in the level of financial inclusion

Geographical location	Male		Female	
	Frequency	Percent	Frequency	Percent
North central	118.45	27.74	36.07	21.61
North East	23.53	5.51	8.29	4.97
North West	42.01	9.84	7.23	4.33
South East	46.01	10.77	37.92	22.72
South South	156.46	36.64	64.64	38.73
South West	40.58	9.50	12.76	7.64
Pooled Northern location	183.99	42.35	51.59	30.91
Pooled Southern location	243.05	56.91	115.32	69.09
FI gender-location gap	59.06	14.56	63.73	38.18
Pearson X^2 statistic	224.31		70.23	
P-value	0.000		0.000	

Source: Author's estimation

Appendix 2: Geographical distribution of rural smallholder farmers by incidence and intensity of multidimensional financial inclusion

Table A2: Geographical distribution of rural smallholder farmers by incidence and intensity of multidimensional financial inclusion

Geographical location	No. of Obs.	Incidence	Intensity	MFII
North Central	98	0.2344	0.8603	0.2016
North East	37	0.1074	0.8274	0.0889
North West	55	0.1012	0.9104	0.0921
South South	190	0.5305	0.8428	0.4471
South East	101	0.3201	0.8774	0.2808
South West	87	0.2680	0.8200	0.2198

Source: Author's estimation

Appendix 3: Matching algorithms and covariate balancing tests

Table A3: Propensity score test with nearest neighbour matching (1) without replacement

Covariate	Mean			t – test		V(T)/V(C)
	Treated	Control	%bias	T	p> t	
Gender	.70459	.68263	4.6	0.75	0.451	.
Age	40.523	40.928	-2.7	-0.44	0.660	0.76*
Marital status	.77844	.77046	1.9	0.30	0.763	.
Primary education	.16168	.17565	-3.8	-0.59	0.555	.
Secondary education	.31737	.32535	-1.9	-0.27	0.787	.
University education	.0519	.0519	0.0	-0.00	1.000	.
Membership of association	.93413	.93014	1.4	0.25	0.802	.
Household size	4.9042	4.8423	1.9	0.31	0.754	1.12
Farm size owned	1.7483	1.8463	-5.7	-0.88	0.377	0.91
Ownership of mobile phone	.87625	.85629	4.7	0.93	0.354	.
Geographical location	.61078	.64471	-7.0	-1.11	0.267	.

* If variance ratio outside [0.84; 1.19]

Ps R2	LR chi2	p>chi2	Mean Bias	Med Bias	B	R	% Var
0.004	5.18	0.922	3.3	2.7	14.4	0.91	33

* If B>25%, R outside [0.5; 2]

Table A4: Propensity score test with nearest neighbour matching (2) without replacement

Covariate	Mean			t – test		V(T)/V(C)
	Treated	Control	%bias	T	p> t	
Gender	.70459	.70958	-1.1	-0.17	0.862	.
Age	40.523	41.141	-4.2	-0.67	0.501	0.77*
Marital status	.77844	.78044	-0.5	-0.08	0.939	.
Primary education	.16168	.17764	-4.4	-0.67	0.501	.
Secondary education	.31737	.31637	0.2	0.03	0.973	.
University education	.0519	.0509	0.0	-0.00	0.943	.
Membership of association	.93413	.93812	0.5	0.07	0.796	.
Household size	4.9042	4.9381	-1.1	-0.17	0.865	1.09
Farm size owned	1.7483	1.7631	-0.9	-0.13	0.893	0.94
Ownership of mobile phone	.87625	.86527	2.6	0.52	0.605	.
Geographical location	.61078	.64072	-6.2	-0.98	0.328	.

* If variance ratio outside [0.84; 1.19]

Ps R2	LR chi2	p>chi2	Mean Bias	Med Bias	B	R	% Var
0.002	2.48	0.996	2.1	1.1	10.0	0.97	33

* If B>25%, R outside [0.5; 2]

Table A5: Propensity score test with nearest neighbour matching (4) without replacement

Covariate	Mean			t – test		V(T)/V(C)
	Treated	Control	%bias	T	p> t	
Gender	.70459	.70758	-0.6	-0.10	0.917	.
Age	40.523	41.357	-5.6	-0.91	0.361	0.78*
Marital status	.77844	.79142	-3.1	-0.50	0.618	.
Primary education	.16168	.18064	-5.2	-0.80	0.426	.
Secondary education	.31737	.31637	0.2	0.03	0.973	.
University education	.0519	.0504	0.8	0.11	0.914	.
Membership of association	.93413	.94361	-3.4	-0.63	0.532	.
Household size	4.9042	4.8383	2.0	0.34	0.737	1.16
Farm size owned	1.7483	1.7823	-2.0	-0.88	0.756	0.95
Ownership of mobile phone	.87625	.86627	2.4	0.93	0.638	.
Geographical location	.61078	.63074	-4.1	-1.11	0.515	.

* If variance ratio outside [0.84; 1.19]

Ps R2	LR chi2	p>chi2	Mean Bias	Med Bias	B	R	% Var
0.002	2.73	0.994	2.7	2.4	10.4	1.03	33

* If B>25%, R outside [0.5; 2]

Table A6: Propensity score test with caliper matching at radius 0.08

Covariate	Mean			t – test		V(T)/V(C)
	Treated	Control	%bias	T	p> t	
Gender	.70459	.68263	4.6	0.75	0.451	.
Age	40.523	40.928	-2.7	-0.44	0.660	0.76*
Marital status	.77844	.77046	1.9	0.30	0.763	.
Primary education	.16168	.17565	-3.8	-0.59	0.555	.
Secondary education	.31737	.32535	-1.9	-0.27	0.787	.
University education	.0519	.0519	0.0	-0.00	1.000	.
Membership of association	.93413	.93014	1.4	0.25	0.802	.
Household size	4.9042	4.8423	1.9	0.31	0.754	1.12
Farm size owned	1.7483	1.8463	-5.7	-0.88	0.377	0.91
Ownership of mobile phone	.87625	.85629	4.7	0.93	0.354	.
Geographical location	.61078	.64471	-7.0	-1.11	0.267	.

* If variance ratio outside [0.84; 1.19]

Ps R2	LR chi2	p>chi2	Mean Bias	Med Bias	B	R	% Var
0.004	5.18	0.922	3.3	2.7	14.4	0.91	33

* If B>25%, R outside [0.5; 2]

Notes: Similar estimates are obtained at caliper matching radius 0.1 and 0.2

Table A6: Propensity score test with kernel matching at bandwidth 0.08

Covariate	Mean			t – test		V(T)/V(C)
	Treated	Control	%bias	T	p> t	
Gender	.70459	.69133	2.8	0.46	0.451	.
Age	40.523	40.934	-2.8	-0.46	0.648	0.82*
Marital status	.77844	.78284	-1.0	-0.17	0.648	.
Primary education	.16168	.17334	-3.2	-0.49	0.622	.
Secondary education	.31737	.309	2.0	-0.29	0.775	.
University education	.0519	.05208	-0.1	-0.01	0.989	.
Membership of association	.93413	.93807	-1.4	-0.25	0.799	.
Household size	4.9042	4.9348	-0.9	-0.16	0.877	1.14
Farm size owned	1.7483	1.8095	-3.6	-0.56	0.578	0.94
Ownership of mobile phone	.87625	.85744	4.5	0.88	0.382	.
Geographical location	.61078	.60703	0.8	0.12	0.903	.

* If variance ratio outside [0.84; 1.19]

Ps R2	LR chi2	p>chi2	Mean Bias	Med Bias	B	R	% Var
0.001	1.66	0.999	2.1	2.0	8.1	1.11	33

* If B>25%, R outside [0.5; 2]

Table A7: Propensity score test with kernel matching at bandwidth 0.1

Covariate	Mean			t – test		V(T)/V(C)
	Treated	Control	%bias	T	p> t	
Gender	.70459	.68807	3.5	0.57	0.570	.
Age	40.523	40.793	-1.8	-0.30	0.764	0.83*
Marital status	.77844	.77656	0.4	0.07	0.943	.
Primary education	.16168	.17243	-2.9	-0.46	0.649	.
Secondary education	.31737	.30503	2.9	0.42	0.649	.
University education	.0519	.05139	0.3	0.04	0.674	.
Membership of association	.93413	.93687	-1.0	-0.18	0.860	.
Household size	4.9042	4.9329	-0.9	-0.15	0.885	1.13
Farm size owned	1.7483	1.8043	-3.3	-0.51	0.610	0.94
Ownership of mobile phone	.87625	.845	5.3	1.03	0.303	.
Geographical location	.61078	.60064	2.1	0.33	0.743	.

* If variance ratio outside [0.84; 1.19]

Ps R2	LR chi2	p>chi2	Mean Bias	Med Bias	B	R	% Var
0.001	1.91	0.999	2.2	2.1	8.7	1.06	33

* If B>25%, R outside [0.5; 2]

Table A8: Propensity score test with kernel matching at bandwidth 0.2

Covariate	Mean			t – test		V(T)/V(C)
	Treated	Control	%bias	T	p> t	
Gender	.70459	.67491	6.3	1.02	0.310	.
Age	40.523	40.56	-0.2	-0.04	0.968	0.81*
Marital status	.77844	.77852	-0.0	-0.00	0.998	.
Primary education	.16168	.17579	-3.8	-0.60	0.551	.
Secondary education	.31737	.27562	9.9	1.45	0.148	.
University education	.0519	.04157	5.5	0.77	0.439	.
Membership of association	.93413	.93201	0.8	0.13	0.893	.
Household size	4.9042	4.9995	-3.0	-0.48	0.630	1.11
Farm size owned	1.7483	1.7625	-0.8	-0.13	0.896	0.96
Ownership of mobile phone	.87625	.81697	14.0	2.61	0.009	.
Geographical location	.61078	.56378	9.7	1.51	0.131	.

* If variance ratio outside [0.84; 1.19]

Ps R2	LR chi2	p>chi2	Mean Bias	Med Bias	B	R	% Var
0.008	11.02	0.441	4.9	3.8	21.0	0.89	33

* If B>25%, R outside [0.5; 2]