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Moving the Agriculture Value Chain Forward in Nigeria: A Review of Digital Technology Trends in Financing Agriculture

Mohammed Abdullahi*

Member, International Society for Development and Sustainability, Japan,Block A, Flat 8, Sani Zangon Daura Estate, Gobir YA Street, Kado, Abuja Nigeria, White Ink Institute for Strategy, Education, and Research (WISER)

Email : shamsudin2002@yahoo.com

Abstract

Nigeria's telecommunication industry has developed since the privatization of the telecommunication industry in the early dispensation of the Fourth Republic in 1999. It has positive transformational development of some sectors of the economy with an impact on the growth, and improving the effectiveness and efficiency of businesses in banking and finance, oil and gas, taxation, and energy sectors with reliance on the development of software and programs and hardware. The neglect of digital technology for an internet economy in the agriculture sector financing can be argued to be a contributor to the negative effect of the overall social system in Nigeria. If there is an increase in digital technology financial services for the agricultural sector in the rural areas in Nigeria, then there will be an increase in agricultural financing agricultural productivity, and agricultural performance. The objectives of this paper are - 1. To examine the problems of digital technology limiting financial agricultural funds in private, public, and international financial institutions and agencies and agricultural sector productivity. 2. To identify the research gaps in digital technology financial services that limit agricultural funding in Nigeria. This paper is structured around multidimensional approaches with emphasis on the theories of development which include the Big Man Theory of Thomas Carlyle, the Management Theory of Frederick Taylor, the Structural Functional Theory of Talcott Parson and Robert K Merton, the Modernization Theory of Emile Durkheim, the Human Needs Theory of David McClelland and Maslow, and Integration Theory of Niemann and Bergmann. The method used for data collection is a secondary source and is based on the review of two journal papers and two international conferences published in journals and academic websites related to financing agriculture and seven digital technology papers that relate to the problem of financial exclusion for agricultural smallholder farmers.

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* Corresponding author.

The findings reveal a lack of a structural framework that supports developed software and hardware and a lack of a universal API that provides financial services to marginalized rural farmers in rural areas. The absence of checks and balances in accounting and the absence of agricultural extension workers limits the services of monitoring and evaluation of agricultural funds and smallholder farmers. It is recommended that digital technology be applied to provide financial inclusion for marginalized farmers in rural areas.

Keywords: Accounting; Conventional Finance; Digital Technology; Fin-tech; Islamic Finance; Monitoring and Evaluation.

1. Introduction

The National Agriculture Development Fund (NADF) was established in 2020 by an Act of the National Assembly to improve agricultural productivity and performance in Nigeria. This allowed the NADF to warehouse the Central Bank of Nigeria (CBN) Commercial Agriculture Credit Scheme (CACS) under the Commercial Agriculture Development Fund (CADF), the Central Bank of Nigeria's (CBN) Agricultural Credit Guarantee Scheme Fund (ACGSF) and the Central Bank of Nigeria's (CBN) Agriculture, Small, Medium, Enterprise Equity Investment Scheme Fund (AGSMEEIS) raised from the contribution of commercial banks 5% profit after tax returns. Before this, in 2019 the Central Bank of Nigeria (CBN) established the Nigeria Incentive Risk Sharing Agricultural Lending (NIRSAL) Micro Finance Banks to disburse the AGSMEEIS funds. This was done outside the activities of Nigeria Incentive Risk Sharing Agricultural Lending (NIRSAL) Plc which has a portfolio to guarantee and insure agricultural loans. The depositors' funds in conventional and Islamic banks in Nigeria have a customer deposit base of 49,796.71 billion dollars or 49.796.71 trillion Naira NDIC, (2022). In addition, the Micro, Small Medium Enterprise (MSME), a 210 billion Naira fund is meant for small and medium enterprises. The activities of these institutions all show there is a public and private capacity for financial depth to cater to agriculture and its value chain in Nigeria.

One may argue why financial depth in the agricultural sector does not have any impact on the smallholder farmers and the GDP economy of Nigeria, could it be attributed to a lack of a structural functional framework and the bureaucracy in the processes of financing the agriculture sector? In practical terms government funding relies heavily on Private Financial Institutions (PFI) to disburse funds to smallholder farmers and with the PFI's priority to maximize profit based on feasibility studies showing high risk for Return on Investment (ROI), PFI rarely open branches in agrarian rural communities in Nigeria. The structural issue makes it difficult for private and public financial institutions including international financial institutions to provide financial services or take advantage of digital financial services to the rural marginalized group.

To bridge the financial inclusion gap for both urban and rural financial services, fin-tech companies like Opay and Moniepoint have provided effective and efficient service delivery between customers and other financial institutions through IXP and API using cloud services or GPS services. However, accessibility to the rural population remains a challenge, and this is because of the challenges of financial institutions which include a lack of financial institutions scaling up mobile apps, agency banking, and fin-tech digital technology services domiciled in the urban areas and a lack of telecommunication hardware like masts remain unresolved. This

impedes capturing economic activities of the rural economy which relies 95% on agriculture and trade.

How will fin-tech companies contribute to the functional unity and universal functionalism of agricultural finance with the sole aim of financial sustainability? How can digital technology experts and telecommunication service providers improve services that will support the development of accounting software and hardware for agricultural financial services with an IXP and API for interface with other financial service providers for the inclusion of smallholder farmers in rural areas? How can these funds be monitored and evaluated while embedded in developed software and hardware to ensure organizational agricultural funding goals are achieved efficiently and effectively by utilizing these funds for the benefit of gross productivity through the supervision of extension workers and between financial providers and financial users? And what steps will be applied to protect these funds from the managerial problems of diversion, mismanagement, corruption, and fraud? These are some of the questions this paper tries to solve in future research investigations.

1.1 Objectives

1. To examine the problems of digital technology limiting financial agricultural funds in private, public, and international financial institutions and agencies and agricultural sector productivity.
2. To identify the research gaps in digital technology financial services that limit agricultural funding in Nigeria.

2. Materials and Methods

The literature review for this paper focuses on a multi-dimensional and multi-disciplinary approach to the development of the agricultural sector. The development theories with a theoretical framework include the Great Man theory by Thomas Carlyle, the Management theory of Fredrick Taylor, Structural functionalism by Talcott Parson and Robert K. Merton, Modernization theory by Emmanuel Wallerstein, Integration theory by Niemann and Bergmann, and the human needs theory of David McClelland and Emmanuel Maslow will be applied for this paper and are based on Rostow's model of the 5 stages of social and economic growth and development in addition, the method used for this paper is the secondary source for data collection.

2.1 Literature Review: Empirical Review

A study by Trendov, Varas, and Zeng [1] indicated that transformative digital technology and innovations in agriculture for financial inclusion are not designed to accommodate rural economies. This is evident in developing countries like Nigeria. Agriculture is a practical occupation that can only be accountable when officials of the Ministry of Agriculture, CBN, financial institutions, fin-tech platforms, and farmers understand that the characters involved in the agricultural value chain are key in promoting efficiency and effectiveness in the management of finance for agricultural production in Nigeria's economy. Management is accountable for institutional funds under their care, so officials and operators must instill character in leadership positions to achieve the desired goal in the distribution of funds allocated to the agricultural sector to real farmers and the small and medium enterprises within the agricultural value chain as argued by Chatman and Goncalo [2]. This will checkmate the problems of diversion, and mismanagement of agricultural funds Abdullahi and Gupta [3]. The financial institutions and

government agencies including international financial institutions have structural issues where smallholder farmers in rural areas have difficulty accessing finance directly from the bank or their agent banking. In 2022 only 23% of the rural populace and 64% of the urban populace in Nigeria and other African countries used the Internet Elayelagha [4], comparative analysis shows that India has 87% digital technology inclusion way above 67% of the world benchmark with a 1.2 trillion dollars fin-tech funds, this shows that financial institutions lack a structural framework and digital technology platforms that make financial inclusion non-feasible. In addition, out of the 200 million people in Nigeria, 120 million people are above 15 years old, and with a total number of 4,437 commercial bank branches in Nigeria, 27,000 people are tied to a branch. In comparison, there are 1.5 million Point of Sale (POS) which represents 80 people to a POS service in Nigeria Abiodun [5]. The CBN and Federal government are the major financial providers for agriculture funds in Nigeria but accessibility of these funds is inevitably impossible because CBN and government programs rely on Financial Institutional structures to reach out to smallholder farmers, unfortunately, these financial institutions lack the structures that reach out and ensure financial inclusion in rural areas Abdullahi and Gupta [6]. The CBN has approved agency banking and fin-tech financial services to boost financial inclusion through access points, but this attempt does not address universal financial services for smallholder farmers because it lacks financial service coverage and accessibility usage to farmers. To support this issue of universal financial services for farmers, the **"Agro eNaira Wallet"** platform unveiled by CBN shows a defect in its establishment.

For instance, to achieve full financial inclusion for farmers, the platform must be functionally united and universally acceptable to have a representation of agricultural activities with a bottom-to-top approach irrespective of association with a view for professional extension workers to identify real farmers needing financial assistance beyond the Association of Northern Agricultural and Allied Commodities Practitioners (ANAACOP) as indicated by Ikeagwuonu [7]. While it is important to note that collateral and interest rates, including the lack of sustainable energy to power the agro manufacturing industry, the lack of finance for mechanization, and irrigation technology, and also the lack of monitoring and evaluation of agricultural funds are major challenges to financing agriculture as shown in Abdullahi and Gupta [8].

Modernizing and designing digital technology in financial institutions and government agencies can lead to the integration of smallholder farmers in rural areas. Based on the different financial institutions' accounting software between conventional and Islamic finance, agricultural finance must be developed based on a System National Accounting (SNA) standardized format that captures the similarities and differences of these financial accounting systems in a unified way considering their rules and norms and the challenges faced in financing agriculture. This will help in monitoring and evaluation of the funds allocated to identified smallholder farmers in rural areas. For instance, conventional finance focuses on maximizing profits based on interest rates even before the advanced money is invested in production and collateral to obtain secured loans while Islamic finance focuses on profit and loss agreement based on risk but puts emphasis on collateral demand which limits production. These existential variables are a continuous problem in the financial inclusion of smallholder farmers. In ensuring accountability for agricultural funds to plants and animals through mechanization and machinery, and agricultural inputs, monitoring and evaluation in the disbursement and performance of these loans to farmers provide the best way to account for agricultural funds and the use of digital technology will help with key performance indicators measures that will help keep track of money spent on agricultural segments, productivity, repayment, savings and

taxation and the modes of financing that will ensure functional unity of agricultural funds and smallholder farmers accessibility.

2.2 Literature Review: Conceptual Review

Financial institutional structures for conventional and Islamic banks, including government agencies and CBN regulatory bodies, in addition to International financial institutions like the World Bank, and Islamic Development Bank are a major challenge to financial accessibility in Nigeria. The use of agency banking, bank application software, and ATMs has been significant in easing branch banking services for customers in urban areas where the use of IXPs is available and telecommunication service providers are functional to provide real-time online services. Interestingly, fin-tech companies like Opay and Moniepoint in Nigeria have developed digital technology that transcends institutional IXP's banking structures towards accessing banking and financial services online in rural areas using Google Cloud. The value of transactions for these fin-tech platforms has reached 15 billion dollars monthly and this has revolutionized accessibility of finance to the rural area. One may argue why financial institutions, government agencies, and international financial institutions cannot take advantage of digital technology services to advance comprehensive software for both conventional and Islamic agricultural accounting systems that can be used to justify investment in biological plant and animal assets IFRS [9]. Even though conventional and Islamic accounting systems differ, there is a need to provide the generally marginalized smallholder farmer groups including those affected by their cultural belief issues related to eliminating interest elements in business transactions, a way out that is beneficial to the Internet economy of Nigeria. Based on a review of the Islamic Accounting System, IFRS, World Bank's National Accounting Systems, and the Union Bank of India, a harmonization approach for the accounting systems for agriculture with a designed software and hardware with an Application Programming Interface (API) is necessary to address the many issues of agricultural financing mostly related to interest rates and collateral, the outreach of agency banking and financial services to smallholder farmers using IXP's structures and hardware and the lack of sustainable electricity for telecommunication service providers Abdullahi and Gupta [10]. The consideration of bearer plants' inclusion as part of biological assets, in addition to the taxation fair value measurement and discounted rates are aspects that hinder agricultural production, 10% fees in the de-recognition of financial responsibility between the lender and the borrower. All these must be properly accounted for to improve agricultural production

In consideration of AAOIFI [11] standards for agricultural accounting, for instance, the AAOIFI shariah compliant and the FAS rules have unified a partnership model for the general presentation for all institutions based on sections 55 and 56 of the (AAOIFI, 2021) amended. This will surely help conventional and Islamic financial institutions develop digital technology applications to provide universal accounting for funding the agricultural sector. Both conventional and Islamic financial systems have debt and non-debt instruments that can be utilized in financing agriculture. While the structures are different the aim for consequentialist and utilitarian standards are also different with conventional financial systems focusing on maximizing profit while Islamic financial systems focus on profit and loss-sharing arrangements. Merging the two financial accounting systems in a secular but religious society like Nigeria needs the approach of Parson's AGIL and Merton's 3 Postulates. The FAS and AAOIFI have harmonized the accounting systems of both conventional and Islamic finance which will help in the development of a unified accounting software and hardware. Therefore, agriculture as a sector must be reformed

to address the lapses in human development and contribution to the GDP by focusing on agricultural accounting on a national and international level. **A National Agricultural Accounting System (NAAS)** should be designed using digital technology based on software applications that can capture agricultural issues and at the same time reach out to smallholder farmers. Extension workers are critical to achieving this on the one hand identifying real farmers in rural areas and agency banking and fin-tech companies on the other ensuring the registration of these farmers. This will reduce bureaucracy in government and financial institutions that lead to the diversion, mismanagement, and abuse of agricultural funds. Most of these agricultural funds come from the government source and the other chunk of agricultural funds comes from the 5% contribution of commercial banks yearly. These funds must be consolidated and channeled through this accounting system to strengthen the contribution of funds to the agriculture sector to boost the GDP. This will help develop Zakat's contribution to agriculture and present information fairly to the users of their financial statement as included in (AAOIFI 2021, IN 6 Item h and g) as amended. Smallholder farmers must also be able to have a choice of which accounting system they need (AAOIFI paragraph 37. Item a and b as amended).

A Diagram for a Unified Accounting System for the Agriculture Sector and Value Chain in the Name of the National Agricultural Accounting System in Nigeria.

Table 1: National Agricultural Accounting System (NAAS)

Agricultural Sector Production Segments and Value Chains Production, Processing, Storage and Preservation and Marketing			
Agriculture Funding Sources in Nigeria Ministry of Agriculture and Food Security, State Ministries of Agriculture and Food Security, 774 Local Government Council Areas, CBN Allocations (ABS, CACS, ACGSF, AGSMEEIS, MSME), Banks 5% Contribution, BOA, NIRSAL, Conventional Banks, Islamic Banks, Conventional Micro Finance Banks, Islamic Micro Finance Banks, World Bank, Islamic Development Bank and Other Donor Agencies			
Conventional Financial and Accounting System Debt Instruments	**Conventional Financial and Accounting System Non-Debt Instruments**	**Islamic Financial and Accounting System Debt Instruments**	**Islamic Financial and Accounting System Non-Debt Instruments**
Overdraft Unsecured Investments	Conventional Guarantee	Mudarabah Investments	Islamic Guarantees
Overdraft Secured investments	Conventional Leasing	Musharakah Investments	Islamic Ijarah Leasing
Loan Advances/ Secured	Insurance and Re-Insurance	Salam Receivables	Takaful and Re-Takaful
Loan Advances/ Unsecured	Capital Market Equity In Agriculture	Salam Contracts	Sukuk (Equities) In Agriculture
Venture Capital		Quasi Equity Holders	
Agro-Manufacturing		Istisna Investments	
Trade Finance		Murabaha	
Financial and Balance Sheet Structure		Financial and Balance Sheet structure	

Conventional Financial System for Public, Private and International Agricultural Accounts		Islamic Financial System for Public, Private and International Agricultural Accounts	
Operating Activities/ Financial Information Providers (FIP)			
CBN, NIRSAL, BANKS Debt/ Financial Finance Measured funds (Cash/Interest Element) of Financial Institutions to the Agriculture sector. Overdraft Loan Advances Debt -Equity Non-debt/ Non- Financial Leasing Insurance Capital Market	CBN, NIRSAL, BANKS Finance Accounted to within Agricultural Segments for Plants or Animals (Indicators): Production Processing Storage & Preservation Marketing Tractor Hiring Services, Threshing Machines, Insurance of funds and goods against losses, Venture capital for agro development	CBN, NIRSAL, ISLAMIC BANKS Debt/ Financial Finances Measured (Cash/Nominal Value) to Identified Farmers Mudarabah Musharakah, Al Salam, Istisna. Murabaha. Non- Debt/ Non - Financial Wakalah/ Musharakah Guarantee Ijarah Takaful Sukuk	CBN, NIRSAL, ISLAMIC BANKS Money Accounted to within Agricultural Segments for Plants or Animals (Indicators); Production Processing Storage & Preservation Marketing Tractor Hiring Services, Threshing Machines, Insurance of funds and goods against losses, Venture capital for agro development
Investing Activities/ Financial Information Users (FIU)			
Financial reporting must eliminate interest rate and collateral in medium and long term loans	Accounting system in line with FAS must be in tandem with AAOIFI to ensure collaboration	Financial reporting must eliminate collateral in medium and long term funding	Accounting system must be in line with AAOIFI in collaboration with FAS and approved by Islamic Advisory Committee
Debt Instruments			
Amortization of Unsecured Loan or Benevolence Loan should consider smallholder farmers who cannot bear the interest rates and collateral to obtain a loan	To smallholder farmers with emphasis to benevolence loans monitored to make profit	Funds for Mudarabah should consider smallholder farmers who cannot afford collateral to obtain a loan	To Smallholder farmers with emphasis on trust and monitored for profit and loss agricultural production
Amortization of loans For Secured medium scale farmers who can afford collateral to obtain a loan should be disbursed efficiently and effectively within time	To medium scale farmers with emphasis on debt equity ratio contribution and monitored for optimal investment in an agricultural segment.	Funds for Musharakah and Diminishing Musharakah should consider medium scale farmers who can afford a collateral to obtain a loan	To Medium scale farmers with emphasis on debt equity contribution and monitored for profit and loss agricultural production based on agreed loan repayment
Manufacturing Loans for Agro Producers and Processors	Agro Producers and Processors in Agricultural Production and Processing	Funds for Istisnia Investments in Agro Production and Processors	Agro Producers and Processors in Agricultural Production and Processing
Advance Loan for Agriculture	To Small and Medium scale Farmers in agricultural Production	Funds for Al Salam	To Small and Medium scale Farmers in agricultural Production

Trade Finance	To Marketers and Suppliers in Agricultural Trade and Production	Funds for Murabaha	To Marketers and Suppliers in agricultural Trade and Production
Non- Debt Instruments			
Guarantees	Agricultural Association, Cooperative Groups, Guarantees and Small and Medium Farmers to pay zero interest	Wakalah/Musharakah Guarantees	Agricultural Association, Cooperative Groups, Guarantees and Small and Medium Farmers to make payment for plant/animals production based on a profit and loss agreement
Depreciation of assets/ Lease	Agricultural Association, Cooperative Groups, Guarantees and Small and Medium Farmers to pay installment premium payment in addition	Funds for Ijarah Leasing/ Lease or Hire Purchase	Agricultural Association, Cooperative Groups, Guarantees and Small and Medium Farmers to make installment payment for plant/animal machinery in processing for production based on a profit and loss agreement
Insurance and Re-Insurance	Account for the premium paid for financial loss, agricultural loss from natural disasters	Funds for Takaful and Re Takaful Insurance and Re insurance	Account for the contribution paid for smallholders financial and agricultural losses from natural disasters. Investment in the contribution will also bring in profit for the smallholder farmer in the absence of any loss to be shared by the insurance takaful company.
Equities	Capital market to improve the agricultural sector through equities raised through venture capitals	Sukuk	Account for the contribution of equities raised from the capital market for the activities of the agricultural sector like finds for tractors, plants, and machineries based on debt and non-debt modes of financing.
Financing Activities/ (FIP AND FIU)			
Actual Debt- instrument provided for secured and unsecured investment	Accounted for by agricultural segments providing the number of bags produced per acre or hectare. Share of crops produced without exploiting the farmers	Actual Debt- Instruments Mudarabah/ Al Salam Provided for Investment	Accounted for by agricultural segments Providing number of bags produced per acre or hectare based on a shared profit and loss agreement in proportion of 10% to 90% 20% to 80% 30% to 70% 40% to 60%

Actual Debt- Equity provided for Investment	Accounted for by agricultural segments providing the number of bags produced per acre or hectare. Share of crops produced without exploiting the farmers based on an agreement	Actual Musharakah/ Guarantee or Wakalah Debt- Equity provided for Investment	Accounted for by agricultural segments Providing number of bags produced per acre or hectare based on a shared profit and loss agreement in proportion of 10% to 90% 20% to 80% 30% to 70% 40% to 60%
Actual Manufacturing and Processing Loan	Accounted for by the construction of threshing machines, harrows, poultry cages, refrigerators, flour milling machines, dairy cans, etc.	Actual Istisna Loans for Investments in manufacturing and processing	Accounted for by the construction of threshing machines, harrows, poultry cages, refrigerators, flour milling machines, dairy cans, etc. based on an agreement to advance payment to the manufacturer on behalf of the client who share the profit and loss investment agreement in agricultural equipment with the financier based on a proportion of 10% to 90% 20% to 80% 30% to 70% 40% to 60%
Trade Finance Loan	Account for the procurement of agricultural goods for suppliers for sales based on a profit margin	Murabaha Loan	Account for the procurement of agricultural goods for suppliers for sales based on an agreed profit
Actual Income Provided from Investment	Accounted from the investment in the various agricultural segment / and non-current assets	Actual Profit Provided from Investment (P)	Accounted from the investment in the various agricultural segments based on the agreement of profit and loss including non- current assets like ijarah and takaful
Actual Loss from Investment	Considered based on the reality of natural disasters caused in farming like pests, diseases, flood, drought and wildfires	Actual Loss from Investment (L)	Considered as agreed based on the occurrence of natural disasters, for instance, drought, pests like locust, flooding and wild fires
Loan Repayment	After knowing the kind of harvest made a certain number of crops will be sold to repay the capital sum invested at market value	Loan Repayment	After knowing the kind of harvest made a certain amount of crops bags will be sold at a lower market value for as-salam product to repay the capital sum invested after zakat

Agro Taxes	Agro Tax for conventional finance must not charge beyond repayment and tax paid for financial services in the name of agro financing to avoid exploitation as done by private financiers.	Zakat	A fixed 2.5% tax on agricultural produce is mandatory so before loan repayment this tax will be removed in bags or cash value and credited to a central zakat account in the name of the smallholder farmer producer.
Service charges from Investment	Service charges that justifies transactions both for FIP and FIU should be applied per transaction and should be fixed	Wakalah and Juala charges from Investment	Service charges that justifies transactions both for FIP and FIU should be applied per transaction and should be fixed
Saving from the investment of smallholder farmers profit		Savings from the investment of smallholder farmers profit	
Technology Service Provider (TSP) for Account Aggregator (AA)			
FIP	**AA**		**FIU**
FMOAFS States MOA 774 Local Governments Councils Agriculture Departments Conventional Banks Islamic Banks NADF- Banks 5% Contribution to CBN (AGSMEEIS) CBN (AGCGSF) CBN (CACS) CBN Anchor Borrower Scheme (ABS) CBN, Micro, Small and Medium Enterprises (MSME) Bank of Agriculture (BOA) Nigeria Incentive Based Risk Sharing Agricultural Lending (NIRSAL) Conventional Micro Finance Banks Islamic Micro Finance Banks World Bank Islamic Development Bank	Financial Data Access Fiduacracy AA Products Supported (Smart Technology Applications Android) (Agency Banking Applications) (Automated Teller Machines ATM's) (Cloud Services) (Geographical Point Services GPS) Unifier of the financial ecosystem in the agriculture sector		Identified Smallholder Farmers Identified Medium Scale Farmers Registered Agro Associations Registered Cooperative Groups Identified Local Farmer Groups Agro Manufacturing/ Processors Association Agro Fabricators Association

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The financial standard helps with providing accounting standards which further help with the interconnectivity of financial and sustainable disclosures, but with the use of digital technology, an Account Aggregator Model (AAM) in financing agriculture will assist in accounting and managing agricultural funds as stated in Union Bank., India

[12]. The Internet of Things (IoT) in digital technology is critical in transforming agriculture in Nigeria and making agriculture not only practical but sustainable and viable. The focus on the Internet of Things (IoT) should be based on the Agriculture Internet of Things (IoT) supported by a developed National Agriculture Accounting System (NAAS). Digital banking and finance started in Nigeria in the late and early 90s with the new 4 generation banks FSB International Bank Plc, Diamond Bank, Standard Trust Bank, and Guaranty Trust Bank Plc. They operated based on modems using landlines to convert Analog to Digital technology for the use of computers and vice versa and introduced real-time online banking in Nigeria and operated as Internet Exchange Points (IXPs) for these financial institutions. In addition, this modem-based digital technology introduced Nigeria to the internet and Google. With the privatization of the telecommunications industry in 2002/3, private telecommunications companies like Mtel, Airtel, Globacom, and MTN took over and were using the NITEL satellite to provide mobile handsets GSM line services, and the internet. Today, GPS services and Clouding have taken digital services to a new height with licensed Fin-tech companies providing transformational financial services within the urban areas with little or no exploration to transform financial inclusion in the rural areas in Nigeria where the bulk of the farmers are without access to sustainable digital technology services to boost financing agriculture. To achieve optimal use of digital technology in the agricultural sector with functional unity and universal functionalism an application software must be developed to provide a one-man-stop shop concept that applies accounting and financial of both conventional and Islamic systems in it to provide smallholder farmers with choice. In addition, this developed software application must have a Point of Service (POS) Internet Exchange Point (IXP) that has a Geographical Point Services (GPS) service that can track farming activities and machinery services in farms and can be supported by Cloud services in areas where there is obstruction of services or no telecommunication mast services. This application must be operationally interfaced with other financial institutions and fin-tech companies to make financial accessibility in the remotest area possible where farming activities need a boost to support rural economies through the use of the internet economy.

How should the NAAS work? The operating activities of the NAAS will be on a Public Private Partnership (PPP) agreement with a fin-tech company duly registered for this purpose but with extended financial services to the public. The federal government is the sole financial provider of agricultural funds in Nigeria, followed by the 5% of commercial banks' contribution on an annual basis running in billions of dollars. The contribution of conventional and Islamic bank loans to the agriculture sector is minimal due to the fear of a lack of collateral and repayment defaults from smallholder farmers. This is one reason why monitoring and evaluation from the inception of the loan is critical in the absence of collateral and room for defaults in loan repayments. Since the agricultural sector is financed by the government, and changed through private financial institutions that for obvious reasons cannot get to the real smallholder farmers a developed NAAS with digital technology under a fin-tech is critical to take government funding to the people in the rural area to enhance productivity for farmers and income through taxation for the government. How should the agricultural funds under the fin-tech be invested? The investment activities must reflect an account of the government, private, and international funds channeled to the fin-tech company responsible for disbursement and the fin-tech company using the NAAS software must account for the funds to the production of plants and animals, mechanization, herbicides, and pesticides, harvesting, processing, storage and marketing in the agricultural segments within the country considering climatic condition, security issues, soil profiling, and market outlets to achieve ensure economic sustainability supported

by an internet economy based on financial inclusion.

What are the expectations of NAAS in the finances? The financial activities will define the total finances allocated and disbursed to each agricultural segment including the support of non-debt instruments like leasing and the insurance of these crops and agro-businesses against unexpected circumstances like drought, fires, flooding, and death of smallholder farmers. The projected financial expectations for production must be made based on the measured cost of production per hectare of land for any plant production and cost per animal whether birds, seafood, or cattle for animal production. How much was given out in the loan? And How much of the loan was repaid? How much profit was made from production? How much is Zakat was collected? How much savings was made by small and medium farmers? How much loss was made and what was the cause of the losses? What taxes are paid and how much income was made from agricultural taxes? These are what the NAAS software/ hardware can explain when the infrastructure of financial institutions, agency banking, fin-tech operators, and telecommunication companies are functionally unified to provide not only national agricultural problems but also international funding from international financial institutions investing in agriculture. Priority should also be given to perfecting the NAAS software and hardware to ensure the safety and protection of intangible financial assets of small and medium-scale farmers. One may argue the investigative question of what needs to be operationalized for further research on this topic which includes What are the problems associated with digital technology service providers, fin-tech, financial institutions, and government agencies in financing agriculture? What financial institutions, agencies, or fin-tech platforms have effective financial outreach to smallholder farmers in rural areas that can be efficiently reliable to sustain the financial inclusion of agricultural rural people What software and hardware with both accounting systems of financial systems based on digital technology with telecommunication services provider financial services that will improve accountability of agricultural funds? What measured approach should be adopted to monitor and evaluate digital technology to provide Key Performance Indicators (KPI) for efficient and effective sustainable financial services to smallholder farmers in rural areas?

2.3 Methods

The secondary source of data collection was used for this study. Two published papers in journals and two seminar papers related to financing agriculture were reviewed and evaluated to provide insights into the role of financing agriculture. In addition, seven published articles and papers related to digital technology services in financing agriculture were also analyzed to give in-depth facts about the trends of digital financial services in Nigeria.

3. Results

The findings give a historical and descriptive narration of the problems of digital technology financial services in the agricultural sector. Financial institutions both conventional and Islamic lack the capacity to provide structural offices around the country where financial services close to the people will be accessed. In addition, to this, the agency banking services offered by banks and fin-tech companies are domiciled in urban areas as argued by Elayelagha [4]. This also proves the argument of Trendov, Varas, & Zeng [1] that digital technology transformation does not support rural development, especially in agricultural financing. Rural infrastructure to

support digital technology in terms of masts, GPS, software, and hardware IXP and POS which will transform the rural agricultural economy is lacking in rural areas of Nigeria as argued by Abdullahi, and Gupta [3] based on the distance between financial institutions and government agencies and farmers in the rural areas. While insecurity in many local government areas in the North-West North-East and North-Central continues to impede agricultural productivity so shall it impede the structural development of digital technology to support agricultural financing. Agriculture's financial depth in Nigeria is supported by the government and relying on the PFI's and government partnership with international collaboration has not yielded a positive result in achieving the goals for financial inclusion and agricultural productivity in Nigeria, this is because collateral and interest rates have continued to impede agricultural financing as stated by Abdullahi and Gupta [10]. While the CBN is adamant about developing universal software and hardware that will provide IXP with ease in the rural areas as argued by Ikeagwuonu [7], there is a need to develop software and hardware that will revolutionize agricultural financing through digital technology and ensure that the elimination of interest rates for conventional agricultural financing and the elimination of collateral for both conventional and Islamic agricultural financing including taking steps to ensure monitoring and evaluation that agricultural funds are accounted to provide key performance indicators (KPI) of these funds transparently in practical terms Abdullahi and Gupta [8]. Zakat is a 2.5% tax that is mandatory in all financial and productive activities of Muslims. Agricultural produce is remitted as zakat based on the 2.5% with no numerical value attached to the good or market value of the good. While zakat is a coping strategy to advance agricultural financing in addition to providing food security to the vulnerable in society, it must be organized to provide financial assistance to meet agricultural production with zero interest rate and zero collateral as indicated in Abdullahi and Gupta [8, 10]. The AAOIFI has reviewed the accounting standards based on the IFRS to improve Islamic financial services in conventional financial institutions where Islamic windows provide financial accessibility to smallholder farmers [11]. The idea is to consolidate and develop an IXP based on a POS and API that recognizes the importance of digital technology financial services for agricultural finance in rural areas and also provides other social financial services ensuring financial inclusion for smallholder farmers [12].

3.1 Summary of Findings

The summary of the findings indicates that there is a structural problem in both public and private financial institutions including international financial institutions in providing digital financial services to smallholder farmers in the rural areas because of IXPs and POS agency banking services which hinder agricultural support for agricultural production. The lack of this digital technology created the fin-tech companies who captured outreach for financial services to the rural areas but with little or no effort in reshaping agriculture as a truly viable business. This shows the need to integrate the agricultural value chain the sources of funds or providers into a digital system that allows for functional unity and accessibility with a universal view of the happenings in the agricultural sector. When accessibility of financial services to smallholder farmers is sustained through the developed software and hardware of NAAS then the possibility of poverty, unemployment, malnutrition, and criminality will drastically reduce in Nigeria.

From the literature review, the research gaps identified in this paper include the evidence gap in structures or structural functionalism in the structures of financial institutions and fin-tech digital technology and telecommunications services providers. This structural gap by extension identified the implementation gap in the

processes of financial institutions and government agencies and fin-tech platforms that limit digital technology in funds accessibility, and funds accountability, with insecurity that affects improving the digital infrastructures and a lack of sustainable electricity for grid services for telecommunications service providers. This implementation gap exacerbates the population gap between agencies and structures where agricultural producers are marginalized or excluded from financial affiliation in rural areas. In providing a solution to the problem of digital technology financial services a methodological gap approach in the method is needed to provide functional unified and universally accessible digital technology services in financing agriculture within the banking and finance sector to ensure the financial inclusion of smallholder farmers.

4. Conclusion

The literature review findings indicate general character and managerial issues in the agricultural fund disbursement that elaborates on the importance of a structural infrastructure problem of digital technology in financing agriculture with insufficient IXPs, POS, Masts, and institutional financial structures to support the agriculture sector. In Addition, there should be universal software and hardware IXP to support POS with API services to support agricultural development in rural areas that will help with the monitoring and evaluation of key performance indicators (KPI) in the agriculture sector in Nigeria.

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