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Effect of Financial Inclusion on Crop Production in Selected West African Countries: 2009 – 2022

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Abstract

This study examined the effect of financial inclusion on crop production in selected West African countries. Agricultural production has been the bedrock of the typical African society. Across West Africa, there is a tug-of-war between the need to provide seamless financial transactions for agricultural products and the need to increase agricultural output rapidly to meet increasing demand for food. Financial inclusion and agricultural productivity has been studied by many researchers but empirical findings have varying results. This study specifically examined the effect of value of loans accessed by farmers, bank density, bank deposit to GDP ratio, and mobile banking penetration rate controlled by gross fixed capital formation, human capital index, total labour force, and prime lending rate on crop production in Nigeria, Ghana, Cote D'Ivoire, Senegal, Burkina Faso, Benin, Sierra Leone and Togo. The theoretical foundation of this study is the financial inclusion theory which is hypothesized to be a vital aspect of growth in the agricultural sector. The study applied the Panel Ordinary Least Square (POLS) technique to estimate the model and covered a period of fourteen years from 2009 to 2022 using data that were obtained from the World Bank. The findings revealed that value of loans accessed by farmers, bank density, bank deposit to GDP ratio, mobile banking penetration rate have no significant effect on crop production of selected West African countries: Nigeria, Ghana, Cote D'Ivoire, Senegal, Burkina Faso, Benin, Sierra Leone and Togo. The study concludes that financial inclusion has yet to have the desired effect on crop production. The study recommends that Governments and financial institution in the selected West African countries should provide low interest agricultural loan with flexible repayment terms linked to harvest cycles.

Keywords: Financial Inclusion, Crop Production, West Africa

1. Introduction

Agricultural production has been the bedrock of the typical African society. Since the late 1950s and the subsequent years, such as 60s, 70s, 80s and 90s, agriculture has remained the main source of employment and livelihood for the over 290million people who live in the West African region. According to the World Health Organization (WHO, 2020), agriculture employs 60 percent of the workforce and accounts for up to 35 percent of the region's gross domestic product (GDP). Notably, USAID (2021) [32] observed that West African agriculture ranges from nomadic pastoralism in the far north to root-crop and tree-crop systems in the south. In general, the crop-producing areas are roughly horizontal belts following bioclimatic zones. In the Sahelian zone, millet and sorghum are the predominant crops, transitioning to maize, groundnuts, and cowpeas, farther south in the Sudanian zone. These food crops are among the top five harvested crops in the Sahelian countries: Mauritania, Senegal, Mali, Burkina Faso, Niger, and Chad. Root crops such as cassava and yams are found mostly across the Guinean zone, especially in Sierra Leone, Ghana, Nigeria, and Côte d'Ivoire. Finally, cereals and cash crops such as rice, cocoa, palm trees, or cashew are found in the Guineo-Congolian zone. Rice is also one of the most harvested crops in terms of area; it ranks first in Guinea, Liberia, and Sierra Leone. Rice is the most rapidly growing staple food in West Africa and constitutes a major part of the population's diet.

In the early 1980s, cropland was widely scattered among the natural landscapes of West Africa, covering 10.7 percent of the mapped area (FAO, 2020) [13]. In the next several decades, the Food and Agricultural Organization (FAO) observed that cropland has expanded rapidly and now pervades the whole region. By 2019, the area covered by farmers doubled, reaching a total of 1,100,000 sq km, or 22.4 percent of the land surface (FAO, 2020) [13]. This clearly shows increasing trends for the agricultural sector in the region. In a similar manner, the economic base of most countries in the West African region are mostly agrarian constituting more than 60 percent of the region's gross domestic product (World Bank, 2021) [33]. Even though the discovery of oil in some countries in West Africa shifted this trend, other countries maintained their agrarian nature. One problem these countries faced was the monetization of the agricultural products since most farmers are lacking in financial literacy. This is backed up by the report of the FAO (2020) [13] which stated that more than 50 percent of rural farmers do not have access to modern financial services and even those that have are being limited by the quality of financial technology available at their disposal.

Across West Africa, there is a tug-of-war between the need to provide seamless financial transactions for agricultural products — and the need to increase agricultural output rapidly to meet increasing demand for food and fiber (Nzotta & Okereke, 2009) [21]. Most farms are small, typically 1 to 5 hectares. Although the small size of farms reflects a scarcity of land in heavily populated areas as in parts of Nigeria, it is also a result of the limited technology available to rural households. Financial systems in West African countries developed rapidly during the 1980s and 1990s as a result of financial liberalization drive in many countries in the region at the time (Fowowe, 2020) [14]. In most of these countries, electronic banking started predominantly since the early 1990s when the global trend towards deregulation, the rise of global financial services conglomerates coupled with the rapid technological developments and the global trend of banking deregulation resulted in the removal of several previously-imposed restrictions and monopolies (Roger, 2019) [26]. For instance, Talla (2013) [28] observed that financial institutions were no longer required to specialize in only one product line, meaning that financial institutions such as insurance companies could also offer banking services and vice versa, which naturally increased competitive pressure in the industry and their e-services channels. (Blickle, Parlatore & Saunder, 2001) noted that even large banks specialize in lending to specific industries. The average bank in the sample directs around twenty (20) percent of its total lending into a single top industry far more than into any other industry. This specialization is correlated with more favourable loan terms for borrowers; as measured by loan size, rate spread, and maturity. This holds especially in times when competition, for instance from non-bank entities such insurance companies, is higher and in lending to firms with access to alternate sources of funding. Specialization by banks may in fact be a partly necessary answer to increased loan competition.

The West Africa Economic and Monetary Union (WAEMU) have since searched for a way to integrate financial inclusion into the agricultural sector as this will help boost the economy of the region. Statistics from the World Bank proved that there has been increased adoption of mobile banking within the West African sub-region. For example, Forbes (2022) [15] reports that mobile banking is expected to increase to $129 billion over the next few years and that 40 percent of population of the region prefer using mobile digital platforms for transactions. In addition, financial technology adoption has increased among West African countries as more than 80 percent of banks have extended their services to rural areas and there has been increase in the licensing of microfinance banks to take care of rural banking needs through enhanced service delivery. These statistics have serious implications on the subsistence sector i.e. the agricultural sector. Myriads of questions have arisen as to the extent to which mobile technology usage and advancements in financial technology have affected the agricultural sector output in the West African region. To this study is set out to examine the effect of financial inclusion on crop production in selected West African countries. The study covered eight countries in West Africa (Benin, Burkina Faso, Cote D'Ivoire, Ghana, Nigeria, Senegal, Sierra Leone, and Togo) from 2009 to 2022. To the best of the researcher's knowledge, the study of the eight selected West African countries is a novelty in this subject matter.

2. Literature Review

Exploration of Concepts

Financial inclusion has been defined as access to a wide range of financial services (e.g. loans, savings, and deposits, and insurance) by the lower class of the society who normally these financial services will not reach. The reduction of hunger and poverty and enhancement of the overall financial well-being of individuals is the main focal point of financial inclusion (Evans & Lawanson, 2017) [11]. World Bank (2019) [29] defines financial inclusion as the share of individuals and firms that use financial services. African Development Bank (AfDB, 2012) [1] defines inclusion as all initiatives that make formal financial services available, accessible and affordable to all segments of the population. The financial system of every country in West Africa and indeed the World has formal and informal segments. Informal intermediaries provide only credit facilities while formal ones provide savings, credit, and money transfer services. Within each of the markets, farmers need to make rational choices as to the amount of services they utilize. In the case of informal intermediaries that provide only credit facilities, farmers need to make a choice between using credit and or not using credit. Formal financial intermediaries provide savings, credit, and money transfer services; hence, the farmers have the option to choose among these services or a combination of them. The financial market in an agrarian economy is characterized by a low level of savings, funds transfer facilities, and inadequate insurance (Awunyo-Vitor & Al-Hassan, 2018) [7] coupled with limited coverage. Thus, farmers have to access credit to ease liquidity constraints for production and to smoothen consumption.

Crop production refers to the total quantity of agricultural produce harvested from cultivated crops within a specified period, typically measured in terms of weight or volume. This output is a critical indicator of agricultural productivity and encompasses all varieties of crops such as grains, vegetables, fruits, and legumes. Crop production real output refers to the inflation-adjusted value of all crops produced within a specific period, providing an accurate measure of the true productivity of the crop sector. This concept is

essential for understanding the real growth and performance of agriculture over time, as it accounts for changes in price levels and eliminates the distorting effects of inflation. By adjusting for inflation, the real output offers a more reliable and consistent metric for comparing crop production across different time periods, allowing policymakers, economists, and stakeholders to assess trends, make informed decisions, and implement effective agricultural policies.

Theoretical Foundation

We hinged this study to the assumptions of the financial inclusion theory. Financial inclusion is the process of mainstream institutional actors offering suitable financial goods and services at a reasonable cost to all parts of society, including disadvantaged communities such as poorer sections and low-income groups, in an equitable and open manner. The theory regarding financial inclusion was developed starting with the 60's in the 20th century, the starting point being the work of Gurley & Shaw in 1960. According to the theory, all 'bankable' individuals and businesses have access to credit, all insurable individuals and businesses have access to premiums, and all have access to savings and payment systems. Financial inclusion is defined as the provision of a wide range of financial services (e.g. loans, savings, deposits, and insurance) to the poor who normally do not have access to such services. Financial inclusion can be crucial for the reduction of hunger and poverty (Chaddad, Cook & Heckelei, 2005; Evans & Lawanson, 2017) [10, 11]. Financial inclusion is needed throughout the agricultural value chain to achieve broad-based economic growth which can raise incomes for low income households. Accordingly, the financial inclusion theory involves activities and initiatives that are directed towards the most vulnerable parts of society, such as the poor, young people, mothers, and the elderly, who are disproportionately affected by economic inequality and crises. It makes sense to get poor people into the mainstream banking market because they are especially impacted by financial bubbles and economic recessions. One method to do this is via government-to-person (G2P) social cash transfers into the official accounts of disadvantaged individuals. Making G2P social cash payments to the poor, young people, women, and the elderly enables other poor, young people, women, and the elderly to gain access to the formal financial system and open a formal account in order to receive social cash transfers, thereby increasing the rate of financial inclusion for marginalized groups. Furthermore, since disadvantaged people in society are offered social cash transfers and other services to achieve financial equality, they may feel as if they are being rewarded for the current wealth inequalities, helping them to keep up with the rest of society.

The implication of the theory is that it considers such members of the community as vulnerable; meaning that attempts to increase financial inclusion should be focused on them. The vulnerable groups' financial inclusion theory has certain merits. To continue, the philosophy focuses on vulnerable groups and aims to get them into the structured finance system in order to solve the issue of financial exclusion. Second, under this principle, recognizing the community's financially vulnerable participants is easy. The degree of deprivation, income status, ethnicity, age, and other demographic factors can all be used to classify the population's most vulnerable members. Third, achieving financial inclusion for only the most disadvantaged members of the population could be more cost-effective than achieving financial inclusion for the whole population (USAID, 2021) [32].

Empirical Studies

Norbert and Egwu (2023) [19] examined the implication of financial inclusion for agricultural production among cocoa producers in the Southwest region of Cameroon. Using semi-structured questionnaires, a stratified multistage sampling technique is used to survey 380 cocoa producers. First, through the Cobb-Douglas production function, we show a significant positive association between financial inclusion and cocoa production by 26%. Also, through treatment effect and propensity score matching, financially included producers realized a significant increase in farm income than their excluded counterparts on account of the three main dimensions of financial inclusion: Access (421,804 FCFA), use (803,081 FCFA) and quality (550,678 FCFA). Moreover, unsuitable pricing, inadequate credit, socio-political instability, and inadequate farmland accounted for 70.2% of the problems cocoa producers faced. Hence, a top policy recommendation for sustainability in the cocoa sector warrants that more formal financial institutions are established with an emphasis on the use and quality dimension.

Shen, Guo, and Zhang (2023) [27] focused on agro ecological functions while incorporating total agricultural carbon sequestration and emissions extraction into the evaluation system and used the mixed-direction-distance function to calculate agricultural green total factor productivity. Then, based on panel data from 31 provinces in China collected from 2011 to 2021, they used the two-way fixed effect model, the interactive fixed effect, and the plausibly exogenous variable method to test the impact of digital financial inclusion on agricultural green total factor productivity, and its mechanism of action. The panel-corrected standard error and fixed effect Driscoll–Kraay methods were used to account for the unobserved heterogeneity and cross-section dependence in the panel data. The results showed that digital financial inclusion can significantly improve agricultural green total factor productivity.

Zheng, Zhang, Wang, and Zhao (2021) [34] examined the impact of financial development on fishermen's poverty reduction in China between 1996 and 2017. The state space model and the comprehensive mediation effect test method are employed to verify the affecting channels, while the threshold panel model is introduced to illustrate the specific performance in this process. Results have confirmed the existence of the indirect effect between financial development, economic growth and fishermen's poverty reduction. This means the influence of financial development on fishermen's poverty reduction in China mainly relies on the intermediary role of economic growth. Furthermore, the empirical evidence also supports an asymmetric inverted U-shaped relationship, which is linked to the Greenwood-Jovanovic (GJ) hypothesis.

Arowolo, Ibrahim, Aminu, Olanrewaju, Ashimu, and Kadiri (2022) [5] examined the effects of financial inclusion on livelihood diversification among the smallholder farming households in Oyo State, Nigeria. Primary data were collected through a well-structured questionnaire administered to 400 respondents who were randomly

selected, using a multistage sampling technique. Simpson index with the ordered logit regression model were used for the analysis. The result from the Simpson index of diversity shows that the smallholder farmers pursued some levels of diversification in their livelihoods activities and earned income from multiple sources, with about one-third being highly diversified. The ordered logit regression shows that the probability of the smallholder farming households diversifying their livelihood activities is strongly influenced by age, gender, marital status, and education of the household head, household size, total area of land cultivated, main livelihood activity, access to credit, and ownership of bank account. Access to credit and owning a bank account positively influenced livelihood diversification.

Ojo, Ogundeji, Babu, and Alimi (2020) [23] analyzed the financing gaps relative to production frontier of rice farmers in Southwestern Nigeria. A multistage sampling technique was used to collect cross-sectional data from 360 rice farmers selected from three states in the region. A Cobb–Douglas stochastic frontier and an adapted form of Harrod–Domar (HD) growth model was employed to determine the financing gap required the farmers to be at the frontier level. The empirical results of the frontier model show that quantity of labour, quantity of rice as planting material and herbicides were statistically significant in explaining the variations in the efficiency of rice production in Nigeria. However, age, gender, farming experience, household size, access to credit, access to information, adoption of improved variety and location of rice farmers as sources of technical inefficiencies. As revealed by the result of the HD growth model, the average amount of credit per season that farmers had access to was, ₦38,630.56 while the mean financing in the form of credit required to produce at the frontier level was ₦193,626.50, showing a financing shortfall of about 80%.

Pomeroy, Arango, Cristopher and Lomboy (2020) [25] reviewed the barriers to financial inclusion of small-scale fishing households such as limited financial capability and literacy, lack of assets for collateral, geographic distance from a financial institution and lack of formal identification. It also discusses solutions to address these barriers including financial literacy, de-risking financial institutions, financial data collection, provision of a range of financial services besides credit, and understanding the client that will enable fishing households to retain control over their earnings and savings. Financial inclusion can help reduce the different vulnerabilities of poor fishing house.

Fowowe (2020) [14] carried out a research on the effect of financial inclusion on agricultural productivity in Nigeria. The study made use of the Living Standards Measurement Study– Integrated Surveys on Agriculture (LSMS-ISA) which he considered a new data set on agricultural households which contained information on agricultural activities and various household activities, including banking, savings and insurance behaviour. Considering the data were such that there had observations for households over three time periods, the study exploited the time series and cross-section dimension of the data by using panel data estimation. The empirical results showed that financial inclusion, irrespective of how it was measured, had exerted positive and statistically significant effects on agricultural productivity in Nigeria.

Balakrishna and Virmani (2019) [8] examined the numeracy and financial literacy of the Indian forest-dependent communities (FDC) involved in the joint forest management (JFM) programme, launched by the Government of India in 1990. The research draws sample data from FDCs of two geographical regions with differing resource endowments (Rayalaseema and the coastal region) in the Indian state of Andhra Pradesh. The results showed that a third of the sampled members of the FDCs were able to answer the questions on probability and simple interest correctly. At least half of the sample had a clear idea on the time value of money and had less difficulty in computing when the mathematical questions were framed in the form of sentences which embedded situations from their daily lives. Participants, however, faced difficulty in recognizing mathematical symbols and performing simple computations in addition, subtraction, multiplication, and division. The average scores of the sample in the standard numeracy and financial literacy tests were 4.98 (out of 12 points) and 1.32 (out of 5 points), respectively. The study also identified some socio-economic determinants of (numeracy and) financial literacy. Education has a positive effect on both numeracy and financial literacy, while household size has a negative effect on numeracy, with no effect on financial literacy after controlling for education. Members of FDCs with habitations close to towns are likely to be more numerate and financially literate.

Agbenyo, Jiang, and Antony (2019) [2] did a Cointegration analysis of agricultural growth and financial inclusion in Ghana. Time series data from the period of 1980-2014, Johansen Cointegration approach coupled with Fully Modified Ordinary Least Square method (FMOLS) was used for the estimation of long-run relationship between agriculture growth and financial inclusion in Ghana. The study revealed that, domestic credit to private sector had an inverse relationship but significant. The paper also revealed that lending interest rate proxy for accessibility of financial services to farmers portrayed significantly positive impact on the growth of agriculture. As provision of financial services alone could not enable rural farmers attain financial inclusion, they recommended an urgent need for the provision of domestic credit to the private sector as they help promote economic growth implying that the better the private sector gets, the bigger role they played in the economy.

A study conducted by Agunuwa, Inaya, and Proso (2018) [3] collected information from both primary and secondary sources aimed at investigating the bank's credit and agriculture development from five banks and ten agricultural enterprises in Delta State. The study adopted simple random sampling through the lottery method in selecting its participants who were involved in the survey. Data collected for this study used percentages, mean scores, Standard Deviation, and Pearson product-moment correlation to test the respective hypotheses. They discovered that bank credits to agricultural entrepreneurs encourage agricultural growth and productivity. Elaborating on this finding, we can express that the researcher suggested the need for adequate bank credits.

Awunyo-Vitor (2018) [6] presented a discussion paper on the theoretical and conceptual framework on issues relating to access to financial services by farmers in Ghana. The discussion began by providing details of various theories that underpinned the demand and supply side of access to financial services. The study contended that the supply dimension of access to financial services was guided by the

information asymmetry theory and the transaction cost theory, while the key demand dimension theories were the delegated monitoring theory and the rational choice theory. The study opined that farmers who use formal financial services were able to relieve liquidity constraints for the purchase of inputs and the cultivation of larger areas. They held that formal financial market participation was conceptualized to have a positive effect on the amount of money the farmer spends on variable inputs, farm size, and, consequently, productivity. This, according to the researcher, was because farmers who use formal financial services would be able to relieve liquidity constraints for the purchase of inputs and the cultivation of larger areas. The study recommended the use of empirical analyses to access factors influencing access and the impact of the access to farmers' productivity.

Another study by Ogunniyi, Ajao, and Adeleke (2018) [22] on gender comparison in financing, production and productivity of cocoa farmers relied on the primary source of data, where 100 questionnaires were distributed to cocoa farmers in Oluji Local Government Area Ogun State Nigeria. They found that most cocoa producers were not technically efficient, which implied a lot could be done to increase their productivity. The study discovered that the majority of farmers who engaged in cocoa production were grown-ups as more of the young farmers do not participate much in cocoa production. Low level of education was another factor which they found influenced cocoa production and they held that perhaps this hindered their ability to access financial services. A thorough investigation of the farmers' efficiency revealed that age, education, and experience were significant in technical inefficiency.

Ugbor, Omeje and Mba (2018) [31] investigated the effect of financial inclusion on agricultural sector in Nigeria. The study utilized survey data generated from 600 recovered questionnaires which were administered to farmers in both rural and urban locations in Nigeria. The study developed adequacy gap index and timeliness gap index to measure the penetration gap index theory of financial inclusion through the application of the pecking order theory. The adequacy and timeliness gap indices revealed that the different formal lending agencies were unable to meet the credit needs of these small scale farmers hence, credit was inadequately and untimely provided to small scale farmers because they depend on rain-fed agriculture. The penetration gap index revealed that the penetration of financial inclusion in agricultural sector was still shallow in Nigeria. They recommended among others that government should intensify the efforts to meet the credit needs of farmers (adequacy and timeliness) to ensure the penetration of financial inclusion.

Moses and Thalut (2018) [17] examined the relationship that exists among the latent variables of financial exclusion, sustainable rice production and poverty reduction among some smallholder rice farmers in Ndop, Ngoketunjia Division in the North West Region of Cameroon. Data elicited via survey questionnaire administered on a sample of 206 households was analyzed based on both factor analysis and structural equation modeling. The results indicated that financial exclusion was negatively related to sustainable rice production and poverty reduction. Therefore, a unit increase in the level of financial exclusion would result to 24% reduction in sustainable rice production and exacerbate the level of poverty by 7%. The findings indicated that lack of financial inclusion among rice farmers in Ndop significantly and statistically restraint sustainable rice production and exacerbate the level of poverty.

Olaniyi (2017) [24] examined the effect financial inclusion on agricultural productivity using annual data over the period 1981-2014 in Nigeria. The ARDL bounds testing approach was employed to capture the long run as well as the short-run dynamics of the relationship between financial inclusion and agriculture in Nigeria. Using data on agriculture share of GDP, lending interest rate, broad money, outstanding loans from the financial sector to the agricultural sector, number of banks in Nigeria and GDP per capita, the results showed that usage of financial services had significant impacts on agriculture both in the short and the long run, meaning that for sustainable agricultural development in rural areas, improving financial inclusion was critical. On the contrary, access to finance had insignificant impacts on agricultural growth. The conclusion was that while provision of access to finance to rural farmers could have many benefits, it was more important to consider the usage of the finance in the rural settings and its impact on rural outcomes that we care about. The study stressed the need for more traditional and non-traditional financial service providers to go back to the land and innovate in the Nigerian agricultural space in order to boost financial inclusion in Nigeria while also substantially reducing poverty and stimulating agricultural growth.

3. Methodology

The study used an ex-post facto research design. All the sixteen countries in West Africa (Benin, Burkina Faso, Cape Verde, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo) made up the study's population. World Bank and International Monetary Fund (IMF) development indicators that were evaluated during a fourteen-year period, from 2009 to 2022, provided the study with secondary data. Eight (8) countries (Benin, Burkina Faso, Cote D'Ivoire, Ghana, Nigeria, Senegal, Sierra Leone, and Togo) with data accessible for the study's periods were chosen as the sample size using a purposive sampling technique. Panel Ordinary Least Square (POLS) was used in the study to estimate the model.

This study adapted and modified the model of Ajide (2016) [4] and stated as thus:

$$RGDP = f(CONC, MM, BCP, GNS) \quad [i]$$

Where:
CONC = is bank concentration index,
MM = is ratio of M_3 to M_1,
BCP = is bank credit to private sector,
GNS = is the ratio of national savings to GNS as measures of financial innovation
RGDP = is real gross domestic product

Econometrically modifying equation [I], we have our model which is expressed as thus:

$$CRP_t = \alpha_{0+}\alpha_1 GFCF_{it} + \alpha_2 HCI_{it} + \alpha_3 TLF_{it} + \alpha_4 LON_{it} + \alpha_5 BND_{it} + \alpha_6 DEP_{it} + \alpha_7 MBP_{it} + \alpha_8 PLR_{it} + \varepsilon_t \quad [ii]$$

Where:
CRP = Crop production
GFCF = Gross fixed capital formation

HCI = Human capital index
LON = Value of loans accessed by farmers for the period
BND = Bank density (% of banks per 100,000 adult population)
DEP = Bank deposit to GDP ratio
MBP = Mobile banking penetration rate
PLR = Prime lending rate
$\alpha_{0,}$ = intercept of the model
$\alpha_1 - \alpha_8$ = are the coefficient of the independent variables
ε_t = Stochastic disturbance or error term and "t" is the time period 2009-2022.

The financial inclusion variables are expected to have positive effects on crop production in the selected countries in West African region. To this end, the a-priori expectation of the model can be stated mathematically as: $\alpha_4 - \alpha_7 > 0$.

4. Data Analysis and Discussion of Findings

Descriptive Properties of the Data

Table 4.1 details the descriptive properties of the data used in the analysis. The mean values of the variables: CRP, GFCF, HCI, TLF, LON, BND, DEP, MBP and PLR are 13.81152, 2.95E+12, 0.160122, 12973780, 21.49902, 4.478661, 22.81089, 24.23679 and 9.688462 respectively, while the median of the study variable are 11.42000, 1.53E+12, 0.000000, 5551228, 17.34000, 4.470000, 21.78000, 6.085000 and 5.794165. The maximum values of the series are 30.30000 for CRP, 1.14E+13 for GFCF, 0.450060 for HCI, 73389347 for TLF, 123.9300 for LON, 11.49000 for BND, 42.74000 for DEP, 291.0000 for MBP and 22.16667 for PLR, whereas the minimum values are 6.470000, 7.83E+08, 0.000000, 2177901, 4.770000, 1.830000, 4.640000, 0.080000 and 4.9775 respectively for CRP, GFCF, HCI, TLF, LON, BND, DEP, MBP and PLR. The standard deviation of the variables are 6.637686, 3.51E+12, 0.193972, 0.193972, 15.83458, 1.681118, 9.208885, 38.25502 and 5.971896 for CRP, GFCF, HCI, TLF, LON, BND, DEP, MBP and PLR respectively. The skewness which is a measure of asymmetry of the distribution of the series around its mean reveals that all the variables are positively skewed towards normality. The Kurtosis that measures the peakedness of the distribution for most the variables are more than 3.0 which evidences that variables are leptokurtic in nature except GFCF, HCI, DEP, and PLR. The p-values of the Jarque-Bera for all the variables are significant at 5% level which implies that all the variables are normally distributed and free from any outlier that may affect the regression output.

Table 4.1: Descriptive Properties of Data

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	P-value	Obs
CRP	13.81152	11.42000	30.30000	6.470000	6.637686	1.173741	3.218965	25.94019	0.000002	112
GFCF	2.95E+12	1.53E+12	1.14E+13	7.83E+08	3.51E+12	1.138623	2.863928	24.28705	0.000005	112
HCI	0.160122	0.000000	0.450060	0.000000	0.193972	0.403546	1.215983	17.89253	0.000130	112
TLF	12973780	5551228	73389347	2177901	19097635	2.198331	6.189865	137.6941	0.000000	112
LON	21.49902	17.34000	123.9300	4.770000	15.83458	3.636310	20.88481	1739.534	0.000000	112
BND	4.478661	4.470000	11.49000	1.830000	1.681118	1.440139	6.975583	112.4726	0.000000	112
DEP	22.81089	21.78000	42.74000	4.640000	9.208885	0.080615	2.546290	108.1957	0.000000	112
MBP	24.23679	6.085000	291.0000	0.080000	38.25502	3.493040	22.37276	1979.176	0.000000	112
PLR	9.688462	5.794165	22.16667	4.977500	5.971896	0.791576	1.867909	12.62667	0.001812	112

Source: Output data from E-views 12.0

Levin, Lin and Chu (LLC) Panel Unit Root Test

At first difference: Individual intercept, and individual intercept and trend, the LLC test was performed to ensure that the data have no stationarity defect that may encumber the result of the analysis. The result of the LLC test in Tables 4.2 and 4.3 performed in level form at individual intercept, and individual intercept and trend disclose that all the variables are stationary at first difference.

Table 4.2: LLC Test Result at First Difference: Individual Intercept

Variables	LLC Test Statistic	Pooled Coefficient	Pooled t-Stat.	Remark
CRP	-6.98253 (0.00)*	-1.08338	-10.005	Stationary
GFCF	-6.21049 (0.00)*	-1.71174	-10.474	Stationary
HCI	-8.28421 (0.00)*	-1.89860	-13.176	Stationary
TLF	-3.08153 (0.00)*	-2.61763	-9.528	Stationary
LON	-4.37073 (0.00)*	-1.06917	-7.429	Stationary
BND	-3.03633 (0.00)*	-1.77871	-11.139	Stationary
DEP	-7.29619 (0.00)*	-1.37700	-10.518	Stationary
MBP	-5.23490 (0.00)*	-1.35328	-9.021	Stationary
PLR	-3.76233 (0.00)*	-1.37359	-7.125	Stationary

Source: Computer Output using E-view 12.0.
Note: The optimal lag for LLC test is selected based on the Schwarz Info Criteria (SIC), p-values are in parentheses where (*) and (**) denote significance at 1% and 5% respectively.

Table 4.3: LLC Test Result at First Difference: Individual Intercept and Trend

Variables	LLC Test Statistic	Pooled Coefficient	Pooled t-Stat.	Remark
CRP	-4.85308 (0.00)*	-1.33921	-10.174	Stationary
GFCF	-9.34177 (0.00)*	-1.97469	-15.266	Stationary
HCI	-6.71887 (0.00)*	-2.08346	-14.302	Stationary
TLF	-5.73003 (0.00)*	-3.09926	-13.253	Stationary
LON	-5.54275 (0.00)*	-1.50087	-9.759	Stationary
BND	-10.6248 (0.00)*	-1.74244	-11.085	Stationary
DEP	-6.78692 (0.00)*	-1.51222	-11.477	Stationary
MBP	-7.61481 (0.00)*	-1.85849	-13.484	Stationary
PLR	-4.22044 (0.00)*	-1.76866	-9.020	Stationary

Source: Computer Output using E-view 12.0

Note: The optimal lag for LLC test is selected based on the Schwarz Info Criteria (SIC), p-values are in parentheses where (*) and (**) denote significance at 1% and 5% respectively.

Panel OLS Analysis of Crop Production and Financial Inclusion

The panel OLS was used to analysis the short run relationship between financial inclusion and crop production. The pooled OLS, fixed and random effect were the estimation approach used. The cross sectional estimation was performed based on the fact that the selected West African countries operate in different environment in Africa. The Hausman specification test in Table 4.4 shows the preference of the random effect estimation owing to the insignificant p-value of the Chi-square. Gross fixed capital formation (significant) and bank deposit to GDP ratio (insignificant) have negative relationship with crop production, while human capital index (significant), total labour force, loans accessed by farmers, bank density, mobile banking penetration rate, and prime lending rate (significant) have positive relation with crop production. Holding gross fixed capital formation, human capital index, total labour force, value of loans accessed by farmers, bank density, bank deposit to GDP ratio, mobile banking penetration rate, and prime lending rate constant, crop production would be 9.01. A percentage increase in human capital index, total labour force, loans accessed by farmers, bank density, mobile banking penetration rate, and prime lending rate lead to 4.063785, 4.21E-08, 0.045394, 0.091146, 0.009323and 1.034725 factor appreciation in crop production respectively, whereas a unit rise in gross fixed capital formation and bank deposit to GDP ratio lead to 1.07E-12 and 0.140185 reduction in crop production accordingly.

The adjusted R-square value of 0.849012 reveals that the explanatory variables jointly accounted for -84.90% variations in crop production in selected West African countries within the period of the study. The F-statistic which determine the overall significance of the joint influence of the independent variables shows that financial inclusion (gross fixed capital formation, human capital index, total labour force, value of loans accessed by farmers, bank density, bank deposit to GDP ratio, mobile banking penetration rate, and prime lending rate) significantly explained the variations in crop production in selected West African countries as the p-value is significant at 5% level (0.00 < 0.05). The Durbin Watson statistic of 0.629709 which is the traditional test of autocorrelation is not within the acceptable range of no autocorrelation in a model. However, the serial correlation test in Table 4.5 absolves of the model of any issues of autocorrelation.

Table 4.5: Panel OLS on Crop Production and Financial Inclusion

Variables	Pooled OLS		Fixed Effect		Random Effect	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
C	9.006640	0.0001	26.03522	0.0000	9.006640	0.0002
GFCF	-1.07E-12	0.0005	2.47E-13	0.3109	-1.07E-12	0.0007
HCI	4.063785	0.0346	0.158575	0.9528	4.063785	0.0403
TLF	4.21E-08	0.3577	-3.54E-07	0.0649	4.21E-08	0.3723
LON	0.045394	0.0669	0.033829	0.0792	0.045394	0.0754
BND	0.091146	0.8259	0.189867	0.7709	0.091146	0.8311
DEP	-0.140185	0.0346	-0.111442	0.1801	-0.140185	0.0402
MBP	0.009323	0.3203	-0.007534	0.1714	0.009323	0.3351
PLR	1.034725	0.0000	-0.527479	0.0015	1.034725	0.0000
R-squared	0.864302		0.978800		0.864302	
Adjusted R-squared	0.849012		0.967792		0.849012	
S.E. of regression	2.786249		1.286861		2.786249	
Sum squared resid	551.1859		86.11252		551.1859	
Log likelihood	-190.7169		-116.4602			
F-statistic	56.52740		88.91818		56.52740	
Prob(F-statistic)	0.000000		0.000000		0.000000	
Durbin-Watson stat	0.629709		1.320544		0.629709	
Hausman Specification Test						
	Chi-Sq. Statistic		8.614499			
	P-value		0.375900			

Source: Computer output data using E-views 12.0

Note: Periods included: 14, Cross-sections included: 8, Total Number of Observations: 112

Model Diagnostic Test

Table 4.6 displays the results of the diagnostic test for the created model. It processed the stability (Ramsey specification) and residual (heteroskedasticity and serial correlation). The serial correlation LM test results show that the model does not have autocorrelation (0.3247> 0.05). The model is correctly defined (0.3140 > 0.05) taking Ramsey specification into account, and free of heterskedasticity problems (0.1162 > 0.05).

Table 4.6: Diagnostic Test

Model Estimated Serial Correlation LM Test	F-statistic	Prob.
CRP ← GFCF+HCI+TLF+LON+BND+DEP+MBP+PLR	-0.984825	0.3247
Heteroskedasticity Test		
CRP ← GFCF+HCI+TLF+LON+BND+DEP+MBP+PLR	55.403630	0.1162
Ramsey Reset Specification		
CRP ← GFCF+HCI+TLF+LON+BND+DEP+MBP+PLR	1.03057	0.3140

Source: E-views 12.0 version data output

Granger Causality Effect Result

To examine the effect of financial inclusion measured by value of loans accessed by farmers, bank density, bank deposit to GDP ratio, mobile banking penetration rate on crop production in selected West African countries, the granger causality test was utilized. In the analysis of the selected West African countries, the granger causality result in Table 4.7 shows that there is no unidirectional or bidirectional relationship between financial inclusion: Value of loans accessed by farmers, bank density, bank deposit to GDP ratio, mobile banking penetration rate, and crop production. Causality do not flow from value of loans accessed by farmers, bank density, bank deposit to GDP ratio, mobile banking penetration rate to crop production at 5% level of significance. The implication of the result is that financial inclusion (value of loans accessed by farmers, bank density, bank deposit to GDP ratio, mobile banking penetration rate) has no significant effect on crop production. On the other hand, it was observed that the control variables of gross fixed capital formation, human capital index, total labour force, and prime lending rate have no significant effect on crop production in the selected West African countries.

Table 4.7: Granger Causality Test for Financial Inclusion and Crop Production

Null Hypothesis:	Obs	F-Statistic	Prob.	Remarks
GFCF does not Granger Cause CRP	104	0.05965	0.8075	No Causality
CRP does not Granger Cause GFCF		0.65130	0.4215	No Causality
HCI does not Granger Cause CRP	104	0.20876	0.6487	No Causality
CRP does not Granger Cause HCI		0.59731	0.4414	No Causality
TLF does not Granger Cause CRP	104	1.5E-05	0.9969	No Causality
CRP does not Granger Cause TLF		0.15344	0.6961	No Causality
LON does not Granger Cause CRP	104	0.28194	0.5966	No Causality
CRP does not Granger Cause LON		0.01026	0.9195	No Causality
BND does not Granger Cause CRP	104	1.42925	0.2347	No Causality
CRP does not Granger Cause BND		1.33148	0.2513	No Causality
DEP does not Granger Cause CRP	104	0.75745	0.3862	No Causality
CRP does not Granger Cause DEP		0.90408	0.3440	No Causality
MBP does not Granger Cause CRP	104	0.00014	0.9905	No Causality
CRP does not Granger Cause MBP		0.36015	0.5498	No Causality
PLR does not Granger Cause CRP	73	0.98233	0.3250	No Causality
CRP does not Granger Cause PLR		2.75723	0.1013	No Causality

Source: Computer analysis using E-views 12.0.

Discussion of Findings

The estimation of model one revealed a positive relationship between loans to rural farmers and crop production. Also, positive relationship was found between bank density, mobile banking penetration rate and crop production. In consonance with the finding of Olaniyi (2017) [24], for sustainable agricultural development in rural areas, improving financial inclusion was critical. Thus, the insignificant effect of financial inclusion vide value of loans accessed by farmers, bank density, bank deposit to GDP ratio, mobile banking penetration rate to crop production was upheld in Olaniyi (2017) [24] where-in he found insignificant impact of financial access on agricultural growth. However, Nkwede (2020) [18], Nwankwo and Nwankwo (2020) [20] found a significant negative effect of financial inclusion on agricultural output. One thing that makes the findings of this study unique is the adoption of secondary data for eight selected West African countries. Just like in the study of Ajide (2016) [4], the financial innovation variables were not significant in growing the agricultural sector in the region. Conversely, negative relationship exists between bank deposit to GDP ratio and crop production in the selected West African countries. In effect, bank deposit to GDP ratio decreased crop production. The decrease were however, not significant. This implies that there are not adequate deposits in banks that can take care of the financial needs of the majority farmers who are into crop production, especially in the rural areas. Kouadio & Gakpa (2020) [16] agreed that farmers with no schooling and fewer qualifications were more likely to be financially excluded and this explains the reluctance of banks to increase their credit to the rural farmers even in the face of increasing financial technology trends affect agricultural productivity.

5. Conclusion and Recommendations

The importance of financial inclusion cannot be over-emphasized in empirical research. The agricultural sector has no doubt benefitted from financial services but this may have not been the case for many other African countries especially in the West African sub-region. After a careful analysis of the data gotten from eight West African countries, the study concludes that financial inclusion has yet to have the desired effect on crop production. Thus, there is need to make the financial inclusion wave to reach the crop production sub sector of the agricultural productivity in the West African sub-region through the adoption of one or more of the recommendations. The Governments and financial institution in the selected West African countries should provide low interest agricultural loan with flexible repayment terms linked to harvest cycles. The farmers should be encouraged to form corporative societies and mini-financial groups from where they can access financial institutions for loans. Financial institutions should encourage this particularly.

6. References

1. African Development Bank (AfDB). Financial inclusion in Africa, 2012. available at: www.afdb.org (accessed October 2, 2022).
2. Agbenyo W, Jiang Y, Antony S. Cointegration analysis of agricultural growth and financial inclusion in Ghana. Theoretical Economics Letters. 2019; 9:895-911.
3. Agunuwa EV, Inaya L, Proso T. Impact of commercial banks' credit on agricultural productivity in Nigeria (Time series analysis 1980-2013). International Journal of Academic Research in Business and Social Sciences. 2018; 5:337-350.
4. Ajide FM. Financial innovation and sustainable development in selected countries in West Africa. Journal of Entrepreneurship, Management and Innovation. 2016; 12(3):85-111.
5. Arowolo AO, Ibrahim SB, Aminu RO, Olanrewaje AE, Ashimu SM, Kadiri OJ. Effect of financial inclusion on livelihood diversification among smallholder farming households in Oyo State, Nigeria. Nigeria Agricultural Journal. 2022; 53(1):67-75.
6. Awunyo-Vitor D. Theoretical and conceptual framework of access to financial services by farmers in emerging economies: Implication for empirical analysis. Economics and Business Journal. 2018; 6(2):43-59.
7. Awunyo-Vitor D, Al-Hassan RM. Credit constraints and smallholder maize production in Ghana. International Journal of Agricultural Resources, Governance and Ecology. 2018; 10(3):239-256.
8. Balakrishma S, Virmani V. Numercy and financial literacy of forest-dependant communities. Journal Indexing and Metrics. 2019; 44(2):50-63.
9. Blickle K, Parlatone C, Saunders A. Specialization in banking. FRB of New York Staff Report No. 967, 2021.
10. Chaddad FR, Cook ML, Heckelei T. Testing for the presence of financial constraints in us agricultural cooperatives: An investment behavior approach. Journal of Agricultural Economics. 2005; 56(3):385-397.
11. Evans O, Lawanson O. A Multi-sectoral study of financial inclusion and economic output in Nigeria. Ovidius, University Annals, Economic Sciences Series. 2017; 17(1):195-204.
12. Evans O, Adeoye B. The determinants of financial inclusion in Africa: A dynamic panel data approach. University of Mauritius Research Journal. 2016; 22:310-336.
13. FAO. Providing sustainable agriculture in West Africa; role of digital finance. World Food Review. 2020; 51:185-205.
14. Fowowe B. The effects of financial inclusion on agricultural productivity in Nigeria. Journal of Economics and Development. 2020; 22(1):61-79.
15. Forbes Advisor. Digital banking survey, 2022. Retrieved from: https://www.forbes.com
16. Kouadio H, Gakpa L. Measurement and drivers of financial inclusion in Cote d'Ivoire: A case study of oil palm and rubber tree producers in Sud-Comoé Region. International Journal of Economics and Finance. 2020; 12(10):11-22.
17. Moses AO, Thalut N. Financial exclusion and sustainable rice production: A model of poverty reduction in Ndop, Cameroon SSRG. International Journal of Economics and Management Studies. 2018; 5(12):8-15.
18. Nkwede F. Financial inclusion and economic growth in Africa: Insight from Nigeria. European Journal of Business and Management. 2020; 7(35):71-80.
19. Norbet NN, Egwu MB. Drivers of financial inclusion among cocoa producers in the South West Region of Cameroon. Finance & Economics Review. 2023; 5(1):1-13.
20. Nwankwo O, Nwankwo ONO. Sustainability of financial inclusion to rural dwellers in Nigeria: Problems and way forward. Research Journal of Finance and Accounting. 2020; 5(5):24-31.
21. Nzotta SM, Okereke JE. Financial deepening and economic development of Nigeria: An empirical investigation. African Journal of Accounting, Economics, Finance, & Banking Research. 2009; 5(5):22-33.
22. Ogunniyi LT, Ajao OA, Adeleke OA. Gender comparison in production and productivity of cocoa farmers in Ile Oluji Local Government Area of Ondo State, Nigeria. Global Journal of Science Frontier Research. 2018; 12:59-64.
23. Ojo TO, Ogundeji AA, Babu SC, Alimi T. Estimating financing gaps in rice production in South Western Nigeria. Journal of Economic Structures. 2020; 9(12):1-18.
24. Olaniyi E. Back to the Land: The impact of financial inclusion on agriculture in Nigeria. Iranian Economic Review. 2017; 21(4):885-903.
25. Pomeroy R, Arango C, Christopher GL, Box S. Financial inclusion to build economic resilience in small scale fisheries. Marine Policy. 2020; 118(2):1-16.
26. Roger F. Zain targets African mobile commerce, 2019. http://www.itp.net/578761-zain-targets-african-mobilecommerce.
27. Shen Y, Guo X, Zhang X. Digital financial inclusion, land transfer and agricultural green factor productivity. Sustainability. 2023; 15(8):1-19.
28. Talla JH. An empirical study of e-banking in Cameroon. Published by the Business Management Department, University of South Africa, 2013.
29. World Bank Group. 2 Billion: The number of people worldwide without access to formal financial services,

2019. Retrieved April 14, 2022, from: http://www.worldbank.org/en/news/video/2016/03/10/2-billion-number-of-adultsworldwide-without-access-to-formal-financial-services 2.
30. World Bank. The state of food security and nutrition in the world, 2020. Retrieved from: http://www.worldbank.org
31. Ugbor IK, Omeje AN, Mba AJ. Financial inclusion in the agricultural sector in Nigeria: An index of penetration. International Journal of Economics and Financial Issues. 2018; 8(5):35-44.
32. USAID. Deepening financial inclusion in West Africa. World Agricultural Finance Review, Working Paper No. 964, 2021.
33. World Bank. Digitization of agribusiness payments in Africa: Building a ramp for farmers' financial inclusion and participation in a digital economy, 2021. Retrieved from: https://www.worldbank.org.
34. Zheng H, Zhang L, Wang S, Xu J, Zhao X. The affecting channels and performances of financial development and poverty reduction: New evidence from China's fishery industry. Marine Policy. 2021; 123:1-17.