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Agricultural Cooperatives and Sustainable Food Security: A Study of Small-Scale Farmers in South-East, Nigeria

[1]Dickson, Gift Oke, [1]Nkechi C.Ojiagu and [1]Frank O. Nwankwo

[1]Department of Cooperative Economics and Management,
Faculty of Management Sciences,
Nnamdi azikiwe university, awka

ABSTRACT *: Despite the crucial role played by agricultural cooperatives through the effort of small-scale farmers in the south-east region, they still appeared to be operating under conditions that hinder their productivity and sustainability, hence, necessitating this study that assessed the effect of agricultural cooperatives on sustainable food security among small-scale farmers in South-East, Nigeria. The specific objectives of the study are to ascertain the influence of Agricultural credit on sustainable food availability,determine the effect of marketing network on sustainable food accessibility, identify the extent to which extension services affect sustainable food utilization and analyze the extent to which input supply affect sustainable food stability among small-scale farmers in the study area. The study was anchored on Social Capital Theory. A descriptive survey research design was adopted for the study, with a population of 4,888 agricultural cooperatives in South-East, Nigeria, with a membership strength of 60,860. A sample size of 398 was determined using Taro Yamane's (1964) formula. The data source for the study was primary, witha structured questionnaire being the instrument for data collection. The instrument was subjected to face and content validity, and reliability test using Cronbach Alpha, which returned a reliability statistic of 0.977. Data collected were analyzed using descriptive statistics (frequencies, percentages, mean, and standard deviation) and inferential statistics (Simple Linear Regression, through the Ordinary Least Square method). The hypotheses were tested at a 5% level of significance. The findings showed that agricultural credit has a statistically significant influence on sustainable food availability, there is a statistically significant relationship between marketing network and sustainable food accessibility, there is a statistically significant relationship between extension services and sustainable food utilization, and that input supply statistically and significantly affect sustainable food stability of small-scale farmers in the study area. The study concluded that collectively, these findings underscore the multifaceted importance of cooperative structures as engines of agricultural improvement and food system resilience. Among others, it was recommended that government and cooperative societies should establish targeted micro-credit schemes with flexible repayment cycles specifically designed for small-scale farmers.*

Keywords: Agricultural Cooperatives, Food Security, Agricultural Credit, Marketing Network, Food Availability, Food Accessibility

INTRODUCTION

Agriculture remains the cornerstone of economic and social development across Sub-Saharan Africa, serving as the foundation for employment, livelihood, and food production. In Nigeria, the sector contributes about 24 percent to national Gross Domestic Product (GDP) and employs nearly half of the workforce (Nigerian Economic Summit Group [NESG], 2023). Yet, since the 1970s, the rapid expansion of the oil economy has displaced agriculture as the engine of growth, leading to declining productivity and rising rural poverty (Musa, Jibrin, & Isyaku, 2024). According to the National Bureau of Statistics (NBS) (2025), agriculture accounted for 34.66 percent of total employment in 2024, with over 80 percent of farmers being small-scale producers. These farmers form the backbone of national food systems but operate under severe financial and logistical constraints that undermine their capacity to sustain production and market access.

Agricultural cooperatives have become critical mechanisms for enhancing small-scale farmers' productivity and promoting sustainable food security. Through collective ownership and joint resource mobilization, cooperatives enable farmers to access credit, inputs, and organized marketing structures that are otherwise unattainable individually (Rebecca, Jacob, & Muhammed, 2024). By aggregating members' outputs and facilitating access to rural finance, cooperatives promote economies of scale and greater bargaining power, improving both food availability and accessibility, part of the core pillars of food security identified by the Food and Agriculture Organization (FAO, 2020). Food availability entails a steady supply of safe and nutritious food, while accessibility reflects the physical and economic means to obtain such food.

Access to agricultural credit remains central to this equation. Credit enables farmers to purchase improved seedlings, fertilizers, and equipment that enhance yields and productivity (Adigun, 2022). However, most rural farmers face limited access to formal credit due to stringent collateral requirements and high interest rates (Okonkwo, Akut, & Buden, 2021). Agricultural cooperatives bridge this gap by offering group-based lending schemes that build on social trust, thereby reducing credit risk. Evidence shows that access

to cooperative credit can raise farm output, stimulate technology adoption, and improve resilience against climate and market shocks (Wongnaa, Abudu, Abdul-Rahaman, Akey, & Prah, 2023). Similarly, Balehegn, Adesogan, and Dahl (2025) found that cooperative-based interventions significantly improved smallholder productivity and food system stability in developing countries.

Marketing networks complement credit by linking farmers to efficient value chains. In Nigeria, the absence of transparent and functional market channels has long suppressed farm incomes, allowing intermediaries to capture excessive margins (Adegoke, Ojiagu, & Ariyo, 2023). Agricultural cooperatives facilitate collective marketing, reduce transaction costs, and enhance price discovery (Nwanmuoh et al., 2024). Adeoye, Ogunniyi, and Yusuf (2023) confirmed that cooperative membership increases smallholder market participation and welfare outcomes in Nigeria, demonstrating the transformative potential of structured market access. Similarly, Ahoudjo (2025) emphasized that collective action within farmer organizations enhances value-chain performance, particularly in rice markets of Côte d'Ivoire and Ghana, an insight equally relevant to the Nigerian context. However, despite these gains, small-scale farmers in South-East Nigeria still face limited cooperative coverage, poor infrastructure, and unstable policy support that restrict the full realization of food-security goals. This study therefore focuses on two key cooperative functions, credit and marketing networks, to explore their influence on sustainable food security in the region. Specifically, the study seeks to:

a) Ascertain the influence of Agricultural credit on sustainable food availability among small-scale farmers in the study area.
b) Determine the effect of marketing network on sustainable food accessibility among small-scale farmers in the study area.

REVIEW OF RELATED LITERATURE

Agricultural Cooperatives

Agricultural cooperatives are formed by farmers who voluntarily join the cooperative based on a shared interest in achieving common goals. Membership is open to all eligible farmers willing to participate. They operate on the principle of democratic decision-making, with each member having an equal say in the organization's affairs. Members typically vote on key decisions, such as the election of the board of directors and major business activities. One of the primary purposes of agricultural cooperatives is to facilitate the collective marketing of members' agricultural products (Anshari, Almunawar, Masri and Hamdan, 2019).

Agricultural cooperatives play a crucial role in enhancing the economic well-being of farmers and rural communities by pooling resources and leveraging economies of scale. They provide smallholder farmers with access to markets, credit, and technology that they might not have individually (Qiu, Bai, Wu, Zeng and Zhang, 2024). Additionally, agricultural cooperative has been described as an effective instrument for improving the productivity, as well as the income of farmers (Odido and Nwankwo, 2021). The main goals of agricultural cooperatives are to maximize benefits for their members, reduce income and expenditure inequalities, support economic development, improve the quality and availability of consumer goods, and enhance the overall wellbeing of their members (Apostolakis and Dijk, 2019).

Notably, agricultural cooperative societies in particular are essential for increasing rural inhabitants' incomes and improving their quality of life and an effective mechanism and platform for mobilizing resources of disparate, small-scale farmers to enjoy the benefits of large-scale production (Aboramadan et al., 2023). Agricultural cooperatives' increasing involvement in production and farm input distribution has been widely reported. These include marketing, processing, the supply of farm inputs (seeds, fertilizers, chemicals, and modern farm implements), consumer goods, credit and banking, insurance, warehousing, farm extension, and relevant support such as research and publication (Enefiok and Bassey, 2023; Egwunyenga and Okoh, 2022). Agricultural cooperatives increase farm productivity by securing low-cost inputs, promoting sustainable farming practices, offering credit to members, and operating retail stores through agricultural marketing cooperatives, reducing costs while improving members' management and organizational skills (Adegoke, Ojiagu and Ariyo, 2023).

Sustainable Food Security

The concept of sustainability means valuing and utilizing environmental resources with current and future needs of the people in mind (Eneanya, 2021). Food security, as defined by the Food and Agriculture Organization (FAO, 2020), is the state where "all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life". Hence food security is stated to exist when food is produced and distributed in an amount, quality, and variety that is readily available, accessible, utilised, and stable enough to allow for individual desire (Emelife, Nweke, and Obi, 2023).

Sustainable food security integrates the definition of Food security with the principle of sustainability, emphasizing the long-term viability of food systems that do not deplete natural resources or exacerbate social inequalities. Sustainable food security (SFS) is a critical issue in the 21st century, addressing the need for ensuring sufficient, nutritious, and accessible food for all while minimizing the environmental and social costs of food production. This approach ensures that food systems are environmentally sound,

economically viable, and socially just, supporting biodiversity and ecosystem services for future generations. Sustainable food security implies meeting the needs of present and future generations, while ensuring profitability, environmental health, and social and economic equity which help countries worldwide achieve Zero Hunger and the Sustainable Development Goals (FAO, 2021). Swaminathan, (2020) posit that policies and technologies for Sustainable Food Security should ensure that every individual has the physical, economic, social and environmental access to a balanced diet that includes the necessary macro- and micro-nutrients, safe drinking water, sanitation, environmental hygiene, primary health care and education so as to lead a healthy and productive life.

The essence of sustainable food security lies in ensuring that food systems provide sufficient, safe, and nutritious food for all people at all times while maintaining environmental sustainability, social equity, and economic viability. Sustainable Food Security is a multifaceted concept that integrates the traditional pillars of food security availability, access, utilization, and stability with additional considerations for sustainability and agency. The absence of food security in these dimensions is food insecurity which means lack of access to enough food that can either be chronic or temporary (National Agricultural Policy (NAP), 2020). Sustainable food security is an ongoing challenge that demands a holistic approach, encompassing environmental, economic, and social dimensions. It requires the collaboration of governments, businesses, communities, and individuals to create resilient food systems that not only meet present needs but also safeguard the ability of future generations to achieve food security. Through a combination of sustainable agricultural practices, technological innovations, inclusive policies, and mindful consumption, the goal of sustainable food security can be realized.

The pursuit of sustainable food security goes beyond traditional measures of food availability and access, incorporating dimensions of environmental sustainability, economic equity, and social justice. Sustainable food security will require: (a) availability of food or sufficient food production, (b) access to food and ability to purchase food, (c) sufficiency in terms of nutrition including energy, proteins and micronutrients as well as safety, and (d) the stability and foreseeability of these conditions (Vågsholm, Arzoomand andBoqvist, 2020). Thus contributing to knowledge by emphasizing the integration of sustainability principles into the core dimensions of food security, highlighting the need for environmentally sound, socially equitable, and economically viable food systems. It advances the discourse by framing sustainable food security as a multidimensional approach essential for achieving long-term global food resilience.

Sustainable Food Availability

Sustainable food availability refers to the consistent supply of sufficient, safe, and nutritious food that meets the dietary needs of present and future generations without depleting natural resources (FAO, 2023). It is one of the core pillars of food security and depends on factors such as agricultural productivity, infrastructure, climate resilience, and socio-economic stability. In Nigeria, particularly in the South-East region, agricultural cooperatives have emerged as key players in enhancing food availability by improving production efficiency, market access, and resilience to external shocks. Agricultural cooperatives in South-East Nigeria supposedly serve as vital institutions that empower small-scale Farmers. Their primary objective is to boost the income of their members by providing essential services and by helping farmers overcome obstacles in accessing markets, these cooperatives encourage healthy market competition and elevate product quality standards. Moreover, agricultural cooperatives offer a wide range of services covering production, marketing and economics. They pool financial resources, engage in collective production efforts, and enhance product value to achieve economies of scale. Additionally, they manage the entire value chain collectively and improve market access through negotiations with buyers. Agricultural Cooperatives also provide essential training, networking and extension services, including education and advice on production techniques. By enabling members to share knowledge and experiences, these cooperatives enhance their business management skills and resilience. Furthermore, agricultural cooperatives play a crucial role in enhancing the resilience of their members, shielding them from potential risks and ensuring the continuity of food security (Mumararungu, Ca-MadeberiYa-Bititi, Bisetsa, andBurny, 2024).

Sustainable food accessibility

Food access is domain of food security referring to process of accessing food physically and economically. The food access measure should assess the individuals' ability to obtain food from the supplies and how the poor people increase their accessibility to productive resources, which is a reliable guarantee of food security (Ogot, 2021).Within the UN's framework, food accessibility means that all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The ability to have access to food depends on two major conditions: - Economic access and physical access which depends on one's income, the price of food and the purchasing power of the people. Physical access depends on the availability and quality of infrastructure needed for the production and distribution of food. Lack of economic access to food is as a result of the increase in the rate of poverty (Metu, Okeyika, andMaduka, 2016).

Sustainable food accessibility which is the consistent availability, affordability, and ability of individuals and communities to obtain sufficient, nutritious, and culturally appropriate food without compromising the ability of future generations to meet their own food needs integrates both economic, environmental, and social dimensions to ensure long-term food security (Berry, Dernini, Burlingame, MeybeckandConforti, 2015). Sustainable food accessibility can be affected by affordability, allocation and

preference.Sustainable food accessibility remains a critical challenge in Southeast Nigeria, influenced by economic instability, land tenure issues, poor infrastructure, and climate change effects. Agricultural cooperatives have been identified as a key mechanism for improving food security by enhancing productivity, market access, and resource pooling among farmers. The assessment of global hunger in 2023, measured by the prevalence of undernourishment (PoU) (SDG Indicator 2.1.1), reveals a continuing lack of progress towards the goal of Zero Hunger. Inflationary pressures, in particular increases in the relative prices of food, continue to erode economic gains for many people's access to food in many countries, as the world is still struggling to recover from the global pandemic, hampered by a growing number of conflicts and extreme weather events (FAO, IFAD, UNICEF, WFP and WHO, 2024). Small scale farmers participating in agricultural cooperatives experienced increased human capacity development and expressed high satisfaction levels, leading to improved agricultural productivity. This underscores the potential of cooperatives especially Agricultural cooperatives to enhance food accessibility through member empowerment and resource sharing. Agricultural cooperatives are instrumental in promoting sustainable food accessibility by enhancing farmer satisfaction, advocating for sustainable practices, and implementing strategic improvements, these cooperatives can significantly contribute to regional food security and the overall well-being of small-scale farmers (Okwuokenye and Ovharhe, 2023).

Marketing Network and Sustainable Food Accessibility

Agricultural marketing entails the performance of all business activities that involved the flow of agricultural produce from the point of initial agricultural production to the hands of ultimate consumers (Nwanmuoh, Okolo-Obasi, Anene, Uwakwe, Udu, AmukaandEmeter, 2024).When small-scale farmers have better access to both markets where they buy inputs for their own farming and markets where they sell their goods, they often invest more in their farm, have higher yields, and trade more easily. This helps them produce higher-value crops and have higher incomes. Both farmers and consumers benefited from more stable food prices when farmers used credit and crop storage technologies and had access to better transportation networks like roads (J-PAL. (2025). Effective marketing networks can significantly improve food accessibility for small-scale farmers by creating more efficient and reliable channels for getting their produce to consumers. This can lead to higher incomes for farmers, improved food security for communities, and more stable food prices. Agricultural cooperative promotes various tasks involved in the production of agricultural produce to co-ordination and movement of the produce through various channels such as; wholesalers, agents, retailers and consumers (Nwanmuoh, et al, 2024).

Small-scale farmers often face challenges reaching markets, especially those that offer higher prices or alternative channels. Agricultural cooperative marketing networks can connect them to larger markets, including urban areas and international markets, providing them with more opportunities to sell their produce. Farmers need reliable information about prices, demand, and market trends to make informed decisions. Marketing networks can provide this information, helping them to better manage their production and avoid price volatility. Marketing networks can facilitate the movement of goods from farms to markets, reducing transportation costs and improving efficiency.Increased income gives farmers greater purchasing power, allowing them to buy more food for their families and invest in their farms. By connecting farmers with diverse markets, marketing networks can help to increase the accessibility of a wider variety of foods, promoting more diverse diets and sustainability.

Agricultural Credit and Sustainable Food Availability

Agricultural credit refers to the financial support provided to farmers and rural communities by banks and financial institutions to enhance agricultural production and rural development (Khatun, 2024). Agricultural credit is also the process of obtaining control over the use of money, productive equipment and services in exchange for a promise to repay at a future date (Okonwko and Onoh, 2021). Loans for the production, storage, processing, and selling of agricultural goods are known as agricultural credits. this credit may be short, medium, or long-term. The importance of agricultural credit through the cooperative societies in improving sustainable food security cannot be overemphasized. Agricultural credit is necessary as it enables small-scale farmers to establish and expand their farms as this would increase their income and ability to repay loan. Borrowed agricultural fund (agricultural credit) is one of the pre-requisites for farmers to increase their agricultural output in the process of agricultural development which enhances food avaailabilty (Adigun, 2022). Agricultural credit is among the essential factors needed for agricultural production and with it farmers can secure farm inputs such as farm productive equipment and hired labor, agricultural credit acts as link between adoption of farm technologies and increased farm income among rural farmers in Nigeria (Okonkwo, AkutandBuden, 2021).

Agricultural production is capital intensive generally and in developing countries like Nigeria where majority of her farmers are in the rural areas with traditional method of farming, and these small scale farmers need capital to be injected into agriculture to increase food production (Omodero, Adetula and Iyoha, 2020). Agricultural credit has been recorded by some researcher to be a great contributing factor to agricultural productivity and efficiency in addition to being a driving force behind the movement of agricultural products from local production sites to distant markets where higher market prices may be achievable (Ukwuaba, OwutuamorandOgbu, 2020). The biggest issue impeding agricultural development continues to be a lack of ample funding. This is because the primary input in agricultural production is capital, and small-scale farmers, who create the majority of the country's agricultural output, continue to face threats from the availability of capital. Although farm credit can be obtained from both formal

sources, such as banks and other government owned institutions, and informal sources, such as self-help groups, money lenders, cooperatives, and non-governmental organizations (NGOs). Cooperative societies especially agricultural cooperatives are seen as the last hope for the small scale farmers.

Access to agricultural credit is vital for sustainable food security, as it enables farmers to invest in modern inputs, adopt new technologies, and manage production risks. This leads to increased productivity, higher yields, and greater resilience against climate and market fluctuations (Gelata and Han, 2023). As Adesiyan and Kehinde (2024) note, credit also allows farmers to diversify income sources and adopt sustainable practices, making the agricultural sector more resilient and ensuring consistent food supply for farm families. Similarly, access to credit plays a vital role in ensuring food security and reducing hunger empowering smallholder farmers, who often lack access to capital and resources, enabling them to participate more fully in the agricultural sector and contribute to food security (Wongnaa, Abudu, Abdul-Rahaman, Akey and Prah, 2023).

Empirical Review

Hussain, Li, Kalu, Wu, and Naumovski (2025) conducted a comprehensive review of sustainable food security and nutritional challenges in Switzerland, framed within global trends. The study aimed to assess the current nutritional and food security landscape, identify key drivers of insecurity including economic inequality, environmental stressors, and conflict, examine the double burden of malnutrition and obesity, and propose sustainable strategies for food system resilience. Findings revealed that in 2023, over 345 million people globally faced high levels of food insecurity, while more than 2 billion suffered from micronutrient deficiencies, particularly in vitamin A, iron, and iodine. Simultaneously, over 1 billion adults were overweight or obese, illustrating a growing global nutrition paradox. The study also emphasized the worsening impact of global crises such as COVID-19 and armed conflicts, which have heightened food scarcity, reduced immunity, and increased early mortality. Climate change was identified as a major disruptor, altering traditional growing seasons, lowering crop yields, and intensifying extreme weather events. In Switzerland, despite high food availability, disparities in diet quality and nutritional behavior remain, especially among different linguistic and socioeconomic groups. The study is related to the present study in that it addresses global or national food security, nutrition challenges, public health, climate impacts on agriculture and sustainable food systems**.**

Terngu, Samaila and Daniel (2024) examined effect of agricultural credit on small scale rice farmers in Southern Taraba State, Nigeria. Data were collected from a sample of 139 rice farmers selected through multi-stage sampling procedure using questionnaire and analyzed using simple descriptive statistics and regression analysis. Results revealed that 76% of the respondents were male, 67% were married. The mean household size, farm size and age were 50%, 37% and 30% respectively. Most (81%) of the respondents had one form of formal education or another and family land (48%) was the dominant. Informal credit sources were the majority (75%). The results also indicated thrift and credit (25%) and friends/relatives were the dominated sources of credit among the small-scale farmers. The regression analysis results indicated that farm size, fertilizer, quality of seed, amount of loan and marital status were positive and statistically significant at 5% level of significance, while family labour was positive and statistically significant at 1% level of significance. This implies that increase in these variables lead to increase in the output of rice production all things being equal. The coefficient of determination R2 was 0.77 which implies that 77% of the variations in the rice output were explained by the explanatory variables. This indicates that credit has a great positive effect on small – scale farmers or rural farmers as most farmers invested or used the agricultural loans they procured on agricultural production activities.

Nwanmuoh, Okolo-Obasi, Anene, Uwakwe, Udu, Amuka, and Emeter (2024) examined agricultural marketing and sustainable household food security in Sub-Saharan Africa, focusing on Nigeria. The study aimed to assess how agricultural marketing activities influence food security across the country's six geopolitical zones. Using descriptive and inferential statistics on primary data collected from 800 respondents via multiple sampling techniques, logistic regression analysis revealed that agricultural marketing significantly impacts household food security. The study highlighted that improved rural access roads, better management of oil prices, provision of storage facilities, and regulation of distribution channels are crucial for sustaining food security. These findings are pertinent to current research by emphasizing the critical role of efficient agricultural marketing systems in enhancing food security.

Owoeye, Ojo, Ijigbade, and Oriola (2024) assessed the role of agricultural cooperative societies on farm input supply in Ekiti State, Nigeria, aiming to evaluate the extent of cooperative membership and its impact on farmers' access to inputs and markets. The study found that 71.1% of farmers belonged to cooperative societies, with over half (51.1%) having membership durations of 1-5 years. Notably, 35.6% of farmers inherited their land, cooperatives generally consisted of 6 to 10 members, and 60% of respondents had formal education. Additionally, 64.4% of farmers accessed output markets through their cooperatives, highlighting the critical role these societies play in facilitating farm input supply and market linkages. The findings underscore the importance of strengthening cooperative societies to improve input availability and market access, which is highly pertinent to current research focused on enhancing agricultural productivity and food security through collective action in rural Nigeria.

Edet, Akpan and Patrick (2024) studied Marketing channel choice and its determinants among small-scale oil palm fruit farmers in AkwaIbom State, the southern region of Nigeria. Three hundred oil palm fruit farmers were randomly selected using the multi-stage

random sampling technique. Descriptive statistics and logit regression techniques were employed to analyze the collected data the study revealed that **65%** of farmers preferred selling through middlemen/agents, while **35%** opted for direct sales in local markets. The empirical result identified oil palm fruit farmers' education, experience, socialization, dependent ratio, non-farm income, farm income, land size, and access to credit as significant positive determinants of the choice of middlemen/agent marketing channel. findings revealed that most farmers rely on middlemen due to limited access to infrastructure, formal markets, and market information, which limits their bargaining power and income potential. This relates to the present study by emphasizing how improving farmers' literacy and social networks can empower cooperative members to make better marketing decisions and reduce dependency on exploitative middlemen.

Adegoke, Ojiagu and Ariyo (2023) studied Influence of Agricultural Cooperative in Promoting Food Security in Ekiti State, Nigeria. The study examined the influence of agricultural cooperative societies in enhancing food security in Ekiti state, Nigeria. It adopted field survey research design through a total population of 47, 594 cooperative members across two senatorial zones in Ekiti. A total number of 397 copies of questionnaires were distributed, and 381 copies were returned. Validity and reliability of the instrument were established and the data obtained were analysed using descriptive statistics and paired sample t-test with the aid of SPSS version 20. Findings revealed that adequate storage facilities can help to eradicate food scarcity as revealed by the mean value of 4.39. They also agreed that food security can be enhanced through improvement on agricultural productivity by agricultural cooperative as shown by mean value of 3.59. All the mean responses of the cooperative members were more than 3.0 on farm supply inputs and credit facilities. This implies that members agreed that cooperatives contributed greatly to their financial empowerment and as well provided them with adequate farm inputs to improve their agricultural productivity.

Emaziye, Akporawo, and Onyeidu (2022) examined the effect of agricultural credit on production among smallholder crop farmers in Delta State, Nigeria. Aiming to assess credit accessibility, identify its determinants, and evaluate its impact on agricultural output. Using a multistage random sampling method, data were collected from 210 respondents via structured questionnaires and analyzed with descriptive and inferential statistical tools. Findings showed that most farmers were aged 41–50, married, with secondary education, and had an average household size of eight and an annual income of ₦250,000. The majority relied on personal savings and cooperatives for credit. Key determinants of credit access included interest rates, type of enterprise, and farm size, while constraints included institutional lending policies, lack of knowledge of terms, and collateral demands. This is highly pertinent to the current research, as it reinforces the importance of cooperatives not only as production units but also as financial facilitators that can bridge the credit gap and improve productivity among smallholder farmers.

Oseni, Babalola, and Adesoye (2019) investigated agricultural credit policy as a solution for sustainable food production in Ogun State, Nigeria, employing a multi-stage sampling technique to survey 400 farmers, with 388 valid responses analyzed using descriptive statistics, gross margin analysis, and Logit regression at a 5% significance level. The study aimed to (1) assess the accessibility and sources of agricultural credit, (2) evaluate the impact of credit on farm profitability, and (3) identify factors influencing farmers' access to credit. Results showed that OSAMCA credit was the main source, yet only 39% of farmers benefited, while 47% had no access to any credit source despite a widespread need for credit to recapitalize or expand their agribusinesses. Importantly, a t-test revealed a significant positive effect of credit access on average gross margin per hectare, indicating enhanced profitability for credit beneficiaries. Key constraints included lack of collateral, reported by 74% of farmers, while Logit regression highlighted that variables such as hired labor, cooperative membership, awareness of credit sources, past loan size, and ability to meet down payment positively influenced credit access. Conversely, greater distance from credit sources reduced access likelihood. This study is particularly pertinent to my current research, as it underscores the critical role cooperatives play in improving credit accessibility and profitability for smallholder farmers, reinforcing the need to integrate credit facilitation into cooperative strategies to advance sustainable food production and rural development.

METHODOLOGY

This study adopts a descriptive survey research design that involves asking questions, collecting and analyzing data from supposed representative members of the population at a single point in time to determine the current situation of the population with respect to one or more variables under investigation. The population of the study comprises of all members of Agricultural Cooperatives who are small-scale farmers in South-East, Nigeria. The total number of agricultural cooperatives in South-East, Nigeria is four thousand, eight hundred and eighty-eight (4,888) cooperative societies with a membership strength of eighty thousand, eight hundred and sixty (60,860) which serve as the population of the study (Source: each State Ministry of Agriculture, 2025). The sample size of the study is statistically determined using Taro Yamane's (1964) formula for the finite population, which gave a sample size of 398. Multi-stage sampling technique was used to determine the sampling procedure of the study. The study made use of primary data, obtained from the respondents through a structured questionnaire. In order to validate the instrument, it was subjected to both face and content validity. To ensure reliability, the questionnaire underwent an internal consistency test using Cronbach alpha which returned a coefficient of 0.977, which indicated a high level of internal consistency for the scale. Data collected was analyzed using descriptive statistics (frequencies, percentages and mean) and inferential statistics (Simple Linear Regression using of the Ordinary Least Square [OLS]). Each hypotheses were tested at a 0.05 level of significance.

DATA PRESENTATION AND ANALYSIS

In accordance with the sample size of the study, a total of 398 copies of questionnaire were distributed to the respondents, after which 355 copies were returned. Out of the 355 returned, a total of 26 copies were not responded to completely, hence, the study analyzed 329 copies of questionnaire, which represents 83% of the sample size of the study.

Descriptive Statistics

Research Question One

To what extent does agricultural credit influence sustainable food availability among the small-scale farmers in the study area?

Table 1: Distribution of responses for agricultural credit and sustainable food availability

S/N	ITEMS	SA (5)	A (4)	U (3)	D (2)	SD (1)	Mean	Decision
	AGRICULTURAL CREDIT							
1	Agricultural loans has enabled growth of stable farming operations	119	200	2	6	2	4.30	Accept
2	Agricultural loan has improved members farm yield and food availability	148	172	2	5	2	4.40	Accept
3	Credit availability enhances purchase of farm inputs such as modern technologies	187	124	4	7	7	4.45	Accept
4	Agricultural loan is a passage through which members increase their food supply.	180	131	8	9	1	4.46	Accept
5	Access to credit ensures stable food among members	194	120	8	-	7	4.50	Accept
	SUSTAINABLE FOOD AVAILABILITY							
6	Expansion of farming operations are enhanced due to agricultural loans made available to members	193	126	2	5	3	4.52	Accept
7	Members of the cooperative have easy access to food supply through agricultural loan .	173	144	6	3	3	4.46	Accept
8	Farm inputs buying are made easy to due to farm loan obtained	199	118	2	6	4	4.53	Accept
9	Enough food supply are gotten by members of the cooperative through agricultural loan .	194	123	6	4	2	4.53	Accept
10	Members have access to stable food due to access to credit	205	113	-	10	1	4.55	Accept

Source: Field Survey, July, 2025

Table 1 shows the distribution of responses for agricultural credit and sustainable food availability. The interpretation is based on mean of the individual questionnaire items, with an acceptance threshold of 3 and above. For the item stating that agricultural loans have enabled the growth of stable farming operations, the mean score is 4.30, which is above the threshold of 3, and therefore accepted. The item indicating that agricultural loans have improved members' farm yield and food availability has a mean of 4.40, which is also above the threshold and is accepted. The assertion that credit availability enhances the purchase of farm inputs such as modern technologies recorded a mean of 4.45, making it accepted. The statement that agricultural loans help members increase their food supply produced a mean value of 4.46, which is above 3 and therefore accepted. The item stating that access to credit ensures stable food among members has a mean score of 4.50, leading to an accepted decision.

For sustainable food availability, the item on expansion of farming operations being enhanced due to agricultural loans has a mean of 4.52, indicating acceptance. The statement that members have easy access to food supply through agricultural loans has a mean of 4.46, also accepted. The item that farm inputs are easier to purchase due to farm loans recorded a mean of 4.53, which is accepted. The assertion that members get enough food supply through agricultural loans has a mean of 4.53, thereby accepted. Finally, the item stating that members have access to stable food due to access to credit has a mean of 4.55, which is above 3 and accepted.

Research Question Two

What effect does marketing network have on sustainable food accessibility of the small-scale farmers in the study area?

Table 2: Distribution of responses for marketing network and sustainable food accessibility

S/N	ITEMS	SA (5)	A (4)	U (3)	D (2)	SD (1)	Mean	Decision
	MARKETING NETWORK							
1	Members now have better sustainable food access due to participation in advertising connection	104	212	6	5	2	4.25	Accept
2	Members gain more on joint sales activities that provides easy access to long-lasting food .	160	156	8	3	2	4.43	Accept
3	Members now have information about prices due to marketing connection they use which improved their food access.	187	130	4	7	1	4.50	Accept
4	Joint sales activities improve members source of income which enhances easy access to stable food .	200	110	4	5	10	4.47	Accept
5	Members are free from hunger due to joint sales that provides fair prices	211	106	4	5	3	4.57	Accept
	SUSTAINABLE FOOD ACCESSIBILITY							
6	sustainable food access are made easy due to participation in marketing sales.	214	105	2	6	2	4.59	Accept
7	Access to sustainable food are enhanced through members' joint marketing activities.	201	112	2	7	7	4.50	Accept
8	Food access by members has improved due to information about prices and buyers from their marketing networks	203	112	6	6	2	4.54	Accept
9	Members source of income to access to sustainable food are made possible through Joint marketing activities	182	136	6	2	3	4.50	Accept
10	Due to participation in joint marketing, members have become hunger free	202	108	10	6	3	4.52	Accept

Source: Field Survey, July, 2025

Table 2 reveals the distribution of responses for marketing network and sustainable food accessibility. The interpretation is based on mean of the individual questionnaire items, with an acceptance benchmark of 3 and above. Using the responses presented in Table 4.3, the analysis shows that members reported improved access to sustainable food through marketing networks. The item stating that members now have better sustainable food access due to participation in advertising connections recorded a mean score of 4.25, which is above the threshold of 3 and is therefore accepted. The statement that members gain more from joint sales activities that provide easy access to long-lasting food has a mean of 4.43, indicating acceptance. Similarly, the item showing that members now have information about prices due to their marketing connections which in turn improves food access produced a mean value of 4.50, and is therefore accepted. The view that joint sales activities improve members' income and make it easier to access stable food also recorded a mean of 4.47, which is above the threshold and accepted. The item indicating that members are free from hunger because joint sales provide fair prices yielded a high mean of 4.57, and is therefore accepted.

Regarding sustainable food accessibility, participation in marketing sales was reported to make access easier, with the item producing a mean score of 4.59, leading to acceptance. The statement that access to sustainable food is enhanced through members' joint marketing activities recorded a mean of 4.50, and is also accepted. Furthermore, the item showing that food access has improved due to information about prices and buyers from marketing networks produced a mean value of 4.54, which is accepted. The assertion that members' income for accessing sustainable food is made possible through joint marketing activities yielded a mean of 4.50, and is accepted. Finally, the item indicating that participation in joint marketing has helped members become hunger-free recorded a mean of 4.52, which is above the threshold and therefore accepted.

Test of Hypotheses

Hypotheses One

Agricultural credit does not have a significant influence on sustainable food availability of the small-scale farmers in the study area.

SFAVAI = f (AGRICRE)----------(1)

SFAVAI = Sustainable Food Availability for farmer i

AGRICRE = Agricultural credit accessed by farmer i

Table 3:Model Summaryfor Hypothesis One

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig.
1	.612[a]	.375	.373	1.821	196.153	.000[b]

a. Predictors: (Constant), AGRICRE

Source: Field Survey, July, 2025

Table 3 is a model summary for hypothesis one which states that agricultural credit does not have a significant influence on sustainable food availability of the small-scale farmers in the study area. The Table shows that agricultural credit has a moderately strong positive influenceon sustainable food availability, as indicated by an R value of 0.612. The R Square of 0.375 means that agricultural credit explains 37.5% of the changes in sustainable food availability among small-scale farmers. The adjusted R Square (0.373) confirms that the model fits well, while the standard error of 1.821 shows reasonable prediction accuracy. This suggests that agricultural credit contributes meaningfully to food availability in the study area. Table 4 also indicates that the regression model linking agricultural credit to sustainable food availability is statistically significant at p = .000, which is less than the 0.05 threshold. The F-value of 196.153 further confirms that the model is strong and that agricultural credit significantly influences sustainable food availability among the farmers. This result leads to rejecting the null hypothesis and concluding that agricultural credit has a significant influence on sustainable food availability.

Hypotheses Two

There is no significant relationship between marketing network and sustainable food accessibility of the small-scale farmers in the study area.

SFDACC = f(MKTNET)----------(1)

Where:

SFDACC= Sustainable Food Accessibility for farmer

MKTNET= Marketing network

Table 4:Model Summaryfor Hypothesis Two

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig.
1	.588[a]	.346	.344	1.987	172.818	.000[b]

a. Predictors: (Constant), MKTNET

Source: Field Survey, July, 2025

Table 4 the model summary for hypothesis two which states that there is no significant relationship between marketing network and sustainable food accessibility of the small-scale farmers in the study area. The result shows an R value of 0.588, indicating a moderate positive relationship between marketing network and sustainable food accessibility. The R Square of 0.346 reveals that marketing networks account for 34.6% of the changes in sustainable food accessibility. The adjusted R Square (0.344) supports this level of explanatory power. The standard error of 1.987 shows a reasonable level of predictive accuracy, demonstrating that marketing networks play an important role in supporting food accessibility among cooperative members. The Table also reveals that the relationship between marketing network and sustainable food accessibility is statistically significant at p = .000, which is below the 0.05 level. The F-value of 172.818 indicates a strong model, showing that marketing networks significantly has a relationship with sustainable food accessibility. This result supports rejecting the null hypothesis and confirms that marketing networks are important determinants of access to sustainable food among farmers.

Discussion of Findings

This work examined agricultural cooperatives and the role they play in influencing sustainable food security among small-scale farmers in South-East, Nigeria. From this broad objective, four specific objectives emanated, giving rise to four research questions

and hypotheses that align with the specific objectives. These hypotheses were tested using simple regression, at a 5% significance level. The findings from the first hypothesis shows that agricultural credit has a statistically significant influence on sustainable food availability of small-scale farmers in the study area. That is, agricultural credit significantly enhances sustainable food availability among small-scale farmers. Given that the relationship is positive, it means that the more agricultural credit is made available to cooperative members into farming activities, the more food is made available at a sustainable basis. The strong, positive effect of agricultural credit on sustainable food availability observed in this study coheres with recent local and regional evidence showing that credit access reduces liquidity constraints and enables farmers to secure inputs, expand acreage, and stabilize production. Terngu et al. (2024) found that loan amount, seed quality and fertilizer use were significant predictors of rice output, explaining a large share of variance in yield; Emaziye et al. (2022) documented that many smallholders rely on cooperatives and savings groups for credit and that credit access correlates with higher production; and Oseni et al. (2019) reported that credit beneficiaries had higher gross margins per hectare. These convergent findings suggest that the cooperative channel in the present study functions both as a financier and a governance mechanism (reducing misuse and improving food target), which helps explain the comparatively large effect size observed here.

The findings from the second hypothesis test reveals that there is a statistically significant relationship between marketing network and sustainable food accessibility of the small-scale farmers in the study area. That is,marketing network affects significantly the accessibility of food in the areas studied. This study's finding that marketing networks significantly improve household food accessibility aligns closely with empirical work in the review that links market linkages, price information and joint marketing to higher incomes and reduced exploitation. For example, the multi-zone analysis by Nwanmuoh et al. (2024) shows agricultural marketing significantly impacts household food security by improving rural access roads, storage and distribution; Edet et al. (2024) documented how channel choice dependence on middlemen dampens farmers' bargaining power and incomes; and Owoeye et al. (2024) emphasize cooperatives' role in facilitating access to output markets. The present study replicates and extends these insights by showing that cooperative-based joint sales, price information flows and advertising linkages operate not only to increase incomes but to stabilize household access to diverse and sufficient food.

Conclusions

Sustainable food security remains a central challenge in many developing regions, where small-scale farmers continue to navigate constraints that limit their productive potential. Within this context, cooperative societies have emerged as important platforms through which farmers gain access to resources, information, and support systems that enhance their agricultural livelihoods. This study explored how cooperative-driven mechanisms contribute to the four dimensions of sustainable food security among small-scale farmers in South East Nigeria. The empirical evidence revealed that members who accessed cooperative credit were better positioned to expand production and improve food availability. Participation in marketing networks strengthened farmers' ability to access markets and secure fair prices, thereby improving household food accessibility. Collectively, these findings underscore the multifaceted importance of cooperative structures as engines of agricultural improvement and food system resilience. In essence, the study affirms that Agricultural cooperative strengthening is a decisive pathway to sustainable food security.

Recommendations

Sequel to the findings of the study, the following recommendations are made:

- **a)** Government and cooperative societies should establish targeted micro-credit schemes with flexible repayment cycles specifically designed for small-scale farmers, ensuring that loans are released at the beginning of planting seasons to maximize impact on food availability.
- **b)** Management committee of the Agricultural Cooperatives should create centralized digital and physical market information hubs that provide real-time price updates, coordinate joint sales, and link farmers directly with bulk buyers to strengthen food accessibility and reduce exploitation.

REFERENCES

Aboramadan, M., Kundi, Y. M., & Becker, A (2023), "Green human resource management in nonprofit organizations: effects on employee green behavior and the role of perceived green organizational support". *Personnel Review, 51*(7), 1788-1806

Adegoke, T. D., Ojiagu, C. N., & Ariyo, C. O. (2023). Influence of agricultural cooperatives in promoting food security in Ekiti State, Nigeria. *International Journal of Research and Innovation in Social Science*, *7*(9), 1–10. https://doi.org/10.47772/IJRISS.2023.7903

Adeoye, I. B., Ogunniyi, A. I., & Yusuf, S. A. (2023). Market access, cooperative membership, and welfare of smallholder farmers in Nigeria. *Journal of Agribusiness and Rural Development, 70*(3), 215–230.

Adesiyan, A. T., & Kehinde, A. D. (2024). Is there a linkage between credit access, land use, and crop diversification in achieving food security? Evidence from cocoa-producing households in Nigeria. *Heliyon, 10*(8), e11875.

Adigun, G.T. (2022). Determinants of credit access among smallholder women farmers in kwara state, nigeria. *Nigerian agricultural Journal, 53*(2), 121-128.

Ahoudjo, K. S. (2025). *Collective actions and transformation of food value chains in Sub-Saharan Africa: Insights from the rice value chains in Côte d'Ivoire and Ghana* [Doctoral dissertation, Université Paris-Saclay]. HAL Open Science. https://theses.hal.science/tel-05329111/

Anshari, M., Almunawar, M. N., Masri, M., & Hamdan M. (2019) Digital Marketplace and FinTech to Support Agriculture Sustainability. *Energy Procedia, 156*(2019), 234–238

Apostolakis, G., & Dijk, G. V. (2019). Cooperative organizations and members' role: *A new perspective A new perspective the design of IEP sites:* Aiming for an inclusive economic participation of urban citizens in flanders, University De Liège, Liège.

Balehegn, M., Adesogan, A. T., & Dahl, G. E. (2025). *Interventions for improving livestock productivity in developing countries.* Frontiers in Animal Science, 4, Article 1628166. https://doi.org/10.3389/fanim.2025.1628166

Berry, E. M., Dernini, S., Burlingame, B., Meybeck, A., & Conforti, P. (2015). Food security and sustainability: Can one exist without the other? *Public Health Nutrition, 18*(13), 2293–2302. https://doi.org/10.1017/S136898001500021X

Edet, G. E., Akpan, S. B., & Patrick, I. V. (2024). Marketing channel choice and its determinants among small-scale oil palm fruit farmers in AkwaIbom State, the southern region of Nigeria. *Asian Journal of Agriculture and Rural Development, 14*(2), 62–71. https://doi.org/10.22004/ag.econ.348851

Egwunyenga, E. J., & Okoh, J. O. (2022). *Perception of cooperative farmers on extension service delivery in Delta State, Nigeria*. *Nigerian Journal of Agriculture and Agricultural Technology***,** **9**(1), 33–41. https://njaat.com.ng/index.php/njaat/article/view/619

Emaziye, P. O., Akporawo, S., & Onyeidu, S. O. (2022). Effect of agricultural credits on production among smallholder crop farmers in Delta State. *World Journal of Advanced Research and Reviews, 16*(2), 437–448. https://doi.org/10.30574/wjarr.2022.16.2.1196

Emelife, A., Nweke, C. C., & Obi, C. B. (2023). Causes of food insecurity in South-East Nigeria: Implication for agricultural reform. *West African Journal of Interdisciplinary Research, 1*(2), 21-34. http://www.ijaar.org

Eneanya, A. N. (2021). Innovation and sustainable food security in Nigeria. *Covenant University Journal of Politics and International Affairs, 9*(1), 133–146.

Enefiok, E. O., & Bassey, E. (2023). *Assessment of the role of agricultural cooperatives in input supply among rural farmers in Ekiti State, Nigeria*. *Asian Journal of Agricultural and Horticultural Research***,** *11*(4), 12–22.

FAO, IFAD, UNICEF, WFP and WHO. (2024). The State of Food Security and Nutrition in the World 2024 – Financing to end hunger, food insecurity and malnutrition in all its forms. Rome. https://doi.org/10.4060/cd1254en

FAO. (2002). "The State of Food Security in the World." Food and Agriculture Organization of the United Nations.

FAO. (2018). "The 10 Elements of Agroecology." FAO.

Food and Agriculture Organization (FAO). (2023). *Building climate resilience in smallholder agriculture: A global perspective*. Rome: FAO.

Food and Agriculture Organization of the United Nations (FAO). (2020). The State of Food Security and Nutrition in the World 2020: Transforming Food Systems for Affordable Healthy Diets. FAO.

Food and Agriculture Organization of the United Nations. (2021). *Sustainable food and agriculture*. http://www.fao.org/sustainability/en/

Food Security Information Network (2023). https://www.fsinplatform.org/global-report-food-crises-2023.

Khatun, M. N. (2024). Transformation of the rural credit market in Bangladesh. In *Handbook of Agricultural Economics* (pp. 217-234). Elsevier. https://doi.org/10.1016/B978-0-44-313776-1.00217-8

Metu, A. G., Okeyika, K. O., & Maduka, O. D. (2016). Achieving sustainable food security in Nigeria: Challenges and way forward. In *Proceedings of the 3rd International Conference on African Development Issues (CU-ICADI 2016)* (pp. 182–187). Covenant University.

Mumararungu, I., Ca-MadeberiYa-Bititi, G., Bisetsa, E., & Burny, P. (2024). Enhancing agricultural cooperatives' resilience to food insecurity through cash injection: A case of the Kita Circle in Mali. *African Journal of Food, Agriculture, Nutrition and Development*, *24*(3), 25942–25962. https://doi.org/10.18697/ajfand.128.24280

Musa, M. B., Jibrin U. Y., & Isyaku A. (2024) An Analysis of Sustainable Agricultural Productivity and Food Security in Nigeria. *Journal of Political Discourse*. 2(1): 45-60.

National Agricultural Policy, (NAP) (2020). Agricultural Policy. Abuja: Federal Ministry of Agriculture and Rural Development.

National Bureau of Statistics (NBS). (2025). *Nigerian Gross Domestic Product Report Q4 2024*. Abuja, Nigeria: National Bureau of Statistics.

NESG. (2023). "Nigeria in transition: Recipes for shared prosperity. 2023 Macroeconomic Outlook" Nigerian Economic Summit Group.

Nwankwo, F. C., Eze, S. O., & Okeke, C. C. (2022). Input use and food security status of smallholder farmers in Enugu State, Southeast Nigeria. *Agricultural Economics and Extension Journal*, *16*(2), 56–68. https://doi.org/10.4314/aeej.v16i2.6

Nwanmuoh, E. E., Okolo-Obasi, N. E. V., Anene, J. N., Uwakwe, I. V., Udu, F. T., Amuka, I., & Emeter, P. O. (2024). Agricultural marketing and sustainable household food security in Sub-Saharan Africa: Evidence from Nigeria. *African Journal of Agricultural Science and Food Research*, 17(1), 68–97. *African Journal of Agricultural Science and Food Research*, *17*(1), 68–97.

Ogot, N. (2021). Metrics for identifying food security status. In *Food Security and Nutrition* (pp. 147-179). Elsevier. https://doi.org/10.1016/B978-0-12-820521-1.00007-1

Okonkwo, P.C., Akut, S. D., & Buden A. D. (2021). Evaluate The Gender Disparity In Farmers' Access To Agricultural Credit Among Cooperative Societies In Kaduna State. *IDOSR JOURNAL OF BANKING, ECONOMICS AND SOCIAL SCIENCES 6*(2), 34-47, 2021.

Okonwko, P. C., & Onoh, N. C. S. (2021). Utilization of Credit Among Agricultural Co-Operative Societies Members in Anambra State. https://www.researchgate.net/publication/354995607_Utilization_Of_Credit_Among_Agricultural_Co-Operative_Societies_Members_In_Anambra_State

Oseni, I. O., Babalola, A. D., & Adesoye, B. A. (2019). Agricultural credit policy as a panacea for sustainable food production in Nigeria: Evidence from Ogun State. *SPOUDAI Journal of Economics and Business, 69*(1/2), 18–29.

Owoeye, R. S., OJO OlaniyiOluwatosin, J. O. Ijigbade & MoyinoluwaAyomideOriola (2024). "Assessment of Agricultural Cooperative Societies on Farm Input Supply in Ekiti State, Nigeria". *Asian Journal of Advances in Agricultural Research, 24*(6), 40-47. https://doi.org/10.9734/ajaar/2024/v24i6511.

Qiu, Y., Bai, Y., Wu, J., Zeng, X., & Zhang, L. (2024). Impact of farmer cooperatives on labor employment: Evidence from rural China. *Land*, *13*(12), 2242. https://doi.org/10.3390/land13122242

Rebecca, N., Jacob, K., & Muhammed, M. (2024). Access to Finance and Women Entrepreneurship: A Case Study of Women in Agriculture in Masaka.

Terngu, O., Samaila, D., & Daniel, N. G. (2024). Effect of agricultural credit on small scale rice farmers in Southern Taraba State, Nigeria. *International Journal of Agriculture and Earth Science*, *10*(10), 106–119. https://doi.org/10.56201/ijaes.v10.no10.2024.pg106.119and#8203

Vågsholm, I., Arzoomand, N. S., & Boqvist, S. (2020). Food security, safety, and sustainability—Getting the trade-offs right. *Frontiers in Sustainable Food Systems, 4*, Article 16. https://doi.org/10.3389/fsufs.2020.00016

Wen, C., & Ma, J. (2024). How does social capital influence farmers' adoption of soil testing and formulated fertilisation technology? Evidence from Chinese maize farmers. *Sustainable Futures, 100394*. https://doi.org/10.1016/j.sftr.2024.10039

Wongnaa, C.A., Abudu, A., Abdul-Rahaman, A., Akey, E.A. & Prah, S. (2023). "Input credit scheme, farm productivity and food security nexus among smallholder rice farmers: evidence from North East Ghana", *Agricultural Finance Review*, Vol. 83 No. 4/5, pp. 691-719. https://doi.org/10.1108/AFR-03-2023-0039

World Bank (2017). "Agriculture for Development: World Bank's Role in Agriculture." World Bank.