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Assessment of the Effectiveness and Constraints of the Community-Based Agri-Business Savings and Investments Model among Smallholder Rice Farmers in Jigawa State, Nigeria

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ABSTRACT

Rice farming is a profitable enterprise, yet inadequate finance remains a primary constraint to business expansion for smallholder farmers. This study assessed the effectiveness and constraints of the Community-Based Agri-Business Savings and Investments Model (CASIM) among smallholder rice farmers in Jigawa State, Nigeria. Primary data were collected via a semi-structured questionnaire from 100 trial farmers. Using descriptive statistics and a paired T-test analysis, the results demonstrate the model's profound effectiveness. It established a virtuous cycle, leading to statistically significant increases ($p<0.01$) in yield, income, savings, and investment compared with baseline figures. Consequently, the model enhanced financial resilience by boosting savings, stimulating investment in farm inputs, and significantly reducing debt. Despite this success, key implementation challenges were identified, including gender disparities, low levels of education, and small farm sizes. The findings highlight that targeted; community-based interventions can effectively address systemic financial challenges faced by smallholder farmers.

***Keywords*:** Community-Based Finance, Smallholder Farmers, Financial Resilience, Agricultural Investment

INTRODUCTION

Background

Rice farming is a critical enterprise for food security and livelihoods across Nigeria, particularly in the rice belt of Jigawa State, where it serves as a primary source of income for millions of smallholders (Adeyemo et al., 2020). Despite its potential for good returns on investment, the sector is plagued by a persistent financing paradox: while capital is essential for expansion and resilience, smallholder farmers are systematically excluded from formal financial systems due to a lack of collateral, high perceived risks, and cumbersome administrative procedures (CBN, 2022; Ajieh, 2021). This credit constraint forces farmers to rely on high-interest loans from informal lenders, trapping them in a cycle of debt that erodes profits and perpetuates poverty (Ogunleye et al., 2024). Consequently, farmers are unable to generate capital through savings, which stifles business development, limits investment in improved inputs and technologies, and renders them highly vulnerable to climate and market shocks (World Bank, 2023).

In response to these challenges, numerous policy initiatives and formal microfinance institutions have been promoted, yet their reach and effectiveness remain limited in rural agrarian communities like those in Jigawa (Nwachukwu & Emunemu, 2020). This gap has catalyzed the emergence of Community-Based Savings and Loan Associations (CBSLAs) as a participatory financial alternative. These models, including the Community-Based Agri-Business Savings and Investments (CABSI) Model, are designed to empower farmers through collective savings, internal lending, and investment pooling, thereby fostering financial inclusion and agro-enterprise development from the ground up. By leveraging social capital and local knowledge, such models theoretically circumvent the barriers of the formal financial sector, building a solid economic foundation with members' own resources (Karlan et al., 2017).

While the literature on CBSLAs is growing, significant knowledge gaps persist regarding their application in specific agro-ecological and socioeconomic contexts, particularly in semi-arid regions of Nigeria. Previous studies have often focused on general microfinance impacts without drilling down into the unique constraints of agricultural value chains, where income irregularity and production risks are paramount (Afolabi, 2020). The effectiveness of integrated models like CABSI, which combine savings with explicit agri-business capacity building, remains markedly understudied. Crucially, there is a lack of empirical evidence on the tangible impact of such models on key agricultural metrics, such as productivity, annual income, and debt reduction. The specific systemic barriers—such as land tenure disputes, deep-seated financial illiteracy, and gender disparities—hinder their adoption and effectiveness in Northern Nigerian communities. How these models interact with other pervasive challenges, including climate vulnerabilities and market inefficiencies.

This study fills these critical gaps by conducting a comprehensive assessment of the CABSI model among smallholder rice farmers in Jigawa State, Nigeria. The novelty of this research lies in its integrated mixed-methods approach, which combines geospatial data on environmental constraints (e.g., land degradation) with robust empirical surveys to evaluate both the socio-economic impact and the operational constraints of the model within its real-world context. This study, therefore, advances knowledge of participatory finance models by providing concrete evidence from a semi-arid economy and contributes to the discourse on sustainable rural transformation. Additionally, the findings will provide evidence-based recommendations to refine the implementation of the CABSI model. This will directly inform policy by helping to align state agricultural programs (e.g., the Jigawa State Farm Mechanization Service) with community-centric finance mechanisms and tailor them to mitigate local climate risks. Moreover, the study demonstrates a framework for evaluating similar community-based interventions, integrating pre- and post-intervention financial metrics with qualitative analysis of constraints. Specifically, this study aims to:

1. Assess the baseline level of formal and informal loan access and repayment among rice farmers.
2. Implement and train farmers on the CABSI model for agri-business investment.
3. Evaluate the model's effectiveness on farmers' income, productivity, savings, and debt.
4. Identify and diagnose the contextual constraints limiting its adoption and scalability.

By bridging these implementation and impact evaluation gaps, this research contributes to developing sustainable financial pathways for smallholders, ultimately promoting resilience and economic self-sufficiency in Nigeria's rice belt.

MATERIALS AND METHODS

Study area

The study was conducted in Jigawa State. The State has a land area of 23,154 square kilometers and a population of 4,988,888 people, comprising mainly Hausa, Fulani, Mangawa, and Kanuri. It is located in the northwestern part of the country, between latitudes 11o 00 and 13o 00 North and longitudes 8^{o} 00 and 10^{o}15 East. Kano and Katsina States share borders with it to the west, Bauchi State to the east, and Yobe State to the northeast. Jigawa State shares an international border with the Republic of Niger, which presents a unique opportunity for cross-border trade. There is a Free Trade Zone of Maigatari. People depend mainly on agriculture for their livelihoods, specializing in arable and livestock farming. Agricultural produce includes grains such as maize, millet, rice and guinea corn. Similarly, groundnut, cowpea, sesame, and hibiscus are also grown. Lifestocks are an important aspect of the economy. The state has 27 Local Government Areas with capital at Dutse.

Sampling procedure

The model was tested in Jigawa state using the rice farmers as a trial. A two-stage sampling technique was used to select the study sample. The state is divided into four agricultural zones by the state Agricultural Development Program (ADP). One Local Government Area was purposely selected in each zone because of the concentration of rice farmers there. In each selected LGA, one community was also selected for the same reason. In each community, one registered farmer group was selected for the trial. The list of the members of the Associations formed the sampling frame. In the second stage, 25 members were randomly selected from each association to make the sample size. In all, 100 farmers from four villages were included in the study. These farmers were trained on the model and closely guided in its implementation.

In Hadejia agricultural zone, Auyo local government area was purposely selected due to the high number of rice farmers, and Auyo cikin gari community was also purposely selected due to the high concentration of rice farmers in the area. For the Ringim agricultural zone in the Ringim local government area, Ringim Dabi was also selected due to the high concentration of rice farmers in the area. Moreover, for the Dutse agricultural zone, the Kiyawa local government area was selected, along with the Kiyawa community, due to the high number of rice farmers in the area. Finally, in the Kazaure agricultural zone, the Kazaure Gada community was also selected due to the high number of rice farmers in the area. In four selected communities, 25 farmers were randomly selected from each, for a total sample size of 100 farmers. As presented in Table 1.

Table 1: Sampling Procedure

Zones	Local Governments	Communities	Sample size
Hadejia	Auyo	Auyo cikin Gari	25
Ringim	Ringim	Ringim Dabi	25
Dutse	Kiyawa	kiyawa community	25
Kazaure	Kazaure	Kazaure Gada	25
Total			100

RESULTS

Socio-economic characteristics

Figure 1 indicates that the majority of rice farmers in Jigawa State fall within the economically active age groups, with the largest proportions being between 30-39 years (25%) and 40-49 years (24%), collectively accounting for almost half (49%) of the farming population. Farmers aged 20-29 also represent a segment (18%). There is a smaller proportion of very young (<20 years, 8%) and older (>59 years, 9%) farmers. This implies that there is a concentration of farmers in their prime working age (potentially productive) with accumulated experience and physical strength. This age group is often more receptive to adopting new technologies and practices when appropriate incentives and support are provided (Sani et al., 2017).

Figure 2 reveals that a significant majority of rice farmers in Jigawa State have a Qur'anic education (56%), followed by primary education (19%). Farmers with secondary education are 15%, while those with tertiary education constitute a small minority (8%). "Others" account for 2%. This suggests a relatively low level of formal Western education among the rice-farming population, with traditional religious education as the dominant form. The high prevalence of Qur'anic education, while valuable in its own right, often does not directly confer the literacy, numeracy, or scientific understanding crucial for adopting modern farming practices, interpreting technical advice, or engaging with complex market dynamics (Oluwatayo, 2012; Baiyegunhi et al., 2022). This could significantly hinder the uptake of improved seed varieties, optimal fertilizer application, pest management techniques, and climate-smart agriculture. Traditional extension methods reliant on written materials or complex technical jargon will likely be ineffective for most farmers.

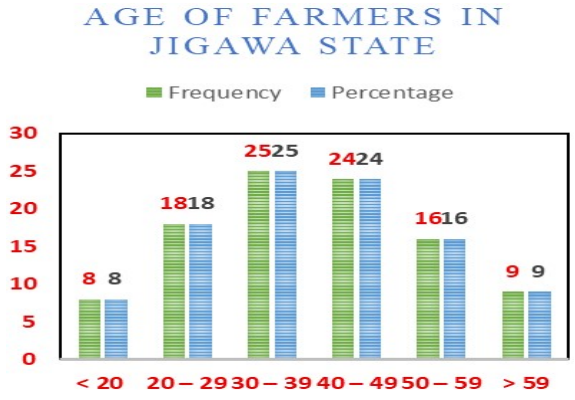

Fig 1: Age.

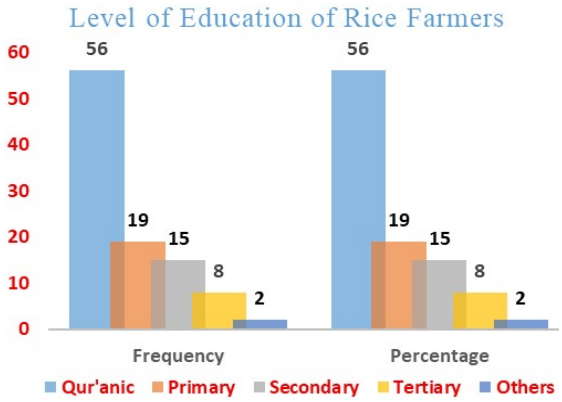

Fig 2: Educational level.

Figure 3 shows that a minority of rice farmers in Jigawa State are members of cooperative societies, with only 30% indicating 'Yes'. The low rate of cooperative membership suggests that most rice farmers operate individually. This significantly limits their collective bargaining power to purchase inputs at lower prices or sell their produce at higher prices, leaving them vulnerable to exploitation by middlemen (Omoare et al., 2020; Okafor et al., 2024). Non-members are likely to face greater difficulties in accessing vital agricultural resources such as improved seeds, fertilizers, credit, and extension services, which are often channeled through organized farmer groups (Obodoechi et al., 2024).

Figure 4 shows that the majority of rice farmers in Jigawa State consider farming as their primary occupation (60%). However, a large proportion (28%) also identifies livestock production as their primary occupation, indicating a strong integration of crop and livestock farming. Other occupations, such as trading (6%), civil service (4%), and "others" (2%), represent smaller segments. The 60% primarily engaged in farming highlights the centrality of agriculture to the livelihoods of a significant portion of the rural population in Jigawa State. This means agricultural interventions will directly impact their primary income source and overall well-being. The high percentage of farmers with livestock production as their primary occupation (28%) indicates a strong prevalence of agro-pastoralism or mixed farming systems. This is a common and often resilient livelihood strategy in Northern Nigeria, where livestock provides manure for crops, a source of income, and a buffer against crop failure (Sulaiman et al., 2021).

Qualitative socio-demographic characteristics

Table 2 shows that the mean years of experience of the rice farmers was 18.2 years. The minimum age was 3 years, and the maximum was 42 years. Farmers with more experience can serve as mentors for younger or less experienced farmers, facilitating knowledge transfer within the community. Highly experienced farmers may sometimes exhibit risk aversion, preferring to stick with proven methods rather than adopting new, potentially

higher-risk technologies, especially if their livelihoods are precarious (Mwalongo et al., 2020). Extension services would need to demonstrate the benefits and mitigate perceived risks effectively. The table further indicates that the minimum farm size for rice farmers in Jigawa State is 0.2 ha, while the maximum is 10.23 ha, with a mean farm size of 2.4ha. This finding confirms the typical agricultural landscape in many parts of Nigeria, dominated by smallholder farmers. Their operations are often characterized by low capital investment, reliance on manual labor, and production primarily for subsistence with some surplus for market (Liverpool-Tasie et al., 2020). Small farm sizes inherently limit the potential for economies of scale, making it challenging for farmers to generate substantial income or invest in costly machinery and advanced technologies (Pattayat et al., 2022). This can trap farmers in a cycle of low productivity and poverty.

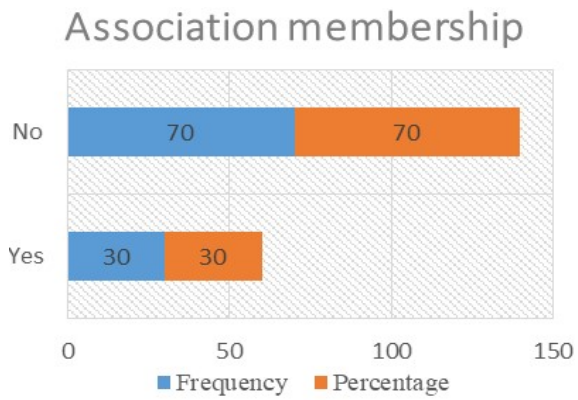

Fig 3: Membership of association.

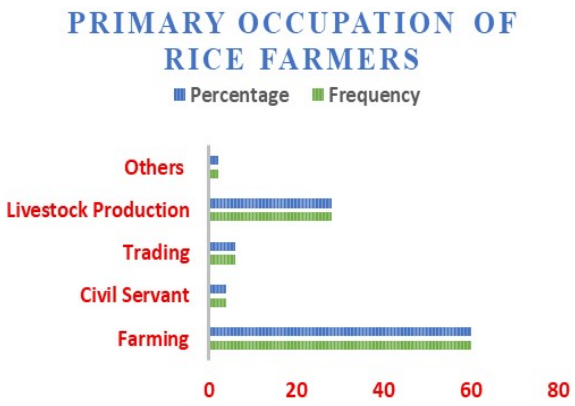

Fig 4: Primary occupation.

Table 2: Quantitative socio-economic variables

Variables	minimum	Maximum	Mean
Farming experience (years)	3	42	18.2
Farm size (ha)	0.2	10.23	2.4
Household size	1	29	10

Regarding household size, the result indicates that the mean household size of the respondents was 10 persons. The maximum and minimum were 29 and 1 people, respectively. This suggests a prevalence of moderately large to large family units. Ayinde et al. (2014) reported that large household size is a significant asset in rice cultivation, often reducing the need for hired labor and associated costs. Larger households also mean more mouths to feed. While more labor is available, the increased dependency ratio (the number of dependents per worker) can put significant pressure on household food security if agricultural productivity and income are not sufficient to meet the consumption needs of all members (Ogunniyi, 2019; Abegunde et al., 2019; UNICEF, 2020). This can drive farmers to seek higher yields or diversify their income sources. In many rural contexts, particularly in Northern Nigeria, larger household sizes can sometimes be correlated with higher levels of poverty and vulnerability if resources are scarce and income-generating opportunities are limited (World Bank, 2015).

Descriptive statistics of the impact of the pilot model on participants' financial resilience and agri-business outcomes

To evaluate the impact of the pilot model on participants' financial resilience and agri-business outcomes, the before-and-after survey by participating farmers measures changes in savings behavior, debt levels, income, and investment in business. The interpretation involves a direct comparison of the pre- and post-test data (Table 3).

Table 3: Impact of the Model on Farmers Income and Output

Financial Resilience Marics and Agri-business outcomes	Before (Pre/baseline)	After (Post/endline)	Difference (Post - Pre)
Average monthly income (₦)	149,456.20	151,478.56	2,022.36
Average annual Income from farming (₦)	512,456.32	734,510.23	222,053.91
Average annual Investment on farm inputs (₦)	125,435.67	194.776.00	69,340.33
Average annual savings (₦)	167,342.21	432,312.23	264,970.02
Average annual debt (₦)	211,567.24	86,476.24	-125,090
Average annual yield per acre (kg)	2,025	2,325	300

Source: Field Survey, 2025

The information provided in Table 3 demonstrates a positive impact of a "model" on farmers' financial resilience and agribusiness outcomes, as evidenced by changes between the baseline ("Before") and endline ("After") data. The "model" appears to have been a successful intervention, leading to tangible improvements in income, savings, and productivity while reducing debt. The most striking finding is the substantial increase in average annual income from farming, which rose to ₦222,053.91. This indicates the model directly improved

farming profitability. The slight increase in Average monthly income (₦2,022.36) suggests that while farming income saw a massive boost, non-farming income may have remained stable or was not a significant contributor to the overall change. This could imply the model was heavily focused on agricultural practices rather than diversification into off-farm activities. The data shows a significant increase in both Average annual investment on farm inputs (₦69,340.33) and Average annual savings (₦264,970.02). This is a crucial finding, as it suggests that farmers are not only earning more but also reinvesting a portion of their income in their farms and building a financial safety net. The increase in investment in farm inputs likely contributed to higher yields, creating a positive feedback loop. The large jump in savings also points to improved financial discipline and resilience against shocks. The model led to a significant decrease in average annual debt (₦125,090). This is a strong indicator of improved financial health. Farmers may have used their increased income and savings to pay off existing loans, reducing their financial burden and risk. The average annual yield per acre increased by 300kg, a direct measure of enhanced agricultural productivity. This improvement in yield is likely a direct result of the increased investment in farm inputs, such as better seeds, fertilizers, or tools, facilitated by the model.

These findings align with and reinforce a common understanding in agricultural development: providing farmers with access to better technology, knowledge, and financial resources leads to improved outcomes. For example, the increase in investment on farm inputs and the subsequent increase in yield aligns with studies on agricultural extension and technology adoption. When farmers have the capital to purchase better inputs, they can improve their productivity, as demonstrated by the positive correlation between investment and yield in this table. The reduction in debt and increase in savings are consistent with research on microfinance and financial inclusion programs that aim to empower farmers to manage their finances better and build resilience. This positive change in farmers' financial behavior (more savings, less debt) can be seen as a sign of enhanced financial literacy and a shift from subsistence farming toward an agribusiness mindset.

Impact of the pilot model on participants' financial resilience and agri-business outcomes

A paired-samples t-test was conducted to evaluate the significance of the Community-Based Agri-Business Savings and Investments Model's impact on key financial and agricultural metrics among smallholder rice farmers. The analysis compared participants' status *before and after* the intervention across six critical variables. The results, presented in Table 4, reveal statistically significant changes in all measured outcomes.

Table 4: Impact of the Community-Based Agri-Business Savings and Investments Model on key financial and agricultural metrics among smallholder rice farmers.

Variable Pairs	Mean diff.	Std. Dev.	Std. Error	t-value	p-value
Monthly Income (Before-After)	-78613.97	61779.63	11279.37	-6.970	0.000***
Annual Income (Before-After)	-111570.32	108007.02	19719.29	-5.658	0.000***
Investment (Before-After)	-23311.61	33426.63	6102.84	-3.820	0.001***
Annual Savings (Before-After)	-116040.90	108387.28	19788.72	-5.864	0.000***
Debts (Before-After)	46091.73	42001.60	7668.41	6.011	0.000***
Yield (Before-After)	-95.87	103.31	18.86	-5.082	0.000***

Note: A negative mean difference indicates an increase in the variable (e.g., Income, Savings) from before to after the intervention. A positive mean difference indicates an increase in Debt.

The analysis indicates a highly significant positive effect of the intervention on farmers' incomes. Both monthly income (M_{diff} =-78,614, *p* <.001) and annual income (M_{diff} = -111,570, *p* < .001) showed substantial and statistically significant increases following participation in the model. This suggests that the agri-business model effectively enhanced farmers' revenue streams. The result shows that there is a significant increase in the amount of savings (M_{diff} = -116,041, *p* < .001) and a significant increase in investment levels (M_{diff} = -23,312, *p* = .001). This demonstrates that the model successfully encouraged a culture of saving and directed capital towards productive investments, which are core objectives of the intervention.

Paradoxically, and of critical importance, the results show a significant increase in debt among participants (M_{diff} = +46,092, *p* < .001). This increase is likely not indicative of financial distress but rather a direct outcome of the model's mechanism. It implies that the program provided or facilitated access to formal credit, which farmers then utilized to fund their increased investments in inputs and technology. Finally, the intervention had a direct positive impact on agricultural productivity. Crop yield significantly increased from before to after the intervention (M_{diff} = -95.87, *p* < .001). This confirms that investments by farmers, potentially in higher-quality seeds, fertilizers, irrigation, or technology, translated into tangible gains in on-farm production.

Constraints limiting farmers' adoption of the model

Table 5 provides critical insights into the various constraints that hinder rice farmers' efficiency in Jigawa State. Given that this table allows for multiple responses, the percentages indicate the proportion of farmers who identified each factor as a constraint. The high percentages indicate that a substantial majority of farmers experience multiple challenges simultaneously, resulting from multiple responses. Low and Irregular Income (92%) and Inadequate

Inputs and Poor Funding (92%) are highly interconnected and represent fundamental challenges. Limited Availability of Suitable Financial Products (90%), Limited Financial Literacy (88%), High Transaction.

Table 5: Constraints faced by Rice Farmers in Jigawa State

Constraints (highlighting pervasive issues, are)	Percentage
Low and Irregular Income	92
Inadequate Inputs and Poor Funding	92
Limited Availability of Suitable Financial Products	90
Limited Financial Literacy	88
High Transaction Costs (Informal Lenders)	86
Land Tenure System	82
Cumbrous Administrative Procedures (for formal linkages)	78
Less frequently, but still present, are:	
Lack of trust and transparency	23
Inadequate Access to Information and Market Linkages	16
External Shocks	14
Poor Group Dynamics and Leadership	12
Total	673*

Source : Field Survey, 2025
*Multiple Reponses

Costs (Informal Lenders) (86%), and Cumbrous Administrative Procedures (for formal linkages) (78%): These constraints point to significant systemic failures in rural financial markets. Farmers face a severe lack of appropriate financial services (e.g., loans tailored to agricultural cycles, affordable insurance, savings products) that meet their specific needs. This is compounded by their limited understanding of financial concepts (financial literacy), making.

It is difficult to navigate complex formal systems. Consequently, they are often forced to rely on informal lenders, who typically charge exorbitant interest rates and impose unfavorable terms, resulting in high transaction costs. The Cumbrous Administrative Procedures for formal linkages further push farmers away from institutional finance. These issues severely limit farmers' ability to access the capital needed for necessary farm investments, manage risks (e.g., through crop insurance), or participate effectively in formal value chains. The high reliance on informal lenders can trap farmers in cycles of debt and further impoverishment, undermining any gains from improved production. This also suggests that even if "access to formal credit" (as discussed in previous tables) exists for some, the usability and suitability of those products are major barriers.

The fact that 82% of farmers cite the land tenure system as a constraint indicates widespread insecurity of land rights, fragmented landholdings, and complex customary land laws that hinder investment and long-term planning. In many parts of Northern Nigeria, customary land tenure, often without formal titles or clear boundaries, can make it difficult for farmers to use their land as collateral for formal loans or to invest with confidence in permanent improvements. According to Wongnaa et al. (2023) and Adegbite & Machete (2020), small-scale farmers face two major constraints: a lack of assets and working capital (land, labor, and capital to produce at economic scales).

Insecure land tenure discourages farmers from making long-term, high-value investments in their land, such as constructing irrigation facilities, applying soil amendments, or planting perennial crops, as they lack assurance of reaping the long-term benefits. It also significantly limits their ability to access formal credit that typically requires documented land ownership as collateral. This is particularly critical for rice, which can benefit significantly from improved land management and irrigation systems. Lack of trust and transparency (23%) and Poor Group Dynamics and Leadership (12%) were, although not as widespread as financial constraints, still affecting a notable portion of farmers and affecting the effective functioning of farmer groups or cooperatives. Inadequate Access to Information and Market Linkages (16%) was relatively low compared to financial constraints, this still affects a notable number of farmers. External Shocks (14%) refers to unforeseen events like droughts, floods, pest outbreaks, or significant price drops. While the percentage is lower than other constraints, this might be due to the specific survey period or farmers prioritizing more constant, systemic challenges. However, Jigawa State, located in Nigeria's semi-arid region, is inherently vulnerable to climate variability. Even if perceived as less frequent in the immediate survey period, external shocks can devastate agricultural livelihoods, wiping out years of investment and progress, and pushing vulnerable farmers deeper into poverty. Building resilience to these shocks remains crucial for long-term sustainability (Intergovernmental Panel on Climate Change (IPCC), 2022).

DISCUSSION

The results presented in the tables provide strong quantitative evidence to assess the effectiveness of the Community-Based Agri-Business Savings and Investments Model for smallholder rice farmers in Jigawa State. The highly statistically significant differences ($p < 0.01$) across all key metrics confirm that the intervention has had a substantial impact, aligning with the global agreement on the potential of community-based financial models. The literature well supports the model's clear effectiveness in improving core financial and agricultural outcomes. The significant increases in monthly income, annual income, annual savings, and investment levels are consistent with findings from Karlan, et al. (2017), who demonstrated that savings groups in Kenya, Mali, and Uganda significantly increased household expenditures, investment in livestock, and resilience.

Furthermore, the significant increase in yield is a critical finding, indicating that financial empowerment translated into tangible agricultural improvements. This supports the work of Abdul-Rahaman and Abdulai (2022) in Ghana, who found that access to credit significantly increased the adoption of productivity-enhancing technologies, such as improved seeds and fertilizer, leading to higher farm outputs. Findings of this study confirm

that the model's provision of capital likely allowed farmers to overcome the "Inadequate Inputs and Poor Funding" (92%) constraint, thereby replicating this positive cycle in the Nigerian context.

The model's design is a direct and logical response to the identified constraints. The high prevalence of Limited Financial Literacy, limited Availability of suitable financial access and poor market linkage explains why traditional formal institutions failed. This is consistent with the findings of Ragasa et al. (2016), Raza et al. (2023), and Rufaidah et al. (2023). The community-based approach's likely success in leveraging social capital to bridge this gap is empirically grounded. Casson & Giusta, (2007) famously established that social networks constitute a form of "capital" that can facilitate economic action. This model operationalizes this by using the group to reduce transaction costs and mitigate information asymmetries that typically exclude smallholders. The findings of this study are also in consonance with those of Nafiu et al. (2024), who outlined small-scale farming communities' challenges as lack of skill, poor capital base, inconsistent government policies, poor business strategy and poor record keeping

However, the constraints also highlight the model's limitations, particularly the concerning rise in indebtedness. While the model may have replaced exploitative informal debt (High Transaction Costs) with better terms, the net increase in debt levels presents a risk. This finding offers a nuanced perspective. It contrasts with some studies that highlight only the benefits of financial inclusion and aligns more closely with critical literature that warns of potential downsides. For instance, Schicks (2013) documented the problem of over-indebtedness among microfinance clients in Ghana, noting that even with good intentions, increased borrowing can lead to financial stress. The study suggests that the farmers' acute need for capital made debt an instrumental tool for growth, but this strategy requires careful management to avoid the pitfalls identified by Schicks (2013) and Muhammed et al. (2020).

Finally, the results on the demographic characteristics of the respondents reveal a tension between potential and barrier. The good age bracket (30-49 years) workforce represents a significant asset, as this group is often more innovative and productive. However, this potential is critically constrained by the low level of formal education, a barrier extensively documented in the literature. Oluwatayo (2012) and Baiyegunhi et al. (2022) have argued that a lack of formal education hinders the comprehension and adoption of modern agricultural techniques and financial management skills. Therefore, while the model has created a virtuous cycle of investment and growth, its long-term sustainability may depend on integrating financial literacy education and robust debt management safeguards to protect against over-indebtedness, turning a potentially risky tool into a sustainable engine for development.

Conclusion

Based on the findings, it can be concluded that the pilot model has been a successful intervention. It directly improved farming profitability, as demonstrated by a substantial increase in annual farming income and yield per acre. The model also enhanced financial resilience by increasing savings, stimulating investment in farm inputs, and significantly reducing debt. However, the respondents outlined some critical challenges, including gender disparity, low education, limited access to finance, and small farm sizes. This success highlights that targeted interventions can effectively address the systemic challenges faced by these farmers.

Recommendations

Based on the findings of the research, the following recommendations were made;

i. Implement programs specifically designed to improve women's access to land, credit, improved seeds, and extension services.
ii. Develop extension materials that use visual aids and local languages. Leverage the influence of religious and community leaders to disseminate information and implement adult literacy programs that combine basic reading and numeracy with agricultural knowledge and financial literacy.
iii. Promote savings groups and village savings and loan associations (VSLAs). Link these informal groups to formal financial institutions to facilitate larger credit access and encourage microfinance institutions to develop agricultural loan products with flexible repayment schedules that align with farming seasons. Support the creation of affordable health insurance schemes for farmers.
iv. Given the significant positive impact of the pilot model, its components and lessons learned should be integrated into broader state and national agricultural policies, and a robust monitoring and evaluation framework should be established to track the long-term impacts of the scaled-up interventions on farmers' livelihoods and productivity.

DECLARATIONS

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savings participation among smallholder rice farmers in Jigawa State. This contribution has not only enhanced academic inquiry but also holds significant potential for improving rural livelihoods through evidence-based policy

Conflict of interest: The authors have no conflict of interest to declare.

Data Availability: Data is available on request

Ethics Statement: This study was approved by the Federal University Dutse Review Board, Jigawa State, Nigeria. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee.

Author's Contributions: Salihu M. conceived and designed the study**.** Wudil A**.** H. contributed to data collection, data cleaning and analysis. Ado N. was responsible for data entry, statistical analysis, and interpretation of results. Bello O.G. contributed to the discussion of findings and carried out the final proofreading and editing of the manuscript. All authors read and approved the final version of the manuscript.

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