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Agribusiness participation and income effects among rural households in South West Nigeria

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Abstract

This study examined the influence of agribusiness participation on household income in Southwestern Nigeria using data from 230 rural households selected through a three-stage random sampling technique. Descriptive statistics and Tobit regression were used for data analysis. Results showed that 47.4% of respondents were aged 41–60 years, 60.4% were male, and 40.9% had secondary education. Tobit results revealed that age ($\beta = 0.3164$, $p < 0.10$) and association membership ($\beta = 2.1120$, $p < 0.01$) positively influenced agribusiness participation, while credit availability ($\beta = -0.8566$, $p < 0.05$) and labour cost ($\beta = -0.5181$, $p < 0.05$) negatively affected participation. The income model indicated that age ($\beta = -0.0991$, $p < 0.05$) and labour cost ($\beta = -0.0787$, $p < 0.01$) reduced household income, whereas farm output ($\beta = 0.1263$, $p < 0.05$) and agribusiness diversification ($\beta = 0.1744$, $p < 0.01$) increased income. Financial and market constraints were identified as the major challenges affecting 64.5% of respondents. The study concludes that improving access to credit, reducing labour costs, and strengthening farmers' associations are essential for enhancing agribusiness participation and household income in Southwestern Nigeria.

Nomenclature and units

y	Tobit
Xi	Independent variable
β_i	vector of parameter estimates

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1.0 Introduction

Agriculture continues to play a central role in the Nigerian economy by providing employment, food supply, raw materials, and income for a large proportion of the rural population. The sector is dominated mainly by smallholder farmers who engage in the cultivation of staple crops such as cassava, maize, yam, rice, and vegetables. Despite their contribution to national food production, many rural farming households still experience low income, food insecurity, and poor living conditions due to inadequate infrastructure, limited access to productive resources, and weak market systems. Rural poverty remains widespread in many parts of Nigeria, particularly among households that depend largely on agriculture for survival (Oyekale et al., 2017).

In response to rising poverty and unemployment, attention has increasingly shifted toward agribusiness as an important pathway for rural economic transformation and livelihood improvement. Agribusiness extends beyond farming activities to include processing, storage, packaging, transportation, and marketing of agricultural products. Through these activities, agribusiness creates employment opportunities, improves value addition, and enhances income generation for rural households. According to Ajekwe and Ibiamke (2020), agricultural entrepreneurship possesses strong potential for stimulating economic growth and reducing unemployment in Nigeria, especially in rural communities where farming remains the dominant occupation.

However, the participation of rural households in agribusiness activities is influenced by several socioeconomic and institutional factors. Limited access to credit facilities, inadequate extension services, poor infrastructure, low educational attainment, high labour costs, and restricted access to improved technologies continue to hinder effective participation in agribusiness ventures. Adeyonu et al. (2022) observed that entrepreneurial capabilities and access to productive opportunities significantly affect the welfare and poverty status of rural farming households in Nigeria. Similarly, Ogunniyi et al. (2021) noted that access to markets, livelihood opportunities, and socioeconomic resources plays an important role in improving household welfare and food security among smallholder farmers.

In addition, income diversification through agribusiness has become increasingly important in reducing rural vulnerability and improving household resilience. Daud et al. (2018) emphasized that diversification of income sources and investment in human capital contribute significantly to improved livelihoods among rural farming households. Nevertheless, many agribusiness enterprises in rural Nigeria continue to operate at low productivity levels due to poor access to finance, inadequate market information, weak institutional support, and unstable economic conditions.

Although several agricultural and rural development programmes have been implemented by government and development agencies to improve productivity and household welfare, the impact of many of these interventions has remained limited. This is partly because many programmes do not adequately address the local socioeconomic realities confronting rural households, including infrastructural deficiencies, market constraints, and financial exclusion. Consequently, there is a growing need for empirical studies that examine the determinants of agribusiness participation and its contribution to household income in rural Nigeria.

Against this backdrop, this study examines the factors influencing rural households' participation in agribusiness and its effect on household income in Southwestern Nigeria. Specifically, the study seeks to identify the major determinants of agribusiness participation among rural households and assess how participation in agribusiness affects household income. The findings of the study are expected to provide relevant information for policymakers, researchers, and development practitioners in designing strategies capable of improving rural livelihoods, promoting agribusiness development, and reducing poverty in Nigeria.

Conceptual Framework and Theoretical Linkages

This study is guided by a conceptual framework that explains the relationship between agribusiness participation, market participation, household income, and poverty reduction as a connected process. Participation in agribusiness activities such as production, processing, and trade enables rural households to engage more actively in markets by improving their access to buyers and suppliers and lowering transaction costs. As households become more integrated into markets, their level of participation increases, which enhances income through improved pricing, increased sales volumes, and higher productivity levels. Ultimately, higher income strengthens household welfare and contributes to poverty reduction by improving consumption capacity and enabling savings and investment.

Existing literature supports this linkage. Studies have shown that greater involvement in agricultural markets improves household income and welfare through increased commercialization and better market access (Barrett, 2008; Reardon et al., 2009). In the same vein, evidence from developing countries indicates that participation in agribusiness activities plays a significant role in promoting rural income growth and reducing poverty (World Bank, 2007; Christiaensen et al., 2011). These findings highlight the importance of integrating rural households into markets as a pathway for economic improvement.

The framework also identifies several key channels through which agribusiness participation influences income outcomes. These include improvements in productivity due to better farming practices and experience, reduced transaction costs arising from improved access to markets, income diversification away from subsistence-based activities, and greater income stability through risk spreading. These mechanisms are consistent with established theories of agricultural commercialization and rural development (Pingali, 1997; Barrett et al., 2012).

From an econometric standpoint, the Tobit model is used because the dependent variables in this study - particularly measures of market and agribusiness participation - are censored at zero, as many households do not engage in these activities. The Tobit model is appropriate in this context as it accounts for both the decision to participate and the degree of participation among those who do engage. This makes it suitable for analyzing limited dependent variables that combine non-participation and varying levels of participation (Wooldridge, 2010).

2.0 Materials and Methods

This study was conducted in Southwest Nigeria, covering Ogun, Lagos, Ondo, Osun, Ekiti, and Oyo States. The region, predominantly inhabited by the Yoruba ethnic group, lies between latitudes 4° - 14°N and longitudes 3°–14°E. It experiences a tropical climate with wet (March-November) and dry (November - February) seasons, annual rainfall of 1,000 - 2,000 mm, and average temperatures ranging from 24°C to 30°C (Idowu et al., 2013). The vegetation includes tropical rainforest, Guinea savannah, and mangrove ecosystems. Agriculture is a major economic activity, with cocoa, cassava, maize, and yam as key crops, alongside strong commercial and industrial activities. The region has an estimated population of 51.2 million, mainly Yoruba, with both rural and urban residents (NBS, 2019).

For this study, Ogun, Osun, and Oyo States were purposively selected due to their strong agricultural potential and relevance to agribusiness activities (Idowu et al., 2013).

2.1 Research Sampling Approach

A three-stage random sampling technique was employed for the study. In the first stage, three states; Ogun, Osun, and Oyo States, were randomly selected from Southwest Nigeria, while Lagos State was excluded due to its predominantly urban characteristics. In the second stage, 15 Local Government Areas (LGAs) were selected using proportionate-to-size sampling, comprising 5 out of 21 LGAs in Ogun State, 5 out of 30 in Osun State, and 5 out of 33 in Oyo State. In the final stage, 15 households were randomly selected from each LGA, resulting in a total sample size of 225 households. Following data cleaning and the removal of incomplete or inconsistent responses, 230 valid observations were retained and used for the Tobit model analysis. The poverty variable was incorporated into the analysis using household income/expenditure thresholds to classify households as poor or non-poor.

2.2 Data Analysis and Analytical Tools

Data were analysed using SPSS and STATA. SPSS was used to examine the socio-economic characteristics of the respondents, while STATA was employed for both descriptive and inferential analyses. Descriptive statistics such as frequencies and percentages were used to summarize key household characteristics. For the econometric analysis, the Tobit regression model was applied to identify the determinants of agribusiness participation and its effect on rural household income. This approach is appropriate for analysing limited dependent variables and censored data structures.

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2.3 Tobit Model Specification

The effect of agribusiness participation on rural household income was estimated using a Tobit model, with farm income (FI) as the dependent variable. Farm income represents agricultural earnings and serves as an indicator of household welfare and potential poverty reduction capacity. It is measured as the proportion of total household income, ranging from 0 (households below the poverty threshold or with no agricultural income) to 100 (households with full reliance on agricultural income or above the income threshold).

The Tobit model, estimated using the maximum likelihood method (Gujarati and Porter, 2009), is used to capture both the likelihood of participation and the intensity of income outcomes, particularly where the dependent variable is censored.

The Tobit model is specified in its latent (unobserved) form as:

$Y_i^* = X_i \beta + \varepsilon_i$ …..

where:

- y^*i is hidden variable
- Xi is a set of independent variables
- β is a vector of parameter estimates
- εi is the error term

The observed variable yi is often defined as:

$yi = y\_i$ if $y\_i > 0$ (or some threshold)

$yi = 0$ if $y^*i \leq 0$ (or some threshold)

The latent variable (y^*i) represents the ith household's potential farm income, which is only observed when it is above zero, while values at or below zero are recorded as censored observations. The Tobit model is designed to handle such censoring at the lower bound, and in some cases at both lower and upper limits, depending on the nature of the data. The vector (Xi) comprises the explanatory variables that influence farm income, with the corresponding parameter vector (β) estimated to measure their effects. The error term (ε_i) is assumed to follow a normal distribution with zero mean and constant variance. The observed outcome (Yi) is therefore a censored transformation of (y^*i), allowing the model to capture variations in income levels more effectively than binary models, which would otherwise fail to account for differences in intensity among households.

The observed variable Y_i is defined as:

$Y_i = 0$ if $Yi^* \leq 0$

$Y_i = Y_i^*$ if $0 < Y_i^* < 100$

$Y_i = 100$ if $Y_i^* \geq 100$

Given the farm income (FI) range of 0 to 100, we adapt the standard Tobit model, which typically assumes censoring at Yi = 0, to accommodate both lower and upper bounds.

This adaptation accounts for both lower and upper bounds in the FI data.

The model assumes a latent variable $Y^*i = Xi\,\beta + \varepsilon_i$, observed for farm incomes between 0 and 100. The bounded range (0-100) of farm income violates normality assumptions. The empirical Tobit model is specified as:

$Yi = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \ldots + \beta_nX_n + \varepsilon i$

This model captures the relationship between farm income and various explanatory variables (X_1, X_2, ..., X_n).

The empirical Tobit model is specified as:

Farm Income = $\beta_0 + \beta_1$ (Age) + β_2 (Gender) + β_3 (Education) + β_4 (Marital Status) + β_5 (Household Size) + β_6 (Farm Size) + β_7 (Years of Experience) + β_8 (Farm Produce Availability) + β_9 (Farm Distance) + β_{10} (Access to Farm) + β_{11} (Transportation) + β_{12} + β_{13} (Credit Access) + β_{14} (Market Distance) + β_{15} (Price) + β_{16} (Labour Cost) + β_{17} (Social Capital) + β_{18} (Infrastructure Facility) + ε

OLS estimation would yield biased estimates (Gujarati, 2004; Goetz, 1995). Therefore, Maximum Likelihood Estimation (MLE) is preferred for Tobit analysis.

Table 1: Description of Variables Used in Tobit Model Analysis (N = 230 Households)

Variable	Description	Measurement	Expected Sign
Farm Income	Total income generated from farming activities	Nigerian Naira (Continuous)	+/-
Age	Age of household head/entrepreneur	Years (Continuous)	+
Sex	Sex of household head	1 = Male, 0 = Female (Dummy)	+/-
Years of Education	Number of years of formal education	Years (Continuous)	-
Marital Status	Marital status of household head	1 = Married, 0 = Otherwise (Dummy)	+/-
Household Size	Number of household members	Number of persons (Continuous)	+/-
Farm Size	Total farm size cultivated	Hectares (Continuous)	+
Years of Experience	Farming experience of respondent	Years (Continuous)	+
Farm Products Availability	Availability of farm products	1 = Yes, 0 = No (Dummy)	+
Farm Distance	Distance from residence to farm	Kilometres (Continuous)	-
Transportation Cost	Cost of transportation	Nigerian Naira (Continuous)	-
Farm Management Laws	Compliance with farm management regulations	1 = Institutional, 0 = Community-based (Dummy)	-
Cultural Beliefs	Influence of cultural beliefs on farming activities	Scale: Not severe to Extremely severe	-
Credit Access	Access to credit facilities	1 = Yes, 0 = No (Dummy)	+
Market Distance	Distance to market	Kilometres (Continuous)	-
Other Income Source	Availability of alternative income source	1 = Farming only, 0 = Otherwise (Dummy)	+
Price	Prices of farm inputs/products	Nigerian Naira (Continuous)	+/-
Labour Cost	Cost of hired labour	Nigerian Naira (Continuous)	-
Association Membership	Membership of cooperative/association	1 = Member, 0 = Otherwise (Dummy)	+

3.0 Results and Discussions

3.1 The socioeconomic characteristics of the respondents

The socioeconomic characteristics of the respondents indicate that the majority of household heads (47.4%) were within the age range of 41- 60 years, suggesting that agribusiness activities were predominantly undertaken by economically active and experienced adults. Only 0.9% were below 20 years, while 14.3% were between 61 and 80 years. Male-headed households constituted 60.4% of the sample, indicating male dominance in rural agribusiness activities, although female participation (39.6%) was also substantial. Educational attainment among respondents was relatively moderate, with 40.9% having secondary education and 21.7% possessing tertiary education. However, 13.5% had no formal education, which may affect access to improved farming practices and agribusiness opportunities. The marital status distribution showed that most respondents were married (72.2%), implying greater household responsibilities and labour availability for farming activities. Household composition revealed that 66.1% of respondents had

between three and four children, while most households had fewer than two male adults (69.6%) and female adults (75.7%). This suggests moderate household sizes with limited adult labour availability, which could influence farm productivity and household livelihood outcomes. Overall, the socioeconomic profile reflects a relatively mature, moderately educated, and family-oriented rural farming population.

3.2 Rural Households' Participation in Agribusiness

The Tobit regression results in Table 3 revealed that the model was statistically significant at the 1% level (Prob > χ^2 = 0.0000), indicating that the explanatory variables jointly influenced rural households' participation in agribusiness activities. The pseudo-R^2 value of 0.4160 implies that approximately 41.6% of the variation in agribusiness participation was explained by the variables included in the model.

Table 3: Factors Influencing Rural Households' Participation in Agribusiness

Variable	Coefficient	Std. Error	Z-value	P-value
Constant	2.6245**	1.1212	2.34	0.019
Age	0.3164*	0.1885	1.68	0.093
Sex	0.0507	0.2701	0.19	0.851
Education	-0.0704	0.1425	-0.49	0.621
Marital Status	-0.0273	0.1914	-0.14	0.886
Household Size	-0.0633	0.0472	-1.34	0.180
Other Income Source	0.1125	0.3291	0.34	0.732
Farm Produce Availability	-0.2495	0.2495	-0.65	0.513
Credit Availability	-0.8566**	0.3673	-1.79	0.020
Labour Cost	-0.5181**	0.3743	-1.38	0.016
Association Membership	2.1120***	0.3933	5.37	0.000
Log Likelihood	65.024			
Wald χ^2	92.24			
Prob > χ^2	0.0000***			
Pseudo R^2	0.4160			

Source: Field Survey, 2024.

*Significance levels: ***p < 0.01, **p < 0.05, *p < 0.10.*

Age had a positive and marginally significant effect (p < 0.10), suggesting that older and more experienced household heads were more likely to participate in agribusiness activities due to accumulated farming knowledge, managerial skills, and production experience. However, variables such as sex, education, marital status, household size, other income sources, and farm produce availability were not statistically significant, indicating that they had limited direct influence on participation within the study area.

Credit availability negatively and significantly influenced agribusiness participation at the 5% level, implying that inadequate access to credit constrains rural households' ability to invest in productive agricultural activities. Limited access to credit may reduce farmers' capacity to purchase improved inputs, expand production, and manage risks associated with agricultural enterprises. This finding supports earlier studies (Dewees, 1995; Dove, 1995; Shively, 1999; Emtage & Suh, 2004) which emphasized the importance of financial access in enhancing agricultural participation and livelihood diversification.

Labour cost also exerted a negative and significant effect on agribusiness participation, indicating that rising labour expenses discourage households from engaging in farming enterprises. Higher labour costs increase the overall cost of production, especially for labour-intensive activities such as land preparation, planting, harvesting, and transportation. This finding is consistent with the work of Okwuokenye and Akintoye (2015), who reported that lower labour costs improve farmers' participation and productivity in agricultural activities.

Association membership had a strong positive influence on agribusiness participation at the 1% significance level. This suggests that households belonging to cooperatives and farmers' associations benefited from improved access to information, farm inputs, financial support, extension services, and market opportunities, thereby increasing their level of participation in agribusiness. The result corroborates the findings of Fonta and Ayuk (2013); Jumbe and Angelsen (2007), who emphasized the critical role of social capital, collective action, and institutional networks in promoting rural households' participation in sustainable agricultural and livelihood activities.

3.3 Influence of Agribusiness on Household Income

The Tobit regression results (Table 4) indicate that the model is statistically significant (χ^2 = 28.00, p < 0.01) and explains about 52% of the variation in household farm income (Pseudo R^2 = 0.5245), confirming a good model fit.

Table 4: Influence of Agribusiness on Household Income

Variable	Coefficient	Std. Error	Z-value	P-value
Constant	1.0526***	0.2281	4.61	0.000
Age	-0.0991**	0.0348	2.85	0.005
Sex	0.0406	0.0489	0.83	0.408
Education	0.0349	0.0251	1.39	0.166
Marital Status	-0.0116	0.0370	0.31	0.754
Labour Cost	-0.0787***	0.0177	4.44	0.000
Credit Access	0.0130	0.0595	0.22	0.827
Farm Output	0.1263**	0.0453	2.79	0.006
Transportation Cost	-0.0831	0.0518	-1.60	0.111
Farm Distance	-0.0109	0.0186	-0.59	0.559
Market Distance	-0.0228	0.0291	-0.78	0.434
Price	-0.0071	0.0220	0.32	0.748
Agribusiness Type	0.1744***	0.0456	3.82	0.000
Log Likelihood	-46.851			
χ^2	28			
Probability of χ^2	0.0000***			
Pseudo R^2	0.5245			
N	230			

Source: Field Survey, 2024.

***, ** significant at 1% and 5% respectively

The results show that age has a negative and statistically significant effect on household income ($\beta = -0.0991$, $p < 0.05$), implying that older household heads tend to earn lower farm income, likely due to reduced physical capacity and labour productivity, consistent with Vedeld et al. (2004) and Köhlin and Parks (2001).

Labour cost also has a strong negative and significant effect ($\beta = -0.0787$, $p < 0.01$), indicating that rising production costs reduce net farm income. This suggests that households relying more on hired labour experience lower profitability, while those using family labour may retain higher returns.

In contrast, farm output positively and significantly influences income ($\beta = 0.1263$, $p < 0.05$), supporting the idea that increased production leads to higher returns and improved household welfare, consistent with findings of Azeez et al. (2011).

Similarly, agribusiness type has a positive and highly significant effect ($\beta = 0.1744$, $p < 0.01$), indicating that diversification into multiple agribusiness activities (crop production, livestock, and agro-processing) enhances household income through risk reduction and value addition.

Other variables such as sex, education, marital status, credit access, transportation cost, farm distance, market distance, and price were not statistically significant, suggesting limited direct influence on income within the study area.

Overall, the results highlight that income performance is mainly driven by production intensity, labour efficiency, and diversification of agribusiness activities.

The estimated Tobit model is specified as:

Farm Income = 1.0526 - 0.0992(Age) + 0.0406(Sex) - 0.0349(Education) - 0.0116(Marital Status) - 0.0787 (Labour Cost) + 0.1263 (Farming activities) - 0.0831 (Transportation) - 0.0109(Farm Distance) - 0.0229 (Market Distance) - 0.0071(Price) + 0.1745 (Agribusiness types).

In summary, the findings confirm that labour cost and ageing reduce agribusiness income, while farm output and diversification significantly enhance household income.

This study examined the relationship between household income and agribusiness participation in Southwestern Nigeria. The findings show that labour cost and poor market access negatively influence participation, while membership in farmers' associations has a positive effect. Improvements in the Market Activities Index (including price, social capital, market distance, and infrastructure) enhance participation levels. In addition, a Value-Added Pricing Strategy (VAPS) can support farmers in shifting from low- to high-value market positions and reducing the effects of market saturation.

The study further indicates that poverty status and farm productivity positively influence both participation and income outcomes. Results from the Tobit model reveal that age, labour cost, farm management factors, and farm output significantly affect household income. Specifically, increasing age is associated with a decline in household income (about 10%), while higher labour costs reduce income by approximately 7.8%. Conversely, improved farm output and effective agribusiness management practices contribute to higher household income.

3.4 Constraints faced by rural households in agribusiness

Rural households engaged in agribusiness face a range of constraints, notably financial limitations, inadequate access to technology, and market-related challenges (Table 5). These constraints vary in frequency, severity, and their impact on agribusiness performance and household income.

Table 5: Constraints Faced by Rural Households Participating in Agribusiness

Constraint	Occurrence	Severity	Impact on Agribusiness
Limited tech access	Occasional (35.5 %)	Medium	Hinders productivity and efficiency
Financial limitations	Common (64.5 %)	High	Affects investment and expansion
Market challenges	Common (64.5 %)	High	Hinders productivity and efficiency
Limited training	Occasional (35.5 %)	Medium	Impacts skill development and innovation

Source: Calculated from field survey, 2024

The findings of this study are consistent with previous empirical studies that identified financial and market-related constraints as major barriers to agribusiness development and rural household productivity in Nigeria. The observed limited access to credit supports the findings of Osabohien et al. (2020), who reported that inadequate access to agricultural credit reduces farmers' ability to adopt improved technologies and modern farm inputs, thereby lowering agricultural productivity. Similarly, Omolade and Adepoju (2019) found that credit-constrained rural households in Nigeria recorded lower productivity because they could not optimally utilize production inputs and technologies.

The result also aligns with the study by Kehinde and Kehinde (2020), which established that access to credit significantly influences the welfare and food security status of rural households in Southwestern Nigeria. In the same vein, Balana and Oyeyemi (2020) observed that poor access to finance remains one of the major impediments to agricultural technology adoption among smallholder farmers in Nigeria.

Furthermore, the finding regarding unstable market conditions corroborates the report by Ilesanmi et al. (2024), which noted that poor market access and weak market systems constrain the effective utilization of credit among rural farming households in Southwest Nigeria. These studies collectively suggest that improving rural financial services and strengthening agricultural markets are essential for enhancing agribusiness productivity, investment, and profitability among rural households.

4.0 Conclusions

The study examined the determinants of agribusiness participation and its influence on household income among rural households in Southwestern Nigeria. The findings revealed that rural agribusiness activities are predominantly undertaken by economically active and moderately educated households. Agribusiness participation was significantly influenced by age, labour cost, credit availability, and association membership. While older household heads and membership in farmers' associations increased participation, high labour costs and limited access to credit reduced households' involvement in agribusiness activities. The study further established that household income from agribusiness was significantly influenced by age, labour cost, farm output, and agribusiness diversification. Increased farm output and diversification into multiple agribusiness activities enhanced household income, whereas rising labour costs and ageing reduced income levels. Financial limitations and market-related challenges were identified as the major constraints affecting agribusiness performance and rural livelihoods. In sum, the findings suggest that improving financial access, reducing production constraints, and strengthening institutional support systems are critical to promoting agribusiness participation and improving rural household welfare in Southwestern Nigeria.

Recommendation

Based on the findings of this study, there is a need for deliberate policy measures aimed at improving rural households' participation in agribusiness and enhancing household income in Southwestern Nigeria. Government and financial institutions should strengthen access to affordable agricultural credit through low-interest loan schemes, flexible collateral requirements, and timely loan disbursement to enable farmers expand production and adopt improved technologies. Efforts should also be directed toward reducing labour costs through the provision of mechanized farming equipment, labour-saving technologies, and subsidized farm inputs in order to improve productivity and profitability. In addition, rural farmers should be encouraged to join cooperative societies and farmers' associations, as these institutions enhance access to extension services, market information, production inputs, financial support, and improved market opportunities. Furthermore, policies that promote agribusiness diversification into crop production, livestock farming, agro-processing, and value addition activities should be encouraged to improve household income and reduce production risks. Government and development agencies should also invest in rural infrastructure such as roads, storage facilities, transportation systems, and market networks to improve market access and reduce post-harvest losses. Finally, regular training programmes, agricultural extension services, and capacity-building initiatives should be strengthened to improve farmers' managerial skills, technology adoption, and overall efficiency in agribusiness operations.

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Declaration of conflict of interest

The authors declare that there are no conflicts of interest associated with the publication of this work. The authors jointly contributed to the conceptualization, design, and development of this manuscript. They were actively involved in drafting, reviewing, and critically refining the content to ensure the

inclusion of substantial intellectual input. This work is original and has not been submitted or considered for publication in any other journal or platform. Furthermore, the authors declare that there are no affiliations or financial interests with any organization that could influence or bias the findings or discussions presented in this study.

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