

ASSessment of Socio-economic and Institutional Factors Influencing Farmers' Willingness to Participate in Tomato Production in APA Local Government Area, Benue State, Nigeria

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ABSTRACT

Tomato (*Solanum lycopersicum*) is a vital vegetable crop that contributes significantly to household nutrition, income generation, and food security in Nigeria. Despite favourable agro-ecological conditions in Benue State, farmers' participation in tomato production remains relatively low in several rural communities. This study assessed the socio-economic and institutional factors influencing farmers' willingness to participate in tomato production in Apa Local Government Area of Benue State, Nigeria. Primary data were collected from 110 farmers selected across the eleven council wards using a structured questionnaire complemented with field interviews. Descriptive statistics, including frequencies and percentages, were used to summarise respondents' socio-economic characteristics, perceptions, and production constraints. The Chi-square test was employed to examine the association between selected socio-economic variables and farmers' willingness to

Introduction

Agriculture remains a key sector in Nigeria's economy, contributing significantly to food security, employment generation, rural livelihoods, and income sustainability among smallholder farmers. Within this sector, vegetable production plays an important role in improving dietary diversity and generating higher income per unit area compared to staple crops, making it a strategic component of rural agricultural development.

Tomato (*Solanum lycopersicum*) is one of the most widely cultivated and consumed vegetable crops globally due to its short production cycle, high yield potential, and adaptability to diverse agro-ecological conditions (FAO, 2022). It is also

participate, while binary logistic regression was used to identify key determinants of participation. The results showed that 65.5% of respondents were male and 77.3% were married, indicating that tomato production is largely dominated by married male household heads. Furthermore, 63.6% of respondents identified crop farming as their primary occupation, with family labour as the major source of labour. Although farmers recognised the economic potential of tomato production, participation remained constrained by lack of capital (45.5%), high cost of inputs (45.5%), and pest and disease infestation (9.1%). Chi-square results indicated varying levels of association between selected variables and willingness to participate, while logistic regression revealed that occupation was the only significant predictor ($p < 0.05$). The study recommends improved access to credit, subsidised inputs, and strengthened extension services to enhance farmers' participation.

Keywords: Agricultural Participation, Binary Logistic Regression, Chi-Square Analysis, Smallholder Farmers, Socio-Economic Determinants.

highly valued for its nutritional content, being rich in vitamins A, C, and E as well as antioxidants such as lycopene, which are associated with improved human health and reduced risk of chronic diseases (Wang et al., 2019). Beyond its nutritional value, tomato is an important industrial crop used in the production of paste, puree, ketchup, and other processed products, making it economically significant across global food systems.

Despite its importance, tomato production in developing countries remains constrained by low productivity and limited farmer participation. In Sub-Saharan Africa, constraints such as inadequate access to credit, weak extension services, pest and disease infestations, poor storage infrastructure, and inefficient market systems continue to limit production efficiency and farmer engagement in horticultural enterprises (FAO, 2021; World Bank, 2022). These structural constraints reduce profitability and discourage sustained farmer participation in tomato farming.

Recent evidence shows that Nigeria is among the leading tomato producers in Africa, with production exceeding 3.6 million tonnes annually as of 2022; however, the country still experiences a significant supply-demand gap due to low productivity and post-harvest losses (FAO, 2023; National Bureau of Statistics [NBS], 2025). Production is largely dominated by smallholder farmers, yet yield levels remain below optimal due to limited mechanisation, inadequate access to inputs, and weak institutional support systems (Yami et al., 2025). Consequently, tomato prices remain highly volatile, and the country continues to import processed tomato products to meet domestic demand.

In Nigeria, tomato is widely cultivated, particularly in the northern and middle-belt regions where climatic conditions are favourable. However, production remains below national demand due to high input costs, seasonal price fluctuations, poor storage facilities, pest and disease pressure, and weak market linkages that discourage sustained farmer participation (FAO, 2021; NBS, 2022).

Benue State, popularly referred to as the “Food Basket of the Nation,” possesses favourable agro-ecological conditions suitable for tomato cultivation. Despite this comparative advantage, tomato production remains relatively low in several rural communities, including Apa Local Government Area. Farmers in the area predominantly engage in staple crop production such as cassava and yam, while tomato farming is either practiced on a small scale or not adopted at all, despite its higher income-generating potential.

The persistence of this production pattern suggests a fundamental problem: farmers’ willingness to participate in tomato production is being constrained by a combination of socio-economic and institutional factors. These include age, education, household size, income level, farm size, access to credit, extension services, market accessibility, and availability of production inputs. Where these factors are inadequate, farmers are more likely to perceive tomato production as risky, capital-intensive, and less profitable than staple crop production (Al-Shadiadeh et al., 2012; Altarawneh et al., 2012).

However, there is limited empirical evidence on the specific socio-economic and institutional determinants of farmers’ willingness to participate in tomato production in Apa Local Government Area. Existing studies have largely focused on general agricultural productivity or technology adoption rather than crop-specific participation behaviour at the local level. This creates a critical knowledge gap that limits the design of targeted interventions to promote tomato production and improve rural livelihoods. Therefore, this study examines the socio-economic and institutional factors influencing farmers’ willingness to participate in tomato production in Apa Local Government Area of Benue State, Nigeria.

Materials and Methods

Study Area

The study was conducted in Apa Local Government Area (LGA) of Benue State, Nigeria, a region recognized for its fertile soils and favourable climatic conditions suitable for vegetable production. The LGA is predominantly rural, and agriculture constitutes the main source of livelihood for most households. Crop farming, including staple and vegetable crops, is widely practiced. The area experiences a tropical climate with distinct rainy and dry seasons, which supports year-round agricultural activities (FAO, 2005).

The choice of Apa LGA was based on its potential for tomato cultivation and the observed low level of farmers' participation in tomato production.

Study Population and Sample Size

The target population comprised all farmers engaged in crop production across the eleven council wards of Apa LGA. A total of 110 farmers were selected for the study.

Farmers were selected using a stratified random sampling technique, with each of the eleven wards constituting a stratum. Within each ward, farmers were randomly chosen to ensure proportional representation across the study area.

Sample Size Determination

The sample size for this study was determined using the Yamane (1967) formula, which is suitable for finite populations and widely applied in agricultural and social science research. The formula is expressed as:

$$n = \frac{N}{1 + N(e)^2} \quad n = 110 / (1 + 110(0.05)^2) = 54$$

where:

n = sample size

N = population size

e = level of precision (sampling error)

This approach ensured that the sample reflected the socio-economic diversity and farming practices of the local population.

Data Collection

Primary data were collected for the study. Structured questionnaire was used to retrieved information from farmers through oral interview with the help of trained enumerators under the supervision of the researcher. The questionnaire included sections on:

1. The dependent variables for the study are: Farmers' Willingness to Participate in Tomato Production: Willingness to participate in tomato production was measured as a dichotomous variable derived from respondents' stated intention to engage in tomato farming. Farmers who indicated willingness were coded as 1, while those unwilling were coded as 0. This operationalization aligns with binary logistic regression requirements.
2. The independent variables comprised socio-economic and institutional factors measured using structured questionnaire items. These include:
 - Socio- Economic Factors

- Age: measured in years and categorized into age groups.
- Gender: measured as a dummy variable (male = 1, female = 0).
- Educational Level: measured based on the highest level of formal education attained.
- Marital Status: measured by respondents' marital categories.
- Household Size: measured as the number of persons living in the household.
- Labour Availability: measured based on the source and adequacy of labour (family, hired, or both).
- Primary Occupation: measured by respondents' primary livelihood activity.
- Grow other Crops: measures if respondents grow only tomato.
- Institutional Factors:
 - Access to Credit: measured by whether the farmer had access to loans or credit facilities.
 - Extension Services: measured by frequency of contact with extension agents.
 - Access to Market: measured by distance to the nearest market and place of sale.
 - Access to Inputs: measured by availability and affordability of improved seeds, fertilizers, and agrochemicals.

Method of Data Analysis

Data collected were analyzed using descriptive and inferential statistical techniques. Descriptive statistics, including frequencies and percentages, were used to summarize the socio-economic characteristics of respondents, their perceptions of tomato production, institutional factors, and constraints.

To examine the relationship between selected socio-economic variables and farmers' willingness to participate in tomato production, the Chi-square test of independence was employed. All statistical analyses were performed using SPSS version 25.0, and significance was evaluated at $p \leq 0.05$.

To further determine the independent effects of multiple variables simultaneously, a binary logistic regression model was applied.

$$\ln \left(\frac{P}{1-P} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

where:

P = probability of willingness to engage in tomato farming,

β_0 = constant term,

$\beta_1 \dots \beta_n$ = coefficients of independent variables,

$X_1 \dots X_n$ = explanatory variables.

Results and Discussion

Table 1. Socio-Economic Characteristics of Respondents

Variable	Category	Frequency	Percentage (%)
Sex	Male	72	65.5
	Female	38	34.5
Age (years)	<30	15	13.6
	31-41	25	22.7
	42-52	30	27.3
	53-63	25	22.7
	>63	15	13.6
Education Level	No formal education	50	45.5
	Primary education	40	36.4
	Secondary education	15	13.6
	Tertiary education	5	4.5
Marital Status	Single	10	9.1
	Married	85	77.3
	Divorced	5	4.5
	Widowed	7	6.4
	Separated	3	2.7
Household Size	1-3	10	9.1
	4-6	50	45.5
	>6	50	45.5
Primary Occupation	Crop farming	70	63.6
	Livestock farming	10	9.1
	Business	15	13.6
	Civil service	5	4.5
	Others	10	9.1

Variable	Category	Frequency	Percentage (%)
Source of Labour	Family labour	60	54.5
	Hired labour	20	18.2
	Both family and hired	25	22.7
	Self labour	5	4.5
Growing Other Crops	Yes	90	81.8
	No	20	18.2

The results indicate that the majority of respondents were male. This suggests that agricultural production in the study area is largely dominated by men, which is consistent with earlier studies indicating that male farmers often control access to land and major agricultural resources in many rural communities in Nigeria (Adenuga et al., 2013; Abu et al., 2011). The predominance of male farmers may therefore influence the level of participation in tomato production, particularly where labour and capital requirements are relatively high.

The age distribution of the respondents shows that a substantial proportion of farmers fall within the economically active age group. This implies that most of the farmers possess the physical strength and farming experience required to engage in labour-intensive agricultural activities such as vegetable cultivation. Similar observations have been reported by Ozor and Cynthia (2010), who noted that middle-aged farmers are often more actively involved in agricultural production because they combine physical capacity with practical farming knowledge.

The results further reveal that a large proportion of farmers in the study area have low levels of formal education, with many respondents having either no formal education or only primary education. Educational attainment has been widely recognized as an important factor influencing farmers' adoption of agricultural innovations and participation in improved production practices (Opara, 2010). Farmers with higher levels of education are generally better positioned to access information, understand improved technologies, and adopt modern agricultural practices. This observation is consistent with the Chi-square results of this study, which indicated that educational level had a statistically significant relationship with farmers' willingness to participate in tomato production.

Household size was found to be relatively large among the respondents, with many households consisting of four or more members. Large household sizes may provide an important source of family labour for farming activities, thereby reducing the cost of hired labour. This finding aligns with the observation of Adenuga et al. (2013), who reported that family labour plays a critical role in smallholder farming systems in Nigeria. The heavy reliance on family labour observed in this study further confirms the

importance of household labour availability in supporting agricultural production activities in rural communities.

Table 2: Institutional Factors and Constraints Affecting Tomato Production (n=110)

Institutional Factor / Constraint	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Tomato can be grown locally	36.36	22.73	18.18	13.63	9.09
Tomato farming is profitable	18.18	22.73	18.18	22.73	18.18
Tomato farming is risky	9.09	22.73	13.63	22.72	22.72
High cost of production	27.27	27.27	18.18	18.18	9.09
Interest in tomato farming	18.18	22.73	22.73	18.18	18.18
Preference for cassava over tomato	36.36	18.18	18.18	13.63	13.63
Lack of capital	45.45	27.27	13.63	9.09	4.54
High cost of inputs	31.81	27.27	18.18	13.63	9.09
Lack of extension service	36.36	27.27	18.18	9.09	9.09
Poor market access	45.45	27.27	13.63	9.09	4.54
Pests and diseases	36.36	31.81	18.18	9.09	4.54
Storage challenges	36.36	31.81	18.18	9.09	4.54
Transport / road issues	36.36	31.81	18.18	9.09	4.54
Preference for tomato over other crops	27.27	22.72	18.18	13.63	18.18

The results relating to farmers' perceptions of tomato production show that a majority of respondents believe that tomato can be successfully cultivated within the study area. This positive perception suggests that farmers recognize the agro-ecological suitability of the area for tomato production. However, perceptions regarding profitability were mixed, with some farmers expressing doubts about the economic benefits of tomato farming. This variation in perception may be attributed to differences in farmers' experiences with production challenges such as pests, diseases, market fluctuations, and high input costs. Previous studies have shown that farmers' perceptions of profitability can strongly influence their willingness to adopt or expand particular farming enterprises (Anyiro & Oriaku, 2011).

The findings also indicate that tomato production is perceived by many respondents as a relatively costly enterprise. High production costs, particularly those associated with

inputs such as improved seeds, fertilizers, and agrochemicals, may discourage farmers from investing in tomato farming. Similar challenges have been reported in other studies on vegetable production in Nigeria, where the high cost of inputs has been identified as a major constraint to agricultural productivity (Singh et al., 2014). Limited access to affordable credit further exacerbates this situation, making it difficult for smallholder farmers to finance production activities.

Institutional constraints were also found to play a significant role in limiting farmers' participation in tomato production. Lack of capital emerged as one of the most serious constraints reported by respondents. Access to credit is essential for enabling farmers to purchase inputs, expand farm operations, and adopt improved technologies. Bonabana-Wabbi (2002) emphasized that limited access to financial resources often restricts farmers' ability to invest in profitable agricultural enterprises.

In addition to financial limitations, respondents identified inadequate extension services as another major constraint affecting tomato production. Extension services serve as an important channel through which farmers receive information on improved farming practices, pest and disease management, and efficient resource utilization. The limited availability of extension services observed in this study may therefore reduce farmers' awareness of improved tomato production techniques and ultimately affect their willingness to participate in the enterprise. Similar findings have been reported by Wachira (2012), who highlighted the critical role of extension services in improving agricultural productivity among smallholder farmers.

Market-related challenges also emerged as important barriers to tomato production in the study area. Poor market access and inadequate transportation infrastructure were identified as significant constraints by many respondents. These challenges often result in high post-harvest losses and reduced profitability for farmers, particularly for perishable crops such as tomato. Studies have shown that improving rural market infrastructure and transportation networks can significantly enhance farmers' participation in commercial agriculture (FAO, 2012).

Pest and disease infestations were also identified as serious production challenges affecting tomato farming. Tomato crops are particularly vulnerable to a wide range of pests and diseases, which can significantly reduce yields and discourage farmers from investing in the crop.

Table 3: Chi-Square Test of Socio-Economic Variables and Participation in Tomato Production (N = 110)

Variable	χ^2 Value	df	p-value	Decision
Sex	3.41	1	0.064	Not Significant

Variable	χ^2 Value	df	p-value	Decision
Age	0.48	4	0.975	Not Significant
Education	9.67	3	0.022	Significant
Household Size	1.72	2	0.423	Not Significant
Primary Occupation	0.82	4	0.936	Not Significant
Growing Other Crops	0.21	1	0.646	Not Significant

Significance level: 0.05

The Chi-square analysis revealed that educational level had a statistically significant relationship with farmers' willingness to participate in tomato production, indicating that farmers with higher levels of education are more likely to engage in tomato farming. These findings are similar to what was reported by Degefa et al. (2022) that farmers with basic education are better equipped for making more informed decision for lives and for their communities and to be active participants in economic, social and cultural dimension of development.

However, age, sex, household size, and primary occupation did not show statistically significant relationships with farmers' willingness to participate in tomato production.

Table 4. Logistic Regression Estimates of Factors Influencing Farmers' Willingness to Participate in Tomato Production In APA LGA, Benue State, Nigeria,

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% Lower	95% Upper
Sex(1)	0.090	0.508	0.031	1	0.860	1.094	0.404	2.963
Age Group			0.329	4	0.988			
Age Group(1)	-0.102	0.856	0.014	1	0.905	0.903	0.169	4.828
Age Group(2)	0.124	0.777	0.026	1	0.873	1.132	0.247	5.190
Age Group(3)	-0.056	0.851	0.004	1	0.947	0.945	0.178	5.012
Age Group(4)	0.338	0.913	0.137	1	0.711	1.402	0.234	8.390
Education			0.186	3	0.980			
Education(1)	0.181	0.610	0.088	1	0.767	1.198	0.362	3.961
Education(2)	0.280	0.765	0.134	1	0.714	1.323	0.295	5.925
Education(3)	-0.081	1.127	0.005	1	0.942	0.922	0.101	8.399
Marital Status			6.550	4	0.162			
Marital Status(1)	2.250	1.281	3.084	1	0.079	9.486	0.770	116.837
Marital Status(2)	2.185	1.646	1.764	1	0.184	8.894	0.354	223.736
Marital Status(3)	0.199	1.713	0.013	1	0.908	1.220	0.042	35.040

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% Lower	CI	95% Upper	CI
Marital Status(4)	3.620	1.975	3.358	1	0.067	37.322	0.777		1791.948	
Household Size			1.064	2	0.588					
Household Size(1)	0.309	0.969	0.101	1	0.750	1.362	0.204		9.101	
Household Size(2)	0.730	0.944	0.598	1	0.439	2.075	0.326		13.209	
Occupation			7.249	4	0.123					
Occupation(1)	1.766	0.869	4.132	1	0.042	5.848	1.065		32.106	
Occupation(2)	- 0.587	0.751	0.611	1	0.434	0.556	0.128		2.421	
Occupation(3)	0.628	1.152	0.297	1	0.586	1.874	0.196		17.934	
Occupation(4)	- 0.924	0.875	1.116	1	0.291	0.397	0.071		2.204	
Labour Source			3.801	3	0.284					
Labour Source(1)	1.211	0.634	3.652	1	0.056	3.357	0.969		11.622	
Labour Source(2)	0.326	0.605	0.290	1	0.590	1.385	0.423		4.531	
Labour Source(3)	- 0.051	1.432	0.001	1	0.971	0.950	0.057		15.734	
Market Access(1)	- 0.114	0.739	0.024	1	0.878	0.893	0.210		3.796	
Extension Access(1)	0.013	0.634	0.000	1	0.984	1.013	0.292		3.508	
Credit Access(1)	0.873	0.567	2.365	1	0.124	2.393	0.787		7.276	
Input Access(1)	- 0.558	0.589	0.899	1	0.343	0.572	0.180		1.814	
Constant	- 3.700	1.859	3.960	1	0.047	0.025				

The logistic regression results showed that occupation was the only statistically significant determinant, while most socio-economic (age, sex, education, household size) and institutional variables (extension access, credit access, market access, input access) were not significant. Marital status and labour source showed marginal significance. The finding that occupation significantly influences willingness ($\text{Exp}(B) = 5.848$, $p < 0.05$) suggests that farmers' livelihood structure strongly determines engagement in tomato farming. This aligns with studies in Nigeria which emphasize that farming decisions are strongly shaped by livelihood dependence and occupational identity

(Ogundeji & Ogunwande, 2024; Tafida et al., 2025). Similarly, Eboh et al. (2012) reported that in sub-Saharan Africa, households primarily engaged in agriculture are more likely to adopt or expand crop production due to higher reliance on farming income. However, this contrasts with studies that prioritize education and institutional access as primary adoption drivers (Mishra, 2022).

In contrast, education was not significant ($p > 0.05$), diverging from established Nigerian and African evidence where education enhances adoption through improved knowledge and risk assessment (Igwe et al., 2023; Tafida et al., 2025). The result suggests that tomato farming willingness in the study area is less dependent on formal knowledge and more on practical livelihood considerations, indicating a disconnect between formal education and agricultural decision-making.

Similarly, extension services were not significant, contradicting widespread findings in Nigeria and Africa that extension contact significantly improves adoption by enhancing farmer awareness and technical capacity (Ogundeji et al., 2023; Tafida et al., 2025). This may reflect weak extension delivery systems or low farmer-agent interaction in the study area, consistent with reports of declining extension effectiveness in rural Nigeria. Although credit access was positively signed, it was not significant, aligning with mixed findings in recent Nigerian studies where credit influences adoption only when access is sufficient and well-structured (Adjognon et al., 2017). The insignificance of market access, input availability, and household size further suggests that these factors may not vary sufficiently across respondents or are not binding constraints in the study area.

The marginal significance of marital status and labour source indicates that household structure and labour availability may indirectly influence willingness, consistent with Eboh et al. (2012), who emphasized labour dynamics as important in labour-intensive agricultural systems.

Overall, the findings deviate from the dominant Nigerian agricultural adoption literature, which emphasizes institutional and human capital variables, and instead highlight a structural livelihood-driven model of adoption, where occupation plays a central role. This suggests that tomato farming decisions in Benue State are shaped more by economic identity than by institutional exposure or demographic characteristics.

Conclusion

The findings revealed that tomato farming in the study area is largely undertaken by male farmers who are predominantly within the economically active age group and engaged primarily in crop farming. However, a substantial proportion of the respondents possess relatively low levels of formal education.

Farmers generally acknowledged that tomato can be successfully cultivated in the area, indicating that the agro-ecological conditions are suitable for its production. Nevertheless, participation in tomato farming remains relatively limited due to several production and institutional challenges. Major constraints identified in the study include lack of capital, high cost of agricultural inputs, pest and disease infestation, limited extension services, poor market access, and inadequate transportation infrastructure. The Chi-square analysis further revealed that educational level significantly influences farmers' willingness to participate in tomato production, suggesting that improved access to agricultural information and training may encourage greater farmer participation in the enterprise.

However, the logistic regression results provided a more robust model-based explanation, showing that occupation was the only statistically significant predictor of willingness, while most socio-economic and institutional variables were not significant. Marital status and labour source showed marginal significance. This suggests that livelihood structure plays a stronger role in determining willingness than demographic or institutional factors in the study area.

Overall, the findings indicate that while the study area possesses considerable potential for tomato production, addressing key socio-economic and institutional constraints is essential for enhancing farmers' participation and improving the productivity of the enterprise.

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