International Journal of Organic agricultural Research & Development
Volume 19 (1) (2024)

FACTORS INFLUENCING THE PARTICIPATION OF POSTHARVEST INNOVATION PRACTICES AMONG TOMATO FARMERS IN OYO STATE, NIGERIA

[1]ADEYEMI, Toyin Rebecca and [2]Olagunju, Funke Iyabo
[1]Department of Agricultural Economics and Extension, Ajayi Crowther University, Oyo, Nigeria,
[2]Department of Agricultural Economics, LAUTECH, Ogbomoso, Nigeria
Coresponding author: tradeyemi@acu.edu.ng +2348060378304

ABSTRACT

Tomato production enterprises in Nigeria are characterized by low output, increasing wastage, inadequate storage facilities, price fluctuations, and a lack of awareness and knowledge regarding innovative practices. This study investigated the factors influencing the participation of postharvest innovation practices among tomato farmers in Oyo State, Nigeria. The specific objectives of the study were to identify the various postharvest innovation practices employed by tomato farmers, determine the socio-demographic and technological factors that influence farmers' participation in the practices, and assess the extent of their participation in the study area. Multistage sampling technique was employed for the study. Primary data were collected from a sample total of 174 respondents using structured questionnaires Data were analyzed using descriptive statistics (frequency, mean, minimum, and maximum) and inferential statistics, specifically Heckman's two-stage probit model. The study revealed that the average age of farmers in tomato production was 46 years, with an average of 19 years of farming experience and an average household size of 7 members. The postharvest innovation practices identified among the farmers included grading and sorting (58.62%), processing into sundried products (11.49%), storage facilities (6.32%), and packaging materials (23.56%). The Heckman selection model identified education ($p = 0.0003$), distance to market ($p= 0.0458$) off-farm income ($p = 0.0277$), and training ($p = 0.0014$) as statistically significant factors influencing farmers' participation in postharvest innovation practices at the 1% and 5% levels. The study concludes that participation in postharvest innovation practices among tomato farmers is essential for enhancing food security and increasing farmers' income. Therefore, the study recommends that policymakers implement appropriate measures to promote engagement in postharvest innovation practices through the dissemination of affordable postharvest technologies, including adequate storage facilities.

Keywords: Postharvest innovation, Tomato farmers, Practices, Participation

INTRODUCTION

Nigeria's reliance on agriculture underscores its abundant natural resources and the vast potential for cultivating diverse crops. The country's favorable environmental conditions enable year-round production, including essential crops like tomatoes. Tomato (Solanum lycopersicum) is a vital crop in Nigeria's agricultural sector, recognized as both fruit and vegetable (Ibitoye et al.,2020). Nigeria ranks as the 14th largest tomato producer globally after Egypt on the African continent. The country produces approximately 1.51 million metric tons of tomatoes, valued at ₦87.0 billion, cultivated over an area of 254,430 hectares (Aminu and Sadi, 2020). It is a staple food, extensively grown across various agro-ecological zones, and a fundamental ingredient in many Nigerian dishes. Tomato farming sustains the livelihoods of millions of Nigerian farmers and is integral to the nation's food security and economic growth. Beyond its nutritional importance, tomatoes contribute significantly to revenue generation and serve as essential raw materials for certain manufacturing industries (Ajibare et al., 2022). However, despite its critical role, the tomato sector faces major challenges, particularly with postharvest losses.

Postharvest losses, largely caused by inadequate handling, storage, and transportation, have significantly impacted Nigeria's agricultural sector, with tomato production being particularly affected. These losses result in substantial economic challenges, reducing farmers' incomes by as much as 50% and worsening food insecurity (Njume et al., 2020). Postharvest losses refer to the deterioration of crops and livestock products after harvest, occurring at various stages of the supply chain, including handling, storage, processing, transportation, and marketing (Nyamah, 2020) According to the Federal Ministry of Agriculture and Rural Development (FMARD, 2016), postharvest losses for tomatoes in Nigeria are estimated to range between 30% and 50%, leading to an annual financial loss of approximately ₦72 billion (around $176 million). This loss not only reduces the availability of food but also compromises its nutritional quality and safety, leading to significant economic losses across the supply chain.

The importance of postharvest innovation in tomato production cannot be overstated. Innovations in tomato production, such as new techniques in tomato processing, improved storage technologies, and practices meant to minimize postharvest losses, are critical for ensuring food security and enhancing economic resilience. Studies have shown that improving storage, transportation, and handling methods can extend the shelf life of tomatoes, preserving their freshness, taste, and nutritional value (Onuwa & Folorunsho, 2022; Eneanya, 2021). According to the Postharvest Education Foundation (2019), postharvest innovation is described as a handling or a method that can be utilized to minimize food losses or waste. It includes all activities related to the renewal and improvement of agricultural and food products, including such activities as drying, storage, packaging, conditioning, transporting, and the economics and marketing of food products (Wahab & Khairuddin, 2020). Many technologies and innovations have been developed to address the various causes of food losses across different regions such as packaging and value addition practices among farmers.

However, the participation of postharvest innovation practices among tomato farmers, particularly in Southwest Nigeria, remains limited and underutilized. This gap significantly impacts food security, farmer's livelihoods, and the overall efficiency of the tomato supply chain. Several factors contribute to this low adoption rate, including poor harvesting techniques, inadequate storage facilities, long distances to market centers, poor road infrastructure, insufficient credit facilities, and lack of information. Research has identified additional factors influencing farmers' participation in postharvest innovations, such as access to resources, knowledge and skills, gender dynamics, and market conditions (Muhammed et al., 2021).

Therefore, addressing this challenge requires a comprehensive understanding of various farmers' postharvest innovation practices, the factors influencing their participation, and the extent to which these factors affect their participation. By identifying and addressing these constraints, Nigeria can reduce postharvest losses, boost farmers' incomes, and strengthen its position in the global tomato market.

MATERIALS AND METHODS

The study area

The study was conducted in Oyo State, located in the southwestern region of Nigeria. Oyo is one of Nigeria's 36 states, covering an area of approximately 28,454 square kilometers, making it one of the larger states in the country. It shares borders with Kwara State to the north, Osun State to the east, Ogun State to the south, and the Republic of Benin to the west. Oyo State has a diverse population, predominantly composed of the Yoruba ethnic group. The state's tropical climate, characterized by distinct wet and dry seasons, is well-suited for cultivating a variety of crops, including tomatoes, maize, yam, cassava, and cocoa along with cash crops like cocoa and cashew nuts.

Sampling procedures

The study focused on tomato farmers within the Ogbomoso Agricultural Development Zone. A multistage sampling technique was used to select respondents. In the first stage, The Ogbomoso Agricultural Development Zone was purposively selected from the four ADP Zones in Oyo State (Ibadan/Ibarapa, Ogbomoso, Oyo, and Saki). The second stage involved the purposive selection of Oriire Local Government due to its high prevalence of tomato farmers. Thirdly, six villages (Agbeja, Temidire, Odo-Ogun, Tewure, Odan, and Aba - Alaro) were randomly chosen from Oriire Local Government's ten wards. At the last stage, thirty respondents were randomly selected from each of the selected villages, resulting in a total sample size of 180. Out of the 180 questionnaires distributed, 174 were completed and returned, with a few questionnaires remaining incomplete.

Method of data collection

Data were collected using primary sources through the administration of structured questionnaires to the respondents. The information gathered included socio-economic characteristics, various postharvest innovation activities practiced by farmers, and the factors influencing farmers' participation in postharvest innovation practices within the study area

Analytical Techniques

The data collected were analyzed using both descriptive and inferential statistical methods. Descriptive statistics included mean, minimum, maximum, frequency counts, and percentages. For inferential statistics, the Heckman two-stage selection model was employed.

The model is specified as follows:

$P_i = \beta^i X_i + \varepsilon i$ .....(1)

$A(Y_i/Pi = 1, Z_i) = \propto^i Z_i + A(u_i/P_i = 1) =$

$\propto^i Z_i + E(\varepsilon i > \beta_i Xi)$.....(2)

$A(_i / {}^1X_i) = {}_u$ .....(3)

$A(Y_i / Pi = 1, Z_i)^i Z_i + {}_{ui}$ ..... (4)

P_i, is the probit model, while the second stage estimates the intensity of postharvest innovation (Y_i) through an OLS estimator

^{i} represent the sets of coefficient estimates of the explanatory variables Z_i,

u_i is the error term.

RESULTS AND DISCUSSION

Socio-demographic characteristics of the respondents

Table 1 provides the summary of the socio-demographic characteristics of the selected tomato farmers. The results show that the average age of the respondents is 46 years, with the average household size is 7 members. Educational attainment among the respondents is relatively high, with 36.78% having completed post-secondary education. The average farming experience is 19 years, indicating a broad range of agricultural knowledge within the study population. About 69.54% of the respondents were male, while 30.46% were female. This distribution demonstrates a higher level of male participation in tomato production within the study areas. The average household size is 7 members. This suggests that larger household sizes serve as a valuable source of family labor, helping to reduce expenses associated with hired labor. This finding aligns with the research by Odoemelam and Nzeakor (2020), which indicates that larger households are more likely to participate in innovations by easing labor constraints during the implementation of new practices. The study reveals that a majority (41.14%) had post-secondary education, followed by 24.57% with secondary education, 13.14% with primary education, 6.86% had junior education, and 10.29% had no formal education. This suggests that farmers with higher levels of education are more likely to adopt innovative technologies, methods, and practices to enhance the efficiency, productivity, and sustainability of tomato production (Adeoye, 2021). The farming experience of the sampled farmers revealed that 16.67 percent had their experience between anything less or equal to 10 years, the mean value was 19 years, 43.10 percent had their experience between 11 and 20 years, 29.31 percent had their own between 21 - 30 years while others 10.92 percent had the experience between 31 and above years. The average farming experience shows the diversity and depth of agricultural knowledge within the studied population.

Postharvest innovations practices among the respondents

Table 2 presents the various postharvest innovation practices by the respondents. Majority (58.62%), are involved in grading and sorting, while 11.39% participate in processing tomatoes into sundried products. Additionally, 23.56% use improved packaging materials, and 6.32% engage in enhanced storage methods. The study concludes that grading and sorting, along with the use of improved packaging materials, are the most common postharvest innovations in the study area. This is because Proper grading and sorting help in identifying and removing damaged or poor-quality produce early, reducing the chances of spoilage during transportation and storage.

Socio-demographic and technological factors influencing the participation of postharvest innovation practices among respondents

Table 3 presents the results from the Heckman two-step selection model, which was used to estimate the factors influencing tomato farmers' participation in postharvest innovation practices. The diagnostic statistics confirm that the model fits the data well, with the chi-square test statistics significant at 1% level, indicating that the explanatory variables are relevant for explaining participation decisions. In the first step of the Heckman two-step procedure, a probit model was employed. The results revealed that education, access to credit, off-farm income, and distance to market significantly affect the decision of farmers to participate in postharvest innovations.

The marginal effects of these variables show the effect of a one-unit change in each independent variable on the likelihood of farmers participating in postharvest innovations. Education has a positive and significant influence on the adoption of postharvest innovations, with a 1% significance level. Specifically, each additional unit increase in education corresponds to a 1.75-unit increase in the probability of participating in postharvest innovations. This finding is consistent with Bojago (2023), which suggests that educated farmers are generally more knowledgeable about technological advancements and are thus more likely to adopt new practices. The distance to the nearest market significantly and negatively influences farmers' participation in postharvest innovation practices at the 5% significance level**.** This implies that as the distance to the market increases, the likelihood of farmers participating in these practices decreases by 3.64%. Consequently, farmers located farther from markets perceive investments in post-harvest innovations as less appealing due to potentially lower returns. This finding aligns with Kumar's (2019) study, which suggests that increased distance to markets often leads to higher transportation costs and logistical hurdles. Off-farm income has a negative and statistically significant effect at the 5% level. As off-farm income increases, the likelihood of participating in postharvest innovations decreases by 10.7%. This result contrasts with Anang et al. (2020), who posited that off-farm income could provide farmers with additional resources to invest in agricultural improvements. Training also has a positive impact on the adoption of postharvest innovations, with statistical significance at the 1% level. Each unit increase in training results in a 16.6 unit increase in the likelihood of participating in postharvest innovations. This effect is likely due to the improved knowledge and skills gained from training, which better equips farmers to implement effective and efficient postharvest techniques.

Factors influencing the extent of participation in postharvest innovation practices among tomato farmers

Table 4 presents the summary of the factors influencing the extent of participation in postharvest innovation practices. The age of farmers has a significant negative influence on the extent of postharvest innovation practices at the 5% level. As farmers age, they tend to implement these practices less intensively, likely due to the physical demands of many innovative practices and declining physical capacity. Additionally, the continuous learning and adaptation required for new technologies can be challenging for older farmers who are more accustomed to traditional methods (Li et al., 2019; Mthethwa et al., 2022). Farming experience positively and significantly influences the extent of postharvest innovation practices at 1% level. Farmers with more experience are more likely to intensify their postharvest practices, as their familiarity with agriculture helps them identify effective approaches to various farming problems (Kaloi et., al. 2021). Access to credit also positively influences the extent of postharvest innovation practices at the 1% level. Access to credit enables farmers to purchase the necessary equipment and invest in practices that enhance their postharvest processes (Agbeno, 2021). Transportation plays a positive and significant role at 10% level in influencing the extent of postharvest innovation practices in tomato production. Better transportation availability improves market access, allowing farmers to reach broader and distant markets. This encourages them to adopt innovations that preserve the quality of their produce during extended transportation. These findings are consistent with Onwude et al. (2020) and Al-Dairi et. al. (2022) which emphasize that efficient transportation reduces spoilage and damage during transit, motivating farmers to invest in practices that maintain the freshness and value of their crops.

Constraints faced by respondents in participating in postharvest innovations

The constraints encountered by farmers in the study area are detailed in Table 5 and ranked based on their perceived severity. Infrastructural problems were identified as the most critical constraint, affecting approximately 42.53% of the respondents. Inadequate capital was reported by about 33.91% of farmers as the second most serious constraint hindering their participation in postharvest innovation

practices. Lack of awareness and training was ranked third, with 15.52% of respondents indicating it as a significant issue. Training is crucial as it provides farmers with the knowledge and skills needed to adopt new postharvest technologies and practices, as well as exposes them to best practices (Fatty et al., 2021). Social and cultural problems were reported by 8.05% of tomato farmers, ranking as the fourth most significant constraint they face.

CONCLUSION

This study examined the factors influencing the participation of postharvest innovation practices among tomato farmers in Oyo State, Nigeria. This study found that tomatoes are highly perishable with a short shelf life, making them particularly susceptible to postharvest losses. The study revealed that the average age of farmers in tomato production was 46 years, with an average of 19 years of farming experience and an average household size of 7 members. Most (58.62%) of the tomato farmers engaged in postharvest innovation practices such as grading and sorting to meet market demands, maintain quality, and reduce waste. Heckman selection model identified several factors significantly influencing farmers' participation in these practices: education ($p = 0.0003$), distance to market ($p = 0.0458$), off-farm income ($p = 0.0277$), and training ($p = 0.0014$), all of which were significant at the 1% and 5% levels. The study concluded that implementing postharvest innovation practices is essential for maximizing the economic and operational benefits of tomato farming while ensuring that products meet market demands and consumer expectations in Oyo State, Southwest, Nigeria. Therefore, this study recommends providing tomato farmers with enhanced training through targeted workshops, which would offer advanced knowledge on postharvest innovations, including proper handling, storage techniques, and efficient transportation methods.

REFERENCES

Adeoye, I. B. (2021). Factors affecting efficiency of vegetable production in Nigeria: a review. Agricultural Economics. https://doi.org/10.5772/intechopen.92702

Agbeno, Y. (2021). Impact of Access to Agricultural Credit on the Productivity of Togolese Farmers, *International Journal of Agricultural Sciences and Technology (IJAGST)*, Svedberg Open, vol. 1(4), November.

Ajibare, D.B, Anthony L., Alabi O.O., Njoku V.O., Ukaoha C.A., and Oluleye O.D. (2022). Resource Use Efficiency and Profitability Analysis of Tomato Production (Lycopersicum Esculetum Species) in Federal Capital Territory, Nigeria. European Journal of Agriculture and Food Sciences. *DOI: 10.24018/ejfood.2022.4.5.539*

Al-Dairi, M., Pathare, P., Al-Yahyai, R., & Opara, U. (2022). Mechanical damage of fresh produce in postharvest transportation: current status and future prospects. trends in food science & Technology, 124, 195-207. *https://doi.org/10.1016/j.tifs.2022.04.018*

Aminu, Y.U., and Sadi M. (2020). Analysis of Profitability of Dry Season Tomato Production in Ikara Local Government Area of Kaduna State, Nigeria. *The Nigeria Journal of Energy & Environmental Economics, 2(1) 1-11.*

Anang, B.T., and Yeboah, R. W. N., (2019). Determinants of Off-Farm Income among Smallholder Rice Farmers in Northern Ghana: Application of a Double-Hurdle Model. Advances in Agriculture, 1–7.

Bojago, L.M, E. (2023). Adoption of modern hive beekeeping technology: Evidence from Ethiopia. *https://doi.org/10.5772/intechopen.106890* .

Eneanya, A. N. (2021). Innovation and Sustainable Food Security in Nigeria. Covenant University Journal of Politics & International Affairs (Special Edition), 9(1). Retrieved from

Fatty, L.K.M., Ode I.O., and Ahule B.G (2021). Effectiveness of Agricultural Extension Services to Minimize Postharvest Losses of Horticultural crop Produce West Coast Region of the Gambia. *International Journal of Advanced Economics. Volume 3, Issue 2, P.No. 10-25.*

FMARD, (2016). The agriculture promotion policy. Building on the success of agriculture transformation agenda closing key gaps. Federal Ministry of Agriculture and Development, Abuja.

Fatty, L.K.M., Ode I.O., and Ahule B.G (2021). Effectiveness of Agricultural Extension Services to Minimize Postharvest Losses of Horticultural crop Produce West Coast Region of the Gambia. *International Journal of Advanced Economics. Volume 3, Issue 2, P.No. 10-25.*

FMARD, (2016). The agriculture promotion policy. Building on the success of agriculture transformation agenda closing key gaps. Federal Ministry of Agriculture and Development, Abuja.

Ibitoye, S.J., Shaibu U.M., and Omole B.(2020). Analysis of Resource Use Efficiency in Tomato (Solanum lycopersicum) Production in Kogi State, Nigeria. *Asian Journal of Agricultural Extension, 6(4): 220-229.*

Kaloi, F., Isaboke, H., Onyari, C., & Njeru, L. (2021). determinants influencing the adoption of rice intensification system among smallholders in Mwea irrigation scheme, kenya. Advances in Agriculture, 2021, 1-8. *https://doi.org/10.1155/2021/1624334*

Kumar, N., Raghunathan, K., Arrieta, A., Jilani, A., Chakrabarti, S., Menon, P., & Quisumbing, A. R. (2019). Social networks, mobility, and political participation: The potential for women's self-help groups to improve access and use of public entitlement schemes in India. World Development, 114, 28–41.

Li, H., Huang, D., Ma, Q., Qi, W., & Li, H. (2019). Factors influencing the technology adoption behaviors of litchi farmers in China. Sustainability, 12(1), 271. *https://doi.org/10.3390/su12010271*

Mthethwa, K., Ngidi, M., Ojo, T., & Hlatshwayo, S. (2022). The determinants of adoption and intensity of climate-smart agricultural practices among smallholder maize farmers. Sustainability, 14(24*), 16926. https://doi.org/10.3390/su142416926*

Muhammed, A. H., Ibrahim .S., and Bako H. (2021). Level of gender participation in tomato production in the Agricultural Zone 1 of Niger State, Nigeria

Njume, C.A., Ngosong, C., Krah C.Y., and Mardjan S., (2020). Tomato food value chain: managing postharvest losses in Cameroon. IOP Conf. Series: Earth and Environmental Science 542 (2020) 012021.*doi:10.1088/1755-1315/542/1/012021*

Nyamah, E.Y. (2020). Perception and adoption determinants of pre and post-harvest technologies: tomato value chain perspective. *International Journal of Postharvest Technology and Innovation.* Vol. 7, No. 2

Odoemlam, L.E and Nzeakor, F.C (2020). Factors influencing the adoption of improved vegetable production practices among women farmers in aguata- agricultural zone, Anambra state, nigeria. *Agrosearch, 20(2), 67-81, (2020) https://dx.doi.org/10.4314/agrosh.*

Onwude, D., Chen, G., Eke-emezie, N., Kabutey, A., Khaled, A., & Sturm, B. (2020). Recent advances in reducing food losses in the supply chain of fresh agricultural produce. Processes, 8(11), 1431. *https://doi.org/10.3390/pr8111431*

Onuwa, G., & Folorunsho, S. (2022). Determinants of Tomato Farmers Participation in Agricultural Services and Training Centre (ASTC) Activities. *Turkish Journal of Agriculture - Food Science and Technology, 10*(8), 1369–1376. *https://doi.org/10.24925/turjaf.v10i8.1369-1376.4905*

The Postharvest Education Foundation (2019): Integrating postharvest development capacity into national extension service. ADMI 1st International Congress on Postharvest Loss Prevention.*www.postharvest.org*

Wahab, N. F., & Khairuddin, F. (2020). Risk Identifications of Postharvest Handling in Pineapple Crop that Affecting the Fruits Quality. *International Journal of Academic Research in Business and Social Sciences. 10(9), 671-680.*

Figure 1: Map of Oyo State indicating the ADP zones

Table 1: Distribution of respondent's socio-demographic characteristics

Socio-demographic variables	Frequency	Percentage
Age (Years)		
≤ 30	3	1.72
31 - 40	28	16.09
41 - 50	116	66.67
51 – 60	16	9.20
Above 60	11	6.32
Mean = 45.8		
Gender		
Male	121	69.54
Female	53	30.46
Marital Status		
Single	27	15.52
Married	119	68.39
Divorced	18	10.34
Widow/widower	10	5.75
Household size		
≤ 5	36	20.69
6-10	134	77.01
Above 10	4	2.30
Mean Household Size = 7.45		
Educational level		
No formal Education	18	10.29
Adult literacy	7	4.00
Primary Education	23	13.14
Junior Secondary Education	12	6.86
Senior Secondary Education	43	24.57
Post-Secondary Education	72	41.14
Farming experience		
≤ 10 years	29	16.67
11 - 20 years	75	43.10
21 - 30 years	51	29.31
31+ years	19	10.92
Mean Farming Experience= 19.4 years		

Source: Field Survey, 2024

Table 2: Distribution of respondents by postharvest innovation practices among the respondents

Postharvest innovation activities	Frequency	Percentage
Grading and sorting	102	58.62
Processing into sundried etc	20	11.49
Packaging materials	41	23.56
Storage	11	6.32
Total	**174**	**100**

Source: Field Survey, 2024

Table 3: Socio -demographic and technological factors that influence the participationn postharvest innovation practices among tomato farmers

Variable	dy/dx	Coefficient	Standard error	P-value
Socio-demographic variables				
Age of the farmers	0.0412	0.0266	0.3538	0.2200
Education	0.0175	0.0052***	0.0772	0.0003
Gender	0.0664	0.1524	0.4456	0.0333
Farming experience	0.0007	0.0465	0.3911	0.4418
Distance to market	-0.0364	-0.0992**	0.0586	0.0458
Off-farm income	-0.1074	-0.0146**	0.0618	0.0277
Technological variables				
Packaging material	0.0021	0.0343	0.6648	0.4444
Training	0.1626	0.0111***	0.48274	0.0014
Constant	0.1244	0.0829	1.6371	0.0028

Source: Field Survey, 2024
No of observation: 174 ; Wald Chi^2= 91.38; Log likelihood = 34.31 ; Prob >chi2 =0.000
***, **, *statistical significance at 1%, 5% and 10% levels, respectively

Table 4: Factors influencing the extent of participation in postharvest innovation practices among the respondents

Variable	Coefficient	Standard error	Z	P-value
Age of the farmers	- 0.2245**	0.4646	0.6167	0.0356
Education	0.4075	0.8655	0.5312	0.0714
Gender	0.7467	0.4447	0.3324	0.5000
Household size	- 0.0811	0.3482	`1.800	0.0846
Farming experience	0.1746***	0.3363	0.5573	0.0008
Access to credit	0.3336***	0.7825	0.8466	0.0005
Off-farm income	0.2276	0.3885	1.2735	0.6000
Distance to market	0.5846	0.8420	2.6651	0.3825
Drought	0.2337	0.1698	0.5923	0.8658
Packaging material	0.2228	0.2476	0.3331	0.1284
Transportation	0.6227*	0.5880	1.3035	0.0572
Quantity of harvested tomatoes	0.3645	0.4442	0.8317	0.0985
Constant	1.5632	2.7111	1.2684	0.0034

Source: Field Survey, 2024
No of observation: 174 : Mill Lambda = 44.64 log likelihood = 17.22 Prob >chi2 =0.000 sigma= 1.2147
Rho = 0.3683
***, **, *statistical significance at 1%, 5% and 10% levels, respectively

Table 5: Distribution of respondents by the constraints faced in the study area

Constraints	Frequency	Percentage	Rank
Inadequate capital	59	33.91	2
Lack of awareness and training	27	15.52	3
Infrastructural problems	74	42.53	1
Social/cultural problems	14	8.05	4
Total	**174**	**100**	

Source: Field Survey, 2024