



Determinants of Climate Change Adaptation Strategies among Cereal Crop Farmers in Kwara and Niger States, Nigeria

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Abstract: This study analysed the determinants of climate change adaptation strategies among cereal crop farmers in Kwara and Niger States, Nigeria. A multivariate logit (MNL) model was employed to analyse farmers' adaptation decisions. Primary data were collected from 397 respondents selected through a multistage sampling technique using a structured questionnaire administered through Kobo Toolbox. Descriptive statistics, farm budgeting techniques and ordinary least squares (OLS) regression were used for data analysis. The results revealed that farmers adopted several adaptation strategies including crop rotation, mixed cropping, rainwater harvesting, mulching and the application of organic manure. Livelihood diversification through non-farm activities was also common among farming households. Profitability analysis showed that cereal crop production was economically viable in both states, with higher net farm income recorded in Niger State (₦364,989/ha) compared with Kwara State (₦334,820/ha). The regression results indicated that education, farming experience, training, extension contact, cooperative membership and access to credit significantly influenced the adoption of adaptation strategies. The study concludes that climate change adaptation strategies enhance farm profitability and resilience among cereal crop farmers. It is therefore recommended that government and agricultural development agencies strengthen extension services, expand farmers' access to credit facilities and promote climate-smart agricultural practices among smallholder farmers.

Keywords: Determinants, Climate, Adaptation, Cereal crops, Farmers.

Introduction: Household livelihoods remain a critical and persistent development challenge in Nigeria, where a significant proportion of the population relies directly or indirectly on agriculture as their primary means of survival and economic sustenance. According to the National Bureau of Statistics, about 63% of Nigerians were classified as multidimensionally poor in 2024, with rural households accounting for over 70% of this population (National Bureau of Statistics (NBS), 2024). Rural livelihoods are predominantly agrarian, characterized by smallholder farming systems that provide food, income and employment for households, yet remain highly vulnerable to economic and environmental shocks. The World Bank (2025) estimates that agriculture supports the livelihoods of more than two thirds of Nigeria's poor, underscoring its critical role in household welfare, food security and poverty reduction. Livelihood outcomes in Nigeria are further shaped by low and unstable household incomes, limited access to productive assets and weak social protection mechanisms. Recent evidence indicates that over 65% of farming households live below the national poverty line, with income volatility driven largely by climate variability,

market fluctuations and rising production costs and inflation rate of 20.12% as at August 2025, (Food and Agricultural Organization (FAO), 2023; NBS, 2025). Food insecurity remains widespread, as approximately 26.5 million Nigerians were projected to face acute food insecurity during the 2023 lean season, with rural farming households being the most affected (FAO and World Food Programme (WFP), 2023). These conditions highlight the fragile nature of household livelihoods and the strong dependence of well-being on agricultural performance, thereby revealing the need to situate livelihood challenges within the broader national and agro-ecological context in which agricultural activities take place. These climatic changes further complicate farming activities in Nigeria, disrupting traditional agricultural calendars and affecting the timing and success of planting, harvesting and other critical operations. In view of the foregoing, the study was carried out to achieve the following: estimate the determinants of climate change adaptation strategies by cereal crop farming households in the study area; and evaluate the effects of climate change adaptation strategies on livelihood status of cereal crop farming households.

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Climate change poses significant challenges to agricultural productivity and rural livelihoods in Nigeria, particularly among smallholder cereal crop farmers who depend heavily on rain-fed systems. In states such as Kwara State and Niger State, increasing climate variability—manifested through irregular rainfall patterns, prolonged dry spells, flooding, and rising temperatures—has adversely affected cereal crop yields, food security, and farmers' incomes. Many farmers continue to face persistent constraints, including limited access to climate information, inadequate extension services, poor access to credit and farm inputs, low levels of education, weak institutional support, and socio-cultural barriers. These challenges significantly hinder their capacity to effectively respond to climate risks. Despite growing policy attention and intervention efforts, there is insufficient context-specific empirical evidence on the key constraints limiting farmers' adoption of adaptation strategies in Kwara and Niger States. This knowledge gap restricts the development of targeted, evidence-based policies and programs that can enhance farmers' resilience. Therefore, a critical need exists to systematically examine the constraints to climate change adaptation among cereal crop farmers in these regions in order to inform effective intervention strategies and promote sustainable agricultural productivity.

Study Area: This study was conducted in Kwara and Niger States located within the North Central region of Nigeria. The North Central region is made up of Niger, Nasarawa, Plateau, Benue, Kogi, Kwara, States, and the Federal Capital Territory (FCT), Abuja. The region occupies a total land area of 76,363 km², representing about 9.3% of the total land area of Nigeria. It covers Latitudes 8°20' North to 11°30' North of the equator and Longitudes 3°30' and 7°20' East of the Greenwich Meridian. Niger State is the largest state in Nigeria by landmass with 25 Local Government Areas (LGAs). According to recent demographic projections, Niger State has an estimated population of approximately 7,500,000 people in 2025, comprising about 3,650,000 males (48.7%) and 3,850,000 females (51.3%). (NPC projection, 2025). This reflects significant growth since the 2006 National Population Census, when the state had a population of 3,950,249 comprising 2,032,725 males and 1,917,524 females (NPC, 2006) and a percentage share of 51.5% male and 48.5% female. While Kwara State is located in the North Central geopolitical zone of Nigeria with its 16 Local Government Areas (LGAs), The state capital, Ilorin, serves as the administrative and commercial centre of the state. Based on recent demographic projections for 2025, Kwara State has an estimated population of approximately 3,834,000 people, comprising about 1,900,000 males (49.5%) and 1,934,000 females (50.5%). This population estimate reflects continued growth since the 2006 National Population Census and is based on trends in urbanisation and demographic change. (NPC projection, 2025).

Methodology: Multi-stage sampling method was used in the selection of respondents for this study. The first stage

involved purposive selection of Niger and Kwara States because of prevalence production of cereal crops that is maize, rice, millet and guinea corn in the States. In the second stage six (6) Local Government Areas (LGAs) were randomly selected from each of the two States following their agricultural zones. The LGAs that were randomly selected are Borgu, Lapai, Mariga, Mokwa, Paikoro, Shiroro in Niger State and Edu, Ifelodun, Ilorin East, Kwara Central Asah, Moro, and Patigi in Kwara State. The third stage involved the random selection of two villages from each of the selected Local Government Areas (LGAs), resulting in a total of twenty-four (24) villages. In the final stage, the sample size was determined using the Yamane formula, while proportionate allocation techniques were employed to select respondents, as adopted by Omonona and Agoi (2018). Consequently, a total of 396 respondents were included in the study. Primary data were collected from the farmers using a structured questionnaire administered through Kobo Toolbox software. The data obtained were analyzed using both descriptive and inferential statistical methods. Descriptive statistics, including means, frequencies, and percentages, were used to summarize the data. Farm budgeting analysis was conducted using the Net Farm Income (NFI) model to assess profitability. Objective i was achieved using multivariate regression while objective ii was achieved using livelihood status index.

Results and Discussion: Socio-economic Characteristics of the Respondent This section describes the socio-economic characteristics of the respondents in the study area. The socio-economic characteristics considered for this study were age, marital status, household size, level of education, farming experience and level of crop farming. The result in Table 1 indicates that the mean age of the cereal crop farming households was 36 and 32 years in Kwara and Niger States respectively. This suggest that they were still within the active and productive age, strong, energetic and full of innovative ideas that could be advantageous in the adoption of new technologies like climate change adaptation strategy (CCAS). Younger farmers often have better physical capacity, are more receptive to training and are more willing to experiment with and implement new technologies compared to older farmers (Mignouna *et al.*, 2021). Table 1 reveals that the majority (78.2%) of cereals crop farming households in Kwara and Niger States were married. This indicates that most of the respondents in the study areas had established family units. Akinbode and Dipeolu (2022) found that 80% of arable crop farmers in Ogun State were married, which they linked to the need for family labour in farming operations. Likewise, Tijani and Bakari (2020) reported that about 76% of rice farmers in Kwara and Niger States Nigeria were married, highlighting marriage as a common social feature among farming households. The result in Table 1 also reveals that the average household size of cereal crop farming households in Kwara and Niger States was 6 and 8 persons respectively. This implies that the farmers in the study areas generally had

moderate to large household sizes. This finding aligns with the National Bureau of Statistics (NBS) Household Panel Survey (2020), which reported that the national average household size in Nigeria in 2019 was six (6) persons. This is expected to influence adoption of CCAS, this is because larger household sizes typically provide more family labour, which is a valuable asset in rural farming systems where mechanization is limited. Table 1 also indicates that 44.0% and 41.8% of the cereal crop farming households in Kwara and Niger States, respectively, had no formal education, while 31.1% and 32.1% had only primary education. On average, respondents in Kwara and Niger States attained approximately 7 and 6 years of formal education, respectively. This implies that the level of formal education among cereal crop farming households in the study areas is generally low, with the majority of them having either no education or only basic primary schooling. This is in tandem with Adebayo and Akogwu (2020) that reported more primary education among climate smart agriculture adopters in Ogun State. Ejechi *et al.* (2021) also reported low literacy status among potato farmers in Nasarawa State of Nigeria. Table 1 further reveals that a majority of cereal crop farming households in Kwara (88.0%) and Niger State (93.3%) were engaged in farming on a full-time basis. With a slightly higher proportion in Niger State, this suggests that farming is the primary occupation for most farmers in the study areas. This could mean that these farmers rely heavily on the success of their agricultural activities for income and sustenance. This also indicates that majority of smallholder farmers had a limited diversification of income sources

Determinants of climate change adaptation strategies used by the farming households: The determinant of climate change adaptation strategies was captured with Multivariate regression model. The results of the analysis is shown in Table 2. The results show that Education significantly influenced the adoption of several climate change adaptation strategies among cereal crop farming households, although the effects varied between Kwara and Niger States. Notably, education was positively and significantly associated with the adoption of mixed cropping in both Kwara and Niger States ($p < 0.05$). It also showed a significant positive relationship with the use of liming in both states ($p < 0.10$ in Kwara and $p < 0.05$ in Niger), as well as with the adoption of early maturing varieties in Niger State ($p < 0.10$). These findings suggest that more educated farmers are more inclined to adopt CCAS that require technical knowledge, innovation, or an understanding of agronomic principles. Education enhances cognitive ability, critical thinking and access to information, factors that enable farmers to understand the long-term benefits and application methods of CCAS like liming or early maturing. In particular, early maturing varieties may be better understood and trusted by farmers with formal education due to exposure to agricultural extension materials, training or participation in cooperative learning. This is in tandem with Nhemachena and Hassan (2007) who opined that education

improves farmers' capacity to perceive, interpret, and respond to climate-related risks, thereby increasing the likelihood of adopting multiple adaptation strategies.

Access to credit had a positive and statistically significant influence on the adoption of certain climate change adaptation strategies among cereal crop farming households in Kwara and Niger States. Specifically, access to credit significantly increased the likelihood of adopting organic manuring ($p < 0.05$ in Kwara; $p < 0.01$ in Niger) and liming ($p < 0.01$ in both States). These results suggest that access to credit plays a vital enabling role in facilitating farmers' adoption of input-dependent adaptation strategies. This corroborate the findings of Mabe *et al.*, (2022) who reported that access to credit as a significant determinant of adoption of new climate smart innovations in Northern Ghana. Extension contact emerged as a significant determinant of the adoption of certain CCAS in both Kwara and Niger States. The variable was positively and statistically significant for crop rotation in both States ($p < 0.05$), indicating that farmers who had regular interactions with agricultural extension agents were more likely to adopt crop rotation as a climate adaptation practice. This result highlights the role that extension services play in disseminating climate-smart agricultural information and building farmers' capacity. Atube *et al.* (2021) reported that extension is one of the vital sources of awareness for farmers in River State, Nigeria. Farming experience significantly influenced the adoption of several climate change adaptation strategies (CCAS) among cereal crop farming households, with notable variations between Kwara and Niger States. In Kwara State, farming experience had a strong positive and statistically significant relationship with the adoption of organic manuring ($p < 0.01$) and mixed cropping ($p < 0.01$), while in Niger State, it was also significantly associated with organic manuring ($p < 0.05$), bush fallowing ($p < 0.05$) and mixed cropping ($p < 0.05$). This finding is in consonance with that of Dang *et al.* (2019) who reported that high experience among the adopters of climate smart farming in Niger State.

Cooperative membership was found to be a statistically significant factor influencing the adoption of several climate change adaptation strategies (CCAS) among cereal crop farming households in both Kwara and Niger States. Specifically, it had a positive and significant effect on crop rotation ($p < 0.01$) and mulching ($p < 0.05$) in both States. This finding suggests that belonging to a cooperative society increases the likelihood that a farmer will adopt certain climate-smart practices. Cooperatives often serve as platforms for sharing information, receiving training, accessing inputs at subsidised rates and fostering innovation diffusion. Atube *et al.* (2021) reported that extension is one of the vital sources of awareness for farmers in River State, Nigeria. Livelihood status was found to be positively and significantly associated with the adoption of several climate change adaptation strategies in both Kwara and Niger States. Specifically, it significantly influenced the use of crop

rotation ($p < 0.05$), rainwater harvesting ($p < 0.01$), organic manuring ($p < 0.05$ in Kwara, $p < 0.01$ in Niger), mixed cropping ($p < 0.01$), liming ($p < 0.01$), early maturing varieties ($p < 0.01$) and mulching ($p < 0.01$) across both States. Moreover, livelihood status is often correlated with higher levels of education, stronger social networks, and better access to extension services. These attributes provide farmers with greater exposure to climate information and training opportunities, which are critical in making informed decisions regarding adaptation. Studies have shown that farmers with improved welfare conditions are more proactive in adopting diverse strategies such as crop diversification, soil fertility management, and water harvesting, as they can better absorb risks associated with experimentation (Nhemachena and Hassan, 2007; Below *et al.*, 2012)

Cosmopolitanism: Cosmopolitanism emerged as a positive and statistically significant determinant of several climate change adaptation strategies among cereal crop farming households in both Kwara and Niger States. It significantly influenced the adoption of crop rotation ($p < 0.01$), rainwater harvesting ($p < 0.01$), organic manuring ($p < 0.01$), mixed cropping ($p < 0.05$), early maturing varieties ($p < 0.01$ in Kwara), and mulching ($p < 0.01$) across the two States. Cosmopolitanism in this context refers to the level of exposure farmers have to urban centres, external ideas, innovations and agricultural trends beyond their immediate communities. Farmers who are more cosmopolitan are likely to have interacted with extension agents, NGOs or visited agricultural exhibitions and towns where climate-smart practices are promoted. As a result, they are more open to innovation and quicker to adopt CCAS. This finding is consistent with diffusion of innovation theory, which highlights cosmopolitanism as a major factor influencing early adoption of innovations. Individuals with broader networks and greater external orientation tend to seek out information actively and are more willing to take risks associated with new technologies (Rogers, 2003).

Livelihood Status of the cereal crop farming households: Table 3 presents the distribution of respondents based on their livelihood status. The results shows that most of the respondents (44.9%) in Kwara State and 51.5% in Niger State had a high livelihood status, while 26.2% and 37.6% of the respondents in Kwara and Niger States respectively fell within the moderate livelihood status category. A smaller proportion of respondents in both States had low livelihood status, with 28.9% in Kwara and 10.9% in Niger. This indicates that most cereal crop farming households in both States enjoy relatively stable and sustainable livelihoods, with a higher percentage of farmers in Niger State reporting improved welfare outcomes. The higher livelihood status may be attributed to better access to agricultural inputs, extension services, or more favourable agro-climatic conditions in Niger State. It should be noted that farmers with high livelihood status are more likely to

adopt diverse and resource-demanding climate change adaptation strategies, as they tend to have better access to finance, information, and labour. These findings are consistent with earlier results in the regression analysis (Table 2), where livelihood status showed a positive and statistically significant effect on the adoption of multiple CCAS across both States. Bene *et al.* (2012) noted that better-off households in Sub-Saharan Africa are more likely to diversify their adaptive practices due to their stronger resource base.

Conclusion and Recommendations: The study concludes that cereal crop farmers in Kwara State and Niger State face substantial constraints that hinder the adoption of climate change adaptation strategies and limit their capacity to effectively cope with climate variability. These constraints are predominantly economic and institutional, including high input costs, limited access to credit, and inadequate extension services. Additionally, restricted access to modern agricultural technologies and timely climate information further constrains informed decision-making. Collectively, these challenges weaken farmers' resilience and reduce the overall effectiveness of adaptation efforts within the study area. To address these challenges, it is therefore recommended that policymakers should prioritize the implementation of targeted input subsidy programs, expansion of inclusive and farmer-friendly agricultural credit schemes, and the strengthening of extension service delivery systems. In addition, investments in the dissemination and adoption of climate-smart agricultural technologies should be scaled up to enhance sustainable productivity and build resilience among smallholder farmers.

References

- Adebayo, O. O., & Akogwu, G. O. (2020). Livelihood diversification strategies and welfare outcomes among farming households in North-central Nigeria. *Journal of Agricultural Extension*, 24(3), 76–85.
- Akinbode, S. O., & Dipeolu, A. O. (2022). Socio-economic determinants of arable crop farmers' productivity in Ogun State, Nigeria. *Journal of Social Sciences*, 31(2), 183–188.
- Atube, F., Musafiri, M., & Nshimiyimana, J. (2021). Determinants of smallholder farmers' adaptation to climate change: Evidence from Sub-Saharan Africa. *Environmental Economics*, 15(4), 72–84.
- Below, T., Artner, A., Siebert, R., & Sieber, S. (2012). Micro-level practices to adapt to climate change for African small-scale farmers: A review of selected literature. *IFPRI Discussion Paper 00953*. Washington, DC: International Food Policy Research Institute.
- Bene, C., Wood, R. G., Newsham, A., & Davis, M. (2012). Resilience: New utopia or new tyranny? Reflection about the potentials and limits of the concept of resilience in relation to vulnerability-reduction programmes. Institute of Development Studies. <https://doi.org/10.1111/j.2040-0209.2012.00405.x>
- Dang, H. D., Li, E., Nuberg, I., & Bruwer, J. (2019). Factors influencing the adaptation of farmers in response to climate change in Oyo State, Nigeria. *Climate and Development*, 11(9), 788–797.
- Ejechi, S. H., Schipper, L., Scoville-Simonds, M., Vincent, K., & Wood, B. T. (2021). Adaptation interventions and their effects on

households' livelihood security. *Global Environmental Change*, 65, 102157. <https://doi.org/10.1016/j.gloenvcha.2020.102157>.

Food and Agriculture Organization of the United Nations (FAO). (2018). The state of food security and nutrition in the world 2018: Building climate resilience food security and nutrition. FAO and Agriculture Organization, & World Food Programme. (2023). *Nigeria: Integrated food security phase classification (IPC) analysis*. Rome, Italy: FAO & WFP.

Hassan, B.A.; Knight, J. (2023) Adaptation to Climate Change and Variability by Farming Households in North-Central Nigeria. *Sustainability* 2023, 15, 16309. <https://doi.org/10.3390/su152316309>.

Mabe, F. N., Sarpong, D. B., & Akudugu, M. A. (2022). Determinants of climate-smart agriculture adoption by farmers in Northern Ghana. *Journal of Climate Resilience*, 3(1), 34–52.

Mignouna, D. B., Manyong, V. M., Rusike, J., Mutabazi, K. D. S., & Senkondo, E. M. (2011). Determinants of adopting Imazapyr-resistant maize technologies and its impact on household income in Western Kenya. *AgBioForum*, 14(3), 158–163.

National Bureau of Statistics. (2020). *National Agricultural Sample Census Report 2020: Summary results* (Report on agricultural households in Nigeria). Abuja, Nigeria: National Bureau of Statistics. Data show that about 40.2 million households in Nigeria practise some form of agriculture, highlighting the sector's role in rural livelihoods.

National Bureau of Statistics. (2024). *National Agricultural Sample Census Report 2022: Summary results* (Report on agricultural households in Nigeria). Abuja, Nigeria: National Bureau of Statistics. Data show that about 40.2 million households in Nigeria practise some form of agriculture, highlighting the sector's role in rural livelihoods.

National Population Commission (NPC). (2006). *Report of Nigeria's National Population Commission on 2006 census. Population and Development Review* 33(1): 206 – 210.

Nhemachena, C., & Hassan, R. (2007). *Micro-level analysis of farmers' adaptation to climate change in Southern Africa*. IFPRI Discussion Paper 00714. International Food Policy Research Institute, Washington, DC.

Omonona, B. T., & Agoi, G. A. (2018). Determinants of food insecurity among households in Ibadan, Oyo State, Nigeria. *Journal of Food, Agriculture & Environment*, 9(2), 76–81.

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). New York: Free Press.

World Bank. (2025). *Poverty and Equity Brief: Nigeria* (April 2025). Washington, DC: World Bank Group. This brief report that rural poverty in Nigeria reached approximately 75.5 %, underlining persistent challenges to rural livelihoods and development.

Table 1: Distribution of respondent according to socioeconomic characteristics

Variables	Kwara n=225		Niger n= 165	
	Frequency	Percentage	Frequency	Percentage
Age				
<20	32	14.2	23	13.9
21-30	36	16.0	38	23.0
31-40	67	29.8	38	23.0
>40	90	40.0	66	40.0
Mean	36		32	
Marital status				
Single	47	20.9	35	21.2
Married	176	78.2	129	78.2
Widow	2	0.9	1	0.6
Household size				
1-5	84	37.3	18	10.9
6-10	126	56.0	85	51.5
<10	15	6.7	62	37.6
Mean	6.0		8.0	
Education level				
Primary	70	31.1	53	32.1
Secondary	29	12.9	21	12.7
Tertiary	27	12.0	21	12.7
Non formal	99	44.0	69	41.8
Mean	7		6	
Level of crop Farming				
Full time	198	88.0	154	93.3
Part-time	27	12.0	11	6.7

Source: Field survey, 2024

Table:2 Determinants of climate change adaptation strategies used by the farming households

Variable	Crop Rotation (Kwara / Niger)	Rainwater Harvesting (Kwara / Niger)	Organic Manure (Kwara / Niger)	Bush Fallowing (Kwara / Niger)	Mixed Cropping (Kwara / Niger)	Liming (Kwara / Niger)	Early Maturing Variety (Kwara / Niger)	Mulching (Kwara / Niger)
Education	-0.0044 (1.76) / -0.0017 (-0.21)	0.0611 (1.28) / 0.0213 (1.21)	-0.0651 (0.26) / 0.0002 (0.05)	0.0876 (0.18) / -0.0101 (-1.33)	0.0101** (2.02) / 0.0037** (2.37)	0.0208* (1.80) / 0.0179** (2.04)	0.0102 (1.75) / 0.0127* (1.81)	0.2352 (1.85) / 0.0131 (1.65)

Farming experience	0.0487 (0.82) / - 0.0025 (- 0.68)	-0.0558 (1.73) / -0.0053 (- 1.27)	0.1323*** (2.91) / 0.0024** (2.17)	0.0721 (0.79) / 0.0036** (2.09)	0.0709*** (3.37) / 0.0046** (2.05)	-0.1460 (1.07) / - 0.0054 (- 1.42)	-0.0828 (0.31) / 0.0101*** (3.28)	0.0697(1.16) / - 0.0072 (-1.07)
Training	0.0468 (2.31) / 0.0241** (2.19)	-0.0362** (- 2.11) / - 0.0261** (- 2.08)	0.0101 (0.15) / 0.0004 (0.08)	0.0021 (0.11) / 0.0006 (0.07)	-0.0125 (- 1.64) / - 0.0210 (- 1.59)	-0.0236*** (2.69) / 0.0035** (2.31)	0.0085 (0.39) / 0.0192** (2.09)	0.0067 (0.31) / 0.0028 (0.28)
Access to credit	0.1326 (0.92) / 0.1248 (0.86)	0.2147 (0.31) / 0.2520 (0.29)	0.0481** (2.48) / 0.0569*** (2.53)	-0.0325 (- 0.55) / - 0.0297 (- 0.49)	0.1067 (1.52) / 0.1179 (1.46)	0.2416*** (3.91) / 0.2641*** (3.80)	-0.0147 (- 0.11) / - 0.0011 (- 0.02)	0.0587 (0.87) / 0.0529 (0.84)
Extension contact	0.1751** (2.11) / 0.1913** (2.26)	-0.2145** (- 2.38) / - 0.2250** (- 2.33)	-0.0489 (- 1.19) / - 0.0543 (- 1.16)	0.0932 (1.39) / 0.0990 (1.30)	0.0675 (0.68) / 0.0722 (0.71)	-0.0931 (- 1.14) / - 0.1016 (- 1.16)	0.0275 (0.41) / 0.0243 (0.35)	-0.0163 (-0.23) / -0.0149 (- 0.19)
Cooperative membership	0.3102 (4.90) / 0.3604*** (4.85)	0.1068 (1.40) / 0.1163 (1.37)	0.0543 (1.23) / 0.0500 (1.22)	-0.1023 (- 1.59) / - 0.0971 (- 1.46)	0.0078 (0.15) / 0.0101 (0.11)	0.0395 (0.78) / - 0.0011 (- 0.02)	0.0405 (0.68) / 0.0445 (0.72)	0.1233** (2.17) / 0.1445** (2.07)
Livelihood status	0.1167** (2.33) / 0.1375** (2.42)	0.2751*** (4.51) / 0.2873*** (4.44)	0.0423** (2.01) / 0.0621*** (2.99)	-0.2651 (- 0.91) / - 0.2482 (- 0.87)	0.4103 (6.97) / 0.4718*** (6.93)	0.1402 (2.81) / 0.1628*** (2.78)	0.1221 (2.85) / 0.1390*** (2.94)	0.3468 (6.68) / 0.3597*** (6.73)
Cosmopolitanism	0.0573 (3.27) / 0.0618*** (3.48)	0.0623 (2.97) / 0.0586*** (2.89)	0.0432 (3.88) / 0.0405*** (4.13)	-0.0193 (- 1.09) / - 0.0162 (- 1.02)	0.0452* (1.98) / 0.0412* (1.93)	0.0263** (2.04) / 0.0043 (0.23)	0.0394*** (2.61) / 0.0295 (0.99)	0.0376*** (2.53) / 0.0416** (2.49)
R-squared	0.4463 / 0.4527	0.3922 / 0.4009	0.2385 / 0.2431	0.2128 / 0.2186	0.2984 / 0.3106	0.2669 / 0.2720	0.3855 / 0.3988	0.3952 / 0.4031
F-ratio	0.0000 / 0.0000	0.0000 / 0.0000	0.0000 / 0.0000	0.0000 / 0.0000	0.0000 / 0.0000	0.0000 / 0.0000	0.0000 / 0.0000	0.0000 / 0.0000

Note: Values in parentheses are *t*-statistics. ***p < 0.01, **p < 0.05, *p < 0.10. Source: Field Survey, 2024.

Table 3: Distribution of respondent according to livelihood status

Livelihood Status	Index Range	Kwara		Niger	
		Frequency	Percentage	Frequency	Percentage
Low	0 – 0.33	65	28.9	18	10.9
Moderate	0.34 – 0.66	59	26.2	62	37.6
High	0.67 – 1.00	101	44.9	85	51.5
Total		225	100.0	165	100.0

Source: Field survey, 2024