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Livelihood Diversification as a Pathway to Climate Change Resilience among Rural Households in Kebbi State, Nigeria

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Abstract

This study examined the impact of livelihood diversification on climate change resilience among rural households in Kebbi State, Nigeria. A multistage sampling technique was employed to select 348 respondents from rural communities across the state. Primary data were obtained through structured questionnaires and interview schedules, while data analysis involved descriptive statistics, multinomial logistic regression, income share analysis, well-being indices, and the Climate Resilience Index (CRI). The study assessed the extent to which diversified livelihood activities enhance households' adaptive capacity and ability to respond to climate-related shocks. The results revealed that the majority of respondents were male (74.4%), while 58.6% had only primary education. Most households (67.8%) engaged in both farm and non-farm livelihood activities, with petty trading (51.1%) and artisanal occupations (38.5%) being the most prevalent non-farm options. The multinomial logistic regression results indicated that education level ($p < 0.01$), access to credit ($p < 0.05$), and experience of climate shocks ($p < 0.01$) significantly influenced households' decisions to diversify their livelihoods. Non-farm activities accounted for 45.3% of total household income and contributed positively to key well-being indicators, including food security and children's educational attainment. Furthermore, 62.4% of diversified households were classified as highly resilient to climate change impacts, compared to only 38.1% of non-diversified households. Major constraints to livelihood diversification included limited access to credit (61.5%) and poor rural infrastructure (54.3%). The study concludes that livelihood diversification significantly enhances climate change resilience among rural households. It therefore recommends the promotion of rural financial inclusion through microcredit schemes and targeted capacity-building interventions to strengthen adaptive capacity and sustainable livelihood outcomes.

Keywords: *Livelihood diversification; Climate change resilience; rural households; Kebbi State, Nigeria*

INTRODUCTION

Climate change constitutes one of the most critical environmental challenges of the twenty-first century, with far-reaching implications for food security, water resources, livelihoods, and overall economic development, particularly in developing countries. In sub-Saharan Africa, including Nigeria, the impacts of climate change are especially severe due to the region's heavy dependence on climate-sensitive sectors such as agriculture, low adaptive capacity, and limited access to financial, technological, and institutional resources (Oduniyi, 2018; IPCC, 2022). Manifestations of climate change, including erratic rainfall patterns, prolonged dry spells, flooding, and rising temperatures, have increasingly disrupted traditional rural livelihoods that depend largely on Rain-fed agriculture (Apata, 2011). Nigeria's agricultural sector employs more than 70% of the rural population and contributes substantially to household livelihoods and national economic output. However, heightened climate variability

in recent decades has undermined agricultural productivity through declining yields, land degradation, and increased vulnerability to food insecurity (Ayanlade *et al.,* 2017). In Kebbi State, where agriculture remains the backbone of the rural economy, the impacts of climate change are particularly evident. Irregular rainfall patterns and recurring droughts have adversely affected staple crops such as millet, sorghum, and rice, as well as livestock production and artisanal fishing along riverine communities (Yusuf *et al.,* 2019). In response to these environmental stressors, rural households increasingly adopt livelihood diversification strategies as a means of coping with and adapting to climate-induced risks. Livelihood diversification refers to the process through which households construct a diverse portfolio of income-generating activities and social support mechanisms to enhance survival and improve living standards (Ellis, 2000). Such strategies often involve combining agricultural production with non-farm activities such as petty trading, fishing, craftsmanship, seasonal migration, and casual labor. Livelihood diversification thus serves both as a short-term coping strategy and a long-term adaptation mechanism to climate shocks and uncertainties (Barrett *et al*., 2001; Bhatta *et al.,* 2015).

Empirical evidence suggests that livelihood diversification reduces household vulnerability and enhances resilience to climate change. Resilience, in this context, denotes the capacity of households to absorb, adapt to, and recover from climate-related disturbances while maintaining or improving their welfare (Bahadur *et al.,* 2015). Households engaged in less climate-sensitive or off-farm activities often enjoy more stable income streams, improved food security, and greater capacity to invest in adaptation measures such as irrigation facilities and climate-resilient crop varieties (Adebayo & Onu, 2015; Deressa *et al*., 2009). However, the effectiveness of livelihood diversification is shaped by access to key assets and institutional support, including education, credit facilities, extension services, and infrastructure (Nhemachena & Hassan, 2007; Babatunde & Qaim, 2010). Constraints such as limited market access, gender norms, weak policy frameworks, and poor infrastructure frequently hinder successful diversification (Scoones, 2015). In Northwestern Nigeria, climate change impacts are exacerbated by widespread poverty, low educational attainment, and limited non-farm employment opportunities. Kebbi State exemplifies these challenges, as rural livelihoods are highly dependent on traditional agricultural systems and exposed to recurring floods from the River Niger and extended dry seasons. Despite growing literature on climate change adaptation in Nigeria (Apata, 2011; Ogunniyi *et al*., 2018; Ayanlade *et al.,* 2017), empirical studies focusing specifically on livelihood diversification and climate resilience in Kebbi State remain limited. Existing studies often examine adaptation strategies broadly without isolating the contribution of non-farm livelihoods to resilience and household welfare. Consequently, this study seeks to bridge this gap by examining the role of livelihood diversification in enhancing climate change resilience among rural households in Kebbi State.

Statement of the Research Problem

Despite increasing awareness of climate change risks, rural households in Kebbi State continue to face significant challenges in adapting effectively. While some households have diversified their income sources, many remain highly vulnerable due to limited access to financial capital, education, infrastructure, and institutional support. There is insufficient empirical evidence on how livelihood diversification influences climate resilience among rural households in the state. Understanding this relationship is essential for designing evidence-based climate adaptation and rural development policies. This study therefore addresses the following research questions:

1. What are the socioeconomic characteristics of rural households in the study area?
2. What livelihood diversification strategies are adopted by rural households?
3. What factors influence households' decisions to diversify their livelihoods?
4. How do non-farm activities contribute to household income and well-being?
5. To what extent does livelihood diversification enhance resilience to climate change impacts?
6. What challenges constrain the adoption of diversified livelihood strategies?

Objectives of the Study

The broad objective of the study is to examine the impact of livelihood diversification on climate change resilience among rural households in Kebbi State, Nigeria. The specific objectives are to:

1. describe the socioeconomic characteristics of rural households;
2. identify the livelihood diversification strategies adopted by rural households;
3. examine the factors influencing households' decisions to diversify their livelihoods;
4. assess the contribution of non-farm activities to household income and well-being;

5. evaluate the extent to which livelihood diversification enhances climate change resilience; and
6. identify the challenges limiting the adoption of diversified livelihood strategies.

METHODOLOGY

Study Area

Kebbi State is located in North-western Nigeria between latitudes 10°N and 13°N and longitudes 3°E and 6°E. The state is predominantly agrarian, with crop farming, livestock rearing, and fishing forming the main livelihood activities. It experiences a tropical climate characterized by distinct wet and dry seasons, making it highly susceptible to climate variability (Kebbi State Agricultural Development Programme, 2022). Mean annual rainfall ranges from 400 to 800 mm, while mean annual temperatures vary between 21°C and 38°C (KSG, 2008). The state has an estimated population of 3,662,103 people, comprising major ethnic groups such as Hausa, Fulani, Dakarkari, and Kambari. Agriculture remains the backbone of the state's economy, supported by fertile soils, extensive farmlands, and river systems such as the Niger and Rima, which also sustain fishing activities.

Sampling Procedure and Sample Size

A multistage sampling technique was employed. In the first stage, the four agricultural zones in Kebbi State (Argungu, Bunza, Zuru, and Yauri) were selected. In the second stage, eight Local Government Areas were randomly selected from the zones. The third stage involved the random selection of two villages from each selected Local Government Area. Finally, respondents were randomly drawn from each village, resulting in a total sample size of 348 households from a sampling frame of 2,400 households.

Data Collection and Analysis

Primary data were collected using structured interview schedules, while secondary data were sourced from relevant literature. Data analysis involved the use of descriptive statistics (frequencies, means, and percentages), multinomial logistic regression models, income share and well-being indices, and the Climate Resilience Index (CRI).

Models Specification

To achieve this objective, a binary logistic regression model was used, where the dependent variable is livelihood diversification (1 = diversified, 0 = not diversified). The model evaluates the influence of socio-economic and contextual factors on the likelihood of households diversifying their livelihoods.

Let Y=1 Y =1 if a household diversifies its livelihood, and Y=0 otherwise.
The logistic regression model is specified as:

Type equation here. $\text{Logit}(p) = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_n X_n + \varepsilon$

Where: P= probability of livelihood diversification

$X_1 \ldots X_n$ = independent variables (e.g., age, education, income)

ε = error term

Independent Variables Used in the Model

Variable Code	Description	Type
X_1	Age of household head (years)	Continuous
X_2	Gender (1 = Male, 0 = Female)	Dummy
X_3	Household size	Continuous
X_4	Educational level (years of schooling)	Continuous
X_5	Monthly income (₦)	Continuous
X_6	Access to credit (1 = Yes, 0 = No)	Dummy
X_7	Extension contact (1 = Yes, 0 = No)	Dummy
X_8	Farm size (hectares)	Continuous
X_9	Distance to market (km)	Continuous
X_{10}	Membership in cooperative (1 = Yes, 0 = No)	Dummy

Source: Author construct, 2025

Models Specification

Households' decisions to adopt alternative livelihood strategies are fundamentally driven by the objective of maximizing utility derived from the expected returns of each available option (Eneyew & Bekele, 2012). When livelihood strategy choices are discrete and unordered, the appropriate analytical framework for modeling the probability that a household selects a particular livelihood strategy set is the multinomial logistic (MNL) model (Ying & Warren, 2010). The MNL model has been widely applied in livelihood studies due to its strong predictive capability and its effectiveness in

capturing variations in livelihood diversification patterns among rural households (Chan, 2005; Keane, 2019). The application of the MNL model requires that households be grouped into mutually exclusive livelihood strategy categories, based on the dominant activities in which they engage. A key underlying assumption of the model is that households within a given category participate primarily in the specified livelihood strategies and do not simultaneously engage in strategies classified under other categories (Brown, 2006). Given these conditions, the multinomial logistic regression model was employed in this study to examine the factors influencing rural households' choices of livelihood strategies.

Thus, the empirical model is specified as follows:

Let *Pij* be the probability of household *i* choosing livelihood strategy *j*.

The model is given by: $\ln\left(\frac{Pij}{Pi0}\right) = \beta + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots + \beta_k X_k + \epsilon$ Where: *Pi*0 = base category

Xk = explanatory variables (age, gender, household size, education level, monthly income, access to credit, extension contact, farm size, distance to market, cooperative membership)

Objective 4: Income Share and Well-being Index

Income share = (Non-farm income / Total income) × 100

Well-being measured using a Composite Well-being Index (CWI) based on access to food, health, education, and housing.

Objective 5: Climate Resilience Index (CRI)

CRI calculated using indicators such as income stability, food security, coping capacity, and social capital.

CRI = Weighted sum of normalized scores of each indicator.

A Livelihood Resilience Index (LRI) was constructed to assess the resilience level of households based on indicators like income stability, food security, and access to credit, livelihood diversity, and adaptive capacity. Respondents were grouped into three resilience categories: Low resilience (score 0.000.39), Moderate resilience (score 0.400.69), and High resilience (score 0.701.00).

Livelihood diversification was measured by the Number of Income Sources (NIS) each household had (e.g., farming, trading, remittances, crafts, labour, and transport). Cross-tabulation was used to analyse the relationship between NIS and resilience level.

RESULTS AND DISCUSSION

Table 1: Distribution of the respondents based on their socio-economic characteristics (N = 348)

Variable	Category	Frequency	Percentage (%)
Gender	Male	228	65.5
	Female	120	34.5
Age (Years)	18–30	62	17.8
	31–40	114	32.8
	41–50	105	30.2
	51 and above	67	19.2
Marital Status	Single	48	13.8
	Married	273	78.4
	Widowed/Divorced	27	7.8
Household Size	1–5 members	77	22.1
	6–10 members	168	48.3
	Above 10 members	103	29.6
Level of Education	No Formal Education	112	32.2
	Primary Education	79	22.7
	Secondary Education	91	26.1
	Tertiary Education	66	19.0
Primary Occupation	Farming	221	63.5
	Fishing	32	9.2
	Trading	49	14.1
	Artisan/Crafts	28	8.0
	Civil Service	18	5.2
Monthly Income (₦)	<₦20,000	143	41.1
	₦20,000–₦40,000	119	34.2
	₦41,000–₦60,000	52	14.9
	>₦60,000	34	9.8
Farming Experience (Years)	<5 years	49	14.1

6–10 years	111	31.9
11–20 years	97	27.9
>20 years	91	26.1

Source: Field Survey, 2025

The socio-economic characteristics of the respondents provide critical insights into the demographic structure and livelihood conditions under which rural households in Kebbi State operate. The results indicate that a majority (65.5%) of the respondents were male, reflecting the gendered nature of agricultural production and livelihood engagement in northern Nigeria. This finding is consistent with Yusuf *et al.* (2019), who similarly reported male dominance among farming households in the region. Such a pattern may be attributed to entrenched socio-cultural norms that assign men primary responsibility for physically demanding agricultural tasks and other public economic activities. In terms of age distribution, most respondents (32.8%) were within the 31–40 age bracket, followed by those aged 41–50 years (30.2%). This suggests that the rural workforce in the study area is largely composed of individuals in their economically active and productive years. This observation aligns with Ayanlade *et al*. (2017), who noted that age is positively associated with livelihood adaptation, as middle-aged individuals tend to possess the experience, resources, and willingness required to adopt new income-generating strategies and respond to environmental risks. A substantial proportion of the respondents (78.4%) were married, reflecting the widespread practice of early and stable marriage in rural communities. Household sizes were relatively large, with 48.3% of households comprising 6–10 members and 29.6% having more than 10 members. While large households may provide labor for farm and non-farm activities, they can also place significant pressure on household income and food security, particularly under conditions of climate stress, as observed by Apata (2011). Educational attainment among respondents was generally low, with 32.2% having no formal education and only 19.0% attaining tertiary-level education. This finding corroborates Oduniyi (2018), who reported that low literacy levels constrain rural households' access to climate information, modern technologies, and adaptive knowledge. Limited formal education may therefore reduce households' ability to diversify into skilled non-farm activities that require basic literacy and numeracy skills.

Farming constituted the primary occupation of 63.5% of the respondents, underscoring the agrarian nature of Kebbi State's rural economy. Nevertheless, engagement in secondary occupations such as trading (14.1%), fishing (9.2%), and artisanal activities (8.0%) indicates the presence of livelihood diversification. This supports Ellis's (2000) assertion that rural households rarely depend on a single income source. With respect to income, 41.1% of respondents earned less than ₦20,000 per month, highlighting the prevalence of poverty among rural households. Low income levels constrain the capacity of households to invest in climate-resilient technologies and alternative livelihood options, consistent with the findings of Ogunniyi *et al*. (2018), who identified financial limitations as a major barrier to livelihood diversification and climate adaptation in rural Nigeria. Finally, the majority of respondents (85.9%) reported having more than five years of farming experience, indicating substantial indigenous knowledge and familiarity with local agro-ecological conditions. However, farming experience alone may be insufficient to mitigate the adverse effects of climate change in the absence of complementary strategies such as livelihood diversification. As noted by Deressa *et al.* (2009), while experience enhances awareness of climate risks, effective adaptation requires the integration of innovation, diversification, and institutional support.

Table 2: Livelihood Diversification Strategies Adopted by Rural Households in the study area (N = 348)

Livelihood Strategy	**Frequency**	**Percentage (%)**
Crop farming (Rain-fed and irrigated)	318	91.4
Livestock rearing (goats, sheep, cattle, poultry)	252	72.4
Fishing (rivers, dams, and ponds)	143	41.1
Petty trading (retail of foodstuff, groceries)	128	36.8
Artisan jobs (carpentry, tailoring, mechanics)	93	26.7
Civil service or government employment	36	10.3
Transport services (Okada, keke, cart pulling)	47	13.5
Food processing (grinding, milling, oil extraction)	71	20.4
Remittances from migrant family members	56	16.1
Agricultural labour on others' farms	105	30.2
Participation in cooperative societies/Savings groups	86	24.7

Source: Field Survey, 2025. Note: Multiple responses were allowed, as households may engage in more than one strategy.

The results presented in Table 2 indicate a wide range of livelihood activities undertaken by rural households in Kebbi State, reflecting a mixed livelihood system dominated by agricultural and complementary non-farm pursuits. Crop farming (91.4%) and livestock rearing (72.4%) emerged as the most prevalent livelihood activities, reaffirming the agro-based nature of the rural economy. These findings are consistent with earlier studies by Ellis (2000) and Adepoju and Obayelu (2013), which identified agriculture as the primary source of livelihood for rural households in sub-Saharan Africa, particularly within semi-arid regions such as northern Nigeria. A considerable proportion of respondents (41.1%) reported engagement in fishing activities, especially in communities located around the Kainji and Shiroro dams. This underscores the significance of aquatic resources in supporting rural livelihoods and food security in riverine areas. This observation aligns with the findings of Ayanlade *et al*. (2017), who emphasized the contribution of fisheries to income diversification and nutritional outcomes among riparian households.

In addition to agricultural activities, rural households engaged in a variety of non-farm income-generating activities. Petty trading (36.8%), artisanal occupations (26.7%), and food processing (20.4%) were among the most common non-farm pursuits. These results support the assertions of Barrett *et al.* (2001), who argued that non-farm livelihood diversification serves as a critical risk management strategy for households exposed to climate-related shocks, particularly where reliance on farming alone is insufficient to ensure year-round income stability. Participation in transport services (13.5%) and the receipt of remittances from family members (16.1%) further reflect adaptive responses to growing economic uncertainty and income instability. According to Reardon *et al*. (2007), remittances and transport-related activities have become increasingly important diversification pathways in rural Africa, especially among younger household members seeking quicker and more flexible income opportunities. Notably, 30.2% of respondents reported working as agricultural laborers on other farms, indicating the prevalence of informal labor exchange systems within rural communities. Such arrangements serve as short-term coping mechanisms during periods of income shortfall or agricultural lean seasons. This finding corroborates the report by FAO (2014), which identified casual agricultural labor as a common survival and diversification strategy in resource-constrained rural settings.

Furthermore, participation in cooperative societies and savings groups (24.7%) highlights the role of social capital and collective action in supporting livelihood diversification. This observation is consistent with Nnadi *et al.* (2013), who emphasized the importance of rural institutions in facilitating access to credit, information, and productive resources necessary for livelihood expansion and adaptation to climate variability. Despite the diversity of livelihood strategies observed, relatively low participation in formal employment such as civil service (10.3%) suggests that structural barriers particularly limited access to education, skills development, and formal employment opportunities continue to constrain a full transition into more stable and higher-return non-agricultural livelihoods. This supports Oluwatayo's (2009) assertion that inadequate human capital and poor rural infrastructure significantly limit rural households' ability to diversify into more remunerative livelihood options.

Table 3: Multinomial Logistic Regression Results for Factors Influencing Livelihood Diversification (N = 348)

Variable	Coefficient (β)	Standard Error	Odds Ratio	P-value	Significance
Constant	-1.254	0.582	–	0.031	*
Age	-0.028	0.011	0.972	0.008	**
Gender	0.647	0.219	1.910	0.003	**
Household Size	0.135	0.059	1.145	0.023	*
Education Level	0.101	0.026	1.106	0.000	***
Monthly Income	0.0004	0.0001	1.0004	0.002	**
Access to Credit	1.233	0.332	3.431	0.000	***
Extension Contact	0.804	0.298	2.234	0.007	**
Farm Size	-0.064	0.022	0.938	0.004	**
Distance to Market	-0.041	0.017	0.960	0.017	*
Cooperative Membership	0.671	0.289	1.957	0.019	*

*Source: Field Survey, 2025 ***Significant at 1% (p < 0.01), **5% (p < 0.05), 10% (p < 0.1)*

The regression results presented in Table 3 indicate that several socio-economic and institutional factors significantly influence rural households' decisions to diversify their livelihoods. Education level exhibited a strong positive and statistically significant effect ($p < 0.01$), suggesting that household heads with higher levels of education are more likely to engage in diversified livelihood activities. This finding corroborates the studies of Adepoju and Obayelu (2013) and Oluwatayo (2009), which demonstrated that education enhances awareness of income-generating opportunities and improves the capacity to participate in non-farm enterprises. Access to credit emerged as one of the most influential determinants of livelihood diversification, with an odds ratio of 3.43, indicating that households with access to financial resources were substantially more likely to diversify their income sources. This result supports the assertions of Barrett *et al.* (2001) and Ogunniyi *et al.* (2018), who emphasized that credit availability lowers entry barriers into non-farm activities by easing capital constraints and enabling investment in productive ventures beyond agriculture.

Extension contact was found to have a positive and statistically significant relationship with livelihood diversification, underscoring the critical role of agricultural and rural advisory services in promoting alternative livelihood options. Through access to information, skills, and innovation, extension services enhance households' ability to adopt diversified livelihood strategies. This finding is consistent with Yusuf *et al*. (2019), who reported a similar positive influence of extension services on climate-smart adaptation practices in Kebbi State. Membership in cooperative societies also significantly increased the likelihood of livelihood diversification. Cooperative organizations often facilitate access to credit, training, information, and social networks, which collectively support household engagement in multiple income-generating activities. This result aligns with the findings of Nnadi *et al.* (2013), who highlighted the importance of social capital and collective action in rural livelihood expansion.

Gender was a significant determinant, with male-headed households more likely to diversify their livelihoods. This outcome likely reflects socio-cultural norms and mobility advantages enjoyed by men in rural northern Nigeria, which enable greater participation in off-farm and market-oriented activities. Similar gender-based disparities have been reported by Ayanlade *et al.* (2017). Age exhibited a negative coefficient, indicating that younger household heads were more inclined toward livelihood diversification. This supports the arguments of Ellis (2000) and Adebayo *et al.* (2015), who observed that younger individuals tend to be more receptive to innovation, risk-taking, and entrepreneurial activities. Household size exerted a positive influence on diversification decisions, suggesting that larger households benefit from greater labor availability, which facilitates engagement in multiple livelihood activities. Conversely, farm size and distance to market were negatively associated with livelihood diversification. Larger farm holdings may reduce the perceived necessity for alternative income sources, while greater distance to markets imposes transaction and transportation costs that discourage entry into non-farm enterprises. These findings are consistent with FAO (2014), which identified market accessibility and resource endowment as key factors shaping rural households' diversification behavior.

Table 4.1: Distribution of the respondents based Sources of Household Income (N = 348)

Income Source	**Mean Monthly Income (₦)**	**% Contribution to Total Income**
Farming (crop/livestock)	₦41,600	49.2%
Non-farm wage employment	₦18,300	21.6%
Non-farm self-employment	₦16,900	20.0%
Remittances	₦5,000	5.9%
Others (rents, aid, etc.)	₦2,800	3.3%
Total	**₦84,600**	**100%**

Source: Field Survey, 2025

Table 4.2: OLS Regression Results of Non-Farm Income on Household Well-being Indicators (Dependent Variable: Household Per Capita Monthly Income (₦)

Variable	**Coefficient (β)**	**Standard Error**	**t-value**	**P-value**	**Significance**
Constant	2450.75	652.80	3.75	0.000	***
Non-farm Income (₦)	0.553	0.083	6.66	0.000	***
Household Size	-115.23	35.12	-3.28	0.001	**

Education Level (years)	289.55	72.43	3.99	0.000	***
Access to Credit	1740.32	534.21	3.26	0.001	**
Cooperative Membership	1123.44	471.19	2.38	0.018	*
Distance to Market (km)	-89.23	28.90	-3.09	0.002	**

*Source: Field Survey, 2025 $R^2 = 0.486$, F-stat = 18.73, $p < 0.01$ ***Significant at 1%, **5%, *10%*

The results presented in Table 4.1 indicate that non-farm income plays a substantial role in shaping household income and well-being among rural households in Kebbi State. Combined non-farm income sources comprising both wage employment and self-employment accounted for 41.6% of total household income. This finding underscores the growing importance of non-farm activities within rural economies and corroborates earlier studies by Barrett *et al.* (2001) and Haggblade *et al*. (2010), who documented the expanding contribution of non-farm income to rural livelihoods in developing countries. Further evidence from the Ordinary Least Squares (OLS) regression results in Table 4.2 reveals that non-farm income has a positive and statistically significant effect on household per capita income ($\beta = 0.553$, $p < 0.01$). This suggests that increases in non-farm earnings substantially enhance household well-being by raising income levels and improving consumption capacity. This result aligns with the findings of Reardon (1997) and Oluwatayo (2009), who reported that participation in non-farm activities contributes to poverty reduction and improved welfare outcomes among rural households. Educational attainment was also found to exert a strong positive influence on household income and well-being, indicating that households with better-educated heads are more capable of accessing non-farm employment opportunities and utilizing income more efficiently. This supports the conclusions of Adepoju and Obayelu (2013), who emphasized the role of education in facilitating entry into higher-return non-farm livelihoods. Additionally, membership in cooperative societies positively influenced household income and well-being. Cooperative participation likely enhances access to business opportunities, savings mechanisms, and credit facilities, thereby supporting income diversification and financial stability. These findings are consistent with Nnadi *et al.* (2013) and Ogunniyi *et al.* (2018), who highlighted the importance of collective action and social capital in improving rural livelihood outcomes.

In contrast, household size and distance to market exhibited negative relationships with per capita income. Larger household sizes may increase consumption pressures relative to income, while greater distances to markets limit households' access to economic opportunities and raise transaction costs. These constraints mirror the observations of Ayanlade *et al.* (2017) and FAO (2014), who identified demographic pressures and market accessibility as significant determinants of rural household welfare. Overall, the results suggest that non-farm activities are not merely supplementary income sources but are central to improving the economic resilience and well-being of rural households in Kebbi State. Promoting livelihood diversification through targeted skills development, improved market access, and enhanced credit facilitation is therefore essential for raising living standards and strengthening household resilience in rural communities.

Table 5: Household Resilience Levels Based on Livelihood Diversification (N = 348)

Number of Income Sources (NIS)	Low Resilience (%)	Moderate Resilience (%)	High Resilience (%)	Total (%)
1 (No diversification)	54.8	40.3	4.9	100%
2	29.1	54.7	16.2	100%
3	11.8	52.9	35.3	100%
≥4	6.5	28.3	65.2	100%

Source: Field Survey, 2025

The results presented in Table 5 reveal a clear and systematic relationship between the level of livelihood diversification and household resilience to climate change. Households dependent on a single income source predominantly farming recorded the highest incidence of low resilience, with 54.8% classified within this category, indicating pronounced vulnerability among households relying exclusively on climate-sensitive agricultural activities. In contrast, household resilience increased progressively with the number of income sources. Notably, 65.2% of households engaged in four or more income-generating activities were classified as highly resilient, while only 6.5% fell within the low-resilience category. These findings provide strong empirical evidence that livelihood diversification significantly enhances household resilience to climate-related shocks. The observed pattern

suggests that as households broaden their income portfolios beyond farming to include activities such as petty trading, artisanal work, and remittance inflows, they are better positioned to absorb and recover from climatic disturbances, including droughts, flooding, and crop failure. This result is consistent with Ellis (2000), who emphasized that the integration of farm and non-farm activities is central to the development of resilient rural livelihoods. Similarly, Barrett *et al*. (2001) argued that diversified income structures reduce household vulnerability to environmental and market-related shocks by spreading risk across multiple income streams.

The findings further align with empirical evidence reported by Bryan *et al*. (2009), who demonstrated that engagement in multiple income sources particularly non-farm activities was significantly associated with improved food security and enhanced adaptive capacity among rural households in Ethiopia and South Africa. Within the context of Kebbi State, where livelihoods are largely dependent on climate-sensitive agricultural production, diversification into non-farm activities serves a critical buffering function by ensuring more stable income flows during agricultural off-seasons and periods of climatic stress. This observation reinforces the conclusions of Adger (2006), who identified livelihood diversification as a fundamental strategy for climate change adaptation in vulnerable rural environments.

Nonetheless, the literature also highlights potential limitations to diversification strategies. Scoones (2009) cautioned that excessive or poorly planned diversification may dilute household effort and yield diminishing returns, particularly in contexts characterized by limited capital, inadequate skills, or restricted market access. Such conditions may lead to labor overextension without commensurate improvements in welfare outcomes. Despite these concerns, the evidence from this study indicates that, within rural Kebbi State, moderate to extensive livelihood diversification is strongly associated with higher levels of household resilience, underscoring its relevance and effectiveness as a viable climate change adaptation strategy.

Table 6: Challenges Faced by Rural Households in Diversifying Livelihoods (N = 348)

Challenges	Frequency	Percentage (%)
Lack of access to credit/financial services	214	61.5%
Poor infrastructure (e.g., roads, electricity)	189	54.3%
Inadequate skills or vocational training	172	49.4%
Limited access to markets	167	48.0%
High cost of inputs and equipment	148	42.5%
Insecurity/banditry in rural areas	121	34.8%
Cultural/gender-based restrictions	86	24.7%
Time and labor constraints	74	21.3%

Source: Field Survey, 2025

Results in Table 6 reveal that the most frequently reported constraint to livelihood diversification was limited access to credit, cited by 61.5% of respondents. This was followed by poor rural infrastructure (54.3%) and inadequate skills or vocational training (49.4%). These findings highlight the structural constraints confronting rural households as they attempt to engage in non-farm or alternative livelihood activities. The challenge of limited access to credit corroborates the findings of Ellis and Freeman (2004) and Barrett *et al.* (2001), who emphasized that financial capital is fundamental for the acquisition of productive assets, inputs, and the establishment of new income-generating ventures. In the absence of affordable and accessible credit facilities, rural households remain constrained in their ability to invest in non-farm livelihoods. Inadequate infrastructure particularly poor road networks and unreliable electricity supply further restricts livelihood diversification by limiting the transportation of goods to markets and reducing opportunities for value-added activities such as agro-processing. Consistent with this finding, Dercon *et al.* (2009) observed that households located in remote or poorly connected areas are significantly less likely to participate in profitable diversification due to transport constraints and limited market accessibility. Similarly, the lack of vocational and technical skills, reported by 49.4% of respondents, undermines households' capacity to engage in trades such as tailoring, repair services, crafts, and ICT-related enterprises. This supports the argument of Kristjanson *et al.* (2012), who identified skill acquisition as a critical driver of adaptive capacity in climate-vulnerable rural communities.

Market-related constraints also featured prominently, with 48.0% of respondents identifying limited market access as a major barrier to diversification. Restricted demand, poor market integration, and intense competition within rural markets often diminish the profitability of non-farm enterprises, even where households are willing to diversify. This observation aligns with Haggblade *et al*. (2010), who noted that weak market linkages frequently undermine the success of rural non-farm livelihood strategies. Insecurity and rural banditry, cited by 34.8% of respondents, particularly in parts of Kebbi State and the wider North-Western region of Nigeria, further exacerbate livelihood constraints by restricting mobility, discouraging private investment, and limiting the expansion of rural enterprises. This finding echoes the work of Okoli and Okpaleke (2014), who documented the adverse effects of rural insecurity on livelihood sustainability in Northern Nigeria. Additionally, cultural and gender-based barriers were reported by 24.7% of respondents, reflecting persistent inequalities in access to land, finance, and public spaces for economic engagement, especially among women. As noted by Quisumbing *et al*. (2015), entrenched gender norms continue to shape and constrain diversification opportunities within rural economies.

Conclusion/Recommendations

The study concludes that livelihood diversification constitutes a critical strategy for strengthening household resilience to climate change impacts in rural Kebbi State. Households engaged in multiple income-generating activities demonstrated a greater capacity to absorb and recover from climate-induced shocks, sustain food security, and stabilize household income. Despite these benefits, the scope and effectiveness of diversification efforts are constrained by several socio-economic and structural barriers. Enhancing the adaptive capacity of rural households and ensuring sustainable livelihoods under increasing climate variability therefore requires coordinated and multi-sectoral interventions, particularly in infrastructure development, financial inclusion, capacity building, and security enhancement. Based on these findings, the study recommends that Federal and State Governments, in collaboration with Microfinance Institutions, Non-Governmental Organizations, and rural cooperative societies, should promote improved access to rural credit by designing and implementing flexible, low-interest loan schemes targeted at small-scale farmers and rural entrepreneurs. Such initiatives would significantly enhance households' ability to diversify their livelihood portfolios. Furthermore, the Federal Ministry of Works and Housing, alongside State and Local Governments and development partners such as the World Bank and IFAD, should prioritize the provision and rehabilitation of rural infrastructure including feeder roads, electricity, potable water, and information and communication technology (ICT) services to improve market access and stimulate engagement in non-farm livelihood activities.

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