

Research Article

Livelihood and Income Diversification among Rural Households in Kaduna State, Nigeria: Evidence from Simpson's Diversity Index

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ABSTRACT

Rural households often combine agricultural and non-agricultural activities to reduce livelihood risk and stabilize income. This study assessed the extent and spatial pattern of livelihood and income diversification among rural households in Kaduna State, Nigeria, using household survey data collected across nine local government areas (LGAs) in three senatorial districts. A multistage sampling procedure produced a target sample of 400 households; Simpson's index of diversity (SID) analysis included 382 households with complete income information. Household income was grouped into agricultural and non-agricultural sources, and the SID was used to measure the number and relative distribution of income sources. Agricultural activities accounted for 71.6% of total household income, while non-agricultural activities contributed 28.4%. The unweighted mean of the three district-level SID values was 0.372, corresponding to moderate diversification in the study classification. Kaduna North recorded the highest district-level SID (0.512), followed by Kaduna Central (0.340) and Kaduna South (0.263). At the household level, 37.4% had low diversification, 31.8% had moderate diversification, 18.6% had high diversification, 5.2% had very high diversification, and 7.0% had very low diversification. The findings show that diversification is widespread but uneven, while agriculture remains the dominant livelihood base. Policies that improve access to productive nonfarm opportunities, finance, skills, markets, and rural infrastructure may help households move from low-return coping activities toward more stable and remunerative livelihood portfolios.

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1 Introduction

Rural livelihood diversification has become a central feature of household economic strategies across much of the developing world. Rather than relying exclusively on a single occupation or income source, rural households usually combine crop and livestock production with wage employment, petty trade, processing, transport, artisanal work, remittances, and other nonfarm activities (Kehinde et al., 2026). Diversification can reduce exposure to agricultural seasonality and production shocks, smooth consumption, and strengthen livelihood security; however, it may also reflect distress where households enter low-return activities because farming alone cannot meet basic needs (Anderzén et al., 2020; Barrett et al., 2001). The developmental significance of diversification therefore depends not only on the number of activities undertaken but also on the productivity, stability, and relative contribution of those activities to total household income (Degefu, 2025).

The distinction between necessity-driven and opportunity-driven diversification is particularly relevant in sub-Saharan Africa, where rural households operate within highly variable climatic, market, and institutional environments. Constraints in credit and labor markets, limited infrastructure, land pressure, seasonality, and exposure to production risk can push

households toward multiple low-return activities, whereas improved education, assets, finance, infrastructure, and market integration can enable them to move into more remunerative nonfarm enterprises (Sankey et al., 2023; Haggblade et al., 2007). Consequently, a diversified livelihood portfolio should not automatically be interpreted as evidence of improved welfare. The distribution of income across activities and the economic quality of those activities are equally important.

In Nigeria, agriculture remains fundamental to rural livelihoods, but farm households increasingly combine agricultural and non-agricultural sources of income (Maje et al., 2026). Empirical evidence has demonstrated considerable variation in the extent and characteristics of this diversification. For example, Fabusoro et al. (2010) reported moderate livelihood diversification among rural households in Ogun State, while Sallawu et al. (2016) found that despite widespread participation in nonfarm activities, farm income remained dominant among sampled households in Niger State. More recent national panel evidence also shows that household assets, education, household composition, access to credit, road accessibility, and geographical location shape diversification patterns (Chukwu & Chukwu, 2023). These findings reinforce the view that livelihood diversification

is spatially differentiated and conditioned by households' access to productive assets and opportunities.

Kaduna State provides an important setting in which to examine these processes. Its rural economy combines crop and livestock production with trading, crafts, transportation, services, wage employment, natural-resource activities, and remittance-based income (Adamu et al., 2021). Previous research in parts of Kaduna State has shown that nonfarm activities make meaningful contributions to rural household income and that participation differs according to household resource endowments and livelihood circumstances (Madaki & Adefila, 2014). Nevertheless, evidence remains limited on how evenly household income is distributed across livelihood sources and how the degree of diversification varies across the state's major geographical divisions.

A further methodological issue concerns how diversification is measured. Simple counts of livelihood activities indicate the breadth of household participation but do not reveal whether income is concentrated in one dominant source or distributed relatively evenly across several sources. Distribution-sensitive measures such as Simpson's index of diversity (SID) address this limitation by incorporating both the number of income sources and the proportional contribution of each source to total household income. Higher SID values indicate a more even distribution of income across multiple sources, whereas values approaching zero indicate concentration in one or very few sources (Minot et al., 2006). This makes SID particularly useful for distinguishing nominal participation in several activities from substantive income diversification.

Given this background, this study examines livelihood and income diversification among rural households in Kaduna State, Nigeria. Specifically, it identifies the composition of agricultural and non-agricultural income, measures the degree of household income diversification using Simpson's index of diversity, and compares the diversification patterns across the three senatorial districts and selected local government areas. By combining household income shares with a distribution-sensitive diversification index, this study provides evidence on both the structure and spatial variation of rural livelihood portfolios. The analysis is descriptive and comparative and does not infer causal effects between diversification and household welfare.

1.1 Conceptualizing Rural Livelihood Diversification

Livelihood diversification refers to the process through which rural households construct and continually adjust portfolios of activities, assets, and income sources in response to changing opportunities, constraints, and risks (Abdeshahi et al., 2026). It therefore extends beyond

the simple coexistence of several occupations: It reflects strategic decisions about how household labor, land, capital, skills, and social networks are allocated across farm, nonfarm, wage, self-employment, and transfer-based activities. Ellis (2000) conceptualizes diversification as a dynamic livelihood process through which rural households seek to improve their livelihood security and living standards, whereas Barrett et al. (2001) emphasize that asset, activity, and income diversification are closely interconnected dimensions of rural livelihood strategies.

The motives for diversification are commonly understood in terms of "push" and "pull" processes. Push or necessity-driven diversification arises when households seek additional income sources because agriculture alone cannot provide adequate or stable livelihoods (Werdofa et al., 2024). Seasonality, climatic variability, declining farm productivity, land constraints, imperfect credit and insurance markets, unemployment, and household shocks can therefore compel households to enter supplementary activities (Girard et al., 2021). Pull or opportunity-driven diversification, by contrast, occurs when households respond to attractive returns outside their principal livelihood activity, including opportunities created by expanding markets, infrastructure, education, technology, rural–urban linkages, and growth in the rural nonfarm economy (Haggblade et al., 2007; Loison, 2015). This distinction is important because the existence of multiple income sources does not, by itself, indicate improved welfare.

Diversification can consequently produce different livelihood outcomes across households. Poorer households may be concentrated in low-entry-barrier and low-return activities, whereas households with stronger asset endowments, education, capital, market access, and social networks may gain access to more remunerative opportunities (Barrett et al., 2001; Loison, 2015). Measurements should therefore capture not only the number of livelihood activities but also the distribution of income among them. In this study, diversification is assessed from realized household income shares using Simpson's Index of Diversity (SID). The index incorporates both the number of income sources and the relative evenness of income across those sources, thereby distinguishing households whose earnings are concentrated in one activity from those with more balanced income portfolios. This income-based perspective is particularly suitable for the present study because the objective is to compare the extent and spatial pattern of household income diversification across Kaduna State rather than to infer causal effects on household welfare.

1.2 Global Comparative Literature on Livelihood Diversification

1.2.1 Sub-Saharan Africa: Survival-Oriented Diversification

Livelihood diversification is widespread across Sub-Saharan Africa, but its form and economic significance are highly heterogeneous. Rural households typically combine crop production and livestock with petty trade, wage labor, services, migration, natural-resource extraction, and other nonfarm activities. Much of this diversification has historically been associated with exposure to agricultural seasonality, climatic risk, imperfect markets, limited insurance, and constrained access to productive assets (Barrett et al., 2001; Loison, 2015). Under such conditions, diversification often functions as a mechanism for income smoothing and risk management rather than as an unambiguous transition away from agriculture.

The welfare implications of diversification therefore depend on the type and quality of activities available to households. Barrett et al. (2001) show that access to attractive nonfarm opportunities is uneven because entry into higher-return activities frequently requires education, skills, finance, infrastructure, or other assets that poorer households possess in limited quantities. Loison (2015) similarly distinguishes survival-led diversification, in which households enter low-return activities because of livelihood pressure, from opportunity-led diversification associated with accumulation and improved economic prospects. Consequently, a highly diversified livelihood portfolio may indicate resilience and opportunity in one setting but vulnerability and livelihood stress in another.

This distinction is directly relevant to the Kaduna State context. The present study identifies several agricultural and non-agricultural income sources, yet agriculture contributes 71.6% of total household income. The coexistence of livelihood multiplicity with continued agricultural dominance suggests that diversification should not be interpreted simply as deagrarianization. Rather, non-agricultural activities may complement farming by spreading risk, filling seasonal income gaps, and providing additional cash income. The extent to which such activities represent survival responses or pathways to accumulation depends on their returns and on households' access to productive assets and enabling institutions.

1.2.2 South and Southeast Asia: Transformational Diversification

In South and Southeast Asia, livelihood diversification has increasingly been associated with broader processes of rural economic transformation. Although necessity-driven diversification remains important, the expansion of rural industries, transport networks, education, market access, and linkages between agriculture and the

nonfarm economy has created opportunities for households to move into wage employment, enterprise, processing, trade, and services. Lanjouw and Feder (2001) argue that the rural nonfarm economy can play important roles in employment generation, income growth, and poverty reduction, particularly where households are connected to expanding markets.

The Asian experience also illustrates that agricultural and non-agricultural livelihoods should not necessarily be treated as competing sectors. An increase in agricultural productivity can stimulate demand for processing, transport, commerce, construction, and services, whereas nonfarm earnings may provide capital for investment in agriculture. Haggblade et al. (2007) therefore situate rural nonfarm development within a wider process of structural transformation in which improved infrastructure and market integration increase the range and productivity of livelihood opportunities. Compared with predominantly distress-driven diversification, this pattern demonstrates how enabling conditions can shift diversification toward higher-return and opportunity-led activities.

1.2.3 Latin America: Mixed Diversification Pathways

Latin America presents a more mixed diversification pathway in which agriculture, rural wage employment, migration, remittances, and nonfarm enterprises interact within increasingly connected rural and urban economies. This region demonstrates that livelihood diversification can emerge simultaneously from economic opportunity and livelihood pressure. Rural households located close to markets or possessing stronger human and physical assets may access relatively productive nonfarm activities, whereas resource-constrained households may depend on temporary employment, migration, or other lower-return activities.

Evidence from rural Peru illustrates this differentiated pattern. Escobar (2001) reported that participation in nonfarm activities is shaped by household assets and access to public and private infrastructure, indicating that diversification opportunities are not distributed uniformly across space or socioeconomic groups. The Latin American experience consequently reinforces a central point in the diversification literature: the welfare significance of diversification depends less on the mere number of activities than on their productivity, accessibility, stability, and relationship to household assets.

1.2.4 Comparison synthesis

The comparison synthesis is shown in Table 1.

Table 1: Global Comparison of Livelihood Diversification Patterns

Dimension	Sub-Saharan Africa	South & Southeast Asia	Latin America
Dominant driver	Push (distress)	Pull (opportunity)	Mixed
Income structure	Agriculture-dominated	Diversified nonfarm	Mixed
Nonfarm income share	20–40%	40–60%+	Moderate–high
Activity type	Informal, low-return	Higher-return activities	Mixed
Infrastructure	Weak	Strong	Moderate
Market integration	Limited	High	Moderate–high
Welfare impact	Limited	Positive	Uneven
Inequality effects	High	Moderate	High

Taken together, the comparative evidence indicates that rural livelihood diversification is not a uniform development pathway. Across regions, households diversify in response to different combinations of risk, asset constraints, market opportunities, infrastructure, institutional conditions, and stages of structural transformation (Ellis, 2000; Barrett et al., 2001; Haggblade et al., 2007; Loison, 2015). The contrast between survival-led and opportunity-led diversification is therefore more analytically useful than treating diversification itself as inherently beneficial. Table 1 summarizes these broad regional tendencies; they should be interpreted as comparative patterns rather than fixed characteristics of every household or locality within each region.

1.2.5 Nigerian Context

Nigeria reflects many of the characteristics observed elsewhere in Sub-Saharan Africa: rural households commonly combine farming with nonfarm activities, but agriculture remains central to livelihoods, and access to remunerative alternatives is uneven. Earlier evidence from Kaduna State shows that nonfarm activities make important contributions to rural household income and that households participate in these activities for both risk-management and income-enhancement purposes (Madaki & Adefila, 2014). Such patterns are consistent with the broader argument that poorer households may diversify because of livelihood pressure, whereas better-endowed households are more capable of entering activities with higher capital requirements and returns (Barrett et al., 2001; Ellis, 2000).

Despite the established importance of livelihood diversification in Nigeria, greater attention should be given to its subnational and spatial differentiation. State-level averages can conceal substantial variation in livelihood opportunities arising from differences in market access, infrastructure, agricultural potential, settlement systems, and household asset endowments.

Kaduna State provides a useful setting for examining this issue because its rural economy spans different Senatorial districts and combines agricultural livelihoods with a range of non-agricultural activities. The present study therefore compares the extent of income diversification across households, senatorial districts, and selected local government areas using income shares and Simpson's index of diversity. In doing so, it contributes geographically disaggregated evidence on the structure of rural livelihood diversification while avoiding the assumption that diversification automatically translates into higher welfare.

1.3 Theoretical Framework

This study is guided by the sustainable livelihoods' framework developed in the rural livelihoods' literature (Scoones, 1998; Ellis, 2000). The framework views livelihood outcomes as the product of household access to assets and how social relations, institutions, organizations, and vulnerability conditions shape livelihood strategies. In rural settings, households may combine natural-resource-based activities such as crop and livestock production with nonnatural-resource activities such as trade, wage employment, services, crafts, and remittances. Diversification can therefore represent either a response to shocks and constraints or a strategy for improving income and livelihood security. In this study, the framework provides the conceptual basis for examining the composition and diversity of household income portfolios, while SID operationalizes the degree to which income is distributed across multiple sources.

2 Materials and Methods

2.1 Study Area

Kaduna State is geographically positioned between latitudes 9°02'N and 11°32' North of the Equator and longitudes 6°15'E and 8°50' East of the Greenwich Meridian (Figure 1). It shares borders with Katsina, Zamfara, and Kano States to the north; Niger State to the west; Bauchi State to the east; and Plateau, Nasarawa States, and the Federal Capital Territory (Abuja) to the south. The state occupies an estimated land area of approximately 43,460 km², representing approximately 4.7% of Nigeria's total landmass.

The study area experiences a tropical continental climate characterized by distinct seasonal variations driven by the interaction of two primary air masses: a warm, moist tropical maritime (mT) air mass originating from the Atlantic Ocean, which results in southwest monsoon winds, and a dry, stable tropical continental (cT) air mass from the Sahara Desert, which is responsible for dry Harmattan winds (Ahmad et al., 2025; Bello et al., 2026). The seasonal rainfall pattern is governed by the shifting boundary between these air masses, known as the Intertropical Discontinuity (ITD) (Abdullahi et al., 2023).

The temperatures remain high year-round, which is characteristic of tropical climates, with the hottest period occurring just before the rainy season, around March to April (Ahmad et al., 2025). The dry Harmattan months (December–January) result in cooler temperatures, sometimes as low as 11°C, because of low humidity and dusty northeast winds from the desert (Ahmad et al.,

2025). The relative humidity ranges from 70–90% during the wet season to 25–30% during the dry season (Mohammed & Bello, 2021). Evapotranspiration rates are notably high during the dry season, contributing to water shortages, especially in northern local government areas (Yakubu et al., 2022).

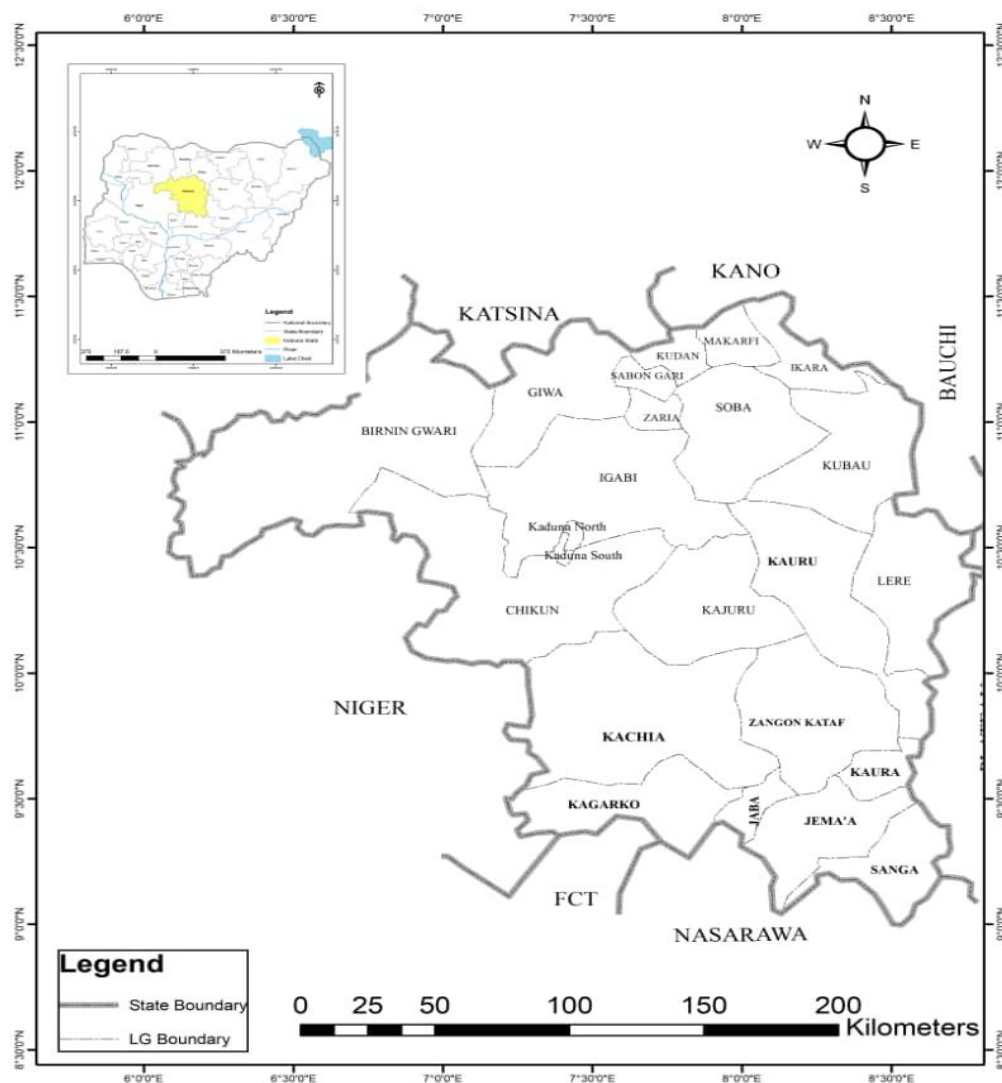


Figure 1: Study Area (Kaduna State)

Source: Adapted from the Administrative Map of Kaduna State, 2021.

Kaduna State is located within the Guinea savanna ecological zone and is characterized predominantly by deciduous woodland vegetation, with leaves being shed during the dry season to conserve moisture (Usman et al., 2022). The state is among the most densely populated states in Nigeria. The state is the largest in the Northwest geopolitical zone in terms of land area and is the second most populous state in the zone (NPC, 2006). This is a result of the liberal nature of the state, as it accommodates all kinds of people. It has a population of more than 6 million people (NPC, 2006). Some of the major ethnic groups are Hausa, Fulani, Bajju, Ham, Atyap, Ikulu,

Agrok, Atakad, Adara, Chawai, Ninzo, Numana, Gbagyi, Kurama, and Rumaya, among others.

2.2 Research Design

A reconnaissance survey was conducted to improve familiarity with the study area, household livelihood activities, village conditions, and practical requirements for field data collection. Local authorities in the selected areas were informed about the study, and field arrangements took into account security conditions and language differences across the sampled communities.

2.3 Sampling Technique and Sample Size

A multistage sampling procedure was used. In the first stage, nine LGAs were purposively selected to capture areas with diverse rural livelihood and income-generating activities across the three senatorial districts: Soba, Kubau and Lere in Kaduna North; Chikun, Igabi and Kajuru in Kaduna Central; and Kauru, Zangon-Kataf and Kaura in Kaduna South. In the second stage, four villages were purposively selected from each LGA on the basis of the presence of agricultural and non-agricultural livelihood activities. In the third stage, household heads were randomly identified within the selected villages with the assistance of local guides. Three trained research assistants worked in each senatorial district, and interpreters were used where necessary. Because LGAs and villages were purposively selected, the findings are most directly representative of the sampled communities and should not be interpreted as a probability estimate for every rural household in Kaduna State.

2.4 Study population

The household population used for sample size determination was based on the official projection of the Kaduna State Bureau of Statistics (KDBS, 2015). The projected household population for the selected LGAs was 676,118. This official projection was adopted as the sampling population for the study rather than independently estimating the current household population from the 1991 census figures.

Using the KDBS (2015) projected household population, Yamane's (1967) formula at a 5% margin of error was applied to obtain a target sample of approximately 400 households. The sample was then allocated across the selected LGAs and villages using the household counts available in the sampling frame.

$$n = \frac{N}{1 + N(e)^2}$$

where n = the sample size

N = Population size of the selected LGAs

1 = a constant

e = Level of significance (0.05)

n = 400

The resulting target sample size was 400 households. Of these, 382 households had complete income information for the SID analysis; the remaining 18 cases were excluded from that specific analysis because complete income-share information was unavailable.

To determine the proportion of the number of questionnaires to be administered to each LGA sample for the research, the following formula was adopted.

$$\text{Sample Size per LGA} = \frac{\text{Selected LGAs Population} \times \text{Total Sample Size for the State}}{\text{Total Population of the Selected LGAs}}$$

To determine the number of questionnaires to be administered to the sampled villages, the total number of

households in that particular village is sourced from the village heads. The total number of questionnaires administered to the LGA of that village was used as the sample size for that particular village, and the number of each village was given by the following formula:

$$\text{Sample size per Village} = \frac{\text{Selected Village's Population} \times \text{Total Sample Size of the LGA}}{\text{Total Selected LGA Population}}$$

The three senatorial districts and their constituent LGAs are shown in Table 2.

Table 2: Senatorial Districts and Local Government Areas

Kaduna North	Kaduna Central	Kaduna South
Zaria	Kajuru	Kachia
Sabon Gari	Chikun	Kagarko
Kudan	Kaduna North	Jama'a
Makarfi	Kaduna South	Kauru
Ikara	Birnin Gwari	Kaura
Kubau	Igabi	Zangon-Kataf
Soba	Giwa	Jaba
Lere		Sanga

Source: Field Survey, 2021

Selected LGAs

Figure 2 presents the LGAs in the three Senatorial districts of Kaduna State. Three LGAs were sampled from each district, yielding nine sampled LGAs in total.

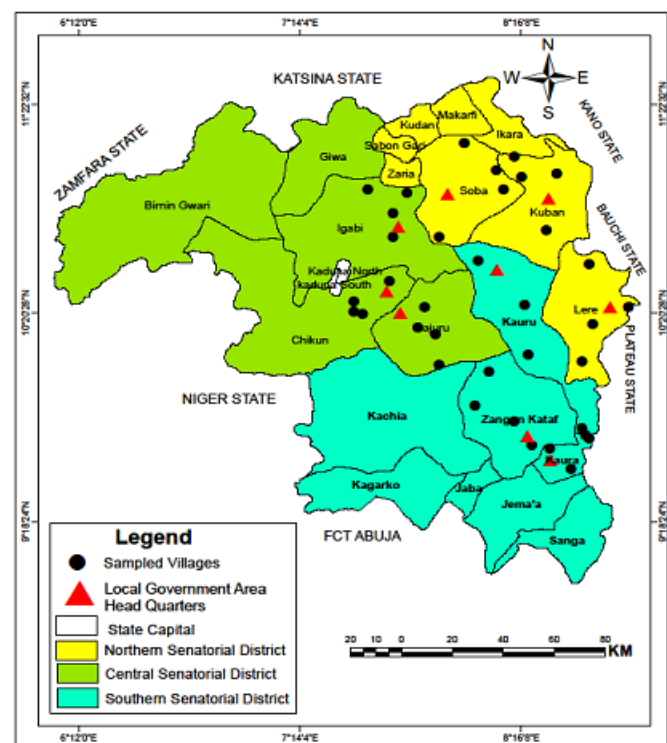


Figure 2: Kaduna State showing the Senatorial Districts and the Sampled Villages

The selected senatorial districts, LGAs, villages, household-frame counts, and allocated sample sizes are presented in Table 3.

Table 3: Sample Size by Local Government Area and Village

S/N	Senatorial District	LGAs	Sample Size by Villages	No. of Households (1991)	Projected No. of Households (2020)	Sample Size
1	Northern Senatorial District	Soba (Maigana)	Ungwan Dan Kande	36	82	11
			Kwasallo	35	80	10
			Gamagira	34	78	10
			Dan Wata	33	76	10
		Kubau (Anchau)	Ungwan Masaka	41	93	11
			Kurfi	29	66	8
			Kuraye	42	97	12
			Kare	39	88	10
		Lere (Saminaka)	Ishemi	25	57	11
			Gurjia	27	62	12
			Gunji	34	77	14
			GoronDutse	25	58	11
Total	3	12	400	914	130	
2	Central Senatorial District	Chikun (Kujama)	GidanAngo	36	83	20
			Chidunu	21	48	12
			Bugai	31	71	17
			Kankomi	39	90	22
		Igabi (Turunku)	Ibada	44	101	22
			Dunki	35	79	18
			Baushe	24	54	12
			Amana	51	117	26
		Kajuru (Kajuru)	Iburu	39	89	10
			Agunu	38	86	10
			Afago	28	65	7
			Kurmi	26	60	7
Total	3	12	412	943	183	
3	Southern Senatorial District	Kauru (Kauru)	Makami	45	102	8
			Kaguta	32	73	5
			Kusheka	49	112	9
			Pari	34	77	6
		Zangon (Zonkwa)	KurminMazuga	53	121	11
			Kankada	44	100	9
			GidanGajere	40	92	8
			Fadiya Mugu	26	60	6
		Kaura (Kaura)	Mafan	17	38	3
			Kizanche	30	69	6
			Bandan	43	99	9
			Matagami	36	82	7
Total	3	12	449	1025	87	
Total	3	9	36	1261	2880	400

The study covered all three senatorial districts, nine of the state's 23 LGAs, 36 villages, and a target sample of 400 households. The distribution of the sample reflects the multistage allocation procedure described above.

2.5 Types and Sources of Data Used for the Study

The household survey collected information on household composition and socioeconomic characteristics; income earned from different agricultural and nonagricultural activities; factors associated with livelihood diversification; livelihood strategies and motivations; livelihood constraints; sources of finance; and perceived opportunities for income-generating

activities. The present analysis focuses primarily on household income composition and the extent of income diversification.

Primary data were obtained through a structured household questionnaire and field observation. Secondary information was drawn from relevant government documents and published literature.

Population and household projection data used for sample planning were obtained from the Kaduna State Bureau of Statistics (KDBS, [2015](#)), while administrative mapping information was obtained from Kaduna State government sources. Published studies, official reports, and related literature were used to provide conceptual

and contextual background.

2.6 Data Analysis

The analysis was conducted using descriptive statistics and Simpson's index of diversity (SID). Frequencies, percentages, and mean values were used to summarize household characteristics and income patterns. Total household income was defined as the sum of income received from the recorded livelihood activities. For each household, the share contributed by each income source was calculated relative to total household income. Agricultural and non-agricultural income shares were then summarized for the study sample. Because the manuscript does not report a multivariable or experimental identification strategy, the results are interpreted as descriptive associations and spatial comparisons rather than causal effects.

The Total Household Income is given as:

$$THI = \sum_i I_i$$

where I_i is income from livelihood activity i .

For each income source, the household income share is

$$p_i = \frac{I_i}{THI}$$

Livelihood diversification reflects both the number of income sources and the evenness with which income is distributed across those sources.

Simpson's index of diversity was used because it incorporates both dimensions and provides a bounded measure that is straightforward to compare across households and areas (Minot et al., 2006; Joshi et al., 2006). The index was calculated as follows:

$$SID = 1 - \sum_i p_i^2$$

where SID is Simpson's index of diversity and p_i is the proportion of total household income derived from source i .

The SID ranges from 0 to 1. A value of 0 indicates complete concentration in a single income source, whereas larger values indicate a more diversified and more evenly distributed income portfolio.

For interpretation, household SID values were grouped as follows:

- i. Very low or no diversification: $SID \leq 0.01$
- ii. Low diversification: $0.01 < SID \leq 0.25$
- iii. Moderate diversification: $0.25 < SID \leq 0.50$
- iv. High diversification: $0.50 < SID \leq 0.75$
- v. Very high diversification: $SID > 0.75$

The household income portfolio included crop production, livestock, manufacturing/crafts,

trade/commerce, construction, transportation, services/repairs, natural-resource extraction, wage income, remittances/salaries/pensions, and other income-generating activities recorded in the survey.

3 Results

3.1 Composition of Agricultural and Non-agricultural Household Income

The composition of household income shows that agriculture remained the principal livelihood base among the surveyed rural households (Table 4). Agricultural activities accounted for 71.6% of total household income, while non-agricultural activities contributed 28.4%. Thus, almost three-quarters of the reported income was derived from agricultural sources.

Table 4: Composition of Household Income by Major Source

Income category	Share of total household income (%)
Agricultural income	71.6
Non-agricultural income	28.4
Total	100.0

The results demonstrate the continued importance of agriculture to rural livelihoods in the sampled communities. Non-agricultural income nevertheless accounted for more than one quarter of total income, indicating that nonfarm activities constituted an important supplementary component of household livelihood portfolios. These percentages represent the aggregate composition of reported income and should not be interpreted as the proportion of households participating in agricultural or non-agricultural activities.

3.2 Income Diversification among Rural Households

Table 5 shows that livelihood diversification was widespread but generally modest among the 382 households with complete income information. Only 7.0% reported very low or no diversification. Low diversification was the largest category (37.4%), followed by moderate (31.8%), high (18.6%), and very high diversification (5.2%). Thus, 55.6% of households fell within the moderate-to-very-high categories, whereas 44.4% were in the very-low or low categories. The distribution indicates that most households combined more than one livelihood source, but relatively few had highly diversified and evenly distributed income portfolios.

Table 5: Level of Diversification

SID Range	Unweighted Mean of District SIDs	Percentage	Extent of Diversity
≤ 0.01	0.372	7.0	Very low
> 0.01–≤ 0.25	—	37.4	Low
> 0.25–≤ 0.50	—	31.8	Moderate
> 0.50–≤ 0.75	—	18.6	High
> 0.75	—	5.2	Very high
Total	—	100.0	

3.3 Spatial Variation in Income Diversification

From Table 6, across the three Senatorial districts, the unweighted mean of the reported district-level SID values was 0.372. This value is the arithmetic mean of Kaduna North (0.512), Kaduna Central (0.340), and Kaduna South (0.263); it should therefore be interpreted as a summary of the three district-level values rather than as a household-level mean SID for the study sample.

Kaduna North also recorded the highest reported mean income (₦2,674,459), followed by Kaduna Central (₦2,258,429) and Kaduna South (₦2,012,398). These aggregated observations show spatial covariation between reported mean income and diversification, but they are not sufficient to establish that diversification causes higher household income.

Table 6: Degree of Income Diversification in Senatorial Districts and LGAs

Senatorial District	State Mean SID	Mean Income (₦)	District SID	LGA	LGA SID
Kaduna North	—	2,674,459	0.512	Lere	0.532
				Kubau	0.512
				Soba	0.493
Kaduna Central	—	2,258,429	0.340	Igabi	0.463
				Chikun	0.308
				Kajuru	0.250
Kaduna South	—	2,012,398	0.263	Kauru	0.322
				Zangon-Kataf	0.206
				Kaura	0.261

Variation was also evident among the sampled LGAs. Lere recorded the highest LGA-level SID (0.532), followed by Kubau (0.512) and Soba (0.493) in Kaduna North. In Kaduna Central, Igabi recorded 0.463, Chikun 0.308, and Kajuru 0.250. In Kaduna South, Kauru recorded 0.322, Kaura 0.261, and Zangon-Kataf 0.206. The results therefore indicate substantial geographic differences in the extent to which household income is distributed across livelihood sources.

4 Discussion

The findings demonstrate that livelihood diversification is widespread among the sampled rural households, but its intensity remains uneven. Although 93.0% of households recorded some degree of diversification, low diversification constituted the largest single category (37.4%), followed by moderate diversification (31.8%), high diversification (18.6%), and very high diversification (5.2%). This pattern indicates that participation in multiple livelihood activities does not necessarily translate into a balanced income portfolio. Many households remain strongly dependent on one or a few dominant sources even while undertaking supplementary activities. This distinction is consistent with the livelihood diversification literature, which emphasizes that diversification can arise either from the

pursuit of higher-return opportunities or from the need to spread risk and compensate for inadequate earnings from a primary livelihood (Ellis, 2000; Barrett et al., 2001; Echebiri et al., 2017).

The continued dominance of agricultural income reinforces this interpretation. Agricultural activities accounted for 71.6% of total household income, compared with 28.4% from non-agricultural sources. Agriculture therefore remains the economic foundation of rural households in the study area, while non-agricultural activities function largely as complementary sources of income (Belonwu, 2024). These results are broadly comparable with evidence from Niger State, where farm income accounted for 63% of sampled household income despite extensive participation in off-farm activities (Sallawu et al., 2016). This differs, however, from findings in Ogun State, where nonfarm activities contributed a substantially larger share of household income, and the overall Simpson diversification index was moderate (Fabusoro et al., 2010). These contrasts highlight the importance of local economic structure, market access, infrastructure, and household asset endowments in shaping the relative importance of the livelihoods of farmers and nonfarmers.

The unweighted mean of the three district-level SID values was 0.372, but this summary should not be

interpreted as a household-level state mean. Nevertheless, the district results show marked spatial variation: Kaduna North recorded an SID of 0.512, followed by Kaduna Central (0.340) and Kaduna South (0.263). Similar variations occurred among the sampled LGAs: Lere recorded the highest SID (0.532), whereas Zangon-Kataf recorded the lowest (0.206). The observed pattern is consistent with the broader proposition that diversification opportunities can vary geographically. National evidence from Nigeria likewise identifies geographical location, access to credit, road connectivity, household assets, education, and demographic characteristics as correlates of off-farm diversification patterns (Chukwu & Chukwu, 2023). Within the sustainable livelihoods framework, these factors provide a useful interpretive context, although the present analysis does not directly test their effects (Scoones, 1998; Ellis, 2000).

Kaduna North also recorded the highest reported mean household income alongside the highest SID, whereas Kaduna South recorded both the lowest district-level SID and the lowest reported mean income. This covariation is noteworthy, but it should not be interpreted as evidence that diversification caused higher income. The analysis is based on aggregated district values and does not control for household characteristics, asset ownership, market accessibility, education, farm size, credit access, or other factors that may influence both income and livelihood choice. Previous studies have shown that the relationship between diversification and welfare is heterogeneous: better-resourced households may diversify into high-return activities as an accumulation strategy, whereas poorer households may diversify into low-return activities primarily for survival and risk management (Barrett et al., 2001; Ellis, 2000). The present findings therefore point to an association requiring household-level multivariable analysis rather than a causal relationship.

The results have important implications for rural development policy. Encouraging households simply to increase the number of income-generating activities is unlikely to be sufficient if additional activities remain low-productivity, unstable, or poorly connected to markets. More consequential interventions are those that improve the quality of livelihood opportunities through access to finance, skills, extension services, transport and market infrastructure, productive technologies, and enterprise support. Such interventions can strengthen agricultural productivity while also lowering barriers to more remunerative nonfarm activities. This interpretation is consistent with evidence that the welfare effects of diversification depend on the returns to available activities and on households' capacity to overcome entry constraints (Fabusoro et al., 2010; Barrett

et al., 2001).

These findings should nevertheless be interpreted within the study's design limitations. The purposive selection of LGAs and villages means that the observed prevalence and degree of diversification should not be treated as statistically representative of every rural household in Kaduna State. In addition, the SID measures the distribution of income across sources but does not, by itself, identify why households diversify or whether diversification improves welfare. Future research should therefore combine household-level diversification indices with multivariable or panel-data models capable of examining the socioeconomic, institutional, and spatial determinants of diversification and its relationships with income, poverty, and livelihood resilience.

5 Conclusion

In this study, livelihood and income diversification among rural households in selected communities across Kaduna State were assessed using Simpson's index of diversity. The findings show that livelihood diversification is widespread but uneven. Among the 382 households with complete income data, low diversification was the largest category, while just over half fell within the moderate-to-very-high diversification categories. Agriculture remained the dominant income base, contributing 71.6% of total household income, compared with 28.4% from non-agricultural activities. Spatially, compared with Kaduna Central and Kaduna South, Kaduna North recorded a higher district-level SID, and substantial differences were also observed among the sampled LGAs.

The results indicate that rural livelihood policy should distinguish between simply participating in multiple activities and gaining access to productive, stable, and remunerative income opportunities. Improving rural finance, skills development, market access, extension support, transport, and other infrastructure can strengthen both agricultural livelihoods and viable non-agricultural activities. Because the sampling of LGAs and villages was purposive and the analysis is descriptive, the findings should not be interpreted as causal estimates for all rural households in Kaduna State. Future research using household-level multivariable models and probability-based sampling would help identify the socioeconomic and institutional factors associated with diversification and test its relationship with household income and welfare.

References

- Abdeshahi, A., Mirzaei, A., & Azarm, H. (2026). Characteristics and factors influencing livelihood diversity in rural and nomadic communities in semi-arid environments. *Journal of Arid Environments*, 235, 105628. <https://doi.org/10.1016/j.jaridenv.2026.105628>
- Abdullahi, M., Musa, S., Yusuf, A., & Bello, R. (2022). Seasonal rainfall variability and agricultural productivity in northern Nigeria. *Climate Research Journal*, 15(1), 34–50.
- Adamu, B. D., Esheya, S. E., & Tanko, F. (2021). Effects of Farm Labour Migration on Crop Productivity Among Farmers in Kaduna State, Nigeria. *Journal of Agripreneurship and Sustainable Development*, 4(3), 109–120. <https://doi.org/10.59331/jasd.v4i3.237>
- Ahmad, M., Ahmed, A. M., Ariko, J. D., & Abdulkadir, H. (2025). Trends of Extreme Temperature and Rainfall Using Innovative Trend Analysis in Kaduna State, Nigeria. *FUDMA Journal of Sciences*, 9(11), 407–420. <https://doi.org/10.33003/fjs-2025-0911-3983>
- Anderzén, J., Guzmán Luna, A., Luna-González, D., Caswell, M., Méndez, V. E., & Morris, K. S. (2020). Effects of on-farm diversification strategies on smallholder coffee farmer livelihoods in Chiapas, Mexico. *Agroecology and Sustainable Food Systems*, 44(6), 759–783.
- Barrett, C. B., Reardon, T., & Webb, P. (2001). Nonfarm income diversification and household livelihood strategies in rural Africa: Concepts, dynamics, and policy implications. *Food Policy*, 26(4), 315–331.
- Bello, N., Balarabe, S. M., & Abubakar, M. L. (2026). Characterization of meteorological drought using SPI and SPEI indices in Kaduna State, Nigeria. *Discover Hazards*, 2(1), 1. <https://doi.org/10.1007/s44475-026-00007-6>
- Belonwu, C. O. (2024). Livelihood diversification as a resilience strategy in rural Nigeria. *Nigerian Journal of Rural Sociology*, 25(1), 47–56.
- Chukwu, N. O., & Chukwu, J. O. (2023). Drivers of households' off-the-farm income diversification patterns in Nigeria: Panel evidence using General Household Survey data. *Journal of Emerging Market Finance*, 28(1), 67–89. <https://doi.org/10.1177/09722661231173122>
- Degefu, S. (2025). Patterns, determinants and contributions of rural livelihood diversification strategies among smallholder farmers in Guliso District, Western Ethiopia. *Discover Sustainability*, 6(1), 1368. <https://doi.org/10.1007/s43621-025-02037-4>
- Echebiri, R. N., Mbanasor, J. A., & Nwosu, I. E. (2017). Patterns and determinants of income diversification among rural farm households in Abia State, Nigeria. *Nigerian Journal of Agriculture, Food and Environment*, 13(2), 53–59.
- Ellis, F. (2000). *Rural livelihoods and diversity in developing countries*. Oxford: Oxford University Press.
- Escobal, J. (2001). The determinants of nonfarm income diversification in rural Peru. *World Development*, 29(3), 497–508.
- Fabusoro, E., Omotayo, A. M., Apantaku, S. O., & Okuneye, P. A. (2010). Forms and determinants of rural livelihoods diversification in Ogun State, Nigeria. *Journal of Sustainable Agriculture*, 34(4), 417–438. <https://doi.org/10.1080/10440041003680296>
- Girard, J., Delacote, P., & Leblois, A. (2021). Agricultural households' adaptation to weather shocks in Sub-Saharan Africa: implications for land-use change and deforestation. *Environment and Development Economics*, 26(5-6), 538–560. <https://doi.org/10.1017/S1355770X2000056X>
- Haggblade, S., Hazell, P., & Reardon, T. (2007). *Transforming the rural nonfarm economy: Opportunities and threats in the developing world*. Baltimore: Johns Hopkins University Press.
- Joshi, P. K., Joshi, L., & Birthal, P. S. (2006). Diversification and its impact on smallholders: Evidence from a study on vegetable production. *Agricultural Economics Research Review*, 19(2), 219–236.
- Kaduna State Government. (2000). *Kaduna State agricultural development report*. Ministry of Agriculture.
- Kaduna State Government. (2000). *Kaduna State Economic Empowerment and Development Strategy (KADSEEDS)*. Ministry of Economic Planning, Kaduna.
- Kaduna State Bureau of Statistics (KDBS). (2015). *Official household population projection used for the study sampling frame*. Kaduna State, Nigeria.
- KDSG (Kaduna State Government). (2014). *Kaduna State Agricultural Development Report*.
- Kehinde, A., Ojo, T., Tijani, A., & Otekunrin, O. A. (2026). Exploring the nexus between financial inclusion, livelihood diversification, and farm income in rural Nigeria. *Frontiers in Sustainable Food Systems*, 10, 1867047. <https://doi.org/10.3389/fsufs.2026.1867047>
- Lanjouw, J. O., & Feder, G. (2001). *Rural non-farm activities and rural development: From experience toward strategy*. World Bank Rural Development Strategy Background Paper, Washington, D.C.
- Loison, S. A. (2015). Rural Livelihood Diversification in Sub-Saharan Africa: A Literature Review. *The Journal of Development Studies*, 51, 1125–1138. <https://doi.org/10.1080/00220388.2015.1046445>
- Madaki, J. A., & Adefila, J. O. (2014). Contributions of non-farm activities to household income in rural areas of Lere Local Government Area, Kaduna State, Nigeria. *Journal of Agricultural Extension and Rural Development*, 6(11), 318–324.
- Madaki, J. A., & Adefila, J. O. (2014). Contributions of rural non-farm economic activities to household income in Lere Area, Kaduna State. *American International Journal of Contemporary Research*, 4(3), 72–80.
- Maje, H. S., Daura, M. M., Boso, B., Adamu, U., & Baba-Adamu, M. (2026). Agricultural Land Access and Livelihood Recovery among Internally Displaced Persons in Yobe State, Nigeria: Evidence from Correlation and Logistic Regression Analysis. *Kaduna Journal of Geography*, 8(1), 257–266. <https://doi.org/10.47514/kjg.2026.08.01.027>
- Minot, N., Epprecht, M., Anh, T. T. T., & Trung, L. Q. (2006). Income diversification and poverty in the Northern Uplands of Vietnam. *International Food Policy Research Institute (IFPRI), Research Report No. 145*.
- Mohammed, A., & Bello, S. (2021). Impact of rainfall variability

- on livestock rearing in northern Nigeria. *Nigerian Journal of Agricultural Meteorology*, 16(1), 40–55.
- National Population Commission (NPC). (2006). *Population and Housing Census of the Federal Republic of Nigeria: National and State Population Totals*. Abuja: National Population Commission.
- Sallawu, H., Tanko, L., Coker, A. A. A., & Sadiq, M. S. (2016). Livelihood and income diversification strategies among rural farm households in Niger State, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology*, 11(4), 1-11. <https://doi.org/10.9734/AJAEES/2016/26010>
- Sankey, A. N., Laah, J. G., Atiyong, B. R., & Wendock, B. N. (2023). Livelihood Challenges and Coping Strategies of The Inhabitants of a Hilly Area: A Study of Mafan Community in Kaura Local Area. *Kaduna Journal of Geography*, 5(1), 13-28. <https://kadunajournalofgeography.org/index.php/kjg/article/view/12>
- Scoones, I. (1998). *Sustainable rural livelihoods: A framework for analysis*. IDS Working Paper 72, Institute of Development Studies, Brighton.
- Usman, J., Musa, A., & Abdullahi, M. (2022). Vegetation and economic trees in Kaduna State: An ecological and socioeconomic analysis. *Environmental Research Letters*, 17(1), 45–58.
- Werdofa, Z. G., Kassahun, S., & Gashu, K. (2024). Household livelihood diversification and its determinant factors in Robe town and its surrounding hinterlands, Bale zone, southeast Ethiopia. *Humanities and Social Sciences Communications*, 11(1), 1744. <https://doi.org/10.1057/s41599-024-04293-7>
- Yakubu, U., Sani, H., & Bello, A. (2022). Rainfall variability and evapotranspiration dynamics in northern Nigeria. *Climate and Environment Journal*, 14(3), 121–136
- Yamane, T. (1967). *Statistics: An Introductory Analysis* (2nd ed.). New York: Harper & Row.