

## LIVELIHOOD DIVERSIFICATION AND INCOME: A CASE STUDY OF COMMUNITIES RESIDENT ALONG THE KIRI DAM, ADAMAWA STATE, NIGERIA

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**Abstract.** This research analysed livelihood diversification and income in resident communities along the Kiri Dam, Adamawa state, Nigeria. The specific objectives of the study were: to describe the socio-economic characteristics of the respondents, assess the level of livelihood diversification of the respondents, analyse income of the respondents, identify factors associated with varying levels of income, and identify constraints to livelihood diversification in the area. A multi-stage sampling technique was used to collect primary data from 120 respondents from the study area. The data collected were subjected to descriptive and inferential statistical analysis. The results showed that the majority of the respondents were male (78%), married (76%), educated (70%), below 60 years of age (93%) and employed in agricultural activities (83%). The Simpson index of diversification shows that 43% of the respondents diversify at an average level. The majority (60%) of the respondents' annual income is over ₦ 200,000. The ordinary least square estimation shows that age, marital status, education, irrigation activities, fishing, farm size and level of diversification affect income level in the area. The main constraints to diversified livelihood in the area were a lack of basic social infrastructure, a hippopotamus menace and flooding. The study recommended the provision of social infrastructure and the control of hippopotamuses.

**Key words:** livelihood diversification, income, Kiri Dam, Adamawa state, Nigeria

### INTRODUCTION

Across the globe, communities employ different livelihood strategies to achieve their diverse livelihood goals. In the last few decades, the use of livelihood approach in assessing the well-being of rural communities has gained much prominence in development discourse. Many scholars from different academic backgrounds have defined the term livelihood. However, most of the definitions considered livelihood as the means of making a living; the various activities and resources that jointly determine the living gained by an individual or a household (Carney, 1998; Oni and Fashogbon, 2013), while livelihood strategies are the range and combination of activities and choices that people make in order to achieve their livelihoods goals (Adger, 2006; Sati et al., 2015). According to Husein and Nelson (1998) and Scoones (1998), a household located in a particular context and economy is usually constrained to choose between three main clusters of livelihood options: agricultural intensification and extensification, livelihood diversification, and migration. These strategies change in response to shifts in a rural household's access to resources and many other external factors. It should be noted that, the main goal of livelihood strategies is to ensure household's economic and social security (Koczberski et al., 2001).

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Recent finding in some parts of the Adamawa state has shown how rural households diversify their livelihood sources for different reasons (Tashikalma et al., 2015). Livelihood diversification refers to attempts by individuals and households to undertake diverse income generating activities (both on- and off-farm activities) over time in order to secure survival and improve standards of living (Ellis, 2000). It is aimed at reducing risk, vulnerability and poverty, increasing income, enhancing security and increasing wealth (Yaro, 2006). However, diversification refers not only to an increase in the number of income sources, but also maintaining a balance among the different sources (Oluwatayo, 2009). Livelihood diversification is inspired by two main factors: the ‘push’ factors or survival-led diversification, and the ‘pull’ factors or opportunity-led diversification (Lay et al., 2008; Loison, 2015). The Push factors are negative factors that may force farm households to seek additional livelihood activities within or outside the farm. Haggblade et al. (2007) outlined the risk associated with agricultural activities (e.g. drought, flooding, pest and diseases etc.) as the push factors. Conversely, when opportunity avail itself to farmers and they decide to take advantage of it not because of any reason other than maximizing gains, such decision is induced by the pull factors. These factors are positive and may provide incentives for farm households to pursue additional livelihood activities to improve their living standards (Loison, 2015). According to Reardon (1997) and Lay et al. (2008), improved technology, expansion of education, proximity to urban centres, improved infrastructure, and new market possibilities are the pull drivers of diversification. In order to use livelihood diversification to secure better living standards, rural households have to be able to generate cash, build assets and diversify across farm and nonfarm activities (Ellis and Freeman, 2004). Livelihood diversification as a strategy and its outcome (income) at the household level depend to a large degree on the amounts and qualities of assets (natural, economic, financial, human and social) owned or those within the reach of households.

In recent past, the policy agenda of agricultural development of most developing nations has evolved from an initial focus on increasing food production to concerns for the environment, poverty and diversified livelihood options (Souvik et al., 2012). The construction of dams in most parts of the world is largely driven by an increasing demand of water from urban and rural

communities for reliable freshwater supply, agricultural irrigation and hydro-electric power (World..., 2000). This resource also attracts tourists and generates employment opportunities for the host communities. Based on this premise, many developing countries and international agencies have undertaken major investments in dam construction (Boateng et al., 2015). However, the social, health and environmental impacts of dams have in too many cases not been assessed in many developing countries (Boateng et al., 2015; Mutangi et al., 2014). Ali et al. (2013) reported that, dam communities in Nigeria have faced the challenges of displacement caused by floods, destruction of arable lands and degeneration of forests and wildlife resources. Similarly, water borne infectious diseases are also common in these dam communities due to frequent exposure to flood waters.

The Kiri dam was constructed to achieve the common objective of providing hydro-electricity, irrigation and water supply through the River Basin Development initiative. The dam was built in the Lower Gongola Basin, Shelleng local government area of Adamawa State, Northeast Nigeria (Adebayo and Yahya, 2015). The dam was largely completed in 1982 and is by far the largest reservoir in the State. The reservoir has a capacity of 615 million m<sup>3</sup>, a land area of about 134 km<sup>2</sup> and irrigable land of about 32,000 ha. Apart from hydroelectricity generation and irrigation, the dam plays a prominent role in the livelihood of its host communities especially in the areas of fishing, recreation, water supply, and flood control (Tukur and Mubi, 2002; Shalangwa et al., 2014). Farming activities in the area are being affected by occasional flood disaster, quelea birds, and activities of hippopotamus; this has seriously affected farmers’ productivity and income (Shalangwa et al., 2014; Tidi and Jummai, 2015).

Considering the status and potentials of this very resource (the dam), the main aim of this study was to assess livelihood diversification and one of its many outcomes (income) in the area. This has a policy implication in terms of improving livelihoods of these communities. It will provide all the key actors in the development of the area with information on policy intervention measures, which could be adopted to promote the well-being of the residents of the area. Against this backdrop, therefore, this paper seeks to specifically to:

- describe the socio-economic characteristics of the respondents

- assess the level of livelihood diversification of the respondents
- analyse income of the respondents
- identify factors associated with varying levels of income in the area
- identify the constraints limiting the undertaking of diverse livelihood activities in the area.

## METHODOLOGY

### Study area

The study was conducted within Shelleng and Guyuk Local Government Areas of the Adamawa state, Nigeria. A local government area is the smallest administrative unit in the country. The dam is located at latitude 9.6797°N and longitude 12.014°E. The area falls within the Northern Guinea Savannah Zone and has a tropical wet and dry climate. Dry season lasts for a minimum of five months (November-March) while the wet season spans April to October. Mean annual rainfall is about 700mm (Adebayo, 1999). The predominant tribes in the area are Kanakuru Lunguda, Ribo, Lala, Yungur, Bura, and the Fulani. The main economic activity of the inhabitants is agriculture.

### Sampling technique

A two-stage sampling technique was used to collect primary data (using questionnaire) from 120 respondents selected randomly from six communities near the dam. These communities included: Baban-Daba, Tallum, Bobbere, Gugu, Tsohon-Banjiram, and Kola-kasa. The respondents were drawn from each community proportionate to its size.

### Analytical technique

Both descriptive and inferential statistics were used to achieve the research objectives of the study. Descriptive statistics was used to describe the socio-economic characteristics of the respondents and constraints they face in their bid to diversify their livelihood sources in the area. Following Sultana et al. (2015), Simpson Index of Diversification (SID) was used to ascertain the level of livelihood diversification among the respondents. Diversification was related to the number of source of income and the balance among them. The index is mathematically expressed as:

$$SID = 1 - \sum P_i^2$$

Where, SID is a measure of income diversification and  $P_i$  is equal to the proportion of income coming from  $i$  source. The value of SID is within the range of 0 and 1. When SID is less than 0.01 (no diversification), SID is equal to 0.01–0.25 (Low diversification), SID is equal to 0.26–0.50 (Average diversification), SID is greater than or equal to 0.51 (High diversification). Multiple Regression Analysis was used to examine the factors associated with varying levels of income in the area. Income of the respondent was used as the dependent variable while their socio-economic variable, as well as other indicator variables, were used as independent variables. The model is specified explicitly as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + U$$

Where:

$Y$  – income (amount in naira)

$\beta_0$  – constant

$X_1$  – age (years)

$X_2$  – gender (male = 1; female = 0)

$X_3$  – marital status (married = 1; single = 0)

$X_4$  – educational status (number of years)

$X_5$  – irrigation activities (yes = 1; no = 0)

$X_6$  – fishing (yes = 1; no = 0)

$X_7$  – membership of cooperatives (yes = 1; no = 0)

$X_8$  – remittance (1 = if they receive in cash or kind; 0 = otherwise)

$X_9$  – farm size (ha)

$X_{10}$  – level of diversification (0 = no; 1 = low; 2 = average; 3 = high)

$U$  – error term.

## RESULTS AND DISCUSSION

### Respondent's socio-economic characteristics

The socio-economic characteristics of the respondents is presented in Table 1. The table shows that, majority (77.5%) of the respondents were male, and also married (75.83%) due to cultural and religious reasons. Age wise, majority (93%) of the respondents are economically active (not more than 60 years of age). Further, bulk (70%) of the respondents had some form of formal education and were primarily into fishing (49%) and small-scale crop farming (34%) cultivating land holding between 1–5 hectares (57.5%). However, traders, artisans and civil servants constituted 6.7%, 5.8% and 4.2% of the respondents respectively.

**Table 1.** Socio-economic characteristics of the respondents (N = 120)  
**Tabela 1.** Socjoekonomiczny profil respondentów (N = 120)

Variable Zmienna	Frequency Częstotliwość występowania	Percentage Udział procentowy
Age (years) – Wiek (lata)		
<20	9	7.50
20–30	26	21.67
31–40	34	28.33
41–50	19	15.83
51–60	24	20.00
60 and above – 60 i więcej	8	6.67
Gender – Płeć		
Male – Mężczyzna	93	77.50
Female – Kobieta	27	22.50
Marital status – Stan cywilny		
Married – Żonaty/zamężna	91	75.83
Single – Kawaler/panna	16	13.33
Widowed/divorced – Wdowiec/wdowa/osoba rozwiedziona	13	10.83
Educational attainment – Wykształcenie		
No formal education – Brak oficjalnego wykształcenia	30	25.00
Primary school – Podstawowe	36	30.00
Senior secondary school – Średnie	40	33.33
Tertiary – Wyższe	14	11.67
Membership of group – Członkostwo w grupie		
Yes – Tak	57	47.50
No – Nie	63	52.50
Primary occupation – Główne zajęcie		
Farming – Rolnictwo	41	34.17
Fishing – Rybołówstwo	59	49.17
Trading – Handel	8	6.67
Civil service – Służba cywilna	7	5.83
Artisan – Rzemieślnictwo	5	4.17
Farm size (ha) – Wielkość gospodarstwa (ha)		
<1	17	14.17
1–5	69	57.50
6–10	34	28.33

Source: field survey, 2015.

Źródło: badania terenowe, 2015.

### Diverse secondary livelihood activities of the respondents

Rural dwellers undertake diverse economic activities apart from farming, which has been the primary. Livelihood activities in the area can be grouped into three categories as can be seen in Table 2. Diversification

**Table 2.** Distribution of respondents according to their secondary livelihood activities (N = 120)

**Tabela 2.** Podział respondentów ze względu na drugorzędne źródło utrzymania (N = 120)

Type Rodzaj działalności	Frequency Częstotliwość występowania	Percentage Udział procentowy
Farm – Rolnicza	98	81.67
Non-farm – Nierolnicza	57	47.50
Services – Usługi	18	15.00

Source: field survey, 2015.

Źródło: badania terenowe, 2015.

into farm activities has the highest (82%) participation rate in the area. Activities that fall under this category includes: dry season farming, fishing and fish processing, hired farm labour. These activities have little entry barriers in terms of both training and start-up capital. Non-farm activities in the context of this study include: trading, blacksmithing, pottery, hunting, canoe driving and lumbering. These activities have a participation rate of 47% in the area. Provision of services has the least (15%) participation rate in the area. Activities under this category include civil service, clergy, tailoring, and mechanic/electrician.

### Level of diversification among the respondents

Analysis of the respondents' level of diversification (Table 3) showed that, only 11.7% of the respondents have a highly diversified livelihood source, while about 15% do not diversify their livelihood source at all (Simpson index value of zero). Further, respondents with low and average level of diversification represented 30.8% and 42% of the respondents respectively.

**Table 3.** Distribution of respondents according to their level of diversification (N = 120)

**Tabela 3.** Podział respondentów ze względu na poziom różnorodności (N = 120)

Level Poziom	Frequency Częstotliwość występowania	Percentage Udział procentowy
No diversification Brak różnorodności	18	15.00
Low diversification Niska różnorodność	37	30.83
Average diversification Przeciętna różnorodność	51	42.50
High diversification Wysoka różnorodność	14	11.67

Source: field survey, 2015.

Źródło: badania terenowe, 2015.

### Analysis of the respondents' income

The respondents' distribution of annual income is presented in Table 4. The table indicated that 18% of the respondents earn less than ₦ 100,000 annually as income

**Table 4.** Distribution of respondents by annual income (N = 120)

**Tabela 4.** Podział respondentów ze względu na roczny dochód (N = 120)

Annual Income (₦)* Roczny dochód (₦)*	Frequency Częstotliwość występowania	Percentage Udział procentowy
≤ 100,000	22	18.33
100,000–200,000	38	31.67
200,001–300,000	35	29.17
300,001–400,000	12	10.00
400,001–500,000	8	6.67
>500,000	5	4.17

\* ₦ 197 is equivalent to 1 USD (Central Bank of Nigeria's official exchange rate as at the time of conducting the survey).

Source: field survey, 2015.

\* 197 ₦ to równowartość 1 USD (oficjalny przelicznik podawany przez Narodowy Bank Nigerii w okresie przeprowadzania badania).

Źródło: badania terenowe, 2015.

from their various livelihood activities. Strikingly, majority (60%) of the respondents' annual income exceeds the ₦ 151,600 recommended to sustain a decent living in rural Nigeria (Financial..., 2016). Similarly, only 4% of the respondents earn above ₦ 500,000 within the same period. This shows that the level income generation in the area is relatively high despite the low volume of non-farm opportunities in the area.

### Factors affecting income among the respondents

The exponential function of the ordinary least squares (OLS) regression used showed that, age, marital status, education, undertaking irrigation activities, fishing, farm size and level of diversification affect the income level in the area (Table 5). The marginal effect showed

that, the probability of having higher income in the area is reduced by 1.11% for a year increase in age ( $X_1$ ) of the respondents. The variable was significant at 5% level. Similarly, marital status ( $X_3$ ) was positively significant at 10% and implies that, married persons have better (23.4% higher) chances of having higher income than their non-married counterparts. This may be due to the fact that, married persons have relatively larger households, which can supply cheap labour for carrying out diverse economic activities.

Education plays an important role in improving the wellbeing of people. The coefficient of years of formal education ( $X_4$ ) was statistically significant at 1% level and has a positive relationship with having increased income. Precisely, the likelihood of having higher income is increased by 3.4% for respondents with more years of

**Table 5.** Parameter estimates of factors affecting income in the study area

**Tabela 5.** Estymacja parametrów czynników wpływających na dochód na badanym obszarze

Variables Zmienne	Coefficient Współczynnik	Standard error Błąd standardowy	t-Statistic Statystyka t	Significance Istotność
1	2	3	4	5
$X_1$ Age – Wiek	-0.010845	0.005171	-2.097087	0.0383*
$X_2$ Gender – Płeć	0.153065	0.111174	1.376815	0.1714
$X_3$ Marital status – Stan cywilny	0.234932	0.127498	1.842632	0.0681*
$X_4$ Education – Wykształcenie	0.034107	0.008093	4.214096	0.0001***
$X_5$ Irrigation – Nawadnianie	0.146437	0.084225	1.738647	0.0849*
$X_6$ Fishing – Rybołówstwo	0.377157	0.088010	4.285368	0.0000***
$X_7$ Membership of group – Członkostwo w grupie	0.071902	0.148559	0.483995	0.6294
$X_8$ Remittance – Wynagrodzenie	0.098116	0.077691	1.262899	0.2093
$X_9$ Farm size – Wielkość gospodarstwa	0.033318	0.014396	2.314432	0.0225*
$X_{10}$ Diversification – Zróżnicowanie	0.127540	0.039742	3.209180	0.0017***
Constant Stała	10.38921	0.439697	23.62810	0.0000***

**Table 5 cont. – Tabela 5 cd.**

	1	2	3	4	5
<i>R</i> -squared Współczynnik determinacji		0.605291			
Adjusted <i>R</i> -squared Skorygowany współczynnik determinacji		0.569079			
Standard error of regression Błąd standardowy		0.397646			
<i>F</i> -statistic Statystyka <i>F</i>		16.71527			

\*, \*\*, \*\*\* mean significance at 1%, 5% and 10% respectively.

Source: field survey, 2015.

\*, \*\*, \*\*\* oznaczają istotność na poziomie odpowiednio 1%, 5% i 10%.

Źródło: badania terenowe, 2015.

formal education. This suggests that, acquiring higher levels of formal education increases the prospect of having a higher income in the area and vice versa. Remarkably, participating in irrigation activities ( $X_5$ ) promotes better livelihood outcomes in terms of earning higher income in the area. The coefficient (significant at 10% level of significance) of the variable shows that, income in the area is increased by 14.6% by virtue of undertaking irrigation activities compared to persons not participating in it.

Fishing activities ( $X_6$ ) which the area is well known for were significant at 1% and increase the respondents' likelihood of earning more income by about 37.7%. This signifies the prominence such activity has on the livelihood of the population of the area. According to Sati et al. (2015), land use has been considered as one of the important factors influencing livelihood of the rural people. Keeping the effect of all other variables constant, a hectare increase in farm size ( $X_9$ ) increases income in the area by 3.3% (significant at 5% level of significance). The low contributions of farm holding in the area may not be unconnected with the challenges of flooding during the rainy season and also the damages being done to crops by hippopotamus and quelea birds. Undertaking diverse economic activities can reduce vulnerability to shock and improve better livelihood outcomes. In the area, level of diversification ( $X_{10}$ ), increases the probability of getting more income by about 12.7%. The coefficient was significant at 1% and it implies that, respondents with diverse income sources will have a much better livelihood outcome (income wise) compared to those who have less.

### Constraints to livelihood diversification

Residents of the study area are clearly faced with some problems which limit their ability to undertake diverse livelihood activities in order to improve their wellbeing (Table 6). Among the many challenges faced by the respondents are: poor infrastructure, especially the road network, which was ranked highest (100%). Due to the basic infrastructural challenges of the area, conveying agricultural and other economic produce to and from the market is a huge challenge. This usually leads to a low income for the residents since most agricultural products in the area are perishable (vegetables and fish) and will have to be sold at a cheap price or face the risk of running a loss. Similarly, traders in non-agricultural commodities experience difficulty in conveying their goods from the market to their respective communities owing to this infrastructural deficit. In the same vein, both social and economic activities of some communities in the area are affected by the activities of hippopotamus (82%). They destroy farm crops (especially on farms very close to the dam) and impede fishing activities and water transportation by posing a threat to human safety and destroying fishing gears and crafts, in line with the views of Tidi and Jummai (2015). The implication of this is that, there is a reduced volume of trade in those communities due to how hippopotamus restrict the transportation of goods and people from one community to the other on water. This in turn reduces income from both farm and non-farm sources. Flood is a major economic shock for the respondents (67%) considering the nature of the area. Flooding is a highly

**Table 6.** Constraints to livelihood diversification in the area (N = 120)

**Tabela 6.** Ograniczenia w zróżnicowaniu źródła utrzymania na badanym terenie (N = 120)

Constraints Ograniczenia	Frequency Częstotliwość występowania	Percentage Udział procentowy
Lack of basic social infrastructure Brak podstawowej infrastruktury społecznej	120	100
Activities of Hippopotamus Szkody wyrządzane przez hipopotamy	98	81.67
Flooding Powodzie	81	67.50

Source: field survey, 2015.

Źródło: badania terenowe, 2015.

destructive threat with the capacity to destroy crops and houses in the area. This suggests that income from farm and non-farm sources can be reduced by its effect depending on the magnitude of the flood.

## CONCLUSION AND RECOMMENDATIONS

It is clear from the research findings that the respondents are engaged in multiple livelihood activities to generate income; and agriculture contributed mainly to the livelihoods of these communities. However, the respondents' capacity to be highly diversified in their livelihood pursuits and earn better income is constrained by some factors outlined in the study. Based on these findings, it is therefore recommended that:

- It is critical for the government to improve the existing social amenities (especially road, market and electricity) in order to promote income generation from diverse sources in the area.
- The State Ministry of Environment in collaboration with the concerned local councils should take adequate flood control measures through early warnings and encouraging activities away from flood prone areas.
- Environmental experts should ensure that both social and economic activities of the respondents are minimally affected by hippopotamus by taking necessary control measures. The use of local method of fencing pool should be encouraged to allow farmers to cultivate crops.

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## ZRÓŻNICOWANIE ŹRÓDEŁ UTRZYMANIA A DOCHODY: STUDIUM PRZYPADKU SPOŁECZNOŚCI ZAMIESZKUJĄCYCH PRZY ZAPORZE KIRI W STANIE ADAMAWA W NIGERII

**Streszczenie.** W niniejszym artykule przeprowadzono analizę zróżnicowania źródeł utrzymania oraz poziomu dochodów społeczności zamieszkujących przy zaporze Kiri w stanie Adamawa w Nigerii. Szczegółowe cele badania to: określenie socjo-ekonomicznego profilu respondentów, ocena poziomu różnorodności źródeł ich utrzymania, analiza dochodu, identyfikacja czynników wpływających na poziom dochodów oraz identyfikacja ograniczeń w zróżnicowaniu źródeł utrzymania na badanym obszarze. Na potrzeby pozyskania danych podstawowych od 120 respondentów posłużono się techniką doboru wielostopniowego. Zgromadzone dane poddano opisowi oraz wnioskowaniu statystycznemu. Przeprowadzone analizy wykazały, że większość (78%) respondentów to mężczyźni, osoby pozostające w związku małżeńskim (76%) i wykształcone (70%). Aż 93% badanych

miało poniżej 60 lat i zajmowało się rolnictwem (83%). Wskaźnik Simpsona wykazał, że 43% respondentów charakteryzowało się różnorodnością na poziomie przeciętnym. Roczny dochód większości (60%) respondentów wynosił ponad 200 tys. ₦. Oszacowanie klasyczną metodą najmniejszych kwadratów wykazało, że wiek, stan cywilny, wykształcenie, działalność w zakresie nawadniania i rybołówstwa, wielkość gospodarstwa oraz poziom różnorodności wpływały na poziom dochodu na badanym obszarze. Głównymi ograniczeniami zróżnicowania źródła utrzymania były: brak infrastruktury społecznej, szkody wyrządzone przez hipopotamy oraz powodzie. Zaleca się zapewnienie odpowiedniej infrastruktury społecznej i opanowanie zagrożenia ze strony zwierząt.

**Słowa kluczowe:** zróżnicowanie źródeł utrzymania, dochód, zaporą Kiri, stan Adamawa, Nigeria

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