AN APPLICATION OF SUSTAINABLE LIVELIHOOD APPROACH TO FISHING HOUSEHOLDS IN JIGAWA STATE, NIGERIA

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ABSTRACT
Livelihood studies have demonstrated the reliance of communities on available capital bases for their survival. The concept of livelihood extends beyond mere economic transactions to include other equally important dimensions that impact people's ability to sustain themselves and thrive. For fishing communities, their livelihoods are deeply connected to their natural resource endowments. With a focus on rural Nigeria as a case study, an assessment of livelihood status of fishing households is presented. The study collected cross-sectional data from 134 households using questionnaire for the 2023 fishing season. To assess their livelihood status, an index was developed on the basis of five components namely financial, human, physical, natural and social. Results of the analysis showed an average livelihood status index value of 0.53 and that the respondents were concentrated (67.16%) in the medium livelihood category. A breakdown showed that natural (0.77) and social (0.67) capitals were the two most endowed capital with physical capital (0.30) being the least. Furthermore, a Tobit regression analysis showed that membership to an association, level of educational attainment and household size significantly influenced livelihood status of the studied households. The study revealed an unbalanced livelihood situation in the study area and has suggested policies for strengthening the development of fishing household livelihood capitals through improvement in human assets by introducing evening classes for school and free education so as to encourage turnout and educate the fishermen on sustainable fishing practices that can improve their incomes and elevate their financial capital.

Keywords: Sustainable livelihood, Fishing households, Jigawa State, Nigeria

INTRODUCTION
Riverine systems are essential components of agro-ecology that contribute to the food and nutritional security of their surrounding communities. They offer conditions that allow for a diverse mix of livelihoods through a combination of irrigation agriculture, livestock and fishing. Although, the livelihoods of rural communities depend primarily on their accessibility to these natural resources, including water and land, they are confronted with limited livelihood options due to their remoteness in rural areas. Nevertheless, the benefits offered by these systems are numerous. For example, in Nigeria, the economic footprints are tremendous and remarkable as estimates by FAO (2025) it is a major source of livelihood for 613800 people in 2022 and contributed 36% of total fisheries production of 1.1 million metric tonnes in 2022.

In Nigeria, Jigawa state's Hadejia Local Government Area (LGA) presents a complex fabric created by the interactions between communities, biodiversity and agricultural production. The area has an extensive riverine system which has formed

a favourable habitat for a wide variety of fish species, creating livelihood opportunities for the region's fishing communities. Hence, the area presents an opportunity for a comprehensive approach to meeting the needs of its inhabitants while helping them build sustainable livelihood strategies.

While existing studies provide valuable insights into fishing communities across Nigeria, there is a dearth of research specifically focused on Jigawa's unique livelihood context. Addressing this gap will not only enhance an understanding of the challenges faced by fishing households but also inform policy interventions aimed at improving their livelihood outcomes. During the heavy rainy seasons, fishing activities are reduced, creating important influences on their livelihood dynamics. Therefore, such analyses are vital as advocated by many researchers. For instance, Pandey et al. (2017) noted that a community that is unable to fulfil its basic need for livelihood capital is not sustainable. Such situation is made worse during the exigencies of extreme events thereby making the community or the individual vulnerable to any potential stressor (Pandey et al., 2017). Therefore, understanding livelihoods is a key component of poverty, famine, and vulnerability analysis in international development (Barad et al., 2020; Boudreau, 2001). Practically, livelihoods description and analysis are used by policymakers and practitioners to examine food security, to forecast needs, to design policy and programmes (Barad et al., 2020). With regards to the fishing communities, such studies could help provide information for developing improved fishing methods and fisheries management that may facilitate improvements in their existing livelihood systems to improve the skill-base of the households. For example, fisheries management decisions may affect postharvest processing of fish and fishery products and marketing, which may be crucial for a sustainable fishing system.

The objective of this paper was twofold. First was to assess the livelihood status of fishing households in the rural communities in Jigawa state. Second was to identify socio-demographic factors affecting the livelihood status of the fishing communities. For this purpose, this paper is organised as follows. Section 2 discusses the theoretical basis on which this study is based. Section 3 describes the study area and presents the methods used. Section 4 discusses the results, and the conclusion is reached in Section 5 together with some policy recommendations.

Theoretical framework and Literature Review: In line with contemporary livelihood assessment studies, the theory guiding this study borders around the framework of asset approach as enshrined in the sustainable livelihood framework (SLF). Livelihood, as conceptualised by Dehghani Pour et al., (2018), refers to the means by which individuals or households secure the necessities of life, encompassing a range of activities, assets, and strategies. The framework was developed by Chambers and Conway (1992), and expanded by the Department for International Development (DFID 1999) provides a useful lens for analysing the livelihood status of fishing households. The framework emphasises the interplay of human, social, natural, physical, and financial capital in determining livelihood outcomes and has found numerous applications in understanding the dynamics of fishing communities. For example, Adebo & Ayelari (2011) applied the framework in southwestern Nigeria with a view to highlight the importance of social capital in mitigating livelihood vulnerabilities. Similarly, Xu et al., (2023) emphasised the role of financial capital in enabling access to better fishing technologies and market linkages.

Empirical studies have shown that fishing households in Nigeria face numerous challenges, including poor access to credit facilities, inadequate fishing equipment, and post-harvest losses. These challenges often result in low productivity and income, thereby undermining the sustainability of fishing as a livelihood activity (Adeosun et al, 2023). Moreover, fishing communities are frequently marginalised in terms of access to healthcare, education, and infrastructural development (Allison & Horemans, 2005; Kadfak, 2020). These systemic challenges exacerbate poverty and vulnerability, particularly for fragile communities around river systems, where economic diversification is limited. Environmental sustainability is another crucial factor influencing the livelihood status of fishing households. The degradation of water bodies due to climate change, pollution, and unsustainable fishing practices has been widely reported in Nigeria. According to Chan

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et. al. (2019), reduced fish stocks and declining water quality have led to a significant decline in fishers' incomes and food security. Adapting to such environmental changes requires innovative livelihood strategies, which are often constrained by low levels of education and access to extension services among fishers (Onyeneke et al., 2020). Socio-demographic characteristics, including age, education, household size, and gender, also play a pivotal role in shaping the livelihood status of any community. In northern Nigeria, traditional gender roles often restrict women's participation in fishing and related value chains, thereby limiting household income diversification (Adam & Njogu, 2023). Moreover, younger fishers are more likely to adopt modern fishing practices and technologies compared to their older counterparts, who tend to rely on traditional methods (Islam et al., 2024). Such generational differences underscore the need for targeted interventions to enhance the productivity and sustainability of fishing activities. Market access and institutional support are equally critical in determining the livelihood outcomes of fishing households. Access to reliable markets enables fishers to sell their produce at competitive prices, thereby enhancing income and livelihood security. However, rural fishers in Nigeria often face significant barriers, including poor road infrastructure and lack of market information (Bolarinwa et al., 2018). In conclusion, the livelihood status of fishing households across Nigeria, is influenced by a complex interplay of socio-economic, environmental, and institutional factors.

METHODOLOGY

Description of the study area: Hadejia LGA lies to the north of the river Hadejia, and it is upstream from Hadejia-Nguru wetlands. The geography of the study area is of the Chad formation with semi-arid type of climate. It is characterised by a long dry season and a short-wet season and has an average annual temperature of 27°C. The total annual rainfall ranges from 600mm to 762mm and falls within the Sudan Savannah with an extensive open grassland and few scattered trees. It is an agrarian environment, supporting a year-round production activity either in the form of rain-fed or dry season irrigation farming. Crops produced include cereals, cowpeas, and vegetables. The river system supports a strong fishing dependence, serving as a livelihood for people living around the floodplains.

Sampling Procedure and Data Collection:
For this study, sample were drawn from fishing households in the study area. A two-stage sampling procedure was employed in selecting the respondents for this study. Firstly, a purposive selection of four popular fishing wards namely *Dubantu, Kasuwar kuda, Yankoli* and *Yayari* were selected from a total of 11 political wards was applied. Secondly, a random selection of 36 fishing households were selected from each community from a sample frame of fishermen association of each community. For this study, a household may be defined "as a small group of persons who share the same living accommodation, who pool some, or all, of their income and wealth and who consume certain types of goods and services collectively, mainly housing and food" (Eurostat, 1996; UN, 1996). Overall, a total of 144 respondents were selected for which data for 2023 fishing season were collected using questionnaire. Ultimately, 134 completed questionnaires were approved for analysis.

Analytical Techniques:
Multiple analytical techniques were used to achieve the objectives of the study.

Livelihood Status Index (LSI): A Household Livelihood Status Index (LSI) was constructed for the analysis. The index can be described as a summary measure of indicators capturing assets in the respondents' wellbeing categorised in five capitals: human, social, physical, natural, and financial capitals. Developing the index involves first 'normalisation/standardisation' of the sub-indicators since they were in different units of measurement so that the data is comparable across indicators. The basic formula was adopted from the Human Development Index as:

$$Zind_j = \frac{Actaul\ Value_j - Min_J}{Max_J - Min_J} \quad \text{--------------------(1)}$$

Where:
Zind$_j$ is the sub-component under consideration, Min and Max are minimum and maximum values obtained for each sub-component variable for the total households. The score for each sub-component

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falls between 0 and 1. Next was a construction of the composite index which was done by averaging all the normalised sub-indicators given by:

$$Q_i = \frac{\sum_{j=n}^{j} zind_j}{n} \text{----------------------------------- (2)}$$

Where:
Q is the criteria score for each sub-component ($0 \leq Q \leq 1$), j represents the jth sub-component of criteria ($j = 1,2,3,.....n$), $Zind$ represents a sub-component, n is the total number of indicators in each sub-component. The composite LSI was then constructed using the following formula:

$$LSI_i = \frac{\sum_{i=1}^{n} w_i Q_i}{\sum_{i=1}^{n} w_i} \text{----------------------------------(3)}$$

Where:
LSI is the weighted average of major components; W is weight determined by the number of indicators used to construct each sub-component. The value of LSI ranges between zero (least endowed) and one (most endowed), The weights of each major component, w_i were determined by the number of sub-components in it. Weights were included to ensure that all sub-components equally contributed to the overall LSI.

Tobit regression technique: A censored Tobit regression technique was used to determine the socio-economic factors influencing the livelihood status of the respondents in the study area. The implicit model was expressed as:

$$Y_i = Y_1^* = X_i\beta + e_I \text{------------------------ (4)}$$

Where:
Y_i = is censored variable of Livelihood Status Index, i = 1, 2, ...n, X_i = vector of explanatory variables, β = vector of unknown parameters, e_i = independently distributed error term. The explicit version of the model is written as:

$$LSI = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + e_i \text{---------------------------(5)}$$

Where:
LSI = Livelihood Status Index, X_1 - X_6 = Age of respondent (Years), Marital status (Dummy variable: 1= Yes & 0 = Otherwise), Highest formal educational attainment, Credit access (Dummy variable: 1 = Yes & 0 = Otherwise), Membership of an association (Dummy variable: 1 = Yes & 0 = Otherwise), Total household size (number), e = Error term and β = Unknown parameters.

RESULTS AND DISCUSSION

Socio-demographic characteristics of sampled households: A summary result of the descriptive analysis of the socio-demographic characteristics of the sampled households is presented in Table 1. Out of the total surveyed sample, maximum age was over 45 years and were mostly married. On the average, they had attained primary education and had access to credit. It is important to note that credit here is not restricted to formal credit but includes credit from family and friends. In general, higher education is low in the area as the highest level attained was secondary. An explanation for this could be the high average family size (10 people) which was higher than the 5 persons reported by Ahmed et. al. (2021) for the floating fishermen of Bangladesh. For large family sizes in rural areas, basic education may not be considered a priority due to the expenses involved. The average annual household income was ₦555447.800 (US$368.57). However, the maximum earned was ₦910000 (US$603.84), revealing a wide standard deviation. This could be attributed to a common fish preservation method of dry-smoking which increases shelf life of their catches making it convenient for sellers to transport dry-smoked fish to other parts of the country for sale at higher profits.

Livelihood capital endowment: In line with the objective of this study, the sub-index of each livelihood capital was estimated and presented in a spider diagram containing the mean values of the capitals as shown in Figure 1. The average livelihood status index for the study area was 0.53. A breakdown of the LSI is needed to understand the various contribution of each capital to the overall score. In this study, human capital as adopted from Slaus and Jacobs (2011) represents the knowledge, skill, attitude, education, mental and physical health, ability to work, be trained, etc. that together enable people to pursue their livelihood strategies. Hence, access to a combination of these elements is a prerequisite to their ability to utilise any of the other four capital assets (Ahmed et al., 2021). A 5.0 score suggested that an average number of household

heads posed some level of education and skills, which is needed in fostering the development of human capabilities. Explanation for this score could be offered from various perspectives. For example, due to the nature of fishing, which is a full-time livelihood source, that sometimes require households to move around in search of better catches, the commitment to obtaining education may be a challenge. Additionally, these fishermen rely on experience in their trade. There were no formal trainings offered that could educate them on sustainable fishing techniques. Another indicator of human capital is health status, a basic requirement to maintaining an appreciable standard of living. An estimated 83,6% of the respondents reported experiencing at least one form of health challenge in the study year. Malaria fever was the most reported case which could be attributed to unhygienic lifestyle and poor sanitation facilities.

The financial and physical capitals were closely tied and show low endowments. The result of financial capital (0.39) could indicate a lack of commitment in savings and investment behaviours. People need financial capital to sustain a reasonable standard of living but unfortunately, the result reflects a low financial capital base. One explanation is that credits from formal financial institutions were rare in the area partly because of the influence of Islamic lifestyle which prohibits interest. Moreover, the people in those communities may lack the requirements necessary to access credits from formal institutions, which explains why credit access is low in the study area.

Unsurprisingly, natural capital was the most endowed (0.77), with physical capital being the least (0.30). Natural capital, as described by Deswandi (2017) is the quality and quantity of natural resources that are available to people and above all, the access and control people have over these natural resources. To measure the natural capital, respondents were asked about the availability and access to land and forest resources like fuelwood, thatch, herbs, small animals, fruits and nuts. In rural communities, especially in northern Nigeria, people have free access to water resources, land and forest resources without restrictions by authorities.

As the least (0.30) endowed capital in the study area, physical capital consists of basic infrastructure such

as transport, shelter, water, energy, communications, production equipment which enables people to pursue their livelihoods (Rakodi, 2014). For this study, such capital included fishing canoes, houses (mostly made of mud and thatch), fishing gear, motorcycles, bicycles, radios and mobile phone sets for which ownerships were based on purchase, inheritance, gift and rent. These results were consistent with rural communities in developing countries as was found by Baffoe and Matsuda (2017) in rural Ghana where natural and social capitals were the top endowments and physical was the least.

The social capital evaluated in this study include mutual trust and reliability on members of the society, relationship with neighbours, association with social institutions and social groups. With a score of 0. 69, it indicates that the existing social relations in the communities are what sustain and unite the people. Interaction with respondents revealed that the households had strong family relationships and informal groups and/or associations abound in the communities. Although, their primary source of livelihood is fishing, they also engage in other income generating activities like rice and vegetable farming. So, it is common for the fishermen to belong to multiple agriculture-based associations/groups and depend on community leaders and Muslim imams for guidance and occasional conflict resolutions. Hence, these social relations are critical safety nets for them in times of adversities (Kleih et al., 2003), and mutual assistance reliance (Baffoe and Matsuda, 2017).
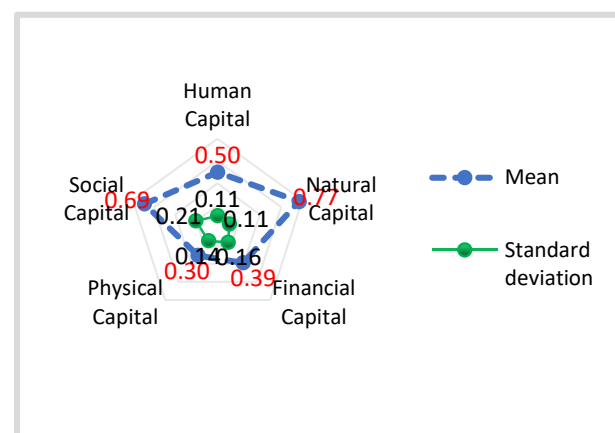
Figure 1: Livelihood capital of the fishing households in Hadejia LGA of Jigawa State

Distribution of livelihood status: The livelihood status scores were categorised and presented in Table 2. With regards to financial capital, 45.5% of the respondents fell within the low medium category. This reflects widespread financial constraints that may limit their ability to not only sustain a stable livelihood but also to invest in other areas of their livelihoods. A substantial portion of the respondents fell into the low medium (50.7%) and medium (48.5%) categories of human capital - although many of them possess some level of education or skills, there is an absence of individuals in the high category, which could hinder economic opportunities. With an abundance of natural capital in the study area, the respondents belonged to the categories of medium and high, which shows their heavy reliance on these natural resources. This raises concerns about sustainability of these resources and the potential impact of natural disasters like drought and flooding on their livelihoods. Physical capital seems to be scarce in the communities as results show that 38.8% and 40.3% were in the low (0.14) and low medium (0.32) categories, respectively. In these communities, physical assets such as houses, lands and fishing equipment are usually possessed through inheritance, purchases or rents. The low physical capital endowment could limit productivity and economic growth. The distribution of social capital favours the high category as represented by 54.5% of the respondents. It shows that about half of them could be benefiting from social networks and community support, which are crucial for resource sharing, community support and collective action. Overall, most of the respondents were in the low medium (32.84%) and medium (67.16%) categories. This indicates that while many households were not at the lowest livelihood status, there were barriers preventing them from achieving higher levels of well-being. The consequence of this finding is that these households could be vulnerable to environmental challenges such as flooding and droughts.

Socio-demographic factors influencing livelihood status: To validate the suggestion in literature about the important roles socio-demographic characteristics in livelihood status of any community, the Tobit regression analysis result is presented in Table 3. Based on the result, access to credit negatively and significantly affected livelihood status at the 1% level. This suggests that increased access to credit may not necessarily translate into improved livelihoods, probably due to misallocation of funds. For both membership of associations and marital status, their coefficients were positive and were significant at the 1% levels, respectively. While associations provide financial support, access to resources, and knowledge sharing, which contribute to enhanced economic well-being (Apeh & Onyekuru 2017), married individuals may have better economic stability and social support that enhance household welfare (Onyekuru et al., 2021). Total household size was positively significant at the 5% level, indicating that larger households may have more labour supply for fishing activities, which can improve livelihoods. However, this effect may depend on the dependency ratio within the household (Omotayo & Fawole, 2022). These findings underscore the importance of education, associations, and marital status in improving the livelihood status of fishing households while highlighting the complexities of credit access and household size dynamics.

CONCLUSION
This study assessed livelihood capital levels of household heads, and the factors associated with it in a rural fishing environment. To do this, a livelihood status index was developed that consists of capital bases. The results show an overall livelihood status of 0.53, which indicates a medium level of livelihood status. A breakdown of the LSI showed that Natural, social and human capital, in that order, were the three most endowed assets, while physical was the least endowed asset. Furthermore, the LSI shows that most of the household heads fell within a medium bracket. An alternative interpretation of the result of the logit regression is that it highlights that low levels of education, low credit membership and large household sizes could be barriers preventing them from reaching higher levels of livelihood. The outcome of this study depicts an unbalanced livelihood situation in the study area while simultaneously providing insight into priority areas for government government/organisations/policy makers to focus their efforts in improving livelihood conditions at individual level/household/community levels. Although it is a complex process, it was argued that for the purposes of fostering household resilience and livelihood sustainability, improving

the levels of physical, financial and human capitals is crucial in moving toward improved conditions of the households. The situation is made more challenging because there is little that can be done by convincing the fishermen to explore other alternative livelihood sources, especially in situations of high fishery dependency. However, a customised holistic approach is undoubtedly required to build their capacity to exploit other complementary/supplementary opportunities that the environment has to offer. Therefore, strengthening the development of fishing household livelihood capitals could be achieved through (i) Improvement in human assets will enhance the accumulation and effective utilisation of other assets. This can be done by introducing evening classes for school and free education so as to encourage turnout, (ii) increasing education can be complemented with educating the households on sustainable use of natural resources so as to maximise the benefits to fishermen participation in sustainable practices in the study area, (iii) educate the fishermen on sustainable fishing practices that can improve their incomes and elevate their financial capital.

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Table 1: Socio-demographic characteristics of the respondents

Variable	Minimum	Maximum	Mean	Std. Dev
Age	<18	>45	2.813	1.284
Marital status	1	4	2.806	1.093
Education	0	2	1.045	0.965
Experience	1	5	1.448	0.762
Access to credit	0	1	0.552	0.499
Association membership	0	1		
Household size	2	31	10.224	3.980
Income	100000.000	910000.000	555447.800	231.301

Source: Computed from own survey, 2023

Table 2: Mean values of sub-components and their distributions

Sub-indicators	Low (0.00 - 0.24)	Low medium (0.25 - 0.49)	Medium (0.50 - 0.74)	High (0.75 - 1.00)
Financial capital	0.14 (25.37)	0.39 (45.52)	0.58 (26.12)	0.80 (2.99)
Human capital	0.23 (0.75)	0.43 (46.27)	0.57 (52.99)	-
Natural capital	-	-	0.67 (64.93)	0.96 (35.82)
Physical capital	0.14 (38.81)	0.32 (40.30)	0.56 (18.66)	0.75 (2.24)
Social capital	-	0.39 (21.64)	0.64 (23.88)	0.83 (54.48)
Overall LSI		0.43 (32.84)	0.58 (67.16)	-

Note: Figures in parenthesis are percentages

Table 3: Scio-demographic factors influencing livelihood status

Independent variable	Coeff.	Stand. Error	T-statistic	P-value
Age	-0.008	0.010	-0.780	0.438
Educational attainment	0.014	0.008	1.770	0.080*
Credit access	-0.067	0.016	-4.290	0.000***
Membership in association	0.101	0.240	4.280	0.000***
Gender of household head	0.044	0.046	0.970	0.332
Marital status	0.056	0.020	2.830	0.005***
Household size	0.004	0.002	1.800	0.074*
Constant	0.289	0.067	4.290	0.000***
X^2	59.960			
DF	7			
Pseudo R^2	-0.282			
Log likelihood	136.123			

Note: ***, ** & * signifies statistically significant at 1%, 5% &10%