



Social Impacts of Hydroelectric Dams on the Livelihoods of Select Communities in Kainji and Jebba, Niger State, Nigeria

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ABSTRACT

Background: Hydroelectric dams are essential for energy security all over the world, including Nigeria, yet their social impacts often undermine the livelihoods of host communities. Despite significant investments in projects such as the Kainji and Jebba dams in Niger State, there have been minimal assessments on the social impacts of these dams on livelihood outcomes.

Objectives: To examine the social impact of hydroelectric dam (population displacement, health and security, cultural heritage loss, and poverty levels) on the livelihoods of selected communities in Kainji and Jebba, Niger State.

Methods: A quantitative cross-sectional survey design was adopted. Using stratified random sampling, 437 copies of questionnaire were distributed to households in the two communities; 380 valid responses (86.95% response rate) were analysed with descriptive statistics, Pearson correlation, and multiple linear regression in SPSS version 25.

Results: All four social impact dimensions (population displacement, health and security, cultural heritage loss, and poverty levels) significantly influence livelihood outcomes ($RZ = 0.696$, $p < 0.001$). Loss of cultural heritage ($\beta = 0.281$) and population displacement ($\beta = 0.293$) emerged as the strongest predictors, followed by health and security ($\beta = 0.231$) and poverty outcomes ($\beta = 0.131$).

Conclusions: When properly managed, hydroelectric dams can enhance livelihoods through structured resettlement, health improvements, and economic diversification.

Unique contribution: This study will provide insight into the relationship between hydroelectric dams and the socio-economic development of resettled communities in Kainji and Jebba. The findings will assist policymakers and stakeholders in designing effective interventions that address the specific needs of the study area.

Key recommendation: Based on the findings, the government, HYPPADEC, and dam management authorities should implement sustainable livelihood support programs, strengthen health and security services, and promote economic diversification in resettled communities. They should also encourage community participation and preserve cultural heritage to ensure that dam development leads to inclusive and sustainable socio-economic benefits for affected populations.

Keywords: Hydroelectric dams, livelihood outcomes, population displacement, cultural heritage, Niger State



INTRODUCTION

Livelihood refers to the capabilities, assets, and activities required for a means of living (Natarajan et al., 2022). These assets include both material and social resources that enable individuals and households to sustain themselves. A livelihood is considered sustainable when it can cope with and recover from shocks and stresses while maintaining or improving its capabilities and assets for future generations. However, large-scale infrastructure projects such as hydroelectric dams often disrupt existing livelihood systems, forcing affected communities to adapt to new economic and social conditions.

Hydropower is currently the world's largest source of renewable and low-carbon electricity, with a global installed capacity of approximately 1,360 gigawatts (International Hydropower Association, 2022). It plays an important role in energy security, economic development, and climate change mitigation. Despite these benefits, the construction of large dams has historically generated significant social and environmental challenges, particularly for communities living within river basins where such projects are located (Adugbila, Todorovski, Pfeffer, & Boerboom, 2024).

In Nigeria, hydropower forms a critical component of the national energy strategy. Major installations such as the Kainji Dam, with an installed capacity of 760 megawatts (MW), and the Jebba Dam, with a capacity of 578 MW (International Energy Agency, 2021). contribute substantially to electricity generation in the country. However, the construction of these dams led to the displacement of thousands of people. For example, the development of the Kainji Dam required the resettlement of about 44,000 people from 167 communities, dramatically transforming the demographic, economic, and social structure of the affected areas.

Despite the long-standing presence of these dams, many host communities continue to face significant developmental challenges. Evidence suggests that the anticipated benefits of dam development have not been fully realized by the displaced populations. Studies indicate that only 29.6% of affected residents experienced any improvement in income after resettlement, while about 42.6% earn less than ₦20,000 per month, reflecting persistent economic hardship (Adeyemi, et al., 2025). Compensation mechanisms have also been widely criticized for failing to adequately account for the long-term loss of land, productive resources, and social networks.

In addition to economic challenges, dam construction has generated notable health, security, and cultural impacts. Changes in river ecology have created conditions that encourage the spread of waterborne and vector-borne diseases. For instance, 67.7% of residents associate the increased incidence of malaria with the presence of the dam, while only 48.7% consider local health facilities adequate. Cultural losses have also occurred as the flooding of ancestral lands and sacred sites has weakened traditional practices, with about 54% of respondents reporting reduced youth participation in cultural activities (Roquetti et al., 2024).

Although several studies have examined aspects of dam-related impacts such as displacement, environmental changes, or resettlement outcomes, existing literature often treats these issues in isolation. There remains a lack of comprehensive studies that simultaneously examine multiple social impact dimensions affecting the livelihoods of displaced communities.



This study therefore addresses this gap by examining how four key social impact factors, population displacement, health risks, cultural heritage loss, and poverty levels affect the livelihoods of selected communities in Kainji and Jebba, Niger State. Anchored on Sustainable Development Theory and Social Impact Theory, the study seeks to provide an integrated understanding of how these interconnected factors influence livelihood outcomes in communities affected by Nigeria's earliest and largest hydropower projects.

- i. To examine the effects of hydroelectric dam-induced population displacement on the livelihoods of communities in Kainji and Jebba.
- ii. To evaluate the impact of hydroelectric dam-related health and security challenges on the livelihoods of communities in Kainji and Jebba.
- iii. To investigate the consequences of hydroelectric dam-induced loss of cultural heritage on the livelihoods of communities in Kainji and Jebba.
- iv. To analyze the influence of hydroelectric dam-related changes in poverty levels on the livelihoods of communities in Kainji and Jebba.

METHODS

Study Design and Area

This study adopted a quantitative cross-sectional survey design to assess the social impacts of hydroelectric dams on community livelihoods. This design allows for the collection of data at a single point in time, facilitating the examination of relationships between variables across the study population. The study area comprised the communities surrounding the Kainji and Jebba dams in Niger State, Nigeria. These locations were selected due to their historical significance as the sites of Nigeria's major hydropower projects and the extensive resettlement that occurred during their construction.

Population and Sample Size

The target population for this study consisted of resettled community members living in the vicinity of the two dams. The specific population figures were 24,449 individuals for the Kainji community and 21,488 for the Jebba community, giving a total target population of 45,948 individuals. To determine an appropriate sample size, the Krejcie and Morgan formula was utilised, resulting in a base sample of 380 respondents. To account for potential non-response and invalid entries, this sample size was increased by approximately 15%, resulting in a final distribution of 437 questionnaires.

Sampling Technique

A stratified random sampling technique was employed to ensure adequate representation from both dam communities. The population was divided into two strata based on location: Jebba and Kainji. This approach ensured that the unique experiences and specific contextual factors of each community were captured in the analysis. Within each stratum, households were randomly selected for participation, ensuring that every member of the target population had an equal chance of being included in the study.



Data Collection Instrument

Data were collected using a structured, self-administered questionnaire designed specifically for this study. The instrument was organised into six distinct sections to capture comprehensive data on the key variables: (1) Demographics: Age, gender, occupation, and education. (2) Population Displacement and Livelihood: Questions regarding resettlement experiences, housing, and compensation. (3) Health, Security and Livelihood: Items assessing disease prevalence, access to healthcare, and safety perception. (4) Cultural Heritage and Livelihood: Questions on the loss of sacred sites, cultural practices, and social cohesion. (5) Poverty Outcomes and Livelihood: Assessment of income, employment, and food security. (6) Overall Livelihood Reality: General perception of livelihood status. Respondents rated items on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Reliability and Data Analysis

To ensure the reliability of the research instrument, a pilot study was conducted in the Shiroro Community, another dam-affected area in Niger State. The reliability analysis yielded a Cronbach's alpha coefficient of 0.85, indicating high internal consistency among the questionnaire items. Data obtained from the main survey were analysed using SPSS Statistics version 25. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarise the demographic profile and the distribution of responses. Inferential statistics, specifically Pearson correlation and multiple linear regression, were employed to test the relationships between the independent variables (social impact dimensions) and the dependent variable (livelihood outcome). The Ordinary Least Squares (OLS) regression technique was applied using the following econometric model:

$$\text{Livelihood Outcome} = \beta_0 + \beta_1 (\text{Population Displacement}) + \beta_2 (\text{Health \& Security}) + \beta_3 (\text{Cultural Heritage Loss}) + \beta_4 (\text{Poverty Outcomes}) + \varepsilon$$

RESULTS

A total of 437 questionnaires were distributed to the respondents in the study areas. Of these, 380 were retrieved and found to be valid for analysis, representing a response rate of 86.95%. This high response rate provides a robust basis for the study's findings.

Demographic Characteristics

The demographic profile of the respondents is presented in Table I. The gender distribution was fairly balanced, with 52.1% male and 47.9% female respondents. In terms of age, the largest group was those aged 26-35 years (35.0%), followed by the 36-45 years age bracket (28.9%). The 18-25 years group constituted 18.4%, while those aged 46-55 and 56+ accounted for 12.4% and 5.3%, respectively. Regarding occupation, farming was the dominant livelihood activity (45%), followed by fishing (20%) and trading (18%). Civil servants made up 12% of the sample, with other occupations accounting for the remaining 5%.



Table I: Demographic Characteristics of Respondents (N=380)

Variable	Category	Frequency	Percentage (%)
Gender	Male	198	52.1
	Female	182	47.9
Age Group	18-25	70	18.4
	26-35	133	35.0
	36-45	110	28.9
	46-55	47	12.4
	56+	20	5.3
Primary Occupation	Farming	171	45.0
	Fishing	76	20.0
	Trading	68	18.0
	Civil Service	46	12.0
	Others	19	5.0

Descriptive Analysis of Variables

The descriptive analysis of the study variables revealed the perceived extent of impacts on livelihoods. Population Displacement had a Grand Mean of 3.43, indicating a moderate positive impact perception regarding specific indicators such as improved housing (Mean = 3.65) and livelihood diversification (Mean = 3.55), although satisfaction with land compensation was lower (Mean = 3.28).

Health and Security impacts showed a Grand Mean of 3.58, suggesting a moderate positive perception. Key contributors included access to healthcare facilities (Mean = 3.71) and improved sanitation (Mean = 3.61), though reduced malaria incidence was rated slightly lower (Mean = 3.42).

Cultural Heritage Loss recorded a Grand Mean of 3.80, indicating a high impact. Respondents strongly agreed on the loss of sacred sites (Mean = 4.12), weakened social cohesion (Mean = 3.75), and the disruption of traditional practices (Mean = 3.68).

Poverty Outcomes had the highest Grand Mean of 3.90, interpreted as a high positive impact in terms of new economic dynamics. This was driven by perceptions of employment opportunities (Mean = 4.05) and income diversification (Mean = 3.98), alongside food security (Mean = 3.68).



Correlation Analysis

The Pearson correlation analysis (Table II) showed statistically significant positive relationships between all social impact dimensions and livelihood outcomes at the $p < 0.01$ level. Cultural Heritage Loss exhibited the strongest correlation ($r = 0.758$), followed by Poverty Outcomes ($r = 0.713$), Health and Security ($r = 0.678$), and Population Displacement ($r = 0.612$).

Table II: Correlation Matrix of Variables

Variable	Livelihood Outcome	Displacement	Health Security	&Cultural Heritage	Poverty Outcomes
Livelihood Outcome	1				
Displacement	0.612**	1			
Health Security	0.678**	0.543**	1		
Cultural Heritage	0.758**	0.589**	0.601**	1	
Poverty Outcomes	0.713**	0.556**	0.592**	0.645**	1

** Correlation is significant at the 0.01 level (2-tailed).

Regression Analysis

Multiple linear regression was conducted to predict livelihood outcomes based on the four social impact dimensions. The results are summarised in Table III. The model summary indicated a strong relationship ($R = 0.834$), with the independent variables explaining 69.6% of the variance in livelihood outcomes ($R^2 = 0.696$; Adjusted $R^2 = 0.692$). The ANOVA test confirmed the model's significance ($F(4, 375) = 214.31, p < 0.001$).

The regression coefficients revealed that all four predictors made statistically significant contributions to the model. Population Displacement ($\beta = 0.293, p < 0.001$) and Loss of Cultural Heritage ($\beta = 0.281, p < 0.001$) were the strongest predictors. Health and Security ($\beta = 0.231, p < 0.001$) and Poverty Outcomes ($\beta = 0.131, p < 0.001$) also significantly influenced livelihood outcomes. Consequently, all four null hypotheses were rejected.



Table III: Multiple Regression Results

Model	Unstandardized B	Standardized Coefficients Beta (β)	t	Sig.
(Constant)	0.412	-	2.845	0.005
Population Displacement	0.285	0.293	6.485	0.000
Health & Security	0.218	0.231	5.304	0.000
Cultural Heritage Loss	0.276	0.281	5.599	0.000
Poverty Outcomes	0.124	0.131	3.566	0.000

Dependent Variable: Livelihood Outcome. R Square = 0.696

DISCUSSION

This study sought to evaluate the effects of hydroelectric dam social impacts on the livelihoods of communities in Niger State. The findings reveal a complex interplay of factors where displacement, health, culture, and economic shifts significantly shape the lived reality of the affected populations.

Population Displacement was found to have a significant positive effect on livelihood outcomes ($\beta = 0.293$, $p < 0.001$). This finding suggests that while displacement is inherently disruptive, the accompanying interventions can yield benefits. The results align with Khanal et al. (2024), who posited that livelihood recovery is heavily dependent on the quality of asset restoration. In the context of Kainji and Jebba, although 51.3% of respondents initially reported declines in traditional fishing and farming activities, the structured resettlement programmes and compensation packages appear to have enabled communities to diversify their income sources over time. This supports the argument by Piggott-McKellar et al. (2020) regarding the critical importance of land-for-land compensation and structured support in mitigating the adverse effects of relocation.

Health and Security also exerted a significant positive influence ($\beta = 0.231$, $p < 0.001$). This presents a nuanced picture. On one hand, the literature and respondent data indicate persistent health risks; 67.7% of respondents linked malaria to dam-related environmental changes (Adeyemi et al., 2025), and waterborne disease risks remain a concern (Kibret et al., 2017). However, the regression results indicate that improved access to healthcare facilities in resettlement areas has a positive net effect on livelihoods. This contradiction—high disease burden versus improved access—highlights that while infrastructure has improved, it may not yet be sufficient, as evidenced by only 48.7% of residents rating facilities as adequate. Continued investment is clearly required to bridge this gap.



The Loss of Cultural Heritage emerged as the second strongest predictor of livelihood outcomes ($\beta = 0.281$, $p < 0.001$). The qualitative loss is profound; the submersion of Old Bussa and numerous sacred sites represents an irreversible erasure of history. As noted by Adeyemi et al. (2025), 65.1% of residents reported disruptions to traditional practices, and 67.2% noted weakened social bonds. These findings are consistent with Hanna et al. (2016), who demonstrated the critical importance of cultural aspects in impact assessments. Interestingly, the positive beta coefficient in the regression might imply that communities have demonstrated resilience, adapting their cultural identity to their new environments, or that strong cultural cohesion has acted as a buffer, facilitating better livelihood adaptation despite the losses.

Poverty Outcomes showed a significant effect ($\beta = 0.131$, $p < 0.001$), reflecting the dual nature of economic transition. The high mean scores for employment opportunities (4.05) and livelihood diversification (3.98) suggest that the dams have catalysed new economic activities, contrasting with the pre-dam agrarian economy. However, this "positive" impact must be interpreted with caution. While there are new opportunities, structural poverty persists, with 42.6% of the population remaining below the poverty line. These findings partially align with Cernea's (2000) impoverishment risk model but suggest more positive outcomes than De Wet's (2000) generally pessimistic assessments of African dams, indicating that the specific management strategies employed in Niger State may have mitigated some worst-case scenarios.

The overall model explains 69.6% of the variation in livelihood outcomes, confirming that these four dimensions are collectively crucial. This validates the Sustainable Livelihoods Framework (Chambers & Conway, 1992), which posits that household resilience is determined by the interaction of multiple forms of capital (human, natural, financial, physical, and social). The study has limitations, including its cross-sectional design which limits causal inference, potential recall bias regarding historical events, and its focus on only two communities. Nevertheless, the policy implications are clear: properly managed hydroelectric projects have the potential to transform livelihoods positively, provided they are accompanied by comprehensive, long-term support programmes rather than one-off compensation payments.

CONCLUSION

Based on the results of this study, it is concluded that hydroelectric dam development has significant social consequences for host communities in Kainji and Jebba in Niger State. The study concludes that while dams contribute to national electricity generation and economic development, they simultaneously create social disruptions that affect the livelihoods and well-being of affected communities. This conclusion is drawn from the observed relationships between dam-related social impacts and the livelihood conditions of residents in the study area.

The study further concludes that inadequate attention to population displacement, cultural heritage preservation, health conditions, and poverty reduction undermines the ability of affected communities to fully benefit from dam projects. Where these issues are not properly addressed through effective resettlement planning, social protection, and livelihood restoration programs, dam development tends to produce long-term socio-economic challenges for local populations.

Therefore, the conclusion of this study is that sustainable hydroelectric dam development in Nigeria requires a more balanced approach that integrates energy production with the protection



of community livelihoods and social welfare. Without deliberate policies that prioritize the welfare of host communities, the developmental benefits of dam projects will remain uneven and may continue to generate social and economic vulnerabilities among affected populations.

Ethical Clearance

Approval to conduct this research was obtained from Ibrahim Badamasi Babangida University, Lapai. Permissions were also sought from community leaders and stakeholders in the study areas (Kainji and Jebba communities). All participants were provided with detailed information about the study's purpose, procedures, and their rights. Informed consent was obtained from all respondents prior to data collection. Participation was entirely voluntary, and respondents were assured of their confidentiality and anonymity. No personally identifiable information was collected, and all data were stored securely and used solely for research purposes.

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Conflict of Interest

The authors declare no conflict of interest, financial or otherwise, related to this research.

Authors' Contributions

Mohammed Maiyaki: Conceptualisation, research design, literature review, data collection, data analysis, interpretation of results, manuscript preparation, and submission. Dr. Abu Idris: Supervision, methodological guidance, critical review of drafts, and approval of final manuscript. Dr. Issa Adamu: Supervision, technical guidance, critical review of content, and approval of final manuscript. All authors have read and approved the manuscript for publication and confer the rights to the corresponding author to make necessary changes required by the editorial team.

Availability of Data & Materials

All data used in this work is readily available upon request.

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