Modelling the Nexus between Physical Infrastructure Adequacy and Livelihood Conditions of Internally Displaced Persons (IDPs) in Borno State, Nigeria

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ABSTRACT

Borno State, Nigeria, grapples with a severe humanitarian crisis stemming from the insurgency of Boko Haram, resulting in the displacement of over 1.8 million individuals who seek refuge in internally displaced persons (IDP) camps. This study presents a detailed investigation of the adequacy of physical infrastructure within Internally Displaced Persons (IDPs) camps in Borno State, Nigeria, and its relationship with the living conditions of IDPs. This study aims to fill existing knowledge gaps by exploring the complex relationship between physical infrastructure and living conditions in conflict-induced displacement settings. Utilising a mixed-methods approach, combining survey research design with geospatial techniques, this study assessed shelter, water, sanitation, and hygiene (WASH) facilities across three selected IDP camps. Statistical techniques, including chi-squared tests and ordinal logistic regression analysis, were utilised to examine the relationships between physical infrastructure adequacy and the Sustainable Livelihoods Score. The findings reveal diverse patterns in Shelter and WASH vulnerabilities across IDP camps, emphasising the need for nuanced interventions tailored to specific challenges faced by IDPs in different locations. Logistic regression analysis provides insights into the significant predictors of the Sustainable Livelihoods Score. The results indicate that the Shelter Vulnerability Score is not a statistically significant predictor of the Sustainable Livelihoods Score, whereas the WASH Vulnerability Score shows marginal significance, suggesting a potential but not strong impact. The goodness-of-fit analysis indicated that the logistic regression model provided a reasonable fit to the data, offering valuable insights into the relationship between physical infrastructure adequacy and livelihood conditions of IDPs in Borno State.

Keywords: Internally Displaced Persons (IDPs), physical infrastructure, livelihoods, geospatial analysis, statistical modelling.

INTRODUCTION

Borno State, located in northeastern Nigeria, has been grappling with a severe humanitarian crisis due to the insurgency of Boko Haram. The conflict has resulted in a massive displacement of over 1.8 million IDPs, forcing them to seek refuge in IDP camps within the state (Internal Displacement Monitoring Centre [IDMC], 2020; International Organization for Migration [IOM], 2021; United Nations Office for the Coordination of Humanitarian Affairs [UNOCHA], 2021). The situation is characterised by overcrowded

camps, strained resources, and a persistent struggle for survival among the displaced population which raises concerns about their well-being and living conditions of these displaced populations (United Nations High Commissioner for Refugees [UNHCR] 2022).

The significance of physical infrastructure in influencing the well-being of individuals, particularly IDPs, cannot be overstated (Ellis & Roberts, 2016). Physical infrastructure, including shelter, water, sanitation, healthcare facilities, and security measures, are fundamental needs for human well-being and are indispensable for maintaining health and dignity. This infrastructure serves as a foundational element for a satisfactory level of well-being among IDPs. And plays a pivotal role in fostering resilience and sustainable livelihoods for IDPs (UNOCHA, 2021). However, the displacement crisis has strained these infrastructures, resulting in substandard living conditions among the IDPs. These challenges contribute to heightened vulnerabilities and hamper efforts to create a conducive environment for rebuilding lives as well as compromising the overall well-being of IDPs.

The ongoing conflicts in Borno state have resulted in a critical need for resilient and sustainable infrastructure to address the challenges faced by IDPs. Recognising the intricate nexus between physical infrastructure and living conditions is imperative for formulating effective policies and intervention strategies tailored to address specific needs within these camps (IOM, 2018; World Bank, 2023).

This study aims to address existing knowledge gaps by exploring the complex relationship between the physical infrastructure and living conditions of IDPs in Borno. While prior research on IDPs has assessed the socioeconomic factors influencing living conditions and contributing to the plights of IDPs, the issue of conflict resilience of basic infrastructure is lacking academic attention in fragile states (International Committee of the Red Cross [ICRC], 2021). This suggests a discernible gap in the in-depth analysis of how physical infrastructure impacts the well-being of displaced individuals, especially in conflict-induced displacement.

Examining the status of physical infrastructure in Borno State provides critical insights into the challenges and opportunities that Internally Displaced Persons (IDPs) encounter in their pursuit of a satisfactory quality of life.

This research endeavours to offer a comprehensive understanding of the specific challenges faced by IDPs due to inadequate physical infrastructure in IDP camps to inform targeted policies and interventions aimed at improving living conditions and fostering sustainable livelihoods for IDPs. The objectives of the study are to determine the relationship between the physical infrastructure of IDP camps and the living conditions, well-being, and resilience of IDPs, assess the physical infrastructure adequacy of IDP camps in Borno State, and examine strategies for addressing physical infrastructure vulnerability. This study aims to uncover patterns and associations that contribute to understanding the intricate dynamics between infrastructure and the well-being of displaced populations, thus offering valuable insights for informed policy formulation and intervention strategies (International Federation of Red Cross and Red Crescent Societies [IFRC], 2022; United States Agency for International Development [USAID], 2023).

Physical infrastructure is central to people's lives, as emphasised by Hallegatte et al. (2019), and is recognised as a crucial element in poverty alleviation (Pouliquen, 2000). Its profound influence is significant on the well-being of individuals, including those experiencing internal displacement, as emphasised by Ellis and Roberts (2016). In the specific context of this research, physical infrastructure emerges as a foundational element for assessing a satisfactory level of well-being among Internally Displaced Persons (IDPs). This demographic group, marked by vulnerability, grapples with the challenges of forced displacement stemming from conflicts, natural disasters, or other emergencies, as highlighted by UNHCR (2021). This review explores the impacts of physical infrastructure on the well-being of displaced populations, unravelling the intricate dynamics that shape the experiences of IDPs in relation to their

physical surroundings, thereby providing insight into the crucial intersection of IDPs and the physical infrastructure of IDP camps for informing policymaking and humanitarian efforts.

Scholars have consistently highlighted the critical role of physical infrastructure, including shelter, access to clean water, sanitation facilities, and proper hygiene practices, in determining the well-being and resilience of displaced populations as fundamental to their health and dignity. For instance, Ari et al. (2020) and Dargin & Mostafavi (2020) investigate environmental health conditions highlighting overcrowding, water poverty and infrastructure disruptions in disasters as risk factors respectively, during displacement, that contribute to infrastructure vulnerability in IDP camps. Gough et al. (2019) and Tsuchiya-Ito et al. (2019) emphasised the implications of extreme weather events and inadequate infrastructure on vulnerable populations, including loss of property, reduced incomes, restricted mobility, and poorer health.

According to Ziersch and Due (2018), the quality of housing, particularly in refugee camps, has an impact on health and well-being, as poor housing conditions are linked to both physical and mental health issues. Similarly, Habib et al. (2011) asserted that housing quality was strongly associated with the occurrence of chronic illnesses which undermined the well-being of IDPs in Beirut, Lebanon. Ward et al. (2020) underscores the role of infrastructure components in building social capital in refugee camps, which is essential for the well-being of displaced populations. Bess et al. (2023) emphasized the impact of housing insecurity on children's health. Williams (2019) investigated the impact of conflict on the security and sustainability of IDP shelters and found that the proximity to conflict zones significantly affected the safety of shelters, emphasizing the need for strategic camp placement and enhanced security measures. (Carnemolla & Skinner, 2021) emphasizes the positive outcomes associated with providing secure, stable, and permanent housing for homeless individuals. Jayakody et al. (2022) highlight the importance of considering housing needs beyond physical aspects for creating resilient and sustainable communities.

The provision of adequate physical infrastructure, including shelter, water, sanitation, and hygiene, significantly impacts the well-being and living conditions of IDPs while Inadequate infrastructure can lead to health issues such as diarrhoea, depression, and anxiety (Behnke et al., 2018; Gichunge et al., 2020; Kusimo, 2019; Shackelford et al., 2020). Unfortunately, the myriad health issues faced by IDPs are due to inadequacy and poor access to these facilities (Kusimo, 2019).Gichunge et al. (2020) emphasised the need for safe drinking water, pit latrines, and sanitation and hygiene training to improve well-being and living conditions in IDP camps. Shrestha et al. (2018) associated higher water security index values with improved physical and psychological health. Access to water, sanitation, and hygiene services for involuntarily displaced populations is an important component of Sustainable Development Goal 6 (Behnke et al. 2018). Ekezie et al. (2019) reported that the absence of sanitation and vaccination in camps could lead to poorer quality of life for IDPs. Thus, emphasising the need for WASH interventions considering consistent water supply, proper sanitation infrastructure, and hygiene education in preventing waterborne diseases and improving the overall well-being of IDPs.

The significance of adequate and secure shelter in shaping the psychological and physical well-being of displaced people necessitates resilience-building measures and resilient infrastructure to mitigate risks and enhance the adequacy and longevity of physical infrastructure in IDP settings. Ekoh et al. (2023) highlights the need for improved health interventions to address housing problems facing IDPs in Abuja camps, which expose them to diseases. Behnke et al. (2020) expanded on these findings, noting the importance of addressing overcrowding, waste management, energy supply, vector control, menstrual hygiene, air quality, and food safety in protracted displacement settings. Dev and Das (2020) emphasised the need for durable and culturally sensitive shelter solutions, highlighting the importance of household or community participation for satisfaction and safe design outcomes in shelter projects. Domini et al. (2022) analyzed latrine management approaches in IDP camps in Myanmar, identifying family-shared, gender-segregated latrines as preferred sanitation strategies. Prescott et al. (2021) advocate for green infrastructure for

sanitation in global South settlements, particularly using constructed wetlands for wastewater treatment. Karsu et al. (2021) proposed a biobjective approach for clean water network design in refugee camps, aiding informed decision-making. Xu (2023) explored the causes, impacts, and measures of water safety in the Kakuma refugee camp, highlighting water insecurity as a global challenge. Yasmin et al. (2023) takes a systems approach to WASH resilience and sustainability in refugee communities, addressing the increasing complexity of these systems. Studies have explored the integration of technology into the design of durable infrastructure facilities. For instance, Alzahrani et al. (2023), Marin & Parra-Valencia (2023), and Mohammed Mustafa & Hayder (2023) examined the role of Internet of Things (IoT) devices in enhancing the monitoring and management of water and sanitation infrastructure for effective cooperation in solving social dilemmas in water management and in building smart cities. The study emphasised the importance of real-time data collection and analysis in ensuring the efficiency and sustainability of WASH facilities, especially in resource-constrained environments. Similar applications can be observed in IDP camps.

Agbajor and Mewomo (2024) and Ikudayisi et al. (2022) explored sustainable and eco-friendly approaches to infrastructure development in IDP settings. This research highlights the potential benefits of using renewable materials, energy-efficient technologies, and nature-based solutions to create environmentally sustainable shelters and WASH facilities.

Further, community participation has emerged as a vital component of infrastructure development, particularly in IDP settings. This approach requires the active involvement of community members in planning and managing sustainable infrastructure, emphasising collaborative partnership efforts, and the interconnectedness of various stakeholders. Mamokhere and Meyer (2023)emphasise the significance of community participation in the integrated development planning process, showcasing its potential to enhance service delivery, democracy, accountability, and community empowerment. HPCR (2015) assessed the effectiveness of policy frameworks and intervention strategies in improving the physical infrastructure for IDPs, emphasising the need for stronger policy enforcement and coordination among humanitarian agencies. Ekezie et al. (2019) further underscored the need for standardised health assessments and resources, particularly in the areas of sanitation and vaccination, as disparities in the distribution of resources can exacerbate these issues. These studies assessed community-led approaches to infrastructure development in IDP camps, emphasising the importance of understanding communities' perspectives for effective project development and successful project outcomes.

STUDY AREA

Borno State, located in northeastern Nigeria, is the focal point of this study because of the significant IDP crisis resulting from the Boko Haram insurgency. The selection of specific IDP camps within the state is guided by the need to capture variations in the physical infrastructure and living conditions of displaced populations. The rationale for choosing these camps considers factors such as representativeness and accessibility. Geographically, the state spans between latitudes 10 °01' 37″ and 13 °74' 49″ north of the equator and longitudes 11 °54' 26″ and 14 °67' 30″ East of the Greenwich meridian, as depicted in Figure 1. It shares its borders with Niger to the North, Cameroon to the East, Adamawa State to the South, Gombe State to the Southwest, Yobe State to the West, and encompasses a significant portion of the Chad Basin to the Northeast. According to data from 2006, Borno State has a population of 4,171,104 residents, with projections indicating an increase to approximately 7,498,333 by 2021. This population is distributed across three Senatorial Districts, each comprising nine Local Government Areas (LGAs), resulting in a total of twenty-seven LGAs (NPC, 2006). The demographic landscape of Borno State is characterised by the predominant presence of the Kanuri ethnic group, accompanied by various other ethnicities, such as the Lapang, Babur, Bura, Mandara, Marghi, and Shuwa Arabs (Scheinfeldt et al., 2010). Agriculture is the primary livelihood of the populace, echoing the economic activities prevalent in many states across the northeastern region of Nigeria. Given its central role as the epicentre of conflict-induced displacement and

humanitarian crisis within Nigeria, understanding of physical infrastructure adequacy for Internally Displaced Persons in Borno State, Nigeria.
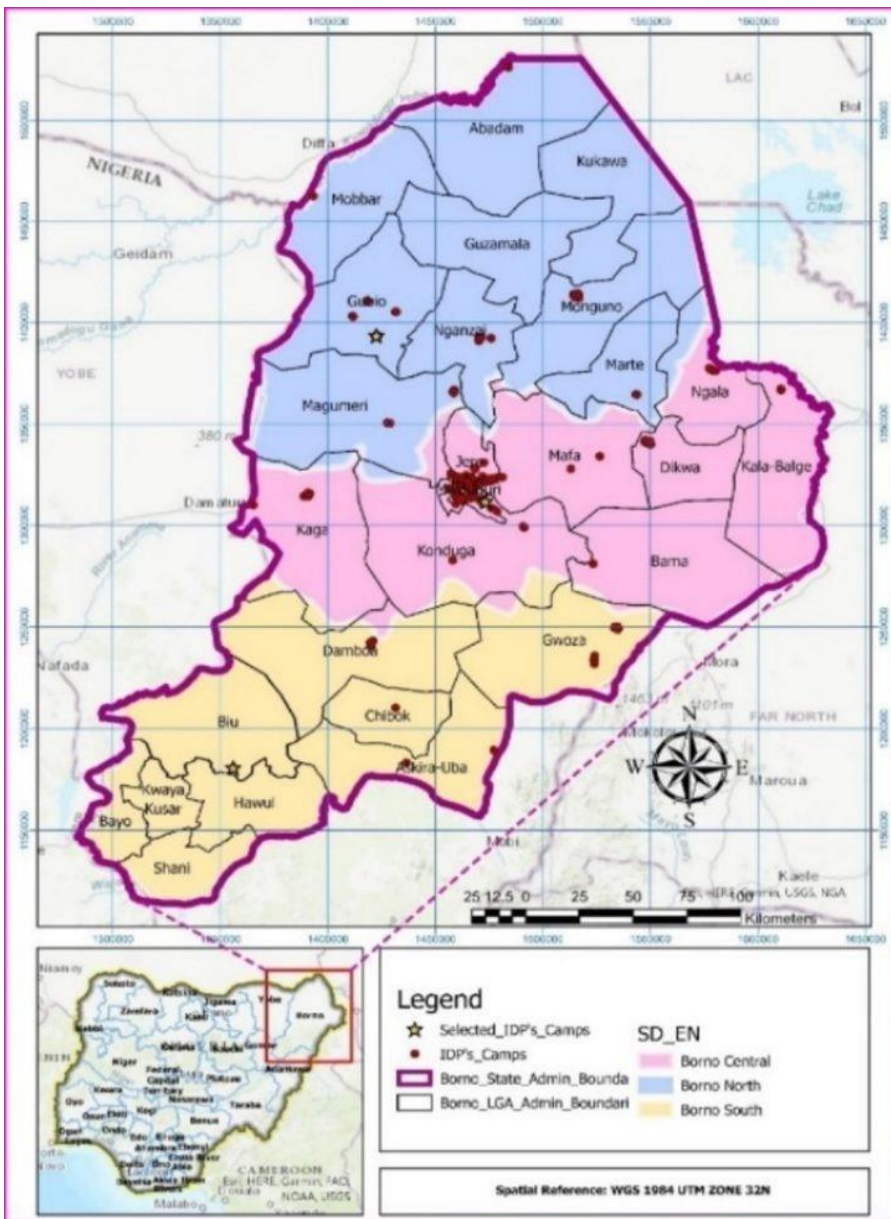
Figure 1: Locations of IDP camps by their respective senatorial districts in Borno State, Nigeria.

Source: Vectorised from Digital Global Satellite Imageryat@ 0.6-meter resolution (2021), paper map acquired from the Borno State Ministry (Borno State Ministry Physical Planning and Urban Development, 1988; International Organization for Migration (IOM) Nigeria, 2021).

MATERIALS AND METHOD

Theoretical Framework of the Research

Understanding the multifaceted dynamics of IDPs and the infrastructure supporting them requires a robust theoretical foundation to guide analysis and interpretation. This study adopts a theoretical framework that amalgamates Human Security Theory and the Capability Approach, offering a comprehensive lens through which to evaluate the adequacy of infrastructure within IDP camps and its ramifications on the well-being of IDPs in Borno State.

Human Security Theory, as articulated by the United Nations Development Programme(UNDP, 1994), prioritises the protection and empowerment of individuals and communities, emphasising diverse dimensions of well-being encompassing economic, health, environmental, and personal security. This theoretical perspective transcends traditional security paradigms focused solely on state and military concerns, underscoring the significance of safeguarding individuals from myriad threats including poverty, disease, environmental degradation, and displacement. This orientation guided the examination of the challenges faced by IDPs and the implications for their physical infrastructure, with particular emphasis on how infrastructure development can contribute to augmenting overall security and well-being.

Concurrently, the Capability Approach, advanced by Sen (1999), posits that development should be assessed based on individuals' capabilities to lead lives they value, rather than solely relying on economic metrics. Within this framework, capabilities denote substantive freedoms and opportunities that individuals possess to pursue valued life trajectories. This approach underscores the importance of not only assessing available resources but also considering individuals' capacity to utilise and transform these resources into meaningful functioning, thereby highlighting the pivotal role of physical infrastructure development in enhancing individuals' capabilities.

The integration of the Capability Approach aligns with the central tenet of this research, which views physical infrastructure as foundational to human development, rather than merely instrumental. By elucidating how infrastructure development can expand the capabilities of displaced populations, this theoretical framework underscores the importance of access to adequate shelter, water, sanitation, and healthcare facilities to foster the health and dignity of IDPs. Consequently, this framework facilitates the exploration of how infrastructure interventions translate into tangible improvements in the well-being and agency of displaced individuals.

Through the synthesis of Human Security Theory and the Capability Approach, this study endeavours to offer a nuanced understanding of the relationship between IDPs and their physical infrastructure. While Human Security Theory elucidates the broader context of threats and vulnerabilities confronting IDPs, the Capability Approach delves into specific mechanisms through which infrastructure can empower and enable displaced populations. This amalgamated theoretical framework serves as a conceptual basis for analysing the adequacy of infrastructure within IDP camps and its implications for the broader capabilities and well-being of IDPs in Borno State, acknowledging the intricate interplay between security, well-being, and capabilities.

Moreover, by contributing to the comprehension of physical infrastructure adequacy for IDPs in Borno State, this study draws upon foundational insights from authoritative sources. For instance, The Sphere Handbook (Sphere Association, 2018), a widely recognised guide in the humanitarian sector, underscores the imperative of upholding dignity and ensuring the well-being of displaced populations through adherence to appropriate infrastructure standards. Additionally, the annual Global Trends report by the United Nations High Commissioner for Refugees (UNHCR, 2022) provides a comprehensive overview of forced displacement globally, emphasising the magnitude of displacement and the pressing need for adequate infrastructure to address associated challenges. Furthermore, studies such as that by Leckie (2008), focusing on housing, land, and property rights in post-conflict settings, though not specific to IDP camps, underscore the criticality of secure and adequate housing as a fundamental aspect of infrastructure for displaced individuals. These scholarly contributions collectively underscore the pivotal role of physical infrastructure in shaping the experiences and livelihood conditions of IDPs, advocating a holistic and rights-based approach to infrastructure provision to ensure the well-being and dignity of displaced populations.

The research employed a mixed-method approach, combining survey research design with geospatial techniques which enabled the aggregation of statistical data and enhanced analytical capabilities. This design allows for a comprehensive investigation of the physical infrastructure adequacy within Internally

Displaced Persons (IDPs) camps in Borno State, Nigeria.

Structured surveys were conducted to gather quantitative data on the current state of the physical infrastructure in IDP camps, including the adequacy of shelters, availability of clean water, sanitation facilities, and security measures. These surveys employed validated tools, adapting relevant elements from studies such as Dargin and Mostafavi (2020) and Galiani et al. (2017) for comprehensive assessments. Qualitative insights were obtained through in-depth interviews and focus group discussions with IDPs. This approach allows researchers to explore individual experiences, perceptions, and coping strategies concerning the available physical infrastructure. Interviews can be guided by themes identified in the literature, such as those related to housing conditions, water and sanitation, and security. Geographic Information System (GIS) mapping can enhance the spatial analysis of infrastructure distribution and its impact on livelihoods. This approach aligns with studies such as Chan and Ma (2020) and Tsuchiya-Ito et al. (2019) that emphasise the importance of considering geographic factors in assessing well-being and infrastructure. Incorporating participatory methods, such as community mapping and participatory action research, can empower IDPs to actively contribute to the research process. This collaborative approach aligns with studies such as Maystadt et al. (2019) and emphasises the importance of involving affected communities in shaping interventions.

Data Collection

The research population comprises 5836 individuals, including household heads and stakeholders from the three (3) senatorial districts in Borno State. Probability and non-probability sampling techniques were employed. A stratified random sampling technique was used to select three camps, considering the three (3) senatorial districts in Borno State which include Kumburi Camp in Gubio Local Government Area, representing Borno North Senatorial District, with a population of 1095 and 207 household heads; Shuwari 5 Camp in Maiduguri Local Government Area, representing Borno Central Senatorial District with a population of 3006 and 601 household heads; and Zonal Educational Centre Camp in Biu Local Government Area, representing Borno South Senatorial District, with a population of 1735 and 285 household heads. This ensured regional representation and comprehensive coverage, as stratification was based on geographical location. The snowball or chain referral sampling technique was used to select IDP camp coordinators, local authorities, and stakeholders for the focus group discussions (FGD) and key informant interviews. With a population size of 1093 household heads, a confidence level of 95%, and a real value within ±5% of the survey value, a sample size of 285 was determined, meeting the minimal requirements proposed by Krejcie and Morgan. The population and sample sizes of the selected IDP camps are presented in Table 1.

Table 1: Proposed sample size for the selected IDP camps

S/No	IDP Camps	Location	Number of Household heads	Sample size
1	Kumburi Camp	Gubio LGA, Borno North senatorial district	207	54
2	Shuwari 5 Camp	Maiduguri LGA, Borno Central senatorial district	601	157
3	Zonal Educational Centre Camp	Biu LGA, Borno South senatorial district	285	74
Total			**1093**	**285**

Sources: Authors Computations, 2021, and adopted from (NPC, 2006; IOM, 2021)

Data Collection Instruments

The complete set of data sources and research instruments is summarised in Table 2. This comprehensive approach to refining research instruments and employing diverse data collection methods ensured that the study yielded robust, reliable, and meaningful results.

Table 2: Data Sources and Instruments

S/No	Target Population	Data Sources and Instruments
1	IDPs' Household heads	Field Surveys; surveys were conducted using structured and unstructured questionnaires. See details in (Appendix II).
2	Camp Coordinators (Commandants and manager)	Focus Group Discussions (FGD); Key informant interview guide was used to elicit the views on IDPs and the effect of existing policies and programs (Appendix VI).
3	Stakeholders (Local, National and International Bodies)	Key Informant Interview (KII); for information on policies and programs initiatives (Appendix III)
	· Non-Governmental Organizations (NGO) International Organization for Migration (IOM)	
	· Ministries, Departments and Government Agencies (MDAs): NEMA; BACSDAHR; and BOSEMA	

Source: Author's Compilation, 2020

Procedure for Data Collection

The data collection process involved a systematic approach, including submission of official applications, letters of introduction, and a chain referral system for distributing questionnaires and conducting interviews. Geographical data collection involved a base map of the study area to enhance the effectiveness of the field survey. Additionally, optical evidence of locations and significant observations related to the research were captured using high-resolution 64 MP digital cameras.

Method of Data Analysis

The data analysis method encompasses several key components, focusing on the assessment of physical infrastructure adequacy within IDP camps. Shelter vulnerabilities are analysed through a combination of quantitative assessments, evaluation of structural integrity and occupancy rates, and qualitative exploration of displaced individuals' experiences. Geospatial mapping utilising GIS technology highlights variations in shelter vulnerabilities, aiding the visualisation of areas with differing levels of adequacy. Similarly, water, sanitation, and hygiene (WASH) vulnerabilities were scrutinised through quantitative evaluations of facility availability and accessibility, along with qualitative insights into usage patterns and challenges. GIS analysis identified spatial patterns of WASH vulnerabilities, pinpointing areas lacking adequate access to clean water

and sanitation facilities. The relationship between physical infrastructure adequacy and livelihood conditions was explored through the formulation of a Sustainable Livelihoods Score, incorporating indicators related to income, employment, health, and education. Statistical techniques, including chi-squared tests and ordinal logistic regression analysis, were employed to identify associations between infrastructure adequacy, livelihood conditions, and demographic characteristics. Surveys covering shelter conditions, WASH facility access, and overall living conditions inform the analysis, whereas satellite imagery and GIS technology aid in mapping infrastructure adequacy and vulnerabilities, facilitating targeted interventions based on spatial disparities.

Statistical analysis techniques, including descriptive and inferential analyses, were applied using SPSS Version 26.0. Descriptive statistics, such as frequencies, percentages, and measures of central tendency, were computed. Inferential statistics, including chi-squared tests and ordinal logistic regression analysis, were employed to test the relationships between variables.

Chi-Squared Tests were used to evaluate the association between Independent and Dependent Variables. The Pearson chi-square-based scale parameter (c) was calculated to adjust the likelihood ratio statistic in the logistic regression. This parameter helped account for overdispersion in the data, improving model fit and information criteria, and was typically computed using the following formula:

$$c = (\chi^2 - df) / (N - p) \tag{2}$$

Where:

- *χ^2 is Pearson's chi-square statistic for the model.*
- *df is the degrees of freedom associated with the model.*
- *N is the total number of observations in the dataset.*
- *p is the number of predictors or parameters in the model (excluding the intercept).*

The Wald Chi-Square (χ^2) statistic, a measure in logistic regression, assessed the significance of coefficients for predictor variables. It tests the null hypothesis that the coefficient is equal to zero, indicating no significant effect on the dependent variable. The significance level was set at 0.05, and the Wald Chi-Square value was compared to the critical value from the chi-square distribution table to determine statistical significance. The formula for the Wald Chi-Square statistic is as follows:

$$\text{Wald Chi-Square } (\chi^2) = (\beta / SE(\beta))^2 \tag{3}$$

Where:

- *β is the estimated coefficient (parameter) of the predictor variable.*
- *$SE(\beta)$ is the standard error of the coefficient estimate β.*

These statistical techniques were crucial in exploring and understanding the relationships and patterns within the dataset, providing a comprehensive analysis of the study's objectives and hypotheses.

Ordinal Logistic Regression Analysis was conducted by considering the dependent variable as ordinal and the independent variables as ordinal. This was done to assess the strength and significance of the relationships. Where the p-values for these variables are significant, it suggests that there are associated. Goodness-of-fit tests were carried out to assess the model's fit to the data. The formula for the Ordinal

Logistic Regression model is as follows:

$$\text{logit}(P(Y \leq j)) = \alpha_j + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_p X_p \tag{4}$$

where:

- $P(Y \leq j)$ is the cumulative probability that the dependent variable Y is less than or equal to category j.
- αj is the threshold parameter for category j.
- $\beta 1, \beta 2, \ldots, \beta p$ are the coefficients of the predictor variables $X1, X2, \ldots, Xp$.
- $X1, X2, \ldots, Xp$ are the predictor variables.
- p is the number of predictor variables.

Logit transformation (log-odds) is represented by the logit function $(P(Y \leq j))$, and the cumulative probabilities are modelled as linear combinations of predictor variables. Thresholds αj represent the points on the latent scale where the cumulative probabilities change. The coefficients $\beta 1, \beta 2, \ldots, \beta p$ indicate the impact of the predictor variables on the log-odds of the outcome.

Ordinal Logistic Regression estimates the parameters (αj and β) that maximise the likelihood of the observed ordinal outcomes given the predictor variables. The model provides insights into the relationship between the predictors and ordinal response variables.

Data Variable Definition

Variables for analysis include dependent variables such as Living Conditions (Human Assets, Physical Assets, Financial Assets, Social Assets, Personal Assets) and independent variables related to Physical Infrastructure Adequacy (Crowdedness, Housing Condition, Security of Tenure, Accessibility to Toilet, Reliability of Sanitation System, Reliability of Solid Waste Management, Accessibility to Water). Physical Infrastructure Adequacy Variable and Policy and Programs Efficacy Variables) adopted for this study are presented in Table 4.

Table 4: Variables Adopted for the Analysis

S/No.		CI Code	*Composite Indicator (CI)*	Variable Code	Variables	Measurement Scale
Dependent Variables						
1	Living Condition	HAI	*Human Assets*	SLS	Livelihoods	1= Low 2= Moderate 3= High 4= Severe
		PhAI	*Physical Assets*			
		FAI	*Financial Assets*			
		SAI	*Social Assets*			
		PAI	*Personal Assets*			
Independent Variables						
1	Physical Infrastructure Adequacy Variable	CRWI	*Crowdedness*	SVS	Shelter Vulnerability	1= Low Vulnerability 2= Moderate Vulnerability 3= High Vulnerability 4= Severe Vulnerability

2		HCI	*Housing Condition*			1= No Risk
3		SoTI	*Security of tenure*			2= Low Risk
4		ATI	*Accessibility to Toilet * 0.3 = A*	WASHVS	WASH Vulnerability	3= Moderate Risk
5		RoSSI	*Reliability of Sanitation System * 0.3 = B*			4= High Risk
6		RoSWMI	*Reliability of SWM * 0.1 = C*			
7		AWI	*Accessibility to Water * 0.3 = D*			

Source: Author's Compilation, 2022

RESULTS AND DISCUSSION

Presentation of Results

1. Pattern in Shelter Vulnerability

The analysis revealed variations in Shelter Vulnerability Scores across different IDP camps. Kumburi Camp in Gubio exhibits a majority with "High" Shelter Vulnerability Scores (61.1%), Shuwari 5 Camp in MMC shows a more balanced distribution between "High" and "Moderate," while Zonal Educational Centre Camp in Biu is predominantly "High" (66.2%). Collective data indicates the need for nuanced interventions tailored to specific challenges in different camps.

2. Pattern in WASH Vulnerability

WASH Vulnerability Scores also varied among camps, with Kumburi Camp having a majority in the "Medium Risk" category (75.9%), Shuwari 5 Camp showing a similar pattern, and Zonal Educational Centre Camp having a higher proportion in the "Medium Risk" category (73.0%). These findings emphasise the necessity of targeted interventions to address the diverse WASH vulnerabilities across IDP camps.
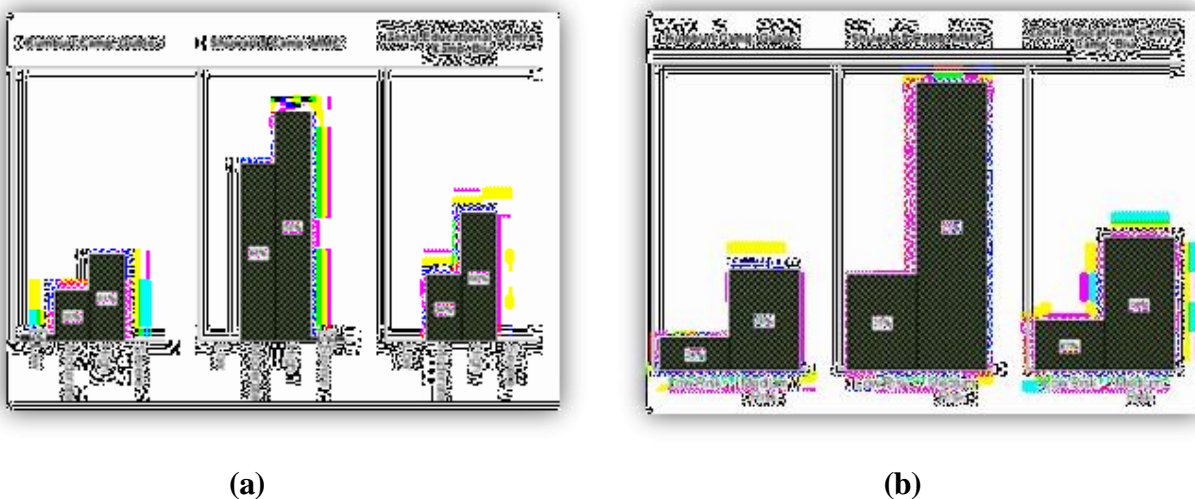

(a)   (b)

Figure 9: (a) Shelter Vulnerability Scores by Camps. (b) WASH Vulnerability Scores by Camps
Source: Author's Computation, 2023

3. Significant Predictors of Sustainable Livelihoods

Logistic regression analysis revealed the key predictors that significantly influenced the overall livelihood conditions of IDPs. Overall, the model was significant ($p < .001$), indicating its explanatory power. Shelter Vulnerability Score was not a significant predictor, while the WASH Vulnerability Score demonstrated marginal significance ($p = .069$), suggesting its limited impact.

Table 5: Regression analysis for the relationship between the physical infrastructure in the IDPs' camps and their living conditions.

Parameter Estimates								
Parameter		**B**	**Std. Error**	**95% Wald Confidence Interval**		**Hypothesis Test**		
				Lower	**Upper**	**Wald Chi-Square**	**df**	**Sig.**
Threshold	[Sustainable Livelihoods Score=1.00]	-3.180	.6081	-4.372	-1.988	27.344	1	.000
	[Sustainable Livelihoods Score=2.00]	5.700	1.1192	3.507	7.894	25.940	1	.000
[Shelter Vulnerability Score (Recoded)=1.00]		-3.180	1.5387	-6.196	-.164	4.271	1	.039
[Shelter Vulnerability Score (Recoded)=2.00]		-.072	.7423	-1.527	1.383	.009	1	.922
[Shelter Vulnerability Score (Recoded)=3.00]		-.660	.5273	-1.694	.373	1.567	1	.211
[Shelter Vulnerability Score (Recoded)=4.00]		0[a]	.	.	.	.	.	.
[WASH Vulnerability Score (Recoded)=2.00]		1.260	.6927	-.098	2.618	3.309	1	.069
[WASH Vulnerability Score (Recoded)=3.00]		0[a]	.	.	.	.	.	.
(Scale)		1[b]						
Dependent Variable: Sustainable Livelihoods Score *Model: (Threshold), Shelter Vulnerability Score (Recoded), WASH Vulnerability Score (Recoded)*								
a. Set to zero because this parameter is redundant.								
b. Fixed at the displayed value.								

1. Tests of Model Effects for Physical infrastructure Adequacy and Livelihood Interaction.

From Table 6, the Wald Chi-Square statistic for the Shelter Vulnerability Score (Recoded) is 5.799 with three degrees of freedom, resulting in a p-value of .122. This p-value suggests that the Shelter Vulnerability Score (Recoded) does not significantly predict the Sustainable Livelihoods Score ($p > .05$).The Wald Chi-Square statistic for the WASH Vulnerability Score (Recoded) is 3.309 with 1 degree of freedom, resulting in a p-value of .069. While this p-value is marginally significant ($p = .069$), it indicates that the WASH

Vulnerability Score (Recoded) may have a limited impact on predicting the Sustainable Livelihoods Score. The relationship is not highly significant but still warrants consideration.

Table 6: Tests of Model Effects for Physical infrastructure Adequacy and Livelihood Interaction.

Tests of Model Effects			
Source	**Type III**		
	Wald Chi-Square	**df**	**Sig.**
Shelter Vulnerability Score (Recoded)	5.799	3	.122
WASH Vulnerability Score (Recoded)	3.309	1	.069
Dependent Variable: Sustainable Livelihoods Score *Model: (Threshold), Shelter Vulnerability Score (Recoded), WASH Vulnerability Score (Recoded)*			

2. Hypothesis I -H_0: There is no significant relationship between the adequacy of the physical infrastructure in the IDPs camps and the living conditions of IDPs.

Based on the parameter estimates for "Physical Infrastructures Adequacy and Livelihood Interaction", the overall model was significant (F = 27.344, p < .001), as it explained a significant proportion of the variance in the Sustainable Livelihoods Score. These findings are important for understanding the factors that contribute to sustainable livelihoods in the context of this study. Logistic regression analysis indicated that the Shelter Vulnerability Score and WASH Vulnerability Score were key predictors of the Sustainable Livelihoods Score. However, several interaction terms involving the predictors from the "Tests of Model Effects for Physical Infrastructure Adequacy and Livelihood Interaction" individually yielded Wald Chi-Square statistic for Shelter Vulnerability Score (5.799) with 3 degrees of freedom, resulting in a p-value of .122. This p-value suggests that the Shelter Vulnerability Score does not significantly predict the Sustainable Livelihoods Score (p >.05). Conversely, the Wald Chi-Square statistic for the WASH Vulnerability Score was 3.309 with 1 degree of freedom, resulting in a p-value of .069. While this p-value was marginally significant (p = .069), it indicated that the WASH Vulnerability Score may have a limited impact on predicting the Sustainable Livelihoods Score. The relationship was not highly significant but still warrants consideration. Therefore, the Null Hypothesis was rejected. The results provide insights into the diverse living conditions and infrastructure adequacy experienced by IDPs and how these variables influence their likelihood of achieving sustainable livelihoods. The results of the model effects tests indicate that the Shelter Vulnerability Score was not a statistically significant predictor of the Sustainable Livelihoods Score, with a p-value greater than the conventional significance level of .05. On the other hand, the WASH Vulnerability Score demonstrates marginal significance, suggesting a potential but not strong impact on the Sustainable Livelihoods Score.

3. Goodness of Fit for Modell of Physical Infrastructure Adequacy and Livelihood Interaction.

Several goodness-of-fit statistics and information criteria were assessed to evaluate the performance and adequacy of the logistic regression model with respect to the dependent variable, "Sustainable Livelihoods Score", and its predictors: Threshold, Shelter Vulnerability Score (Recoded), and WASH Vulnerability Score (Recoded). From Table 7, both deviance and scaled deviance are measures of the model's lack of fit, with lower values indicating better fit. In this case, the value-to-degrees-of-freedom ratio of .475 suggests a reasonable model fit. The Pearson Chi-Square statistic and scaled Pearson Chi-Square value is 2.571 with 6 degrees of freedom. Both statistics were used to assess the overall goodness of fit, with lower values

indicating a better fit. In this case, the value-to-df ratio (.429) suggests a reasonable model fit.

Several information criteria were reported, including Akaike's Information Criterion (AIC):27.503, Finite Sample Corrected AIC (AICC):27.805, Bayesian Information Criterion (BIC): 49.418, and Consistent AIC (CAIC): 55.418. Information criteria was used to evaluate the trade-off between model complexity and goodness of fit, with smaller values indicating better model performance. These criteria help in model selection, with lower values indicating a more parsimonious and better-fitting model.

The goodness-of-fit statistics and information criteria suggest that the logistic regression model with the included predictors provides a reasonable fit to the data. The values of the deviance and Pearson Chi-Square, as well as the information criteria, indicate that the model is a reasonable representation of the relationship between the predictors and the Sustainable Livelihoods Score. However, further evaluation and validation are needed to ensure the adequacy and generalisability of the model.

Table 7: Goodness of Fit for model of physical infrastructure Adequacy and Livelihood Interaction.

Goodness of Fit[a]			
	Value	df	Value/df
Deviance	2.852	6	.475
Scaled Deviance	2.852	6	
Pearson Chi-Square	2.571	6	.429
Scaled Pearson Chi-Square	2.571	6	
Log Likelihood[b]	-7.752		
Akaike's Information Criterion (AIC)	27.503		
Finite Sample Corrected AIC (AICC)	27.805		
Bayesian Information Criterion (BIC)	49.418		
Consistent AIC (CAIC)	55.418		
Dependent Variable: Sustainable Livelihoods Score *Model: (Threshold), Shelter Vulnerability Score (Recoded), WASH Vulnerability Score (Recoded)*			
a. Information criteria are in smaller-is-better form.			
b. The full log likelihood function is displayed and used in computing information criteria.			

These results indicate that the relationship between physical infrastructure adequacy and the Sustainable Livelihoods Score is complex and influenced by various factors. While shelter vulnerability did not show a significant association, the marginal significance of WASH vulnerability suggests a nuanced impact on the living conditions of IDPs.

The study's findings contribute valuable insights into the patterns of Shelter and WASH vulnerabilities across IDP camps, identify significant predictors of the Sustainable Livelihoods Score, and provide nuanced results in the context of the study's hypothesis. These findings have implications for policymakers, humanitarian organisations, and researchers working to enhance the well-being of IDPs in Borno State, Nigeria.

Discussion

Assessing the adequacy of physical infrastructure within Internally Displaced Persons (IDPs) camps in

Borno State, Nigeria, and its impact on the living conditions and sustainable livelihoods of IDPs necessitates a comprehensive methodological approach that combines both quantitative and qualitative methods. Through the utilisation of logistic regression analysis along with in-depth interviews, this study aims to explore the intricate interplay between physical infrastructure and well-being. Rooted in a robust theoretical framework integrating the Human Security Theory articulated by UNDP (1994) and the Capability Approach delineated by Sen (1999), this research prioritises the protection and empowerment of individuals and communities. It emphasises diverse dimensions of well-being, encompassing economic, health, environmental, and personal security.

The analysis revealed significant disparities in the Shelter and Water, Sanitation, and Hygiene (WASH) vulnerability scores among various IDP camps. Whereas certain camps exhibited elevated shelter vulnerability, others demonstrated a more equitable distribution. For instance, Kumburi Camp in Gubio primarily manifests "High" Shelter Vulnerability Scores (61.1%), while Shuwari 5 Camp in MMC displays a more balanced dispersion between "High" and "Moderate" vulnerabilities. Conversely, the Zonal Educational Centre Camp in Biu is predominantly categorised as "High" (66.2%). Likewise, WASH vulnerability exhibited variance across camps, with Kumburi Camp predominantly classified within the "Medium Risk" category (75.9%), paralleled by Shuwari 5 Camp, while the Zonal Educational Centre Camp had a higher proportion classified as "Medium Risk" (73.0%). These findings underscore the imperative of targeted interventions tailored to address divergent shelter and WASH vulnerabilities across IDP camps, consistent with antecedent research accentuating the significance of context-specific approaches (Ellis & Roberts, 2016).

Logistic regression analysis delineated the significant predictors influencing the overall livelihood conditions of IDPs. Consequently, Tests of model effects further corroborated the intricate relationship between physical infrastructure adequacy and Sustainable Livelihood. These findings align with prior scholarship underscoring the pivotal role of physical infrastructure, particularly in WASH facilities, in determining the well-being of displaced populations. Ward et al. (2020)highlighted the critical role of infrastructure components in fortifying resilience and enhancing the living conditions of IDPs. Similarly, the findings support the working hypothesis positing that physical infrastructure adequacy significantly impacts the well-being of IDPs, particularly concerning WASH facilities. Although the Shelter Vulnerability Score did not emerge as a significant predictor, the WASH Vulnerability Score demonstrated marginal significance (p = .069), indicating its limited yet noteworthy impact. This suggests that while shelter vulnerability may not directly influence sustainable livelihoods, WASH vulnerability could exert some influence on the living conditions of IDPs. Although not highly significant, the findings partially corroborate the working hypotheses, implying potential implications for interventions aimed at ameliorating infrastructure and livelihoods, thereby reinforcing the imperative for comprehensive interventions addressing the myriad dimensions of infrastructure vulnerability. The goodness-of-fit statistics indicated that the logistic regression model furnished a reasonable depiction of the relationship between predictors and Sustainable Livelihoods. While the model fit was deemed reasonable, further scrutiny and validation may be required to ensure its adequacy and generalisability, congruent with the iterative nature of scholarly enquiry(IFRC, 2022; UsAID, 2023).

Understanding the nexus between physical infrastructure and living conditions is paramount for effective policy formulation and intervention strategies (IOM, 2018; World Bank, 2023). This study contributes to bridging knowledge lacunae by scrutinising this relationship within the milieu of conflict-induced displacement in Borno State. Through the evaluation of Shelter and WASH vulnerabilities, this study provides insights for targeted interventions, with the aim of enhancing living conditions and fostering sustainable livelihoods for displaced populations. The findings highlight the intricate nexus between physical infrastructure adequacy and the well-being of IDPs. This dovetails with extant literature accentuating the pivotal role of physical infrastructure in shaping the well-being of displaced

populations(Ellis & Roberts, 2016). The complex relationship between physical infrastructure and living conditions has been emphasized by antecedent studies (ICRC, 2021), spotlighting the exigency for meticulous analysis in fragile states. These findings emphasise the necessity for multifaceted interventions addressing diverse infrastructure challenges to ameliorate the living conditions and sustainable livelihoods of IDPs.

From the perspectives of physical planning, these findings emphasize the significance of tailored interventions in mitigating infrastructure vulnerabilities in IDP camps. The disparities in vulnerability patterns across camps underscore the need for holistic and context-specific approaches to infrastructure development and enhancement. Furthermore, the findings underscore the interconnectedness between physical infrastructure, livelihoods, and well-being, highlighting the imperative for integrated planning strategies that encompass multiple dimensions of infrastructure adequacy. This aligns with the precepts of sustainable development and resilience-building, accentuating the importance of infrastructure in fostering enduring stability and prosperity among displaced populations.

Prior research has consistently emphasised the critical role of physical infrastructure, including shelter and WASH facilities, in shaping the well-being and resilience of displaced populations(Behnke et al., 2018; Gichunge et al., 2020; Kusimo, 2019; Shackelford et al., 2020; Ward et al., 2020). Considering that inadequate infrastructure can precipitate various health challenges, exacerbating the predicaments encountered by IDPs, there isa need to empower IDPs and involve them in the planning and management of infrastructural facilities of camps for more effective, efficient, and sustainable outcomes. Thus, community participation emerges as a pivotal facet for improving the physical infrastructure of IDP camps, as it fosters a sense of ownership and empowerment among IDPs, aligning with the findings of this study(Mamokhere& Meyer, 2023).This study contributes to the literature by providing empirical substantiation of the role of physical infrastructure adequacy for sustainable livelihoods, emphasising the necessity for context-specific interventions.

CONCLUSION

This study provides a comprehensive analysis of the physical infrastructure adequacy within Internally Displaced Persons (IDPs) camps in Borno State, Nigeria, and its implications for their living conditions and sustainable livelihoods. Through a comprehensive mixed-methods approach encompassing quantitative analysis, logistic regression, geospatial techniques, and qualitative insights, this study aimed to achieve a nuanced understanding of the intricate relationship between physical infrastructure and well-being. Rooted in a robust theoretical framework comprising Human Security Theory and the Capability Approach, this study prioritised the protection and empowerment of IDPs across various dimensions of well-being to promote resilience to conflict displacement through the development of adequate physical infrastructure. This study sheds light on the significant variations in shelter and water, sanitation, and hygiene (WASH) vulnerabilities among IDP camps. This contributes to bridging knowledge gaps by scrutinising the relationship between physical infrastructure adequacy and sustainable livelihoods in conflict-induced displacement settings. The implications of this study extend beyond academia, providing valuable insights for policymakers, humanitarian organisations, and researchers involved in supporting displaced populations in conflict-affected regions. It advocates for multifaceted interventions and integrated planning strategies for mitigating infrastructure vulnerabilities and fostering enduring stability and prosperity for displaced populations, aligning with principles of sustainable development and resilience-building. The study's objectives, aimed at discerning this relationship, assessing infrastructure vulnerability, and informing targeted policies and interventions, were achieved, laying the groundwork for further research and policy formulation. Further research and validation are warranted to ensure the generalizability and effectiveness of intervention strategies in analogous contexts.

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REFERENCE

1. Agbajor, F. D., &Mewomo, M. C. (2024). Green building research in South Africa: A scoping review and future roadmaps. *Energy and Built Environment*, *5*(2), 316–335. https://doi.org/10.1016/j.enbenv.2022.11.001
2. Alzahrani, A. I. A., Chauhdary, S. H., &Alshdadi, A. A. (2023). Internet of Things (IoT)-Based Wastewater Management in Smart Cities. *Electronics*, *12*(12), 2590. https://doi.org/10.3390/electronics12122590
3. Ari, I. R. D., Hariyani, S., &Waloejo, B. S. (2020). Physical and social infrastructures: understanding holistic water poverty eradication in Indonesia. *IOP Conference Series: Earth and Environmental Science*, *612*(1), 012075. https://doi.org/10.1088/1755-1315/612/1/012075
4. Behnke, N., Cronk, R., Snel, M., Moffa, M., Tu, R., Banner, B., Folz, C., Anderson, D., Macintyre, A., Stowe, E., & Bartram, J. (2018). Improving environmental conditions for involuntarily displaced populations: water, sanitation, and hygiene in orphanages, prisons, and refugee and IDP settlements. *Journal of Water, Sanitation and Hygiene for Development*, *8*(4), 785–791. https://doi.org/10.2166/washdev.2018.019
5. Behnke, N. L., Cronk, R., Shackelford, B. B., Cooper, B., Tu, R., Heller, L., & Bartram, J. (2020). Environmental health conditions in protracted displacement: A systematic scoping review. *Science of The Total Environment*, *726*, 138234. https://doi.org/10.1016/j.scitotenv.2020.138234
6. Bess, K. D., Miller, A. L., &Mehdipanah, R. (2023). The effects of housing insecurity on children's health: a scoping review. *Health Promotion International*, *38*(3). https://doi.org/10.1093/heapro/daac006
7. Borno State Ministry Physical Planning and Urban Development. (1988). *Borno State Ministry Physical Planning and Urban Development 1988 Gazettes*.

8. Carnemolla, P., & Skinner, V. (2021). Outcomes Associated with Providing Secure, Stable, and Permanent Housing for People Who Have Been Homeless: An International Scoping Review. *Journal of Planning Literature*, *36*(4), 508–525. https://doi.org/10.1177/08854122211012911

9. Chan, J. H. L., & Ma, C. C. (2020). Public Health in the Context of Environment and Housing. In *Primary Care Revisited* (pp. 295–310). Springer Singapore. https://doi.org/10.1007/978-981-15-2521-6_18

10. Dargin, J. S., & Mostafavi, A. (2020). Human-centric infrastructure resilience: Uncovering well-being risk disparity due to infrastructure disruptions in disasters. *PLOS ONE*, *15*(6), e0234381. https://doi.org/10.1371/journal.pone.0234381

11. Dev, K. N., & Das, A. K. (2020). SHELTERING EMERGENCIES: Design development process of temporary housing in post-disaster settlement by community participation. *Balancing Innovation and Operation*. https://doi.org/10.35199/NORDDESIGN2020.31

12. Domini, M., Guidotti Pereira, S., Win, A., Win, L. Y., & Lantagne, D. (2022). Qualitative and Quantitative Analysis of Latrine Management Approaches in Internally Displaced Persons Camps in Myanmar. *The American Journal of Tropical Medicine and Hygiene*, *107*(1), 35–44. https://doi.org/10.4269/ajtmh.21-0526

13. Ekezie, W., Timmons, S., Myles, P., Siebert, P., Bains, M., & Pritchard, C. (2019). An audit of healthcare provision in internally displaced population camps in Nigeria. *Journal of Public Health*, *41*(3), 583–592. https://doi.org/10.1093/pubmed/fdy141

14. Ekoh, P. C., Okoye, U. O., George, E. O., Chukwuemeka, E., &Agbawodikeizu, P. U. (2023). Resettlement of internally displaced persons (IDPs) in Nigeria: the housing problems facing IDPs in Abuja camps and the risk of homelessness and secondary displacement. *Journal of Social Distress and Homelessness*, *32*(2), 263–271. https://doi.org/10.1080/10530789.2022.2027069

15. Ellis, P., & Roberts, M. (2016). *Leveraging Urbanization in South Asia: Managing Spatial Transformation for Prosperity and Livability*. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-0662-9

16. Galiani, S., Gertler, P. J., Undurraga, R., Cooper, R., Martínez, S., & Ross, A. (2017). Shelter from the storm: Upgrading housing infrastructure in Latin American slums. *Journal of Urban Economics*, *98*, 187–213. https://doi.org/10.1016/j.jue.2016.11.001

17. Gichunge, C., Mutiso, D., &Brynjarsdottir, J. (2020). Predictors of social support, physical health and mental health among food insecure internally displaced persons in Turkana, Kenya. *Conflict and Health*, *14*(1), 58. https://doi.org/10.1186/s13031-020-00303-y

18. Gough, K. V., Yankson, P. W. K., Wilby, R. L., Amankwaa, E. F., Abarike, M. A., Codjoe, S. N. A., Griffiths, P. L., Kasei, R., Kayaga, S., &Nabilse, C. K. (2019). Vulnerability to extreme weather events in cities: implications for infrastructure and livelihoods. *Journal of the British Academy*, *7*, 155–181. https://doi.org/10.5871/jba/007s2.155

19. Habib, R. R., Yassin, N., Ghanawi, J., Haddad, P., & Mahfoud, Z. (2011). Double jeopardy: assessing the association between internal displacement, housing quality and chronic illness in a low-income neighborhood. *Journal of Public Health*, *19*(2), 171–182. https://doi.org/10.1007/s10389-010-0368-0

20. Hallegatte, S., Rentschler, J., & Rozenberg, J. (2019). *Lifelines: The Resilient Infrastructure Opportunity*. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-1430-3

21. HPCR. (2015). *HPCR ADVANCED PRACTITIONER'S HANDBOOK ON COMMISSIONS OF INQUIRY MONITORING, REPORTING, AND FACT-FINDING*. www.hpcrresearch.org

22. ICRC. (2021). *INFRASTRUCTURE CONCESSION REGULATORY COMMISSION (A REPORT ON THE ACTIVITIES OF THE INFRASTRUCTURE CONCESSION REGULATORY COMMISSION AND THE AUDITED ACCOUNTS FOR THE YEAR ENDED 31ST DECEMBER, 2021 AGM Report)*. www.icrc.gov.ng

23. IDMC. (2020). Global Report on Internal Displacement. *Internal Displacement Monitoring Centre*. https://www.internal-displacement.org/global-report/grid2020/

24. IFRC. (2022). *IFRC_Annual_Report_2022*.

25. Ikudayisi, A. E., Chan, A. P. C., Darko, A., &Adegun, O. B. (2022). Integrated design process of green building projects: A review towards assessment metrics and conceptual framework. *Journal of Building Engineering*, *50*, 104180. https://doi.org/10.1016/j.jobe.2022.104180

26. IOM. (2018). *IOM GLOBAL REPORT 2018 OPERATIONS AND EMERGENCIES*. www.iom.int

27. IOM. (2021). DTM Nigeria IOM NIGERIA DISPLACEMENT TRACKING MATRIX (DTM) DISPLACEMENT REPORT 37. *International Organization for Migration, IOM*.

28. Jayakody, C., Malalgoda, C. I., Amaratunga, D., Haigh, R., Liyanage, C., Hamza, M., Witt, E., & Fernando, N. (2022). Addressing housing needs of the displaced people promoting resilient and sustainable communities. *International Journal of Disaster Resilience in the Built Environment*, *13* (3), 368–385. https://doi.org/10.1108/IJDRBE-09-2021-0124

29. Karsu, Ö., Kara, B. Y., Akkaya, E., & Ozel, A. (2021). Clean Water Network Design for Refugee Camps. *Networks and Spatial Economics*, *21*(1), 175–198. https://doi.org/10.1007/s11067-020-09514-5

30. Kusimo, O. C. (2019). Findings from a Windshield Survey Conducted in an Internally Displaced Community in Nigeria. *Health*, *11*(01), 50–56. https://doi.org/10.4236/health.2019.111006

31. Leckie, S. (2008). Possible Components of a Unified Global Policy on Housing, Land, and Property Rights in UN Peace Operations. In *Housing, Land, and Property Rights in Post-Conflict United Nations and Other Peace Operations* (pp. 329–356). Cambridge University Press. https://doi.org/10.1017/CBO9780511575471.011

32. Mamokhere, J., & Meyer, D. F. (2023). Towards an Exploration of the Significance of Community Participation in the Integrated Development Planning Process in South Africa. *Social Sciences*, *12*(5), 256. https://doi.org/10.3390/socsci12050256

33. Marin, B.-E., & Parra-Valencia, J.-A. (2023). *Leveraging IoT and System Dynamics for Effective Cooperation in Solving Social Dilemmas in Water Management* (pp. 263–280). https://doi.org/10.1007/978-3-031-40635-5_11

34. Maystadt, J.-F., Hirvonen, K., Mabiso, A., & Vandercasteelen, J. (2019). Impacts of Hosting Forced Migrants in Poor Countries. *Annual Review of Resource Economics*, *11*(1), 439–459. https://doi.org/10.1146/annurev-resource-090518-095629

35. Mohammed Mustafa, H., & Hayder, G. (2023). Water Quality Monitoring Using Internet of Things (IoT). In *Phytoremediation of Domestic Wastewater with the Internet of Things and Machine Learning Techniques* (pp. 89–96). CRC Press. https://doi.org/10.1201/9781003359586-7

36. NPC. (2006). Population Census, Archived at the Wayback Machine. Federal Republic of Nigeria, National Bureau of Statistics. *National Population Commission of Nigeria (NPC)*.

37. Pouliquen, L. (2000). *INFRASTRUCTURE AND POVERTY*.

38. Prescott, M. F., Dobbie, M. F., & Ramirez-Lovering, D. (2021). Green Infrastructure for Sanitation in Settlements in the Global South: A Narrative Review of Socio-Technical Systems. *Sustainability*, *13* (4), 2071. https://doi.org/10.3390/su13042071

39. Scheinfeldt, L. B., Soi, S., &Tishkoff, S. A. (2010). Working toward a synthesis of archaeological, linguistic, and genetic data for inferring African population history. *Proceedings of the National Academy of Sciences*, *107*(supplement_2), 8931–8938. https://doi.org/10.1073/pnas.1002563107

40. Sen, A. (1999). *Development as freedom*. Oxford University Press.

41. Shackelford, B. B., Cronk, R., Behnke, N., Cooper, B., Tu, R., D'Souza, M., Bartram, J., Schweitzer, R., & Jaff, D. (2020). Environmental health in forced displacement: A systematic scoping review of the emergency phase. *Science of The Total Environment*, *714*, 136553. https://doi.org/10.1016/j.scitotenv.2020.136553

42. Shrestha, S., Aihara, Y., Bhattarai, A. P., Bista, N., Kondo, N., Futaba, K., Nishida, K., & Shindo, J. (2018). Development of an objective water security index and assessment of its association with quality of life in urban areas of developing countries. *SSM – Population Health*, *6*, 276–285. https://doi.org/10.1016/j.ssmph.2018.10.007

43. Sphere Association. (2018). *The sphere handbook : humanitarian charter and minimum standards in*

humanitarian response.

44. Tsuchiya-Ito, R., Slaug, B., & Ishibashi, T. (2019). The Physical Housing Environment and Subjective Well-Being Among Older People Using Long-Term Care Services in Japan. *Journal of Housing For the Elderly*, *33*(4), 413–432. https://doi.org/10.1080/02763893.2019.1597803

45. UNDP. (1994). *United Nations Development Programme (UNDP) Human Development Report 1994*.

46. UNHCR. (2022). *UNHCR GLOBAL REPORT 2022*.

47. UNOCHA. (2021). *OCHA UNITED NATIONS OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS ANNUAL REPORT 2021*.

48. UsAID. (2023). *Agency FinAnciAlRepoRt CONTINUING PROGRESS BEYOND PROGRAMS*. https://www.usaid.gov/

49. Ward, M., Poleacovschi, C., Faust, K., Weems, C. F., &Gabiam, N. (2020). Evaluating the Role of Infrastructure Components and Demographics on Social Capital in Refugee Camps. *Journal of Management in Engineering*, *36*(3). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000754

50. Williams, W. (2019). *Shifting Borders: Africa's Displacement Crisis and Its Security Implications*.

51. World Bank. (2023). *in Development A New Era Contents*.

52. Xu, Q. (2023). Research on the causes, impacts and measures of water safety – Taking Kakuma refugee camp as an example. *Theoretical and Natural Science*, *8*(1), 140–145. https://doi.org/10.54254/2753-8818/8/20240374

53. Yasmin, T., Dhesi, S., Kuznetsova, I., Cooper, R., Krause, S., & Lynch, I. (2023). A system approach to water, sanitation, andhygiene resilience and sustainability in refugee communities. *International Journal of Water ResourcesDevelopment*, *39*(5), 691–723. https://doi.org/10.1080/07900627.2022.2131362

54. Ziersch, A., & Due, C. (2018). A mixed methods systematic review of studies examining the relationship between housing and health for people from refugee and asylum seeking backgrounds. *Social Science & Medicine*, *213*, 199–219. https://doi.org/10.1016/j.socscimed.2018.07.045

APPENDIX IX

Geo-Tagged Photo documentation of the condition of IDPs Camps in study