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IMPACT OF ADAPTIVE STRATEGIES IN URBAN FLOOD MANAGEMENT IN LOKOJA, KOGI STATE, NIGERIA

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Abstract

Flooding poses a persistent challenge to Lokoja, a city in Nigeria strategically located at the confluence of the Niger and Benue Rivers. This study investigates the adaptive strategies employed by residents to mitigate the impacts of recurrent floods. Using a mixed-methods approach, data was collected through surveys and interviews with residents and stakeholders. Findings indicate that 73% of respondents identified the construction and maintenance of drainage systems as the most effective adaptive measure, emphasizing the urgent need for improved urban infrastructure. Community-based flood management initiatives, supported by 52% of participants, were highlighted as essential for

Keywords: Adaptive Strategies, Urban Flood Management, Lokoja, Kogi, Nigeria.

INTRODUCTION

Flood is a major problem in many Nigerian cities, especially Lokoja, the capital of Kogi State, because of its position on the Niger-Benue confluence (Bello *et al.*, 2024). Flooding is a common phenomenon in the city especially during the rainy season and has led to many people being forced to live in camps, loss of property, and disruption of activities in the affected sectors of the economy. Urbanisation and lack of proper planning do not help since pavements and other similar surfaces make runoff higher and water infiltration lower. There has been changes in the climate system which has worsened flooding in Lokoja by affecting the raining season and the river levels (Ndimele *et al.*, 2024). These challenges require the use of flexibility in the responses needed to reduce the effects of floods in urban areas and to protect the development of the city. Mitigation measures in urban flood control entails preventive measures that

fostering collective resilience through grassroots engagement. Additionally, 47% of respondents advocated for the implementation of early warning systems to enable timely responses to impending floods. The study reveals significant variability in the perceptions of adaptive measures, underscoring the necessity for tailored interventions that address the specific needs of vulnerable populations. It advocates for a multi-stakeholder approach involving government agencies, community leaders, and non-governmental organizations to ensure sustainable flood management. The findings emphasize the importance of integrating innovative solutions, policy support, and community participation to enhance Lokoja's resilience. This research contributes to the broader discourse on urban disaster management and offers practical recommendations for mitigating flood risks in similar settings.

aim at minimising risks and increasing community's ability to cope with floods (Wang *et al*., 2022). In Lokoja, such measures may involve flood control and drainage systems, warning systems, flood education, and the utilisation of green infrastructure like wetlands and other tree plantations (Buba *et al*., 2021). These strategies are implemented best through multiple stakeholder involvements, sufficient funding, and local and national policy enforcement. Research shows that sustainable flood control not only reduces the perils of floods and other disasters in the first instance but also enhances the sustainability of urban growth (Echendu, 2020).

Methods

Study Area

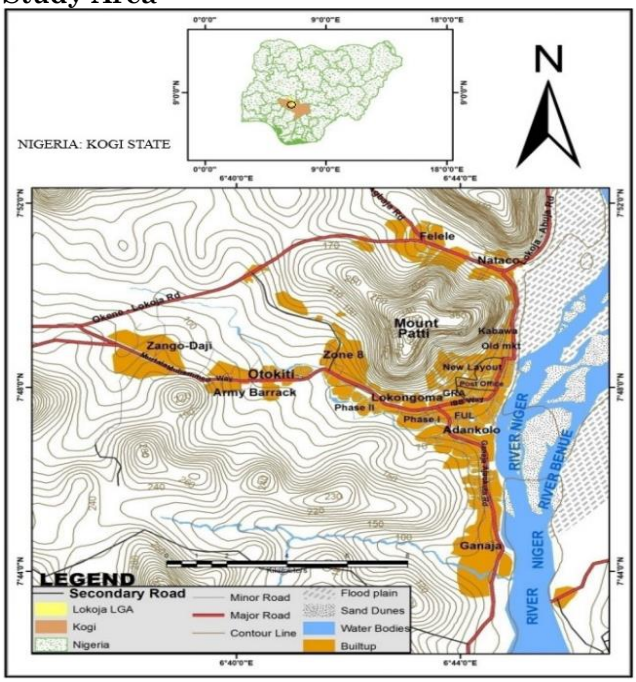

Figure 1: Map of the Study

Lokoja is situated on latitude 7.8023° N and longitude 6.7333° E, with a surface land cover of 3,180 km² (Olusanmi, 2023). Lokoja it is the capital of Kogi state. The city's strategic position at the confluence of the Rivers Niger and Benue has made it a well-known destination (Adeoye, 2019). Being one of the oldest cities in Nigeria, Lokoja is historically significant and serves as the capital of Kogi State (Chikezie, 2023). Due to its location at the confluence of these two significant rivers, it has long been a significant hub for regional trade, business, and transportation.

Research Method

This study employed quantitative research method. Quantitative research is a systematic method investigations that aims at measuring variables in order to establish the extent of a phenomenon, relationship or pattern (Sürücü & Maslakci, 2020). It uses computation techniques to analyse quantitative data obtained from questionnaires, experiments, or other databases. This approach is especially appropriate in research intended to assess the prevalence of a problem, determine the relationship between variables, or make generalisations across samples (Creswell & Creswell, 2017). Quantitative research is highly structured, is based on facts rather than perceptions, and is therefore suitable for providing numerical analysis and guidance for decision making.

The application of the quantitative method is most appropriate in this case on the effect of adaptive strategies of flood management in Lokoja. It makes it easier to gather quantitative data that can include the number of floods, the level of flood intensity, the amount of property loss, and the results of measures taken. Structured questionnaire and statistical tools can be used to measure the perception of the residents and stakeholders about these strategies and the socio- economic benefits of these strategies. Also, the method allows making comparisons, for instance, comparing the results in the given fields where certain adaptive measures are applied to those areas where they are not used.

However, the quantitative approach enhances objectivity in analysing the effectiveness of flood management strategies as well as provide policy makers with quantitative numerical figures to work with. The method also allows the study to look for patterns or associations, for instance between the awareness of flood risks and the ability of the community to cope with disasters (Bryman, 2016).

Data Collection

Data for this study was collected through online surveys, targeting residents of three highly flood-prone areas in Lokoja: Adankolo, Kabawa, and Ganaja. These neighbourhoods were targeted since they are frequently flooded and they offer a perfect background to assess the impact of adaptive strategies in urban flood management in the communities. The study aimed at obtaining the first-hand data on the adaptive strategies in urban flooding, actions taken by the inhabitants to address the problem, and their knowledge of measures adopted to adapt to floods.

The participants of this study were contacted in these areas and the local networks and leaders were particularly helpful in providing the online surveys. Their participation thus made it possible to have a larger representation and therefore hear from more residents who are affected by floods. The aim of the surveys was to develop short questionnaires containing specific questions on basic demographic characteristics, flooding incidence, actions taken, and impressions of the measures taken.

In the case of the current study, the use of online surveys was especially beneficial in the recruitment of participants since face-to-face data collection in flood-prone regions can be difficult (Vehovar & Manfreda, 2017). It also made it possible to get diverse responses within a short duration and therefore provided statistically validated information for the quantitative assessment of urban flood management in Lokoja.

Sampling Strategy and Techniques

This study utilised purposive sampling to select local residents for the online surveys from the three flood-prone neighbourhoods in Lokoja. Purposive sampling involves identifying and selecting individuals or groups that are especially knowledgeable about or experienced with the phenomenon of interest (Creswell & Creswell, 2017). Because this study aims to examine the impacts of and adaptations to urban flooding in Lokoja, purposive sampling was used to target residents of communities known to be highly vulnerable to frequent flooding events - Adankolo, Kabawa, and Ganaja. The experienced perceptions of these selected residents provide important firsthand insights into the localised effects of adaptive strategies in urban flooding. Purposive sampling enabled efficient collection of in-depth, relevant primary data from those most affected in Lokoja (Barratt *et al*., 2015). Overall, this strategic non-random sampling technique garnered quality information from knowledgeable informants to meet the study goals.

Method of Data Collection

The Likert-rating related questions in the questionnaire was analysed using standard deviation. In analysing the Likert-rating questions within the questionnaire, the standard deviation becomes an essential metrics. The arithmetic mean and the standard deviation tests of each Likert-scale question are carried out to establish the central tendency and the response variability. These statistical indicators offer a clear picture of how respondents see the issue, and the extent of agreement or disagreement with the proposed adaptive strategy. Interpretation of results involves a great deal of stakeholder consideration, which gives the ability to assess the efficiency and acceptability of the proposed adaptive measures. Standard deviations may vary from one respondent to another, which may be indicative of their different attitudes or priorities; this can be the basis for different respondents to specify different preferred targeted interventions and policies.

Ethical Considerations

Ethical considerations in research are the concepts and rules that researchers must adhere to in order to perform their study in an ethical and responsible way (Israel, 2014). The ethical considerations for this study include informed consent, privacy, confidentiality and data security.

Before engaging in the research, researcher ensured that all participants express informed consent. They must understand the objectives, risks, potential benefits of partaking in this study, and how their data were utilised (and how to withdraw it if they so decide). The researcher ensured that the participants are informed about their right to withdraw from the survey at any given point in time without any penalty. Also, the researcher protected participants' privacy by keeping their personal information confidential. The researcher also anonymised the data and guarantee that respondents are not identified in reporting findings. Lastly, the researcher secured all research data, so as to avoid unauthorised access or data breaches.

RESULTS

Table 1 presents the descriptive statistics of the respective Likert-rated item regarding the impact of adaptive strategies in urban flood management in Lokoja state.

Table 1: **Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Impact of Adaptive Strategies	204	1	5	2.30	1.276
Valid N (listwise)	204				

Source: Author's Survey (2024)

The descriptive statistics presented in Table 4.2 shed light on the perceived effectiveness of the adaptive strategies in coping with urban flooding in Lokoja city by the respondents, who used a Likert scale of 1 (Not effective at all) to 5 (Very effective) for the assessment. The average score of 2.30 indicates that the majority of respondents believed the indicated flood adaptive strategies will be somewhat effective in the area.

The minimum score of 1 indicates that some respondents see the adaptive strategies as not effective at all, while the maximum score of 5 shows that some respondents view the strategies as very effective. On the other hand, the standard deviation of 1.276 shows that there is a moderate level of variability in respondents' perceptions, meaning that their opinions on the effectiveness of these strategies are dispersed among respondents. Generally, the study showed that the adaptive measures have a high potential in the proper management of urban flooding in Lokoja city. Some participants believe in the effectiveness of these measures, but there are others who doubt their influence. This, thus, highlights the need for further study and probably specific actions to rectify the loopholes and enhance the efficiency of flood management efforts in the area.

Figure 2 presents the findings on the respondents' preferences of adaptive measures to flooding in Lokoja city are illustrated. The most striking finding of the study is that a majority of the respondents (73%) favour the option of constructing drainage systems. This proves that an adequate drainage system is considered as important aspect in the water management and the absence of flood, which further proves that the absence of adequate drainage system is vital in the flood prevention. Second on the list of the preferred approach of flood management was the community-based flood management receiving 52% of the participant's response. This focus on community participation is indicative of the growing role of community mobilisation in developing the resilience needed to combat flooding. This strategy does not only enhance the flood prevention but also enhances the sense of ownership whenever the community is engaged in the management of any natural disasters or environmental hazards.

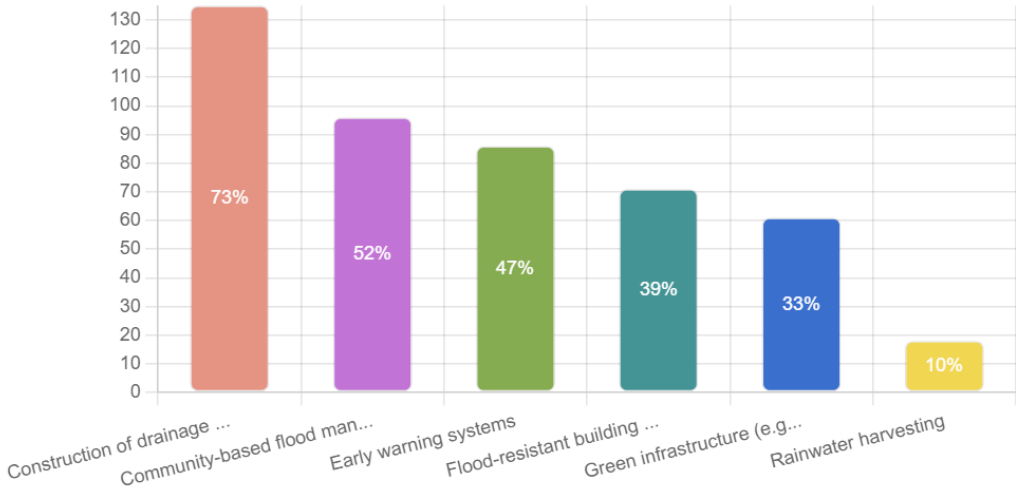

Figure 2: Flooding adaptive strategies

Discussion and Conclusion

The fact that 73% of the respondents largely favoured the construction of drainage systems as an adaptation measure indicates the attitude of the community, which is aware of the provision of adequate drainage infrastructure in the successful management of water and consequent flooding. The issues of proper design and maintenance of drainage systems have thus been among the general trends in many studies that have made similar recommendations to avert the risk and impact of urban flooding - for example, Oladokun and Proverbs (2016). Effective drainage systems contribute not only to the release of surplus water from the urban areas, but also to prevent the accumulation of water and the related incidences of flooding during heavy rainfall events. Moreover, the strong preference by this strategy from respondents in Lokoja city suggests a high level of need for investment in the improvement and expansion of already-present drainage infrastructure to foster the city's resilience to flooding.

The second most strongly adaptive strategy favoured by survey respondents was community-based flood management, at 52%, which clearly showed that the support for community involvement and grassroots participation in the development of local resilience in the face of natural hazards related disasters - including flooding - has been constantly increasing. This stems from the Theory of Urban Resilience to Floods which focuses on the development of city inundation preparedness and recovery capacities derived from community-based approaches toward anticipation, preparedness, response, and recovery from flood events (Alem & Namangaya, 2021).

It is, therefore, the key to the community-based flood management process where the local people are made participants in the preparedness and response and recovery initiatives. It is a flood resilience-enabling strategy but also enables collective ownership and sharing of responsibilities critical for long-term sustainability in flood management efforts. Previous studies have shown that community-based approaches enhance risk awareness,

knowledge sharing, and mobilising local resources to reduce flood risks (Djalante *et al*., 2012).

Survey results showed a high percentage of the respondents, at 47%, being interested in early warning systems for floods. This finding, therefore, underlines the importance of timely warnings in reducing the impacts of floods and brings out the need for taking preventive measures in enhancing preparedness and overall capacities of disaster management. Early warning systems serve a most important function: giving the communities time to take proactive measures of either evacuations or protection of their property, thus minimising potential loss of life and property damage.

The strong support for early warning systems in the survey sample in Lokoja city aligns with the Theory of Urban Resilience to Floods (Alem & Namangaya, 2021), which substantially underlines that in developing the resilience capacity of a city to floods, the preparatory capacities and early warning mechanisms should not be underrated. For example, such anticipatory mechanisms and early warning systems enable good monitoring and forecast systems that are followed by effective communication to reach the community in time and with precision of information. The survey further shows that the level of acceptance differs for other options for flood adaptation, for instance, flood-resistant building technologies, green infrastructure designs, and rainwater harvesting approaches. These approaches are premised on the general principles of urban resilience and sustainable urban development, and address the need to include environmental considerations within urban planning and design (Aguilar Meléndez *et al*., 2019).

Flood-resistant building technologies, where design features support the reduction of water ingress and damage to structures, might reduce the impacts of floods (Escarameia & Tagg, 2021). Green infrastructure designs using permeable surfaces and retention basins could improve stormwater management and avoid urban flooding (Green *et al*., 2021). Rainwater harvesting approaches could be applied in water conservation to reduce demands on the prevailing drainage in times of intense rain (Pala *et al*., 2021).

Descriptive statistics presented in Table 1 show the overall feeling of the respondents towards the (perceived) nature of effectiveness of described flood adaptive strategies in the management of urban flood in Lokoja city, which garners a mean score of 2.30 from a 5-point Likert scale. However, the moderate value of the standard deviation at 1.276 indicates some level of variability in the perception of respondents, with some considering these strategies as better compared to others. This variability in perception agrees with earlier works that have revealed the complexity and context specificity of strategies for flood management (Oladokun & Proverbs, 2016). Certain adaptive strategies may also be of relatively high efficacy in some contexts, where such an efficacy could be conditioned by geographical features, socioeconomics, or the availability of resources and institutional support.

Conclusion

Lokoja has continued to experience flood which affects the lives of the people, their belongings, and business ventures due to the geographical location of the city. The research presented in this paper emphasises the role of the coping mechanisms in preventing floods in urban areas. The results showed that respondents agreed with the

statement that the construction of drainage systems is the most effective measure supported by 73% of participants. This therefore calls for proper funding of good drainage systems to help minimise cases of floods as much as possible.

Flood management at the community level which received 52% support shows that people of the community are very important in the implementation of this solution. Community participation in preparedness, response, and recovery activities increases ownership, knowledge and utilisation of resources in promoting sustainable flood management. Another adaptive measure identified was early warning systems, which received a 47% response emphasis in relation to the use of timely action to reduce the effects of floods.

Although the study highlights the effectiveness of these strategies, the variations in the response show that the strategies should be fashioned to suit the respondents. There is a need for effective policies and funding to support policies as well as constant engagement of the community. The problems that should be solved include the lack of necessary infrastructure, increase of people's awareness, and application of innovative approaches can help Lokoja to become a city with flood resistance and effective development. This is in compliance with the international policies in the management of disasters and building resilience in urban centres.

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