Architectural Designs and Disaster Management: Evidence from Flood Incidence in Rivers State

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Abstract

This study examined the impact Architectural Designs and Disaster Management: Evidence from Flood Incidence in Rivers State. Data were collected and analyzed using questionnaire and it was distributed among State Flood management committee, Employees of Nigeria emergency management Authority in the state, staff of ministry of Housing and Urban Development. A total number of 346 respondents using purposive sampling were given questionnaires to complete, data was gathered, examined and were analyzed using descriptive statistical analysis. The qualitative and quantitative research methodology focused on the flood levels, structures, materials, and quantities since the research is a survey. The qualitative information was transcribed and examined using themes. The data were summarized using matrices, and the analysis was then presented thematically in narrative form. The study found that 19 respondents which represent 9.0% agree that architectural design ameliorates the challenges of flooding in Rivers State, 37 respondents which represents 17.5 opined high extents, 59 respondents by 27.9% agree on moderate extent, 82 respondents by 38.9% agree on very low extent while 14 respondents by 6.6% agree on low extent. 32 respondents opined that architectural design avert the problem of flooding in Rivers State, this represents 15.2% of total percentage distribution, 31 respondents opined high extent which is 14.7%, 23 agree on moderate extent which is 10.9%, 47 opined on very low extent which is 22.3% while 78 by 36.9 agree on very low extent, we conclude inductively that architectural design does not significantly avert the problem of flooding in Rivers State. 49 respondents agree that architectural design help to manage the incidence of flooding in Rivers State, 58 respondents agree on high extent which represents 27.5%, 22 respondents by 10.4% agree on moderate effect of architectural design help to manage the incidence of flooding in Rivers

State. 33 respondents by 16.3% opined very low effects while 49 by 23.2 agree on low effect of architectural design on the managing the incidence of flooding in Rivers State. 71 respondents agree that architectural design control flooding in Rivers State 33.6%, 55 respondents agree on high extent which represents 26.1%, 28 respondents by 13.3% agree on moderate effect of architectural design on flooding control flooding in Rivers State in Rivers State. 34 respondents by 16.1% opined very low effects while 23 by 10.9% agree on low effect of architectural design on flood control in Rivers State. The study recommends that appropriate measures be put on ground to regulate structural building design in Rivers State. The government should ensure that environmental management policies such as building design are properly enforced in the country. Development control activities should be taken seriously to avoid the erection of developments on flood plains and flood prone areas.

Keyword: *Architectural Designs, Disaster Management, Flood Incidence, Rivers State*

INTRODUCTION

The function of architect is particularly interesting due to their potential to affect the management and control environmental factors that threaten human existence such as flooding (Bosher & Dainty, 2011). Among the few studies that focused on the effect of architectural design on disaster management in the developed building environment clarifies the issue in detail and provides a comprehensive summary of the possible roles of architectural designers along with other professionals. Authors conceive shelter or housing just a delivery problem and contended there may not be a need for the architect. To include the architecture to be part of the solutions, they need to learn how to talk to people and collaborate with other disciplines. Developing post-disaster solutions however require different skills than a commercial practice and an ability to understand the contextual differences between normal disaster situations (Thurairajah et al., 2011). Consequently architects might have to 'unlearn' their usual approaches and relearn new ways of working to be effective where the ability to engage in collective problem solving becomes especially critical (Cage et al., 2009). Disaster management is defined as a collective term encompassing all aspects of planning for and responding to disasters, including both pre- and post-disaster activities (CERO, 2004). Researchers often highlight a paradigmatic shift concerning the approaches to manage and avoid Pro-active strategies, with a more holistic and long-term approach, place emphasis on disaster preparedness, hazard mitigation and vulnerability reduction rather than the often reactive focus on disaster management and relief to address pre-event vulnerabilities.

From the perspective of architects and planners, flood resilience is an interdisciplinary problem, and the design decisions of architects and planners have an important impact on the building life-cycle. Research suggests that 20% of design decisions are made in the initial stages, which subsequently affect the remaining 80% of design decisions (McClymont et al. 2020) and these initial decisions usually involve multiple influences such as a large number of building codes, owners' opinions, interdisciplinary suggestions and architects' own subjective concepts. When it

comes to inter-disciplinary goal optimization, traditional design methods are not well-suited to dealing with complex problems, and empirical methods are inefficient for realizing the optimal solution (Jalali, Noorzai & Heidari, 2020). Floods can be environmentally important to local ecosystems. Having a better understanding of what causes flooding can help people to be better prepared and to perhaps minimize or prevent flood damage. The primary causes of flooding are ocean surge, tropical rains and blocked drainages in urban areas. Flooding is endemic in the coastal zone, in the flood plains of many of our rivers and in many urban areas.

Disasters, whatever their origin, can be traumatic events for a society, causing extensive loss of life and other large scale material/non-material losses, and disrupting its normal functioning (Malalgoda et al., 2010). Many scholars agree that the scale of threats facing the contemporary cities have escalated in recent decades due to economic, demographic and socio-political changes due to rapid urbanization and, accordingly, the vulnerability of the marginalized groups, especially those struggling with poverty in the poorly built environments have raised (Bosher and Dainty 2011, Owen & Dumashie, 2007, Lloyd-Jones et al., 2009). Architecturaldesigners and universities are often thought to take critical roles in the disaster management process, in cooperation with other governmental and non-governmental stakeholders (Amaratunga & Haigh, 2010; Llyoyd-Jones, 2009; Thurairajah et al.., 2011). Technical know-how and the routines of the built environment professionals including the design, construction, planning, procurement and management of the built environment facilities have a clear relationship with the disaster management initiatives and they can significantly contribute to the prevention and minimization of disaster losses if they broaden their traditional roles with appropriate training architectural designs.

Furthermore, raising awareness on the potential roles of architectural designers in the as flooding appears critical in the early steps. One major cognitive barrier is the widely shared view among architect's roles is confined to developing individual prefabricated units for emergency or temporary housing. Such isolated view of the architect's roles may be unsurprising for many, considering the typical emphasis placed on individual space and architecture of ego in a traditional instructional environment. An understanding of the general context appears critical to go beyond unit and assess the wider role of architect. This is necessary, first, to build awareness on the idea that a design solution which might be influential under certain circumstances may become less efficient or totally dysfunctional when the disaster scenarios or needs change. Accordingly, there are multiple patterns of architectural design solutions for different disaster scenarios. Second, understanding and appreciating the heterogeneity of vulnerable or targeted groups in terms of their characteristics and needs requires an intellectual familiarity with the problems of a contemporary society. From the above, this study examined the impact of architectural designer disasters, flood management in Rivers State.

LITERATURE REVIEW

Architectural Design and Disaster Management

Cage et al. (2009) contended that architects might have to 'unlearn' their usual approaches and relearn new ways of working to be effective where the ability to engage in collective problem solving becomes especially critical. Team working skills are important not only for interdisciplinary collaboration, but also for collaborative problem-solving. Felix et al., (2013)suggested that an efficient process can involve the Provision of individual space and the discussion of individual design proposals; developing a common understanding and identification of needs; division of labor for teamwork; returning back to individual level or 'individual space' whenever needed to explore alternative views and approaches; and disseminating information on different technical matters, once a group consensus is reached.
Many authorities share the view that hazards are likely to become more significant in future years due to ecological, political and economic crises. Although education is considered as a proactive and long-term strategy to build resilience at all levels, an overwhelming majority of architects graduate without knowledge of disaster management perspective and skills. On the other hand, a quick analysis of the literature suggests that design-for-disaster) is not considered as an integral part of the disaster management cycle except for concerns for strong structural designs.

Architects can more efficiently take role in the process to enhance the capacity of the society to respond to disasters via sustainable and socially/culturally responsive design solutions. Felix et al. (2013)suggested that there are a couple of key issues in the educational context to achieve this goal: (i) shift towards a more collective problem solving space in the design studio along with an intellectual familiarity with the problems of contemporary society; (ii) an understanding of the heterogeneity of the needs and characteristics of different vulnerable groups; an adequate background knowledge to filter and adapt common design principles and norms, so that they are relevant to disaster and project scenarios; (iii) a familiarity with technical solutions patterns such as open prefabrication and adaptive re-use. In addition, more systemic interventions such as making D4D part of accreditation processes are likely to generate quick results in integrating disaster management perspective into the higher education system. An architectural process can be a primary contributor to a disaster but also can provide meaningful solutions and significantly impact the overall effectiveness of aid relief. In recent years, there have been multiple tragedies resulting from poorly built or under-supported structures.

Source: Google search.com
Figure 1: Picture showing the collapse of 7 storeys building in Port Harcourt

Architecture has a long standing tradition of addressing urban disaster. It also integrates the future and the past in its usage, making the present thick with experiences, material and technics from the past, and expectations of the future and has the quality of combining wisdom with cunning. This proposed way of viewing disasters, through a local and architectural lense, requires a revision of the role of local architect in the social compendium, not only as a main actor in the production of space, but also as a carrier of culture, as architectural theorist Antoine-ChrysostomeQuatremère de Quincy (1755- 1849) noted that the traditional role of architect, particularly in post-disaster environments, moves from being an element resisting to change to one that is adapting to change and taking an active part in it. In the Eleven Exercises, Marco Frascari envisions the architect as the alchemist from the tarot card, a mothering magician that takes material and transforms it into space that holds emotional meaning both to the individual and to the society.

In the case of post-disaster reconstruction, an architect can create spaces in which destruction, ruin, and the fragmented fields of past capital and habitus can crystallize keeping open the gap between past and future such as allowing the disaster to serve as an ongoing drive, not only through memory, but through changed everyday practices. Historically, architecture, building practices, and city planning often underwent radical changes as a result of disaster. The great fire of London in 1666 devastated five sixths of the medieval city and caused a need to fill the historical,

economic, social and conceptual gaps the disaster created, as well as reinventing the city as a whole. The fire, in addition to changing methods of construction and the physical presence of the city through building regulations, triggered attempts to re-conceptualize the space. The loss of the most valuable referents of the culture, that is the narrative attached to the city, to its streets and buildings, affected the construction of spaces from the dwellers' perspectives. Architectural treatises, although not addressing the question of reconstruction after major disasters as a main theme, have approached how architects have dealt with decay, destruction and the impacts of these events on inhabitants. In fact, historically, architects were leaders in disaster response amongst their communities.

Flooding

This phenomenon occurs when water covers previously dry areas, such as when large amounts of water flow from a source such as a river or a broken pipe onto a previously dry area, or when water overflows banks or barriers. Nigeria's coastal belt is low lying and is subject to flooding as a result of heavy rainfalls and ocean surge. An estimated 25 million people or 28% of Nigeria's population live in the coastal zone and are at risk from flooding. The areas that receive severe flooding impact include the coastal areas of Lagos, Ondo, Delta, Bayelsa, Rivers, AkwaIbom and Cross River States. Many of the country's larger rivers have flood plains, which are subject to flooding during the rainy season. These include the Rivers Niger, Benue, Cross River, Katsina and Imo. A flooding contingency plan can be made based on regional and weather forecasts, geographic information systems, ground stations and satellite imaging. During flooding, timely and detailed situation reports are required by authorities to locate and identify the affected areas and to implement corresponding damage mitigations. During this period of response or relief, it is essential that information be accurate and timely in order to address emergency situations like search, rescue and relief. Information collected on the mitigation, preparedness, response and recovery phases can be integrated into master flood prevention projects.

Source: Google search.com
Figure 2: Picture showing the flooding in Rivers State

Source: Google search.com
Figure 3: Picture showing demolition of Houses in waterways in Port Harcourt.

Victor, Eric and Kyeba (2023) discusses the risk of flooding in Kenya as one of the many outcomes of climate change in the face of urgency to adapt Kenya's built environment to flooding which is likely to continue to prevail in the decades as a result of the looming climate change. It also sought to evaluate the physical, traumatic, and psychological effects on communities affected by flood events. This cross-sectional survey, both qualitative and quantitative in nature, executed between 13th January 2021 and 14th July 2021 with 132 respondents along the western shoreline of Lake Baringo, near Marigat Town focused on the flood levels, structures, their materials, and quantities. Results show that the area covered by Lake Baringo increased by 18% from 236 km^2 to 278 km^2. The depth of floods ranged from 0.3 m to 1.2 m and exceeded 1.6 m during heavy rainfall up to 3.2 m with homes completely submerged by the lake. Flooding was experienced more by residents living in low areas nearer to the shoreline of the lake as compared to those living on higher grounds. 100% of the structures didn't have the architectural technology to withstand the impacts of flooding with 59% of housing made of corrugated iron sheets both on wall and roofing, 22% of mud houses roofed with either corrugated iron sheets, 10% being timber with thatch and only 8% stoned walled houses. This predisposed all the residents to the harmful impacts of flooding. Piled sandbags by locals as a mitigating measure proved inadequate to withstand the forces of the rising waters. Flood walls were built around local lodges near the lake but the rising water level quickly breached these defences. The study recommends that county and national governing authorities develop flood adaptation strategies for resilience. These include long-term land-use planning, the establishment of early warning systems, evacuation plans, identification of vulnerable or high-risk

populations, measures to ensure water quality, sanitation, and hygiene. Flood-resilient architecture including stilt and floating houses that mechanically rise and fall with respect to the highest water mark are recommended during flood events. Bridges on swollen rivers and resilient construction materials like reinforced concrete are to be used for sustainable development for flood risk adaptation.

Methodology

This cross-sectional study collected data from 346 respondents through questionnaires carried out over 4weeks. The qualitative and quantitative research methodology focused on the flood levels, structures, materials, and quantities since the research is a survey. Key informants included members of the Rivers State Flood management committee, Employees of Nigeria emergency management Authority in the state, staff of ministry of Housing and Urban Development. The qualitative information was transcribed and examined using themes. The data were summarized using matrices, and the analysis was then presented thematically in narrative form. Tables and simple percentage were used to describe the opinions of the respondents.

ANALYSIS AND DISCUSSION OF FINDINGS

Data Presentation

Three hundred and forty six copies of questionnaire were purposely distributed; two hundred and eleven were successfully retrieved and used for analysis. This represents 60.9% while the remaining one hundred and thirty five which represents 39.0 were not retrieved due to time and unwillingness of the respondents. The table below has the detail:

Table 1: The extent to which architectural design ameliorates the challenges of flooding in Rivers State

Nature of Response	No. of Respondents	Percentage
Very High Extent	19	9.0
High Extent	37	17.5
Moderate Extent	59	27.9
Very low Extent	82	38.9
Low Extent	14	6.6
Total	**211**	**100**

Source: Authors Research Desk, 2023

Evidence from the respondents shows that 19 respondents which represent 9.0% agree that architectural design ameliorates the challenges of flooding in Rivers State, 37 respondents which represents 17.5 opined high extents, 59 respondents by 27.9% agree on moderate extent, 82 respondents by 38.9% agree on very low extent while 14 respondents by 6.6% agree on low extent.

Table 2: The extent to which architectural design avert the problem of flooding in Rivers State

Nature of Response	No. of Respondents	Percentage
Very High Extent	32	15.2
High Extent	31	14.7
Moderate Extent	23	10.9
Very low Extent	47	22.3
Low Extent	78	36.9
Total	**211**	**100**

Source: Authors Research Desk, 2023

Research question two was formulated to investigate the extent to which architectural design avert the problem of flooding in Rivers State. 32 respondents opined that architectural design avert the problem of flooding in Rivers State, this represents 15.2% of total percentage distribution, 31 respondents opined high extent which is 14.7%, 23 agree on moderate extent which is 10.9%, 47 opined on very low extent which is 22.3% while 78 by 36.9 agree on very low extent, we conclude inductively that architectural design does not significantly avert the problem of flooding in Rivers State

Table 3: The extent to which architectural design help to manage the incidence of flooding in Rivers State

Nature of Response	No. of Respondents	Percentage
Very High Extent	49	23.2
High Extent	58	27.5
Moderate Extent	22	10.4
Very low Extent	33	16.3
Low Extent	49	23.2
Total	**211**	**100**

Source: Authors Research Desk, 2023

The above table the extent to architectural design helps to manage the incidence of flooding in Rivers State. 49 respondents agree that architectural design help to manage the incidence of flooding in Rivers State, 58 respondents agree on high extent which represents 27.5%, 22 respondents by 10.4% agree on moderate effect of architectural design help to manage the incidence of flooding in Rivers State. 33 respondents by 16.3% opined very low effects while 49 by 23.2 agree on low effect of architectural design on the managing the incidence of flooding in Rivers State.

Table 4: The extent to which architectural design control flooding in Rivers State

Nature of Response	No. of Respondents	Percentage
Very High Extent	71	33.6
High Extent	55	26.1
Moderate Extent	28	13.3
Very low Extent	34	16.1
Low Extent	23	10.9

Total	**211**	**100**

Source: Authors Research Desk, 2023

Table 4 described respondents view on the extent to control flooding in Rivers State. 71 respondents agree that architectural design control flooding in Rivers State 33.6%, 55 respondents agree on high extent which represents 26.1%, 28 respondents by 13.3% agree on moderate effect of architectural design on flooding control flooding in Rivers State in Rivers State. 34 respondents by 16.1% opined very low effects while 23 by 10.9% agree on low effect of architectural design on flood control in Rivers State.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Flooding has also been identified as having negative impact on the livelihood activities of man due to its devastating nature. Ojikpong*et al.* (2016) noted that flooding leads to the destruction of lives, properties and socio-economic activities. However, the level of loss and destruction caused by flood depends on factors such as season and timing of floods, location, damages on the embankment and walking roads, location of river encroachment, status and condition of the drainage system, and prior experience of flood and flood management strategies. Flooding therefore affect the livelihood activities of the residents in both rural and urban areas in so many ways. Flooding cause collapse of buildings and bridges submerge farmlands and market places, while crops are destroyed or sometimes washed away. The above means strategies for flood management are relevant to government and individual. This study examined the impact architectural design and disaster management with focus on the incidence of flooding in Rivers State. Findings in this study validate the role of architectural designs in managing flood in Rivers State. The study makes the following recommendations:

i. The study recommends that appropriate measures be put on ground to regulate structural building design in Rivers State. The government should ensure that environmental management policies such as building design are properly enforced in the country. Development control activities should be taken seriously to avoid the erection of developments on flood plains and flood prone areas.

ii. The government and its agencies should ensure that architectural design is in line with urban planning and development to manage the incidence of flooding in the state. National Emergency Management Agency should embark on some measures such as dredging and re-dredging of drains, erosion passages, construction of embankments, channelizing some routes prone to flooding, and direct clearing of some existing drainages.

iii. There should be agency to monitor and checkmate architectural design to ensure that all designs and housing plans are in line with disaster management and sustainable to manage flood.

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