RESILIENCE AND LIVABLE CITIES IN A WARMING WORLD

A FESTSCHRIFT IN HONOUR OF

TPL. DR. JOSHUA ADEWUMI ADEBISI FNITP, RTP



EDITED BY

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CHAPTER 20

MITIGATING URBAN FLOOD RISKS: LESSONS FROM IBADAN FOR A DISASTER-RESILIENT CITY

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Abstract
Worldwide, flooding has nowadays become a common environmental hazard. This has increased as a result of climate change, and the impact has been felt more by the poor in developing nations of the world. Urban flooding is a serious problem in most cities in Nigeria and Ibadan, particularly, has had numerous flood disasters which have claimed lives and income, damaged property and caused diseases. In keeping with the sub-theme Risk Reduction and Disaster-Resilient Cities, this study looks at the flood control approaches towards Ibadan and how they can be adopted to create a prototype of a disaster resilient city. It also conducts an in-depth discussion of the Ibadan Urban Flood Management Project, one of the significant projects that the Oyo State Government, with the help of the World Bank, has implemented to create a long-term flood-resilience of the city, after the catastrophic Ibadan flood Disaster of 2011. IUFMP uses integration of modern technology, community participation and sustainable practices to use structural and non-structural approach to flood management. The structural facet encompasses building and maintenance of drainage networks, culverts, bridges and rivers. At the same time, the non-structural part that includes flood risk assessment, establishment of early warning technologies, the necessity to involve the community in the process, and enhance urban master planning were conducted. Some lessons learned in Ibadan include: complete assessment of risks, consistency in infrastructure investments, enforcement of policies and inclusive governance in order to succeed in flood resilience initiatives. These results show that IUFMP has made great progress in improving the flood resilience of Ibadan giving much valuable lessons to inform planners and policymakers in other cities prone to flooding.

Keywords: Urban Flood Risk, Rapid Urbanization, Disaster-Resilient, Flood Management, Risk Reduction

1.0 Introduction

Urban flooding has become more than a temporary inconvenience into a widespread and catastrophic menace in Nigerian cities, and spans a major barrier to sustainable development. It is not just a natural hazard but a multifaceted result of socio-economic, environmental, governance failures. Land use trends have changed drastically due to the rapid urbanization, which is usually unplanned and uncontrolled (Adelekan, 2020). Building in aroused natural landscapes into impervious surfaces (concrete and asphalt and roofs) has decreased infiltration and increased surface runoff (Busari and Adedeji, 2024). To exacerbate this, current drainage systems often fail to meet the demand of augmented amounts of storm water as they are either insufficient, poorly maintained, or entirely lacking (Lucas, 2021; Oguntokun and Fayomi, 2025).

The developing countries have a special paradox in terms of the rate of urbanization. However, the question is not whether urbanization is taking place too fast or too slow, but whether the institutional structures within which urban development takes place can keep up with the changes in population. Systemic urban governance weaknesses such as weak implementation of land use plans, corruption in land distribution and poor investment in urban utilities have spawned the prolific settlement on floodplains, wetlands, and river corridors in the Nigerian case (Nkwunonwo et al., 2020). Other sources of the ongoing problem in most cities in Nigeria are the solid waste management crisis, where the drainage channels are full of plastic waste and other debris, and therefore cannot be effective even during the moderate rainfall events (Yusuf, 2023). Climate change is exacerbating the situation, raising the occurrence of extreme rainfall events and exceeding the coping capacities of the already strained urban systems (World Bank, 2021). Their effects are serious and they encompass loss of human life, destruction of livelihoods and homes, interference with economic activities, destruction of infrastructures that are critical and creating more problems to other health crises facing the people. The 2022 Nigeria floods that displaced more than 1.3 million people and left quite a lot of people dead is a poignant indicator of the national magnitude of this issue (OCHA, 2022).

The city of Ibadan, which is third-largest in terms of population in Nigeria, is a perfect example of such vulnerability. It has a history of devastating floods, the last of which hit it in 1963, 1980, and 2011 and showed that there was a serious structural flaw in the urban governance and infrastructure (Lucas, 2021; RMSI, 2019; Eguaroje et al., 2015). The history of perennial flood disasters in Ibadan has shown that the existing social systems to control floods have been inadequate, since the area has constantly faced the challenge of floods, which the traditional method of dealing with floods through mainly structural means without considering the underlying socio-economic and governance drivers (Salisu, Akanmu, and Ogunsesan, 2026).

This study presents an argument on the fact that the mitigation of urban floods needs a comprehensive approach which involves structural engineering with well-established policy, planning and community. In connection with the sub-theme of Risk Reduction and Disaster Resilient Cities, this paper has the following objectives: analyze the integrated flood risk management strategies that have been used under the Ibadan Urban Flood Management Project (IUFMP); assess their results, difficulties and gaps; generalize the transferable lessons learned in the case of the Ibadan experience in reducing flood risks in building the cities in disaster resilience; and offer evidence.

1.1 History and Vulnerability of Floods in Ibadan

The city of Ibadan is one of the largest Nigerian cities that represent the dilemma of the urban flood threat in Nigeria. It has suffered historically because it simply is in a unique geographical position and because of its developmental story. The city is geometrically marked with a row of ridges and valleys, the city being drained by a thick mesh work of rivers and streams, including the Ogunpa, Ogbere, Kudeti, and Ona. This topography, which has traditionally had the benefit of defending through its features, has redirected the storm water in huge amounts into low-density, high-density

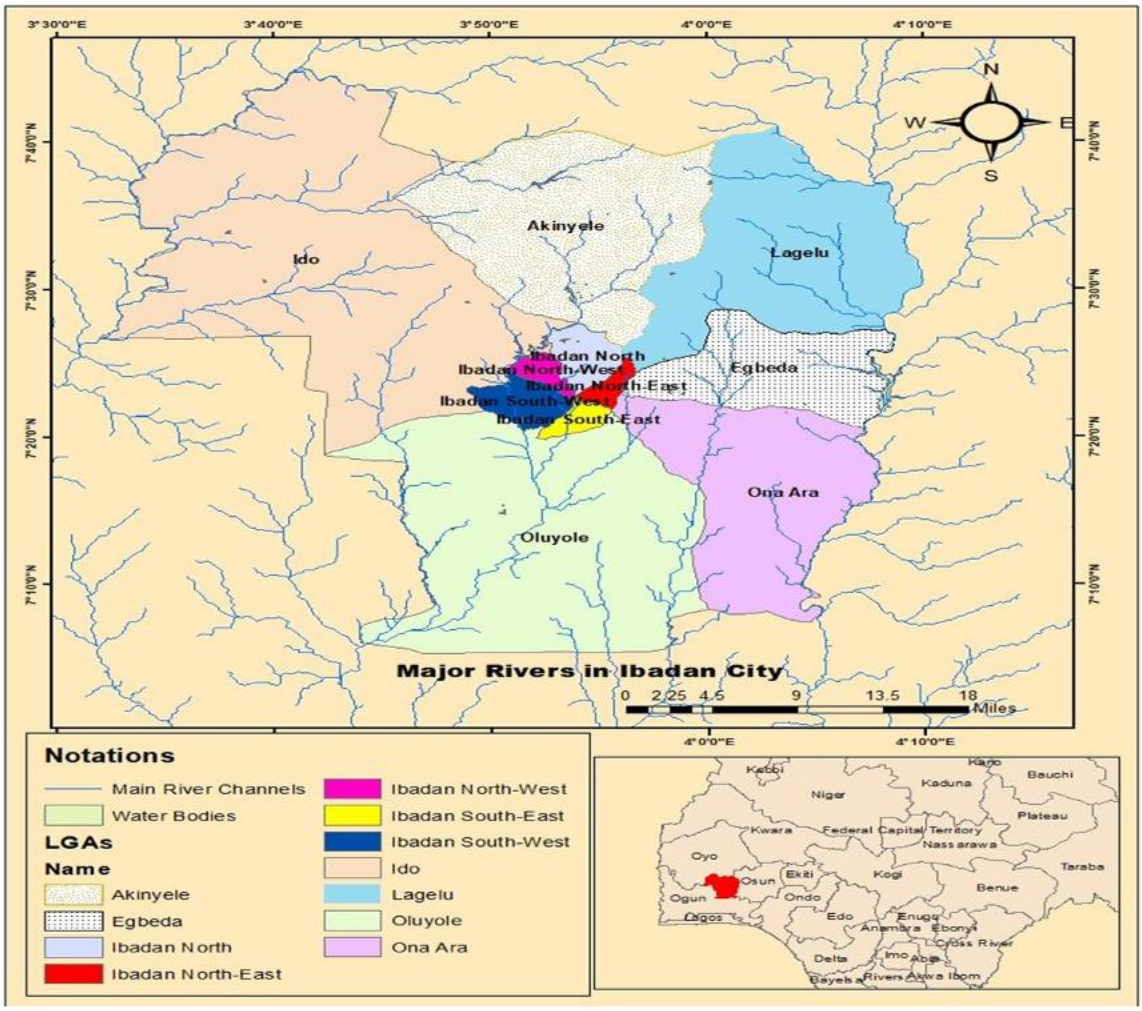


Fig. 1.1: Major Rivers in Ibadan (Source - Ayorinde, et al, 2023)

neighborhoods. Ibadan has a sad story of disastrous floods. The 1963 flood was a big disaster but it was the more destructive flood of August 1980 that was a wake-up call and they started Ogunpa River Channelization Project. That intervention, however, being partial and not permanent enough, and accompanied by the ongoing urban sprawl, preconditioned even a more tragic result.

The August 26, 2011, flood continues to be a watershed in the history of the city. The flood was triggered by a long-lasting and intense downpour, which pushed the floodwaters beyond the capacity of the drainage systems in the city, resulting in the death of more than 100 individuals, displacement of thousands, and billions of Naira in damaged property, infrastructure, and businesses (Agbola et al., 2012; Oladokun and Proverbs, 2016). This became a pivotal point and a force that had to be acted upon by

the government, and the Ibadan Urban Flood Management Project (IUFMP, 2020) was created. The 2011 disaster revealed the weaknesses of prior, piecemeal solutions, and demonstrated the systemic character of the risk, which was caused by factors including:

i. Intrusion into Drainage Paths: Inconsiderable building and construction in floodplains and marginal banks of major rivers.
ii. Poor Drainage: The drainage system at hand was inadequate and was filled with solid waste that had silted it.
iii. Weak Institutional Capacity: There is no coordinated planning, enforcement and disaster preparedness between government agencies (Agbola et al., 2012).

1.2 Significance of Flood Risk Mitigation to Disaster-Resilient Urban Development

The fact that the startling floods in Ibadan and other urban centers in Nigeria are a recurring nature highlights a stark reality: a paradigm shift between the disaster response modes to proactive disaster risk management is very necessary to resilient urban development. Flood management is not a sectoral activity but a pillar of planning a sustainable city. Mitigation is an investment that saves lives and minimizes economic losses to secure the lives of both the community and individuals. It enhances economic stability by helping to protect businesses and critical infrastructure, and it enhances social equity by securing the most vulnerable groups that tend to live in the risky regions (UNDRR, 2022).

Flood resilience is a paradigm shift in flood risk management that is no longer reactive, i.e. focusing on prediction and control but rather proactive, holistic and adaptive. It combines structural protection such as levees and strong infrastructure with non-structural means of control such as early warning systems, community education, and the reestablishment of natural ecosystems that absorb floodwaters. This goes beyond structural engineering solutions, and adopts a system thinking and whole-life sustainability, integrating social, economic, and environmental concerns to create communities that are not only resistant, but actually resilient and able to adapt to future challenges (Zevenbergen et al., 2020). An example of a disaster-resilient city is thus a city that is able to anticipate and absorb, accommodate and recover the impact of an incident in an efficient and timely way. To Ibadan and its counterparts, such resilience can only be achieved by ensuring that every aspect of urban governance, including land-use planning and environmental conservation, infrastructure development and community empowerment is informed by this flood risk management. UN-Habitat (2012) accentuates that environmental risks such as flooding are critical in the prosperity of cities through inclusive and sustainable urban planning.

1.3 Brief Introduction to the Ibadan Urban Flood Management Project (IUFMP)

The Oyo State Government, following its former progress, in reaction to the 2011 disaster, in 2013, through the financial and technical support of the World Bank, developed the Ibadan Urban Flood Management Project (IUFMP). The IUFMP was a multi-dimensional program that aims at mitigating the factors of flooding in Ibadan by

not just involving the engineering-driven solutions of the yester years, but it is a holistic program. The general aim of it was to mitigate the risk of floods in the city and increase the city resilience to the occurrence of future floods (Ayorinde et al., 2023). Multiple components were put in place in the project such as construction and rehabilitation of key drainage systems, strategic master plans, early warning systems, institutional strengthening and community engagement programs (World Bank, 2013). The IUFMP is the main case study of this paper; it provides many lessons about the involved complexities of the implementation of an integrated flood risk management program in a dynamic and challenging urban setting.

2.0 Literature Review

2.1 Conceptual Review

2.1.1 Urban Flood Risk

Urban flood risk is the possibility of harmful effects produced by the interaction between the at-risk urban systems and flood hazards. It influences and adversely affect the livability of cities in diverse ways (Akanmu, Salisu, Gbadamosi & Sonde, 2025; Akanmu & Salisu, 2024; Akanmu, Gbadamosi & Omole, 2022). Three elements determine the conventional conceptualization of risk: a hazard (the possibility of the incidence of a flood of a certain extent), exposure (the population, the infrastructure, and the property that is at risk of being damaged in case of a flood), and vulnerability (the easiness at which unprotected elements can be adversely affected in case of a flood) (Nkwunonwo et al., 2020). Flood risk does not exist as a static condition in the city, but it instead becomes challenging with urban growth, changing land use and changing climate patterns.

2.1.2 Disaster Resilience

The multifaceted concept of disaster resilience comprises of a system, society, or community being resistant, accommodating, absorbing, adapting to, transforming and recovering the impact of a hazard in a timely and efficient way (UNDRR, 2022). According to Zevenbergen et al, (2020), flood resilience is defined as a paradigm shift in flood control. While traditional methods tried to stop water entirely with walls, resilience accepts that flooding will happen, and the emphasis shifts toward reducing the impact and ensuring a fast recovery. A resilient system is usually defined by its redundancy, flexibility, and overall robustness.

2.1.3 Integrated Flood Risk Management (IFRM)

IFRM is a universal practice comprising structural (such as drainage systems, levees, dams) and non-structural (land use planning, early warning systems, community preparedness) measures in sustainable development setting. The strategy is aware that flood risk cannot be fully eradicated but can be mitigated to controllable rates by ensuring that various sectors, and different governance levels take concerted efforts to tackle the problems (Ogunsesan, Akanmu & Salisu, 2025). IFRM centers on the overall disaster management cycle of prevention, mitigation, preparedness, response and recovery.

2.1.4 Disaster-Resilient City

A disaster-resilient city is a city that has intentionally reduced its exposure to natural hazards through proactive planning, strong infrastructures, good governance and empowered communities. The UN-Habitat and IHS-Erasmus University Rotterdam (2018) advocate that resilient cities have inclusive forms of governance, and that disaster risk reduction becomes part of the urban planning procedures, which ensures that investments into infrastructure and services contribute to the long-term resiliency, thereby discouraging formation of new risks. An enforceable land use policy, operational early warning systems, sustained drainage systems, community awareness and preparedness, and financial disaster response and recovery are some of the key factors that would suggest a city resilient to disasters.

2.2 Empirical Review

Urban flooding in Nigeria has always been empirically studied, and in all studies, the key cause of the growing risk of floods was rapid, unplanned urbanization. Adelekan (2020) recorded the increase in surface runoff in Ibadan, where transformation of the land surface by impermeable concrete, as opposed to the permeable vegetation has more than tripled surface runoff in certain catchments between 1984 and 2015. A comparative study of the effects of floods in six cities in Nigeria by Lucas (2021) revealed that Ibadan, Lagos, and Port Harcourt have the greatest negative economic impacts of floods, with estimated total damages of more than ₦100 billion per year in the country. This is evidenced in the work of Salisu, Akanmu, and Ogunsesan (2026) who offer an in-depth analysis of the nature of the perennial flood calamities in Ibadan and the manner in which the normal operations in the public safety systems are always overwhelmed when there are major rainfall events. Through their analysis, they find that the risk of floods has been growing higher even with the many interventions that the government has made, owing to the joint action of demographic growth, informal settlements growth, and climate variability. They attributed the inability to end flooding to governance and institutional failure, as opposed to technical failure.

Ogunsesan, Akanmu, and Salisu (2024) explored the nexus of policy, regulation and spatial development in Ibadan, and discovered that the most important aspect that continues to perpetrate the flood risk is weak enforcement of the current building codes and land use regulations. They reported more than 5,000 structures erected in specifically designated floodplains in the Ibadan metropolitan region, many of which were allowed by the local planning authorities, regardless of their breaking state and national policies.

Meanwhile, Henderson and Turner (2020) in their critical re-evaluation of the dynamics of urbanization in the developing world, argue that urbanization is not happening too fast as it might be perceived. Their discussion of demographic and economic statistics of 120 developing countries indicates that the rate of urbanization is widely aligned with historical trends of the currently developed countries. They instead argue that a critical difference needs to be made in the institutional capability and not in the rate of urbanization to ensure that urban growth is put to productive use. It was observed that developing cities do not have the governance framework, technical know-how, and finances to offer proper housing, infrastructure, and services to their

increasing populations. This institutional inadequacy leads to informality, environmental degradation and helplessness to disasters.

According to the State of African Cities 2018 report (UN-Habitat and IHS-Erasmus University Rotterdam, 2018), African cities are urbanizing on an unparalleled scale, and the urban population in the continent is expected to triple by 2050. Such quick increase is in an environment of constrained municipal budgets, ineffective land administration and escalating climatic hazards. The report highlights the fact that African cities present an exceptional chance to leapfrog outdated forms of development by adopting integrated, resilient, and sustainable urban and planning methods in the first place. However, the practice in other countries with combined flood risk management provides useful insights to the Nigerian cities. The Room for the River program in the Netherlands that involves floodplain restoration along with structural defenses has minimized the potential risk of floods and increased ecological values (Zevenbergen et al., 2020). The effectiveness of the integration of technological monitoring with local knowledge and response capacity has been seen in the case of community-based flood early warning systems in Bangladesh and Vietnam in Southeast Asia.

Akanmu, Salisu, Ogunsesan, and Olorunfemi (2024) investigated resilient infrastructure and climate adaptation plans in the Nigerian context where Nigeria has largely been dependent on structural interventions in managing floods without considering the governance and social aspects of resilience. They recommend a middle ground that equally invests in hard infrastructure and soft measures like community participation, institutional capacity building and adaptive planning.

2.3 Theoretical Review

2.3.1 Systems Theory and Urban Flood Risk

The systems theory offers a theoretical backbone to the concept of the urban flood risk that is a product of complex interactions between natural and human systems. It is in this sense that flooding is not an external shock to an otherwise stable urban system but is instead a creation of the organization of the system. Decision on land use, investments in infrastructure, waste management and governance arrangements all contribute to vulnerability or resilience of the system to rainfall events. Integrated approach of IUFMP is systems thinking, as it considers various interacting factors that contribute to flood risk, and not just symptoms.

2.3.2 Risk Society Theory

According to the risk society theory of Ulrich Beck, societies in the present day are being structured around the production, distribution, and management of risks with a large number of these risks being man-made instead of natural. When this structure is applied to Ibadan, the 2011 flood can be inferred not as a natural disaster but as a social problem due to decades of unplanned urbanization, poor governance and environmental degradation. The theory notes that risk distribution tends to be unequal, with the marginalized groups having a disproportionate exposure because of a lack of capacity to move or protect themselves because they are in flood-prone regions.

2.3.3 Adaptive Governance Theory

The theory highlights the significance of adaptive and learning-based systems of governance that can react to uncertainty and change. It also reinforces the fact that the conventional command-and-control methods of flood management are not sufficient, especially when considering climate change, which is changing the rainfall patterns and the frequency of extreme events. The adaptive governance demands polycentric institutional set-up, stakeholder involvement, ongoing monitoring and evaluation, and responsiveness of strategies to new data. The focus of IUFMP on capacity building, stakeholder involvement, and master planning can be viewed as an effort to institutionalize adaptive governance to flood risk management in Ibadan.

2.3.4 Urban Flooding Political Ecology

Political ecology offers a critical approach to the analysis of the way the relations of power, economic organization, and political processes influence the environmental risks. The vulnerability of floods is not a random distribution in Ibadan but rather accumulated in the low-income settlements which have been relocated to the marginal and flood prone areas owing to the failure to acquire land in safer locations at affordable costs. The political ecology approach shows how elite capture of the planning processes, corruption of land allocation processes, and how economic growth has been prioritized over environmental protection which has produced systematic flood risk to the vulnerable populations. The theoretical approach highlights the inadequacy of technical flood management solutions in the absence of political and economic motivations of vulnerability.

3.0 Materials and Methods

3.1 Study Area

Ibadan is the capital of Oyo State in southwestern Nigeria. The city has been defined by the fact that it is located between seven major hills, which have historically affected how the space and drainage pattern are shaped. Geographically, it is located at about 7° 23' 47" approximated North latitude, 3° 55' 0" approximated East longitude, which means that it is only 119 kilometers northeast of Lagos, the economic center of Nigeria, and as a result, social and economic exchange is highly developed (RMSI, 2019).

Ibadan is a metropolis of immense size and great importance demographically. The population growth is deep-rooted and its population size is estimated to be 4,632,287 in 2024 and 3.35 every year. The city administrative structure covers eleven (11) Local Government Areas (LGAs) that make the large Ibadan Metropolitan Area. This huge urban complex has cemented Ibadan as the biggest native city in West Africa, a recognition of its long-standing Yoruba and heritage, and the third most populous city in Nigeria, next to Lagos and Kano. The metropolitan area population density is at 586 people per square kilometer, which covers up much internal variation, with the historic core areas having higher densities (Oyo State Bureau of Statistics, 2024; Ayorinde et al., 2023).

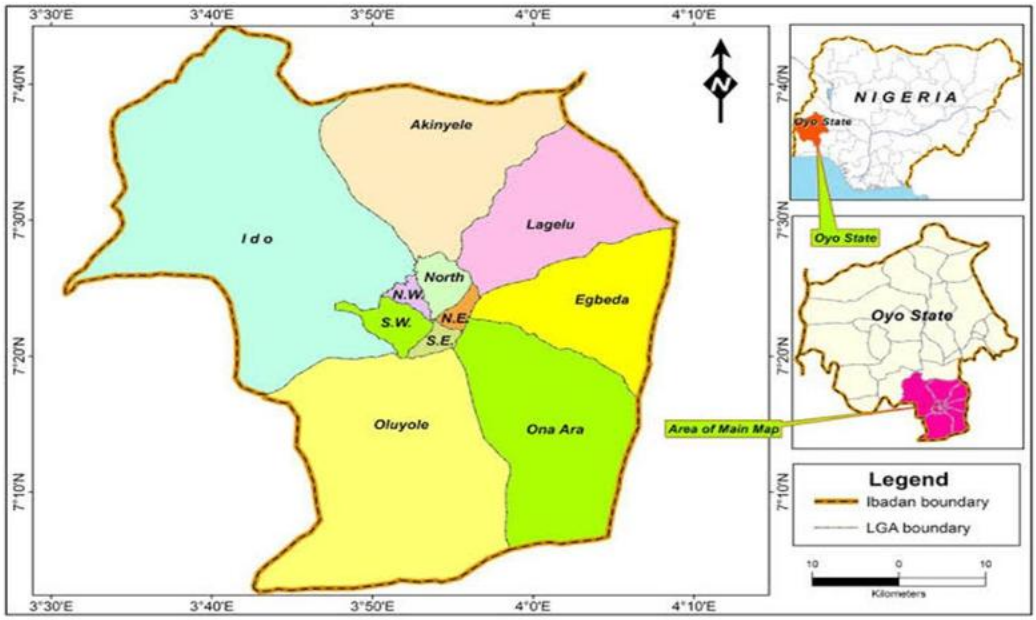


Figure 1.2: Ibadan Metropolitan Area showing the Eleven (11) Local Government Areas (Source - Adelekan et al, 2020)

3.2 Methodology

The case study research design was used in this study with the Ibadan Urban Flood Management Project (IUFMP) serving as a unit of examination. This research method is suitable to examine complex and real-world occurrences in their setting and allows the integration of different sources of data and approaches to analysis (Yin, 2018). It was a retrospective and evaluative kind of research study on the implementation of projects in the period of 2013 to 2024. The study made use of many data sources to ensure triangulation and rigor in analysis, including primary data from: The Ibadan Urban Flood Project (IUFMP) 2014- 2023 Annual and Progress Reports: IUFMP 2013 World Bank Project Appraisal Document (PAD); 2019 Ibadan Flood Risk Master Plan (IFRMP); 2015- 2023 World Bank Implementation Status and Results Reports (ISRs); and Technical studies and consultancy reports contracted by IUFMP.

The Secondary Data Sources include the peer-reviewed journal articles on the urban flooding of Ibadan and Nigeria; state and national policy documents (such as the Nigerian Urban Development Policy and National Water Resources Policy); UN-Habitat reports on African urbanization; Oyo State Bureau of Statistics demographic statistics; and the media broadcast and publication of flood events and project implementation.

3.2.1 Data Collection and Analysis

i. Documentary Analysis: There was a systematic review of project documentation and policy frameworks. The content of documents was examined based on the project goals, intervention design, implementation process, outcomes, difficulties, and lessons learned. Standardized abstraction form was applied, to extract consistent information across documents.

ii. Arrangement of the Interventions: Flood risk reduction interventions were divided into structural (physical infrastructure) and non-structural (policies, plans, capacity building, and community engagement) parts. Interventions were sub-categorized within the types and scales of each category.

iii. Geospatial Analysis Review: Articles that applied GIS and remote sensing in flood risk analysis in Ibadan were searched. Special focus was given to the application of LiDAR (Light Detection and Ranging) aerial mapping to prepare the Ibadan Flood Risk Master Plan by IUFMP. The review viewpoint discussed the application of geospatial technologies to flood hazards mapping, vulnerability assessment, and land use.

iv. Evaluation Framework: The interventions of IUFMP were assessed based on four outcomes developed through literature on disaster resilience, namely: (1) hazard reduction (less frequency/severity of flooding); (2) exposure reduction (less people/assets in flood prone regions); (3) vulnerability reduction (increased ability of the exposed components withstands flood); and (4) response capacity (improved preparedness and Each of the criteria was synthesized on the basis of accessible documentation.

v. Stakeholder Engagement Analysis: A framework was used to analyze community participation strategies based on the degree of engagement (information provision, consultation, collaboration, empowerment) and the means of integrating community input into the process of project decision-making.

4.0 Results and Discussion

4.1 Structural Interventions that were Implemented within IUFMP

i. The most visible part of the project was the IUFMP implementation of a large portfolio of physical works that sought to control floodwaters physically. This involves the following;

ii. Rehabilitation of Drainage Systems: A key operation was the comprehensive clearing and desilting, widening and concrete lining of primary and secondary drainage systems in the flood-prone areas in Ibadan. This had a direct effect of augmenting the hydraulic capacity of the drainage system reducing cases of overland flow and street flooding in the targeted regions. The significant development of major works on the Ogbere and Ogunpa channels also enhanced the conveyance of water (IUFMP, 2022). Primary and secondary drains amounting to about 45 kilometers were rehabilitated in the metropolitan region.

iii. River Channelization and Training: The extension of channelization activities to other important rivers such as the Ogbere and Kudeti, is based on the previous Ogunpa project by the IUFMP. These included straightening and lining

riverbanks with concrete to avert erosion, meandering, and the riverbanks collapsing into settlements thus safeguarding the properties nearby. The channelization works that were included have hydraulic design standards of 25- to 50-year return period flood events.

iv. Eleyele Dam Restoration: The restoration of Eleyele dam was an urgent intervention. The dam, which is a major water supply and a flood control project, was in a deplorable state. It was restored by reinforcing its structure, enhancing its spillway, and placing modern monitoring devices, which increased its working safety and its capacity to control the downstream flow, in case of heavy rainfall (World Bank, 2021).

v. Hydraulic Infrastructure Upgrades: The project identified and removed old and undersized bridges and culverts which were bottlenecks and led to the water stagnating and overflowing to the upstream areas. New hydraulically friendly structures were constructed that enhanced the uninterrupted movement of water in the drainage system in the city. The project area saw 23 bridges and 56 culverts being replaced or upgraded.

4.2 Non-Structural Interventions

The most innovative aspect of the IUFMP was the heavy focus on the following non-structural measures since it recognizes the inadequacy of infrastructure to achieve long-term resilience;

i. Creation of Integrated Flood Risk Master Plans: The project resulted in the development of Ibadan Flood Risk Master Plan (IFRMP), an all-inclusive document that offers a long-term (20-year) plan of flood management. The IFRMP goes beyond the individual projects and suggests a comprehensive approach that entails land-use planning, infrastructure development, environmental management, and institutional reforms. It is an essential instrument of future direction of the communal investment and control of the private growth of flood-prone regions (IUFMP, 2019). The master plan contains the flood hazard maps, zoning recommendations of land use and priority investment area.

ii. Flood Early Warning and Response Systems (FEWS): A significant achievement was the establishment of a FEWS. This system combines real time hydrological and meteorological information of automated rain and river gauges. The information is analyzed to predict possible floods and send warnings via several methods, such as SMS alerts, radio, and community loudspeakers to vulnerable communities and the emergency departments (RMSI, 2019). The system now has 15 automatic rain gauges and 10 river level sensors spread throughout the major catchments.

iii. Capacity Building and Institutional Coordination: The project spent a lot of money on training the staff of the relevant MDAs (Ministries, Departments, and Agencies) in the fields of flood risk modeling, project management, and maintenance planning. More than 500 governmental staff were trained in different technical and managerial fields. This was to ensure a legacy of local skills that would not be lost with the project. Moreover, it led to better

coordination systems among the agencies that were hitherto siloed like the environment, physical planning, and emergency management authorities.

iv. Waste Management Improvements: Recognizing the importance of solid waste and drainage blockage, the IUFMP launched programs in support of better waste management. This involved community education on proper disposal of wastes, supplying waste collection bins to communities, and pilot wastes recycling projects in an effort to minimize amounts of waste into the drainage systems (Yusuf, 2023). In flood prone areas, more than 200 community collection points were installed to collect wastes.

4.3 Outcomes Evaluation: Better Flood Resilience Indicators

A combination of these interventions has resulted in quantifiable, albeit skewed, gains in Ibadan flood resilience which include:

i. Less Frequency and Impact of Flooding: In certain areas within the catchment where intensive structural works have been done, including areas of the Ogbere basin, there has been a significant decrease in the frequency and extent of flooding during normal and heavy rainfall events. A post-intervention monitoring shows a 60-70 percent decrease in reported flood incidences in these locations as compared to pre-intervention levels. This has directly safeguarded an estimated 50,000 properties and enhanced the livelihood of the residents (IUFMP, 2022).

ii. Heightened Institutional Co-ordination: The project has led to a more cooperative atmosphere among government agencies. Some institutional barriers, such as a more coherent planning and response effort, have been broken down by the establishment of technical working groups and a common interest in the Master Plan. Quarterly inter-agency coordination meetings (previously quarterly) have action items and follow-up, and are documented.

iii. Greater Preparedness: FEWS operationalization has changed the city preparation strategy to be more proactive than only reactive. The system has been able to provide early warning to three large rainfall events during the 2022 and 2023 rainy seasons and this allowed targeted evacuation and emergency resource deployment. As coverage and reliability continue to be scaled up, the system is offering a backbone to save lives by evacuation in time (RMSI, 2019).

iv. Beneficiary Reach: According to World Bank reports, the project has directly delivered flood protection benefits to more than 100,000 households and indirectly, to a significantly larger population, by its city-wide planning and early warning efforts (World Bank, 2021). The project carried out beneficiary satisfaction surveys that indicated that 78% of the people living in the intervention areas felt that there was less risk of flooding.

4.4 Identified challenges and gaps

Even with these successes, there are major challenges which continue to jeopardize the sustainability of the benefits of the project in the long term. These challenges include:

i. Urbanization Rush: Urbanization of Ibadan is on a breakneck rush. New informal settlements are being established in high-risk regions, and densification of existing areas adds to the amount of runoff. According to Taiwo (2022), the built-up area in Ibadan grew by 28% between 2013 and 2022, with 15 percent of new growth found in areas classified as at risk of floods. The planning and regulatory frameworks are failing to keep abreast with this dynamic growth, and new exposures are being generated and the old ones reduced.

ii. Enforcement Problems: Presence of master plans and building regulations has not necessarily resulted in compliance. The ability to continue encroaching on drainage setbacks and floodplains is enabled by weak enforcement capacity that is commonly caused by political interference, corruption, and resource shortage. According to Ogunsesan, Akanmu, and Salisu (2024), building permits issued in floodplain locations between 2015 and 2020 less than 30% of the building permits issued in floodplain areas were set back as per the IUFMP guidelines. This is, perhaps, the most unresolved problem.

iii. Long-term Solid Waste Management Crisis: Although the efforts of the IUFMP were worthwhile, they could not address the issue of solid waste management in the city. Every day, Ibadan produces 1,500 tons of solid waste, and only 40% of them are collected and disposed of (Yusuf, 2023). Poor collection facilities and littering practices imply that newly built drains soon become clogged once again, significantly diminishing the efficiency with which they were designed and necessitating frequent and expensive repair. Drain inspections conducted after the intervention showed that a high percentage of 45 of the rehabilitated channels were heavily blocked 18 months after the end of the interventions.

iv. Effects of Climate Variability: The structural interventions design standards were informed by the past rainfall data. Nevertheless, climate change is resulting in more severe and unpredictable rainfall patterns that can be more than the new infrastructure can handle in the future. According to the projections made by World Bank (2021) the extreme intensity of rainfall in Ibadan may rise by 15-25 percent by 2050, which might exceed the capabilities of infrastructure that is planned according to the traditional patterns. This presents an ongoing adaptive challenge, which present planning frameworks are not adeptly set up to handle.

v. Lack of Community Engagement Depth: The IUFMP did have elements of community engagement, but it was often superficial in nature (information provision and consultation, as opposed to collaboration and empowerment). According to Akanmu et al. (2024), communities that were impacted by flood management projects, such as the displaced population of channelization projects, claimed that they felt disenfranchised by the process and as a result, developed resentment towards the projects, which, in some instances, contributed to active opposition to the projects.

4.5 Lessons Learned in the Integrated Approach of Ibadan

The IUFMP experience provides a number of vital lessons to the field of urban flood management in the Global South and these include:

i. Integration is Non-Negotiable: The project shows that the structural and non-structural measures are the two sides of a coin. Poor waste management and absence of enforcement can turn a multi-billion Naira drainage channel into a waste and just as a flawless early warning system is of no use when there are no safe evacuation channels, so too are the communities. The combination of the two in a synergetic way is the key to success.

ii. Master Plans are not Finished Products: Master plans such as IFRMP are very important milestones that are achieved but their usefulness is achieved only through constant implementation, monitoring and updating of the master plan. It should be a living document, supported by political will and budget allocation. Ibadan experience indicates that without a consistent political support, the most excellent technical plans remain dusty on the shelves of government.

iii. Technology should be socially integrated: FEWS and GIS tools are strong, yet they cannot be effective without being associated with community knowledge and trust. End-users should be co-designed to technology solutions so that they are comprehensible, reachable and implementable. Communities where local volunteers were trained to become a community flood marshal gave the highest rates of adoption of the early warning system because they were intended to interpret the warning and distribute it.

iv. Sustainability Demands Local Ownership: The sustainability of the project will be defined by the ability of the local institutions and communities to sustain, operate and expand the investments of the project once the external funds run out. Thus, capacity building and stakeholder engagement are not peripheral elements of resilience building but central elements. The budgetary allocations by Oyo State to maintain the drainages reduced by 40 percent after the end of World Bank to fund this aspect, raising questions on the sustainability in the long term.

v. Political Economy Cannot Be Ignored: The IUFMP experience shows that the political economy of flood risk cannot be overcome by technical solutions alone. The interests are powerful and they are interested in unregulated development of land within floodplains and have been able to fight off the interests. To successfully address the flood risk issue, it is necessary to overcome these political-economic causes, rather than only engineering issues.

4.6 Implications to Wider Urban Flood Risk Management

The Ibadan lessons can be largely applied in other Nigerian cities such as Lagos, Port Harcourt, and Abuja, and in most of the fast urbanizing cities in Africa and Asia. These cities experience the same problems of informality, lack of governance, and infrastructural shortages, and climate strains. A template of combining targeted infrastructure investment with strategic planning, institutional strengthening, and community engagement is a viable, but challenging, template offered by the IUFMP model. According to the State of African Cities 2018 report (UN-Habitat and IHS-

Erasmus University Rotterdam, 2018), African cities can skip the outdated development paradigm. The experience of Ibadan indicates that this leapfrogging would demand the transition towards systemic reforms in urban governance and the break of the tradition of projects financed by donors. The main problem, Henderson and Turner (2020) believe, is not the rate at which urbanization occurs but the institutional strength to handle it constructively. This capacity will be developed through long-term investment in local government, professional development, and responsible governance.

Moreover, Ogunsesan, Akanmu, and Salisu (2025) believe that integrated flood risk management should be integrated into wider resilience policies of cities and not considered an independent sector. This involves integrating flood management with housing policy, transportation planning, environmental management and social protection. The IUFMP achieved some of these connections, but failed in others, especially in integrating with housing and land policy.

5.0 Conclusion and Recommendations

The case of Ibadan and its efforts to deal with a long-term risk of floods via the IUFMP is a potent story of both aspirations and caution. The extreme susceptibility of the city was determined by its geography and its past of unplanned development, which led to the tragic floods in 2011 that became an impetus to a fundamentally different approach. The IUFMP was a breakthrough in the disjointed, engineering-based interventions of the previous generation towards a more integrated, holistic flood risk management paradigm.

This study has outlined the two-pronged approach of the project; the implementation of essential structural measures to improve physical flood management, and the innovative establishment of non-structural pillars including Flood Risk Master Plan, Early Warning System, and extensive capacity building initiatives. These efforts have already brought real gains such as the decrease of flooding in the specific locations, the enhanced institutional coherence, and the creation of a system of proactive risk management. While the voyage is not over, the continued existence of such daunting problems as runaway urbanization, laxity in regulation, a long-standing solid waste management crisis, and the accelerating risks of climate change all highlight the fact that infrastructure and plans cannot be used to ensure resilience. The lasting experience of Ibadan is that the technical control of floodwaters should be closely connected with the overall governance of the urban development. Effective land-use control, effective municipal services and empowered communities finally determine the success of concrete channels and early warning systems.

Therefore, to create an Ibadan, and similar cities, that is not only disaster resilient but also proactively and thoroughly committed, requires a long-term dedication. It involves breaking the cycle of thought (project-cycle) and adopt the idea of continuous adaptive management where learning, monitoring and course correction become part of urban governance. The IUFMP has made an excellent and significant foundation. The future is now in the capacity of the city to consolidate and develop this base with political will, financial investment and unswerving intent to ensure that risk reduction is the pillar of all urban development. In order to stabilize the benefits of the IUFMP

and lead Ibadan and other cities in the future, the following recommendations are evidence-based:

i. Enhance Implementation of Land Use and Building Policies: Municipal and state officials must be equipped with digital tools (e.g., GIS-based land registries), spatial planning tools such as land use plans, zoning ordinances, and flood risk early warning systems which will play a vital role in flood prevention and mitigation (Fabiyi, 2023), and political support to enforce the Flood Risk Master Plan provisions This involves zoning and existence of floodplains and wetlands to avoid encroachment and punishing non-compliance without exception to avoid creating new risk. It should be created by having a special law enforcing unit that reports to no one to minimize cases of political interference.

ii. Sustain and Grow Investment in Drainage and Hydraulic Infrastructure Repair: Create a special and separated, so-called Drainage Maintenance Fund that is funded by state budgets, development partners, and perhaps innovative revenue sources, such as a small levy on property taxes. Switch to a non-programmed desilitation system to a programmed regular system of maintenance of the drainage system as a whole. Maintenance fund must be enshrined in law and cannot be diverted to other budgetary items and audits of the fund must be published annually.

iii. Improve Solid Waste Management Systems: Invest in modernizing the solid waste management value chain. This will involve hiring more waste collection trucks, facilitation of formal and informal partnerships in waste collection, instituting material recovery centers where waste can be recycled, and initiating a long-term campaign of creating awareness among people on the direct relationship between waste disposal and flooding. There should be a gradual implementation of a principle of a polluter pays on commercial generators of waste.

iv. Scale-up Flood Early Warning Systems and Community Preparedness Programs: Increase the size of the network of hydro-meteorological monitoring stations to the tributaries. Combine the FEWS with strong, community-based disaster risk management (CBDRM) programs. This includes training of community volunteers, regular evacuation drills and making the warning messages context-specific and actionable by all layers of the population, including the most vulnerable. They should expand the flood marshal program throughout the city and provide necessary incentives and rewards.

v. Adopt Green and Nature-Based Infrastructure (NBS) Solutions: Proactively complement grey infrastructure with NBS. This involves the restoration of urban wetlands to serve as natural sponges, development of riparian buffer zones by rivers, encouragement of rainwater collection and the use of permeable pavements in the open areas. NBS are capable of increasing water retention, decreasing runoff, and co-benefiting the environment, such as better biodiversity and recreational areas. At least three sub-catchments should implement Pilot NBS projects over the next two years.

vi. Develop Multi-Stakeholder Governance: Introduce sustainable, multi-level, multi-stakeholder flood risk governance framework that integrates all levels of

government, community representatives, academia, the private sector and NGOs. This platform will be in charge of executing the master plan, coordination, and mobilization of resources and sharing of knowledge. It must be a platform where terms of reference are clear, there is a secretariat that is known to help, and it must report regularly to the State Executive Council.

vii. Provide Continuous Flood Risk Assessment with Updating GIS and Remote Sensing Tools: Use dynamic and adaptive process of planning. Use high-resolution satellite imagery and drone technology to constantly track changes in land-use, urban development, and infrastructural status. Periodically refresh flood risk models using new climate and urban data to ensure the relevance and effectiveness of planning and interventions in the context of evolving conditions. Annual flood risk reports are supposed to be published and be made publicly available.

viii. Enhance Climate Adaptation Integration: update the infrastructure design guidelines to include a consideration of the climate change forecasts, and not just previous rainfall data. The designs of the 25-year and 50-year return period should be revised to reflect the expected future rise of 15-25% in the intensity of rainfall by 2050. The resilience to climate must become a compulsory factor in any investments of infrastructure at the state level.

ix. There should be Sustainable Financing Mechanisms: Oyo State should come up with sustainable financing mechanisms of flood risk management that are beyond donor-funded projects. This may involve climate resilience bonds, infrastructure maintenance through partnerships between the government and the private sector, and incorporation of disaster risk reduction into local budgets. The flood risk management activities should be allocated at least a percentage (e.g., 5 percent) of the state annual capital budget.

x. Empower Affected Communities: Change to participatory modes of flood risk management. Create locally-managed flood management committees that make decisions on local interventions. Make direct budgetary allocations to small-scale flood mitigation projects on community organizations. Make sure that the redress mechanisms of grievances are available, open, and sensitive to the community issues against the displacement, damage of property, or insufficient compensation.

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