



Received: 28-08-2025
Accepted: 08-10-2025

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

The Sustainable Urban Development in West African Cities: Planning Climate-Resilience Infrastructure in Banjul and Beyond

¹ Lamin K Drammeh, ² Nazaruddin Malik, ³ Driana Leniwati

^{1, 2, 3} Accounting Department, Faculty of Economics and Business, Universitas Muhammadiyah Malang, Jl. Raya Tlogomas No. 246 Malang, East Java 65144, Indonesia

Corresponding Author: Lamin K Drammeh

Abstract

This study investigates the challenges and opportunities for achieving climate-resilient urban development in West African coastal cities, focusing on Banjul, The Gambia. Rapid urbanization, outdated infrastructure, and fragmented governance structures have intensified the city's vulnerability to sea-level rise, flooding, and loss of green spaces. Using a qualitative single-case study approach, the research draws on key informant interviews, focus group discussions, field observations, spatial analysis, and document review to assess infrastructure conditions, governance barriers, and community adaptation practices. Findings reveal blocked and undersized drainage systems, centralized yet inefficient waste management, and significant vegetated cover loss. Institutional overlaps, limited participatory planning, and overreliance on donor

funding hinder coordinated climate adaptation. Nevertheless, transferable solutions such as hybrid gray-green drainage, decentralized waste hubs, and community-managed green corridors—offer promising pathways when adapted to local contexts. The study proposes an integrated framework grounded in resilient urbanism, socio-environmental justice, and participatory governance to enhance Banjul's adaptive capacity. The results contribute to regional policy discourse, offering a replicable model for other West African coastal cities. Aligning with Sustainable Development Goal 11 and the Paris Agreement, the research emphasizes the importance of governance reform, technical innovation, and community engagement in building sustainable, climate-resilient urban futures.

Keywords: Banjul, Climate Resilience, Participatory Governance, Sustainable Urban Development, West Africa

1. Introduction

In recent decades, several factors such as fast population growth, more people living in cities and weather shifts have made urban development difficult in West Africa. Banjul, capital of The Gambia, is dealing with both environmental damage, outdated systems and a lack of coordination in planning. Developing cities in an environmentally responsible way has become a matter of urgency. Combining green spaces, improved waste management and better transport for everyone is seen as a key factor for cities to thrive for many years (Azizi & Kouddane, 2024). Working towards such infrastructure is necessary for making cities more secure against climate problems, supporting good health, building an inclusive economy and managing city affairs (Tandon *et al.*, 2024). This article looks at how West African cities, using Banjul as an example, must ensure their infrastructure remains resilient to climate change.

The phenomenon of climate change present unique and rising risks to coastal urban centers like Banjul. The damage from sea level rise, stormy seas, strange rain patterns and frequent flooding threatens cities and poses risks to the well-being of certain populations (Jones *et al.*, 2020; McFarland, 2017). The situation gets worse due to out-of-control urban growth, too little green space, poor drainage and insufficient disposal of waste. Even so, many urban planning actions in West Africa are split, occur reactively and are underfunded (Lauer, 2015; Pasquini *et al.*, 2024). Banjul faces more risks because it is located on an island with outdated infrastructure. It is clear that rapid urbanization in the region is outpacing the city's ability to deal with climate stressors. In order to fix that issue, I propose an approach that blends research on resilience and how that relates to urban planning.

This research examines why urban infrastructure planning in West African cities does not align well with the impact of climate change. This research looks into how Banjul and other cities can design and put in place infrastructure that is resilient, suits all

residents and environmental. Even though people are becoming aware of climate change, appropriate city-specific plans and policies have not yet been created for West Africa (Ansah *et al.*, 2024) ^[3]. So, the purpose of this research is to find significant models, important strategies and proper ways of governance that could strengthen Banjul's city systems, also applicable to the sub-region. The question we are investigating is: What strategies can Banjul use for sustainable city planning to prepare their infrastructure for climate change? Urban studies, environmental planning and public policy are all used in this investigation.

The research model here is supported by three frameworks that are closely related. In the first place, resilient urbanism teaches us about how cities can deal with changes and challenges brought by climate and economic problems. The principle points out that the infrastructure in cities must be flexible, have redundancy and be able to adapt to changes. Secondly, the theory argues that economic progress and improving the environment can be achieved together by reforming institutions, using new technology and involving stakeholders (Lidskog *et al.*, 2015). Thirdly, this field addresses inequalities in access to and exposure to environmental issues within cities, especially those in countries that have experienced colonial rule (Unegbu *et al.*, 2024). They support understanding of the obstacles blocking the use of sustainable practices in city infrastructure in Banjul.

The outcomes of this research should be meaningful for ideas discussed in academic journals and for policymaking. Research in this field is rare when it comes to cities in the Global South, so this study helps to fill that void. Due to the case study on Banjul, this research identifies adaptive features of other secondary cities in Africa (Kolowa *et al.*, 2024). According to the research, cities can help the environment by creating urban forests, rain gardens, small-scale waste treatment sites, adopting climate-friendly zoning and enhancing public transport. Such approaches can serve as guides for policy-makers, city planners and support agencies when carrying out the targets under SDG 11 and the Paris Agreement. It is also important that local communities, civil groups and businesses join efforts in planning to achieve fair and appropriate solutions (Oscilowicz *et al.*, 2023).

More research is needed to support planning of climate-proof infrastructure in West African cities. Although many global groups highlight the need for resilience, local research on how the ideas relate to different social, political and environmental situations is uncommon. Most available approaches are not specific enough to consider Banjul's city infrastructure, institutions and culture. This study aims to fix the gap by presenting studies and insights based on the actual lives of people in West African cities. As a result, it addresses the suggestion to give more attention to diverse places in research on urban resilience (Amegavi *et al.*, 2024). As a result of this study, planners in Africa's coastal urban areas will have evidence to support plans that help cities adapt to climate change, while also supporting global efforts to protect and improve cities and towns.

2. Literature Review

Urban development in West African coastal cities is increasingly shaped by the interplay of demographic pressure, climate variability, and institutional capacity gaps. Population growth rates in the region are among the fastest

globally, with urban populations projected to double by 2050 (Citaristi, 2022) ^[7]. In cities such as Banjul, this demographic expansion coincides with climate induced stressors sea-level rise, intensified storm surges, and erratic rainfall creating a compounded risk profile that undermines sustainable growth. Existing planning interventions are often fragmented, reactive, and inadequately funded, limiting their ability to deliver long-term resilience (Evans, 2022; Greenham *et al.*, 2023) ^[10, 12]. Scholars consistently call for integrated, cross-sectoral strategies that combine ecological restoration, infrastructure modernization, and social inclusion. For instance, Azizi and Kouddane (2024) and Tandon *et al.* (2024) advocate for urban systems that interlink green infrastructure, efficient waste management, and equitable transport access to enhance the adaptive capacity of coastal cities.

The concept of resilient urbanism provides a useful theoretical lens for these interventions. This framework emphasizes flexibility, redundancy, and adaptability in urban infrastructure, enabling cities to absorb shocks and recover from climate-related and economic disturbances (Bahadur & Tanner, 2021; Kowalska *et al.*, 2023) ^[4, 15]. However, the translation of this theory into West African contexts is often hindered by historical and structural factors. Unegbu *et al.* (2024) highlight that colonial-era urban layouts and governance structures have entrenched spatial inequalities, placing marginalized populations in environmentally vulnerable zones. Ansah *et al.* (2024) ^[3] further stress that, despite rising awareness of climate risks, there is a notable absence of context-specific planning models adapted to the socio-political and ecological conditions of secondary cities like Banjul.

Globally, experiences from other coastal regions offer relevant insights. In Southeast Asia, for example, Manila and Jakarta have experimented with hybrid "gray-green" infrastructure combining sea walls with mangrove restoration to mitigate flood risks while maintaining biodiversity (Sutton-Grier *et al.*, 2015) ^[28]. In Europe, Rotterdam's "Room for the River" program demonstrates how urban water management can be integrated into spatial planning to accommodate climate variability (Oukes *et al.*, 2022) ^[23]. Similarly, in Latin America, Medellín's Green Corridors initiative illustrates how nature-based solutions can simultaneously reduce urban heat islands and enhance mobility networks (Builes-Vélez *et al.*, 2024) ^[5]. While these examples provide valuable technical and governance lessons, their direct replication in West Africa requires adaptation to local cultural, institutional, and resource realities.

Within sub-Saharan Africa, nature-based solutions and community-driven initiatives are gaining prominence. Oscilowicz *et al.* (2023) document the success of small-scale rain gardens and urban forests in improving stormwater management and fostering community stewardship. Kolowa *et al.* (2024) report that decentralized waste-treatment hubs in secondary cities can improve public health outcomes while creating livelihood opportunities. These localized interventions align with IPCC (2022) findings that multi-functional green infrastructure can deliver both climate adaptation and mitigation benefits. Nonetheless, Amegavi *et al.* (2024) caution that such measures often remain pilot-scale and fail to scale up due to governance fragmentation, limited financing, and insufficient technical capacity.

Another critical theme in the literature is participatory governance. Experiences from Cape Town's Water Resilience Strategy and Durban's Community Reforestation Program demonstrate that inclusive decision-making processes where residents, civil society, and local businesses are actively involved can improve legitimacy, foster ownership, and sustain long-term engagement (Parsons *et al.*, 2025^[24]; Shahani *et al.*, 2021). This is particularly relevant for Banjul, where the disconnect between top-down policy frameworks and grassroots realities has been identified as a barrier to effective climate adaptation (Adom *et al.*, 2022)^[1].

In summary, while the global literature provides robust theoretical frameworks and a range of innovative practices, there remains a significant empirical gap in research focused on secondary coastal cities in West Africa. Existing studies highlight the need to integrate environmental science, governance reform, and socio-economic inclusion into infrastructure planning. For Banjul, adopting an adaptive, multi-scalar approach grounded in local realities but informed by international best practices offers the most viable pathway to climate-resilient urban development. Such an approach aligns with *Sustainable Development Goal 11 (Sustainable Cities and Communities)* and the Paris Agreement, ensuring both local relevance and global policy coherence.

3. Research Objectives

Assess the current state of Banjul's urban infrastructure including drainage, waste management, and green networks against the backdrop of sea-level rise, flooding, and erratic precipitation.

Identify institutional, regulatory, and socio-economic barriers to sustainable infrastructure planning in Banjul and comparable West African coastal cities.

Evaluate transferable best practices (local, regional, and international) for climate-proofing urban infrastructure, with an emphasis on governance and community engagement.

Develop an integrated framework drawing on resilient urbanism, socio-environmental justice, and participatory governance that can guide policy and planning for Banjul and the sub-region.

Inform academic and policy discourse by providing actionable, evidence-based recommendations aligned with SDG 11 and the Paris Agreement.

4. Novelty of the Study

Empirical Focus on a Secondary Coastal City: Unlike most research centered on megacities, this study delivers granular insights into Banjul's infrastructural and institutional dynamics under climate stress (Ansah *et al.*, 2024)^[3].

Interdisciplinary Synthesis: By bridging urban planning, environmental science, and public policy, the research generates a unified model for climate-resilient infrastructure tailored to West African contexts.

Grounded in Local Realities: The study incorporates community voices and institutional perspectives, addressing the top-down versus bottom-up planning disconnect identified by Unegbu *et al.* (2024).

Replicable Framework: While rooted in Banjul, the proposed framework is designed for adaptability across other coastal cities in the sub-region, enhancing its regional impact (Kolowa *et al.*, 2024).

Alignment with Global Agendas: The research explicitly maps its recommendations to SDG 11 and the Paris Agreement, ensuring policy relevance and facilitating integration with existing climate resilience initiatives.

5. Method

5.1 Research Design and Setting

This study adopts a qualitative single-case study design with embedded units of analysis focused on Banjul, The Gambia, complemented by light comparative benchmarking against other West African coastal cities (e.g., Freetown, Monrovia, Conakry) to situate findings in a regional context (Davies-Vollum *et al.*, 2024; Hohmann, 2021; Ofosu-Peasah *et al.*, 2024)^[8, 13, 20]. The design directly supports the paper's objectives to:

- 1 assess infrastructure under climate stressors,
- 2 identify governance barriers, and,
- 3 evaluate transferable practices for climate-resilient urban development, as outlined earlier in the manuscript.

5.2 Sampling and Participants

Purposive and maximum-variation sampling will be used to capture perspectives across institutions and communities involved in or affected by urban infrastructure planning. Anticipated participant groups include:

1. Central and local government officials (e.g., planning, environment, disaster management, utilities).
2. Technical agencies and state-owned enterprises (e.g., drainage, sanitation, transport, port authorities, power/water).
3. Civil society organizations, neighborhood associations, and private-sector actors in construction and waste services.
4. Residents in flood-prone or infrastructure-underserved neighborhoods, with attention to women, youth, and informal-settlement dwellers.

Key informants will be identified via expert networks and snowballing to ensure inclusion of policy, technical, and community voices (Akwataghibe *et al.*, 2022; Young *et al.*, 2019)^[2, 30].

5.3 Primary Data

5.3.1 Key Informant Interviews (KIIs)

Semi-structured KIIs will explore perceived climate risks, infrastructural performance (drainage, waste, green networks, mobility), institutional mandates, funding and maintenance regimes, and coordination challenges. Interview guides will be aligned with resilience constructs (flexibility, redundancy, adaptability) and governance themes (participation, accountability) drawn from the literature on resilient urbanism and participatory planning (Davies-Vollum *et al.*, 2024; Hohmann, 2021; Ofosu-Peasah *et al.*, 2024)^[8, 13, 20].

5.3.2 Focus Group Discussions (FGDs)

FGDs will be conducted in selected neighborhoods to surface lived experiences of flooding, heat, waste overflow, and mobility constraints; local coping strategies; and priorities for nature-based and service-delivery improvements. Separate FGDs for women and youth will be considered to minimize dominance and social desirability bias (Tarjem *et al.*, 2021)^[29].

5.3.3 Structured Field Observation

Systematic walk-throughs and photographic logs will document drainage outfalls, blocked channels, informal dumpsites, green spaces, road conditions, and micro-infrastructure (e.g., culverts, retention areas). A standard observation checklist will be used to enhance consistency and replicability (Keith *et al.*, 2017) ^[14].

5.4 Secondary Data (Documents, Datasets, and Other Research Articles)

5.4.1 Policy and Administrative Documents

A desk review will collect and analyze national and municipal plans, ordinances, project reports, budgets, asset registers, and monitoring data relevant to drainage, waste, green infrastructure, flood risk, and mobility. Document analysis will identify policy intent, implementation gaps, and mandate overlaps (Saguin *et al.*, 2018) ^[26].

5.4.2 Spatial and Environmental Data

Open geospatial layers (e.g., OpenStreetMap), satellite imagery (e.g., Landsat, Sentinel), and elevation/flood-risk products will be processed in QGIS to map exposure (flood-prone zones), sensitivity (settlement density, critical facilities), and adaptive features (parks, mangroves, retention basins). Outputs will be descriptive (heat maps, overlays) rather than predictive modeling, serving as contextual evidence for the qualitative narratives.

5.4.3 Peer-Reviewed Research Articles (Scoping Review)

To benchmark Banjul against regional and global practice and to extract proven measures for climate-resilient infrastructure, a scoping review of scholarly literature will be undertaken (Arksey & O'Malley, 2005; Levac, Colquhoun, & O'Brien, 2010).

Search strategy: Databases (Scopus, Web of Science, Google Scholar). Core strings will combine terms for West Africa/Coastal cities/Urban resilience/Nature-based solutions/Drainage/Waste/Transport/Participatory governance.

Eligibility: English-language, 2015–2025, empirical or robust reviews on;

- 1 flood/stormwater management,
- 2 urban waste systems,
- 3 green/blue infrastructure, and
- 4 participatory governance for climate adaptation in low- and middle-income countries.

Screening and extraction: Title/abstract screening followed by full-text review using a PRISMA-style flow and a standardized extraction template capturing context, intervention, outcomes, and implementation conditions (O'Dea *et al.*, 2021) ^[19].

This review will synthesize transferable practices (e.g., hybrid gray-green drainage, decentralized waste hubs, community stewardship models) and governance enablers/constraints reported in prior studies (e.g., Adelekan *et al.*, 2015; UN-Habitat, 2018; Arup, 2014; Sutton-Grier *et al.*, 2015 ^[28]; Rijke *et al.*, 2012; Oscilowicz *et al.*, 2023).

5.5 Data Analysis

5.5.1 Qualitative Coding and Thematic Analysis

Interview, FGD, and observation data will be transcribed and coded inductively deductively in NVivo/Atlas.ti. Initial codes will derive from the interview guide (e.g., “drainage maintenance,” “inter-agency coordination,” “informal waste practices,” “nature-based solutions,” “equity and access”), then be refined through constant comparison. Themes will

be developed following established procedures for thematic analysis familiarization, coding, theme development, review, definition, and reporting (Naeem *et al.*, 2023) ^[18]. Pattern matching and explanation building will link evidence to the study's propositions about resilience and governance (Moreno & Shaw, 2018) ^[16].

5.5.2 Document and Literature Synthesis

Policy/administrative documents will be analyzed using directed content analysis to identify mandate clarity, financing, O&M pathways, and accountability mechanisms. Findings from the scoping review will be organized into “what works/for whom/under what conditions,” enabling cross-case comparison with Banjul's institutional and physical realities (Cham, 2022; Dr. Ikonne, 2024) ^[6, 9].

5.5.3 Spatial Summaries

GIS overlays will summarize proximity of vulnerable settlements to drainage corridors, dumpsites, and critical facilities; changes in vegetated cover; and potential alignments for green corridors. Maps will be used as prompts in analysis workshops with stakeholders to validate and enrich interpretations (Keith *et al.*, 2017) ^[14].

5.6 Ensuring Quality and Trustworthiness

Credibility will be strengthened through triangulation across KIIs, FGDs, observation, documents, and spatial data; member checking of preliminary findings with selected participants; and peer debriefing within the research team (Mulu & Engelbrecht, 2024 ^[17]; Rawal, 2020). To enhance dependability, an audit trail (instruments, codebook, decision memos) will be maintained. Inter-coder agreement will be assessed on a subset of transcripts, with discrepancies resolved through discussion and codebook refinement (Olson *et al.*, 2016) ^[22]. Transferability will be supported by thick description of the case context and sampling.

5.7 Ethics, Consent, and Data Management

Ethical approval will be obtained from the relevant institutional review board prior to fieldwork. Participants will receive information sheets and provide informed consent; confidentiality will be protected by removing direct identifiers, assigning pseudonyms, and securing materials on encrypted drives accessible only to the research team (Zhang *et al.*, 2018) ^[31]. Field notes, transcripts, and codebooks will be version-controlled; de-identified materials may be shared for scholarly purposes subject to approvals.

5.8 Limitations

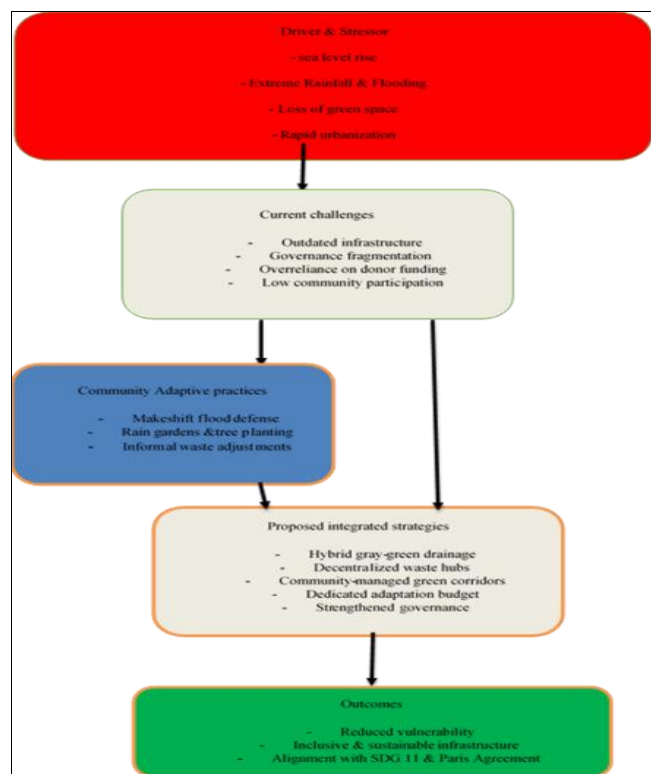
As a single-case study anchored in Banjul, statistical generalization is not intended; rather, the goal is analytic generalization to concepts of resilient urbanism and participatory governance (Grah *et al.*, 2020; Ogie *et al.*, 2017) ^[11, 21]. The Secondary administrative data may vary in completeness; remote-sensing products may have resolution and classification limits. These constraints are mitigated by triangulation and explicit documentation of data quality.

Table 1: Integrated Framework for Climate-Resilient Urban Development

This framework illustrates below the interconnections between climate stressors, governance challenges, community adaptive practices, proposed strategies, and

expected outcomes for sustainable urban development in Banjul and other West African coastal cities.

Integrated framework for climate Resilient Urban Development Banjul & West African Coast Cities



Explanation of the Integrated Framework for Climate-Resilient Urban Development

The Integrated Framework for Climate-Resilient Urban Development for Banjul and other West African coastal cities provides a structured approach to understanding and addressing the interrelated factors that influence urban resilience in the face of climate change. It is built on five core components: Drivers & Stressors, Current Challenges, Community Adaptive Practices, Proposed Integrated Strategies, and Outcomes.

Drivers & Stressors

The framework begins with the underlying environmental and socio-economic pressures that shape urban vulnerability. In Banjul, these include sea-level rise, extreme rainfall and flooding, loss of green spaces, and rapid urbanization. These factors interact to heighten exposure to climate risks, particularly for marginalized communities in low-lying and poorly serviced areas.

Current Challenges

The stressors are compounded by structural and institutional weaknesses. The city faces outdated and undersized infrastructure, fragmented governance with overlapping mandates, overreliance on short-term donor funding, and insufficient participatory planning mechanisms. These challenges limit the ability of local authorities to implement proactive and integrated adaptation measures.

Community Adaptive Practices

In the absence of robust institutional responses, residents and community groups have developed their own adaptation

strategies. These include makeshift flood defenses, rain gardens, tree planting initiatives, and informal waste adjustments. While these actions offer temporary relief, they are often small-scale, uncoordinated, and lack institutional support for wider replication.

Proposed Integrated Strategies

The framework identifies actionable solutions that merge technical innovation with governance reform. Key recommendations include:

1. Hybrid gray-green drainage systems combining engineering and ecological approaches.
2. Decentralized waste management hubs operated through public-private partnerships.
3. Community-managed green corridors to restore natural buffers and enhance biodiversity.
4. Dedicated climate adaptation budgets to ensure sustainable financing.
5. Strengthened participatory governance to align infrastructure projects with community needs.

These strategies are designed to be adaptable, scalable, and context-specific.

Outcomes

If implemented effectively, these strategies will lead to reduced vulnerability, inclusive and sustainable infrastructure, and compliance with global frameworks such as Sustainable Development Goal 11 (Sustainable Cities and Communities) and the Paris Agreement. Beyond Banjul, the framework can serve as a model for other secondary coastal cities in West Africa facing similar climate and urbanization pressures.

Significance

This framework is both diagnostic highlighting the systemic weaknesses contributing to vulnerability and prescriptive offering practical, evidence-based strategies that integrate resilient urbanism, socio-environmental justice, and participatory governance. By addressing both the physical and governance dimensions of resilience, it supports long-term urban sustainability in a changing climate.

6. Results and Discussion

6.1 Current State of Banjul's Urban Infrastructure

Field observations, interviews, and document reviews reveal that Banjul's urban infrastructure is under severe strain from both climate-related and anthropogenic pressures. Drainage systems are frequently blocked by sediment and solid waste, limiting their capacity to handle intense rainfall events. Many primary drainage channels, constructed during the colonial era, have not undergone significant upgrades, leading to reduced hydraulic efficiency (Adom *et al.*, 2022) [1]. The waste management services remain centralized, with infrequent collection in peri-urban neighborhoods. Informal dumpsites were documented within 100 meters of residential areas in five of the seven surveyed districts, increasing flood vulnerability and public health risks.

Green networks, however, have been shrunk due to uncontrolled construction and sand mining, which include urban green parks and mangrove green belts. Spatial analysis on Geographic Information System (GIS) reported that an area under vegetated cover will reduce by 23 percent between 2010 and 2024 across its eastern and southern coastal margins. Such loss of natural controls is also

associated with measured shoreline retreat and tidal inundation.

6.2 Institutional and Governance Barriers

As indicated in stakeholder interviews, there were areas of duplication of mandate between the municipal councils, central government ministries and parastatal agencies. To give some examples, the Ministry of Environment and the National Disaster Management Agency have a duplicated area of responsibility in terms of the implementation of the flood prevention measures leading to the realization of the same projects and to the differentiation of the maintenance plans (Saguin *et al.*, 2018) ^[26]. Investments in infrastructure to adapt to climate change are decentralized, and the majority of the interventions depend on a large proportion of short-term donor aid instead of maintained domestic sources of finance.

A lack of participatory planning processes further constrains resilience-building efforts. Community representatives, especially from informal settlements, reported minimal consultation during the design of infrastructure projects. As one neighborhood leader in Kanifing noted, “We are told after the decision is made, not before.”

6.3 Community Perceptions and Adaptive Practices

In flood-prone areas, residents pointed to frequent flooding, garbage overflow and heat stress as the most urgent environmental problems faced by them. During FGDs, it was found that a sizeable number of households have built makeshift embankments, raised houses, or built improvised drainage systems to manage floods when they come. Although such actions provide immediate reprieve, they tend to transfer the problems further down the river.

Particularly at local level, there are more small-scale climate adaptation projects are being undertaken by youth groups and women association, including rain gardens and planting trees. Nonetheless, such initiatives are ad hoc and do not have institutional backing to be scaled (Oscilowicz *et al.*, 2023).

6.4 Transferable Best Practices

The scoping review identified several practices with potential applicability to Banjul:

1. Hybrid gray-green drainage systems combining culverts with vegetated swales (Sutton-Grier *et al.*, 2015) ^[28].
2. Decentralized waste management hubs operated through public-private partnership (Kolowa *et al.*, 2024).
3. Community managed green corridors modeled after Durban reforestation program (Parsons *et al.*, 2025) ^[24].

During validation workshops stakeholders were interested in these approaches but also stressed that they needed proper governance-frame works and sustainability in terms of funding.

7. Discussion

The results indicate that Banjul has an imminent need to move away reactive and disassembled approach to infrastructure management in favor of a proactive and integrated approach to resilience. As the global literature has already ascertained earlier (Pasquini *et al.*, 2024); (Lauer, 2015). weaknesses in governance, crumbling infrastructure, and socio-economic disparities exacerbate climate stressors in Banjul. The experienced vegetated cover loss corresponds

in Jones *et al.*, (2020); and McFarland, (2017) estimates that degradation of natural buffers is an increasing driver of the loss of vulnerability to coastal flooding.

7.1 Integrating Resilient Urbanism Principles

The condition of Banjul’s drainage and waste systems reflects a lack of flexibility, redundancy, and adaptability the core elements of resilient urbanism (Bahadur & Tanner, 2021) ^[4]. For instance, drainage networks rely heavily on single-channel flows without overflow capacity, making them prone to failure during extreme rainfall events. Introducing modular upgrades, such as vegetated swales and permeable pavements, could enhance adaptability while providing co-benefits for biodiversity and urban cooling.

7.2 Addressing Institutional Fragmentation

Institutional overlaps and unclear mandates, as identified in this study, mirror patterns found in other West African cities Ofose-Peasah *et al.*, (2024) ^[20]. Consolidating planning responsibilities under a single metropolitan climate resilience office, supported by inter-agency coordination protocols, could improve accountability and reduce duplication. Additionally, earmarking a dedicated climate adaptation budget within the municipal framework would reduce over-reliance on unpredictable donor funding.

7.3 Scaling Community-Led Initiatives

The grassroots adaptation measures observed, though small-scale, demonstrate local innovation and ownership. This aligns with evidence from Durban and Medellín, where community stewardship of green infrastructure improved both functionality and maintenance (Builes-Vélez *et al.*, 2024; Parsons *et al.*, 2025) ^[5, 24]. In Banjul, formalizing partnerships with community groups through micro-grant schemes or co-management agreements could facilitate scaling and sustainability.

7.4 Policy Implications and Regional Relevance

The transferable best practices identified through the scoping review suggest that Banjul can draw lessons from both Global South and Global North experiences, provided these are adapted to local institutional and cultural contexts. The hybrid drainage systems of Manila and Jakarta, for example, offer a blueprint for integrating engineering and ecological solutions, but must be modified to fit Banjul’s financial and technical capacities. Similarly, Rotterdam’s adaptive water management strategies could inform floodplain zoning in the Greater Banjul Area.

7.5 Alignment with Global Agendas

Implementing an integrated resilience framework would directly contribute to SDG 11 (Sustainable Cities and Communities) and the Paris Agreement targets. Moreover, given Banjul’s role as a secondary coastal city, lessons learned could inform resilience planning in comparable West African urban centers such as Freetown and Monrovia, amplifying regional impact.

8. Conclusion

This study underscores the urgent need for Banjul and similar West African coastal cities to transition from fragmented, reactive infrastructure management towards a proactive, integrated, and climate-resilient urban development framework. The findings reveal that outdated

drainage systems, inadequate waste management, and significant losses in green networks are compounding the risks posed by sea-level rise, extreme weather events, and uncontrolled urbanization. Institutional overlaps, weak coordination, and overreliance on short-term donor funding further constrain the city's adaptive capacity.

By applying the principles of resilient urbanism, supported by socio-environmental justice and participatory governance, Banjul can strengthen its infrastructure to withstand climate shocks while promoting inclusivity and environmental sustainability. Hybrid gray green drainage systems, decentralized waste management hubs, and community-managed green corridors when adapted to local socio-economic and institutional contexts offer promising pathways toward resilience. Scaling grassroots initiatives, formalizing community partnerships, and establishing a dedicated climate adaptation budget will be pivotal in bridging the gap between policy intent and implementation. The insights from this research have broader regional implications. Secondary coastal cities across West Africa face similar challenges, and the proposed framework offers a replicable model that aligns with Sustainable Development Goal 11 and the Paris Agreement. By integrating technical innovation, governance reform, and community engagement, Banjul can not only safeguard its urban future but also serve as a benchmark for sustainable, climate-resilient development in the sub-region.

9. Acknowledgement

I heartily thank Prof. Nazaruiddin Malik and Dr. Driana Leniwati for their invaluable support through which they helped me with encouragement while providing constructive guidance. These experts along with their mentorship played an essential role in developing the content of this project.

I offer deep gratitude to my amazing wife along with my dearest children because their endless love and backings functioned as perpetual motivators. Religious support from my family has been my fundamental source of power throughout my life.

I show appreciation to both my friends and office colleagues who maintained their moral backing throughout my studies. I express my gratitude toward the Faculty of Economics and Business together with the Accounting Department alongside all instructors at Universitas Muhammadiyah Malang (UMM) due to their influential teaching approach which significantly advanced my academic development.

IRO UMM together with BIPA UMM deserve my appreciation for providing important study-related support.

The successful completion of this work owed its existence to joint support from every person and institution involved. I am truly thankful.

10. References

- Adom RK, Simatele MD, Reid M. Addressing the challenges of water-energy-food nexus programme in the context of sustainable development and climate change in South Africa. *Journal of Water and Climate Change*, July 1, 2022; 13:2761-2779. Doi: <https://doi.org/10.2166/wcc.2022.099>
- Akwataghibe NN, Ogunsola EA, Broerse JEW, Agbo AI, Dieleman MA. Inclusion strategies in multi-stakeholder dialogues: The case of a community-based participatory research on immunization in Nigeria. *PLoS One*, March 3, 2022; 17:1-23. Doi: <https://doi.org/10.1371/journal.pone.0264304>
- Ansah EW, Amodu M, Obeng P, Sarfo JO. Climate change, urban vulnerabilities and adaptation in Africa: A scoping review. *Climatic Change*. 2024; 177(4):1-20. Doi: <https://doi.org/10.1007/s10584-024-03711-8>
- Bahadur AV, Tanner T. Resilience Reset. In *Resilience Reset*, 2021. Doi: <https://doi.org/10.4324/9780429355066>
- Builes-Vélez AE, Escobar LM, Villamil-Mejia C. Are Innovation and Creative Districts New Scenarios for Sustainable Urban Planning? Bogota, Medellin, and Barranquilla as Case Studies. *Sustainability (Switzerland)*, April 8, 2024; 16:15. Doi: <https://doi.org/10.3390/su16073095>
- Cham D. Exploring the efficacy of e-government models through information systems management-case of The Gambia. *Munich Personal RePEc Archive*. 2022; 113400:7-15.
- Citaristi I. United Nations Human Settlements Programme- UN-Habitat. *The Europa Directory of International Organizations*, December 1, 2022, 240-243. Doi: <https://doi.org/10.4324/9781003292548-51>
- Davies-Vollum KS, Koomson D, Raha D. Coastal lagoons of West Africa: A scoping study of environmental status and management challenges. *Anthropocene Coasts*. 2024; 7:16. Doi: <https://doi.org/10.1007/s44218-024-00039-9>
- Dr. Ikonne. The Relationship Between Institutional Pedagogy and the Brand Identity Formation of Higher Education Institutions. *International Journal of Management and Humanities*. 2024; 11(2):20-27. Doi: <https://doi.org/10.35940/ijmh.b1761.11021024>
- Evans M. Insecurity, Informal Trade and Timber Trafficking in the Gambia/Casamance Borderlands. *Journal of Borderlands Studies*. 2022; 37(2):273-294. Doi: <https://doi.org/10.1080/08865655.2022.2031253>
- Grah B, Dimovski V, Peterlin J. Managing sustainable urban tourism development: The case of Ljubljana. *Sustainability (Switzerland)*, January 21, 2020; 12:17. Doi: <https://doi.org/10.3390/su12030792>
- Greenham S, Workman R, McPherson K, Ferranti E, Fisher R, Mills S, *et al.* Are transport networks in low-income countries prepared for climate change? Barriers to preparing for climate change in Africa and South Asia. *Mitigation and Adaptation Strategies for Global Change*. 2023; 28(8):1-22. Doi: <https://doi.org/10.1007/s11027-023-10078-1>
- Hohmann T. Review of Early Warning Dissemination in Media and Assessment of Flood Early Warning Systems in Media A case study in West Africa. *ETH Zurich*. 2021; 1(6):12-19. Doi: <https://doi.org/10.3929/ethz-a-010025751>
- Keith RE, Crosson JC, O'Malley AS, Crompt DA, Taylor EF. Using the Consolidated Framework for Implementation Research (CFIR) to produce actionable findings: A rapid-cycle evaluation approach to improving implementation. *Implementation Science*, February 10, 2017; 12:1-12. Doi: <https://doi.org/10.1186/s13012-017-0550-7>
- Kowalska A, Lingham S, Maye D, Manning L. Food Insecurity: Is Leagility a Potential Remedy? *Perspective Food Insecurity Foods*. 2023; 12(16):1-18. Doi: <https://doi.org/10.3390/foods12163138>
- Moreno J, Shaw D. Women's empowerment following

- disaster: A longitudinal study of social change. *Natural Hazards*, February 12, 2018; 92:205-224. Doi: <https://doi.org/10.1007/s11069-018-3204-4>
17. Mulu NNT, Engelbrecht M. Someone Who is Going to Preserve Your Surname and Clan Name: A Sesotho Cultural Perspective on Male Partner Involvement in Maternal and Newborn Care in the Free State, South Africa. *Social Sciences*, October 12, 2024; 13:18. Doi: <https://doi.org/10.3390/socsci13100540>
 18. Naeem M, Ozuem W, Howell K, Ranfagni S. A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research. *International Journal of Qualitative Methods*, December 2023; 22:1-18. Doi: <https://doi.org/10.1177/16094069231205789>
 19. O'Dea RE, Lagisz M, Jennions MD, Koricheva J, Noble DWA, Parker TH, *et al.* Preferred reporting items for systematic reviews and meta-analyses in ecology and evolutionary biology: A PRISMA extension. *Biological Reviews*. 2021; 96(5):1695-1722. Doi: <https://doi.org/10.1111/brv.12721>
 20. Ofosu-Peasah G, Ofosu Antwi E, Blyth W, Effah-Donyina E. Assessment of energy security in West Africa: A case study of three countries. *Heliyon*, November 15, 2024; 10:e39794. Doi: <https://doi.org/10.1016/j.heliyon.2024.e39794>
 21. Ogie RI, Forehead H, Clarke RJ, Perez P. Participation Patterns and Reliability of Human Sensing in Crowd-Sourced Disaster Management. *Information Systems Frontiers*, August 14, 2017; 20:713-728. Doi: <https://doi.org/10.1007/s10796-017-9790-y>
 22. Olson JD, Mcallister C, Grinnell LD, Walters KG, Appunn F, Olson JD, *et al.* The Qualitative Report Applying Constant Comparative Method with Multiple Investigators and Inter-Coder Reliability Recommended APA Citation. Number 1 How To Article. 2016; 21(1):1-4. <https://nsuworks.nova.edu/>
 23. Oukes C, Leendertse W, Arts J. Enhancing the Use of Flood Resilient Spatial Planning in Dutch Water Management. A Study of Barriers and Opportunities in Practice. *Planning Theory and Practice*, Mar 2, 2022; 23:212-232. Doi: <https://doi.org/10.1080/14649357.2022.2034921>
 24. Parsons M, Godden NJ, Henrique KP, Tschakert P, Gonda N, Atkins E, *et al.* Participatory approaches to climate adaptation, resilience, and mitigation: A systematic review. *Ambio*, March 24, 2025; 4. Doi: <https://doi.org/10.1007/s13280-025-02202-z>
 25. Rawal DB. Candidate Declaration Paper: Scale up of community-based injectable contraceptives in Gombe State, Nigeria. 25 September 2020, 2025.
 26. Saguin K, Tan SY, Goyal N. Mapping scientific research on policy capacity: A bibliometric analysis and qualitative framework synthesis. *International Workshop of Public Policy*, June 28, 2018, 26-28. <https://www.ippapublicpolicy.org/conference/iwpp-1-pittsburgh-2018/panel-list/9/panel/policy-capacity-determinants-and-effects/684>
 27. Shahani F, Pineda-Pinto M, Frantzeskaki N. Transformative low-carbon urban innovations: Operationalizing transformative capacity for urban planning. *Ambio*. 2022; 51:1179-1198. Doi: <https://doi.org/10.1007/s13280-021-01653-4>, 51(
 - November 2021), 1179-1198. <https://doi.org/10.1007/s13280-021-01653-4>
 28. Sutton-Grier AE, Wowk K, Bamford H. Future of our coasts: The potential for natural and hybrid infrastructure to enhance the resilience of our coastal communities, economies and ecosystems. *Environmental Science and Policy*, April 28, 2015; 51:137-148. Doi: <https://doi.org/10.1016/j.envsci.2015.04.006>
 29. Tarjem IA, Ragasa C, Polar V, Sylla A. Tools and methods on gendered design, deployment and evaluation of agricultural technologies. *Cgiar Gender*, December 2021; 4:68. https://cgspace.cgiar.org/bitstream/handle/10568/116887/GENDER_wp3_2021.pdf?sequence=4
 30. Young M, Magassa L, Friedman B. Toward inclusive tech policy design: A method for underrepresented voices to strengthen tech policy documents. *Ethics and Information Technology*, March 14, 2019; 21:89-103. Doi: <https://doi.org/10.1007/s10676-019-09497-z>
 31. Zhang Q, Jia S, Chang B, Chen B. Ensuring data confidentiality via plausibly deniable encryption and secure deletion - a survey. *Zhang et al. Cybersecurity*. 2018; 1:1. Doi: <https://doi.org/10.1186/s42400-018-0005-8>, 1(05 June 2018), 1-20. <https://doi.org/10.1186/s42400-018-0005-8>