

Can Dhaka Become a Sponge City? A Qualitative Assessment of Urban Water Governance

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Abstract: Dhaka, the capital of Bangladesh is having a problem with waterlogging and flooding in the city. This is happening because of things like too many people moving to the city, not enough good drainage systems losing natural wetlands building on canals and climate change. When it rains a lot the water is too much for the cities drainage system to handle. This causes problems with transportation, damage to buildings affects people's health and costs a lot of money. The people in charge of the city are not working well together, which makes it harder to manage the water. This is why Dhaka needs a way to manage water that is good for the environment and can handle climate change. The Sponge City idea is a way to manage water in cities. It helps cities to absorb, store and clean rainwater of just letting it flow away. This idea uses spaces like parks, wetlands and green roofs and combines them with the city's existing drainage system. This helps to reduce flooding makes the water cleaner and makes the city stronger. To make this idea work the city needs to plan work together have good policies and invest in good infrastructure. This study is trying to figure out if Dhaka can really use the Sponge City idea. It is looking at how the city manages water how the institutions work what policies are in place and what challenges there are. The study is talking to people and looking at policy documents to find out what is stopping Dhaka from using the Sponge City idea and what can be done to make it work. The goal is to give advice to policymakers to help them make better decisions adapt to climate change and reduce flooding.

Keyword: *Sponge City, Urban Water Governance, Dhaka, Waterlogging, Climate Change, Nature-Based Solutions, Green Infrastructure, Bangladesh.*

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I. INTRODUCTION

Rapid urbanization and climate change have increased the frequency and severity of urban flooding in many places worldwide. Traditional sewage networks, which mainly depend on traditional structures, are finding it harder to manage heavy downpours. Many cities are shifting to sustainable stormwater management systems that combine green infrastructure and Nature-Based Solutions (NbS) to improve urban resilience and reduce the risk of floods.(1,2)

Bangladesh's metropolis, Dhaka, one of South Asia's fastest-growing megacities, is constantly flooded during the monsoon season. Sharp population growth, unchecked urban development, encroachment of marshes and waterways, inadequate sewage infrastructure, and inadequate solid waste disposal have all severely reduced the city's natural drainage capacity. Because of this, even light rainfall causes substantial flooding, which harms buildings, disrupts

transportation, compromises public health, and causes large financial losses. The effectiveness of conventional flood control methods is declining due to a rising number of extreme rainfall events caused by climate change.(3–5)

An inventive and ecological method of managing metropolitan stormwater is the Sponge City concept. Instead of quickly releasing rainfall through conventional sewage systems, the idea encourages the use of green roofs, impermeable roads, horticulture, swamps, city parks and other green structures. Sponge City methods provide an efficient framework for urban sustainability since they not only lessen urban inundation but also enhance groundwater replenishment, water purity, biological diversity and climate adaptability.(6,7)

Even while the Sponge City concept is becoming more and more well-known worldwide, putting it into practice calls for more than just technical fixes. Successful implementation

requires effective urban water governance, which includes integrated planning, administrative coordination, policy support, stakeholder involvement and sufficient funding. Sewage, zoning, water control and safeguarding the environment are all separated among several organizations in Dhaka, which frequently leads to disjointed administration and poor coordination. The implementation of combined and naturalistic methods to residential flood management is hampered by these societal problems.(8)

In light of this, the study evaluates Dhaka's organizational and governance potential for implementing the Sponge City concept. The study looks at current urban water governance, identifies key institutional and policy constraints, and investigates how to incorporate Sponge City concepts into Dhaka's urban design using a qualitative research approach based on regulatory document analysis and stakeholder viewpoints. The results are anticipated to support climate-resilient city administration and offer useful suggestions for decision-makers looking for long-term fixes for the city's persistent flooding and waterlogging issues. (9) (10).

➤ Conceptual Framework:

This study is predicated on the idea that robust urban water governance is just as important to efficient urban flood management as physical infrastructure. The theoretical basis is provided by the Sponge City idea, which encourages the use of Nature-Based Solutions (NbS) and green infrastructure to improve rainwater infiltration, storage, and reuse while lowering urban flooding.

The independent variable in the study is urban water governance, which includes planning capability, policy frameworks, stakeholder participation, and institutional coordination. The effective application of Sponge City principles, such as green roofs, permeable pavements, wetlands, rain gardens, and restored canals, is influenced by these governance elements. It is anticipated that the successful implementation of these strategies will boost urban flood resilience, as evidenced by decreased waterlogging, improved water quality, increased climate resilience, and improved drainage efficiency.

As a result, the conceptual framework suggests that improved urban water governance makes it more feasible to put Sponge City ideas into practice, which will ultimately support climate-resilient development and sustainable urban water management in Dhaka.



Fig 1 Conceptual Framework

II. LITERATURE REVIEW

Through the integration of green and gray infrastructure, the sponge city concept has garnered international attention as a sustainable method to urban water management. According to studies, low-impact development

(LID) successfully lowers flooding, strengthens climate resilience, and improves water quality. However, execution is hampered by issues including poor planning, fragmented governance, and a lack of institutional coordination, underscoring the necessity of integrated and flexible urban water governance frameworks. (11) (12,13)

The sponge city idea, which integrates integrated stormwater management, low-impact development (LID), and green infrastructure, is recognized in the literature as a novel strategy for sustainable urban water management. Research shows that it can improve water quality, increase groundwater recharge, lessen urban flooding, and increase climate resilience. However, efficient planning, institutional coordination, integrated governance, and adaptation to local socio-environmental variables are necessary for successful implementation, especially in fast urbanizing areas. (14) (15)

According to recent research, sponge city growth has progressed from pilot initiatives to integrated municipal water management, integrating gray and green buildings to reduce flooding, increasing climatic resilience, repair urban cycles of hydrology, and boost water quality. Stakeholder collaboration, biological preparation, responsive administration and land fit evaluation are necessary for successful execution. These results demonstrate sponge cities as a workable paradigm for environmentally friendly and resilient urban development in areas that are quickly urbanizing. (16–18)

Existing literature highlights sponge cities as a successful nature-based solution for reducing city flooding with green buildings, low-cost construction and comprehensive stormwater management. According to studies, public involvement, hydrodynamic modeling, integrated land-use strategy and flexible governance are necessary for successful execution. The usefulness of GIS, simulation models, and visualization tools for enhancing flood-risk evaluation, planning effectiveness and decision-making is also highlighted by recent studies, especially in quickly urbanizing places. (19–21)

➤ *Research Gap:*

Previous research on urban floods and sewage overflow in Dhaka has mostly concentrated on technical-based flood prevention strategies, meteorological evaluations, sewage infrastructure and the effects of climate change. The promise of Nature-Based Solutions (NbS) and the Sponge City idea for green water management for cities has been emphasized by a number of studies, but the leadership and institutional conditions necessary for its effective adoption have received less focus. Specifically, there is a dearth of qualitative research on the institutional obstacles to implementing Sponge City theories in Dhaka, the effectiveness of current rules and regulations, and the cooperation of important urban water management institutions. By analyzing the city's urban water governance system and determining whether it is prepared to support the implementation of Sponge City, this study closes this gap.

III. RESEARCH METHODOLOGY

➤ *Research Design:*

The study adopts a qualitative research design to assess the viability of implementing the Sponge City concept in Dhaka in terms of urban water governance. The qualitative approach was adopted to better comprehend the institutional arrangements, policy frameworks, governance challenges

and stakeholders' perspectives that influence urban water management.

➤ *Study Area:*

The study area is the capital city of Bangladesh, Dhaka, which is prone to urban flooding and waterlogging due to rapid urbanization, poor drainage infrastructure, loss of wetlands, and impact of climate change. Dhaka as the political and economic hub of the country provides a good case for studying the potential of Sponge City implementation.

➤ *Data Collection:*

It is based on secondary data collected from peer-reviewed journal articles, government reports, policy documents, publications of international organizations and other relevant academic literature. The sources were selected to provide a comprehensive view of urban water governance, flood management and the notion of Sponge City.

➤ *Data Analysis:*

The data collected were thematically analyzed. The relevant data were systematically analyzed, coded and organized, and the main themes were identified, including governance structure, institutional coordination, policy and regulatory framework, infrastructural obstacles, and prospects for Sponge City implementation. Thematic analysis was undertaken to identify key governance challenges and possible policy actions.

IV. RESULTS AND DISCUSSION

➤ *Current Status of Urban Water Governance in Dhaka:*

According to the analysis, Dhaka's urban water governance is typified by dispersed institutional responsibilities. Water management and drainage services are provided by a number of organizations, including the Bangladesh Water Development Board (BWDB), Dhaka North City Corporation (DNCC), Dhaka South City Corporation (DSCC), Dhaka Water Supply and Sewerage Authority (DWASA), and Rajdhani Unnayan Kartipakkha (RAJUK). However, decision-making is frequently delayed and flood management programs are implemented inefficiently due to overlapping duties and poor interagency collaboration. One of the primary obstacles to integrated urban water management is still this disjointed governance structure. (22–24).

➤ *Challenges to Sponge City Implementation:*

The results show a number of obstacles that restrict the viability of putting the Sponge City idea into practice in Dhaka. Wetlands, canals, and open areas that naturally hold stormwater have been drastically diminished by rapid urbanization. Drainage effectiveness is further decreased by inadequate drainage infrastructure, unlawful encroachment on waterways, poor maintenance, and inappropriate solid waste disposal. Adoption of Sponge City ideas is further hampered by a lack of funding, technical know-how, and a thorough policy framework for Nature-Based Solutions (NbS). (25–27).

➤ *Opportunities for Sponge City Development:*

Despite these challenges, Dhaka has a lot of potential to apply Sponge City strategies. Existing parks, lakes, retention ponds, canals, and urban open spaces can be restored and integrated into a sustainable stormwater management system. Green roofs, permeable pavements, rain gardens, bioswales, and wetland restoration might all be used in future urban development projects to improve rainwater penetration and reduce surface runoff. Increased legislative focus on climate adaptation and sustainable urban development also makes the launch of Sponge City programs viable.(28,29).

➤ *Discussion:*

The analysis shows that Dhaka's waterlogging issue, which is not just brought on by inadequate drainage infrastructure, is closely related to issues with urban water governance. Despite providing a workable framework for sustainable stormwater management, the Sponge City concept will need consistent investment in green infrastructure, efficient policy integration, and well-coordinated institutional frameworks to be implemented successfully. Therefore, implementing Sponge City ideas should be seen as a prerequisite for bettering government. Dhaka may promote environmentally friendly urban expansion and bolster its resistance to climate change by fusing engineering methods with Nature-Based Solutions and integrated governance. (30,31).

V. CONCLUSION

The growing susceptibility of Dhaka to urban flooding and waterlogging emphasizes the critical need for more integrated and sustainable methods of managing urban water. From the standpoint of urban water governance, this study evaluated the viability of putting the Sponge City concept into practice. The results show that while Dhaka has a lot of potential to apply Sponge City principles, there are still a lot of obstacles to overcome, including dispersed institutional responsibilities, poor interagency coordination, insufficient policy coherence, and little investment in green infrastructure.

The study also shows that by combining Nature-Based Solutions with traditional drainage systems, the Sponge City idea can offer an efficient framework for improving urban resilience. Waterlogging can be decreased while enhancing water quality, groundwater recharge, and environmental sustainability through actions like rainwater harvesting, permeable pavements, green roofs, canal restoration, and wetland conservation.

Infrastructure development should be accompanied by governance reforms in order to achieve these advantages. Successful implementation requires strengthening institutional coordination, incorporating Sponge City concepts into urban planning regulations, safeguarding natural water bodies, and encouraging stakeholder participation. Dhaka can more effectively handle the problems of fast urbanization and climate change while promoting sustainable urban development by implementing a

more integrated and climate-resilient urban water governance system.

Future research should include primary data, stakeholder interviews, and empirical case studies to further assess the practical applicability and efficacy of Sponge City interventions in Dhaka, even though this study offers insightful information through a qualitative assessment based on secondary data. Such studies would aid in the creation of resilient and sustainable cities in Bangladesh and assist evidence-based policies.

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