Exploration अन्वेषण
A Peer-Reviewed Multidisciplinary Journal
ISSN 2542-2944 (Print)
Published by the Research Management Cell
Darchula Multiple Campus, Khalanga, Darchula
Far Western University, Nepal

Exploring the Prospects and Challenges of Sustainable Waterfront Development in Bangladesh

Farhadur Reza, PhD
Jahangirnagar University, Bangladesh
farhadrezaurp@juniv.edu

A.B.M. Siddiqul Abedin
Local Government Engineering Division, Bangladesh
hamim.ju43@gmail.com

Yeasir Mohammad Amin
Jahangirnagar University, Bangladesh
yeasir.amin108@gmail.com

Lutfun Nahar Lopa
Jahangirnagar University, Bangladesh
lutfunnaharlopa87@gmail.com

Abstract

Urban waterfronts are dynamic social and ecological systems that embody the relationship between people and water. This study investigates the prospects and challenges of developing a sustainable urban waterfront along the Turag River in Dhaka, Bangladesh. The study employed an observational structured checklist and short interviews for qualitative data collection of the Turag riverfront area. The data encompasses daily activities and available facilities to draw a current scenario of the waterfront, sorted and organised under the theme of the sustainability pillars. The collected data was analysed thematically to draw an interpretation to fulfil the study objectives. Results reveal that while the waterfront supports multiple livelihoods, leisure, and transportation activities, it suffers from pollution, unequal accessibility, and inadequate management. Findings emphasise the need for participatory governance, ecological restoration, and inclusive design aligned with national policies such as the Bangladesh Delta Plan 2100. Based on the findings, the study tries to advocate for some recommendations for the sustainable future of the Turag River.

Keywords: *Sustainability, Turag River, Urban, waterfront*

Introduction

Urban waterfronts represent one of the most contested yet promising zones of modern cities. As public spaces where water and land converge, they hold both ecological and cultural significance (Üzümcüoğlu and Polay, 2022). Around the world, cities have regenerated waterfronts to revitalise urban identity and economic life (Giovinazzi and Moretti, 2010; Pekin, 2013). In Bangladesh, however, rapid urbanisation and unregulated industrial activity have degraded these zones, especially in Dhaka, where rivers like Buriganga and Turag face severe ecological stress (Whitehead et al., 2018).

The Turag Riverfront, situated in the northwestern edge of Dhaka, demonstrates this contradiction. It functions as a vibrant corridor for transportation, trade, and recreation, yet experiences pollution, encroachment, and uneven access. Earlier studies identified the need for sustainability-oriented design and management of waterfronts (Ragheb and El-Ashmawy, 2020; Hussein, 2014). However, few have investigated how existing socio-economic and environmental conditions interact in Dhaka's context.

This study examines how the Turag Riverfront can move toward sustainability despite existing constraints by identifying the activities and facilities distributed along the waterfront, assessing its environmental, social, and economic conditions, and analysing the challenges and drivers that shape its sustainable transformation. Waterfront sustainability relies not only on physical design but also on social inclusion, ecological functionality, and economic resilience, as highlighted by Evans et al. (2022) and Niemann and Werner (2016). By addressing these dimensions through a focused analysis of the Turag corridor, the study adds empirical insights from Dhaka while connecting them to broader regional and global discussions on sustainable waterfront planning noted by Zaki and Hegazy (2023) and Tan (2024).

Literature Review

Urban Waterfronts

Urban waterfronts represent dynamic interfaces where water meets the built environment, embodying complex ecological and socio-economic processes (Üzümcüoğlu and Polay, 2022). Traditionally, these areas evolved as centres of trade, transportation, and settlement, but with industrial decline, cities worldwide began reimagining waterfronts as spaces for recreation, tourism, and ecological restoration (Giovinazzi and Moretti, 2010; Pekin, 2013).

According to Hussein (2014), the success of a waterfront lies in balancing its ecological, functional, and aesthetic dimensions. This transformation aligns with global trends toward sustainable urbanism, where environmental regeneration and social inclusivity are prioritised (Niemann and Werner, 2016). Urban waterfronts can thus serve as both ecological buffers and cultural commons, linking natural systems with urban lifestyles (Evans et al., 2022).

Waterfronts offer multi-sensory experiences that shape urban life. Visual reflections, movement of water, and natural soundscapes generate psychological comfort and aesthetic satisfaction (Timur, 2013). As Omen (2007) and Ragheb and El-Ashmawy (2020) highlight, the interaction of visual, auditory, tactual, and psychological features contributes to a sense of place, belonging, and relaxation.

Figure 1 below illustrates the multifaceted features of an urban waterfront, based on the synthesis of these sensory and functional dimensions (Ragheb and El-Ashmawy, 2020; Hussein, 2014; Timur, 2013). It retains the conceptual form of the original figure but is rewarded for clarity and modern academic tone.

Sustainability and Urban Waterfronts

Sustainability in waterfronts entails harmonising environmental, social, and economic dimensions. Hussein (2014) defines sustainable waterfronts as those that "restore ecological integrity while maintaining accessibility and cultural continuity." Evans et al. (2022) extend this by arguing that a sustainable waterfront "works" when it integrates long-term ecological health, community well-being, and equitable governance.

Niemann and Werner (2016) and Salama (2022) emphasise strategies such as habitat rehabilitation, mixed-use planning, and climate-sensitive design as essential tools for sustainability. In Penang, Malaysia, sustainable waterfront projects have enhanced urban resilience by integrating social, economic, and ecological objectives (Tan, 2024). Similarly, Shah et al. (2023) found that community-led wetland restoration improves urban livability and resilience.

The sustainability debate also involves inclusive design and social justice. According to Weerakoon and Rathnaweera (2022), assessing recreational waterfront projects requires measuring accessibility for all groups, including women, the elderly, and disabled users. Tasnim, Raisa, and Sagor (2024) propose integrating local heritage and informal livelihoods in canal rejuvenation projects in Chittagong, echoing global best practices.

The Bangladesh Context

In Bangladesh, urban rivers like Buriganga, Balu, and Turag face intense pollution and encroachment due to industrial expansion (Whitehead et al., 2018). Yet they remain critical to Dhaka's identity and economy. Recent projects by the Bangladesh Inland Water Transport Authority (BIWTA) aim to formalise riverfront walkways and reclaim encroached areas (The Financial Express, 2023).

Siddika (2020) observed similar issues in Sylhet, where waterfronts suffer from a lack of planning and poor public participation. These findings highlight that sustainability challenges in Bangladesh are deeply institutionally linked to weak governance, fragmented policies, and informal land use practices. However, national strategies like the Bangladesh Delta Plan 2100 and 8th Five-Year Plan recognise river-centric development as a key component of future urban sustainability (Zaki and Hegazy, 2023).

Conceptualising the Sustainability Framework

From the global to the local perspective, sustainability in waterfronts rests upon three core principles (Hussein, 2014; Evans et al., 2022; Tan, 2024). Environmental Integrity – protection and restoration of aquatic ecosystems, pollution control, and resilience to climate change. Social Equity – universal accessibility, safety, and participatory governance of shared spaces. Vitality – balancing commercial activity with environmental and social responsibility. These principles frame the conceptual foundation for this study, guiding analysis of the Turag River waterfront. They allow assessment of how environmental degradation, socio-economic usage, and policy frameworks interact in shaping Dhaka's evolving waterfront.

The reviewed literature shows that sustainable waterfronts are multidimensional entities requiring integrated management. International cases (Evans et al., 2022; Tan, 2024; Niemann and Werner, 2016) demonstrate that successful transformations depend on environmental restoration and community participation. However, South Asian examples reveal persistent governance and pollution challenges (Siddika, 2020; Tasnim et al., 2024).

From the literature, it can be seen that although there are multiple studies regarding sustainable waterfront development worldwide, along with successful examples of such

developments globally and specifically South Asian context. Although there are attempts for waterfront development and revitalisation, and studies on comprehensive sustainable development for urban river waterfront are still not established in Bangladesh. So, the study aims to bridge the gap in the literature to address the need for sustainable waterfront development in Dhaka, Bangladesh.

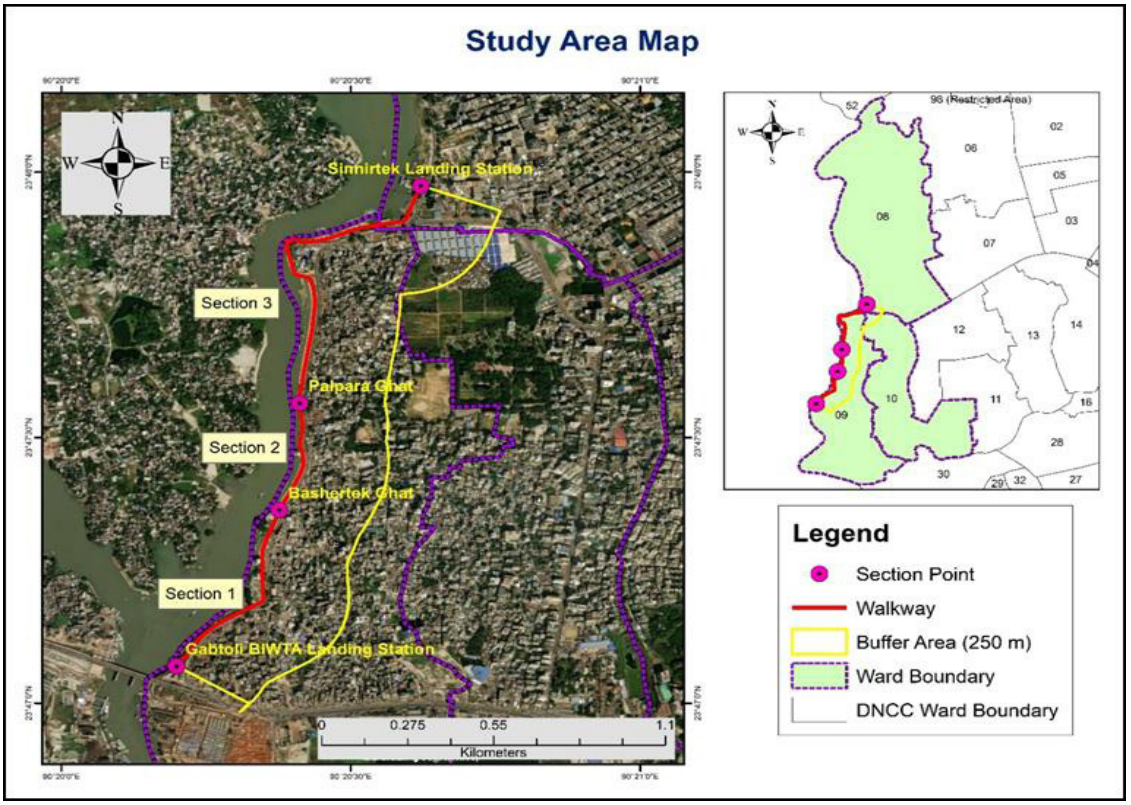
Methods and Procedures

This study adopted a qualitative case study approach to assess the sustainability conditions of the Turag River waterfront in Dhaka. The method was chosen because it allows for an in-depth understanding of the complex social, environmental, and economic interactions that define the riverfront. By combining direct observation, facility assessment, and semi-structured interviews, the research sought to explore how daily activities, infrastructure distribution, and ecological conditions influence the overall sustainability of the waterfront.

The study used four observation points along the Turag River front to ensure maximum coverage and data diversity. The observation data were later validated by insights from interviewing 12 respondents along the riverfront area, including pedestrians, local shop owners and residents.

Figure 1

Map of the Turag riverfront study area

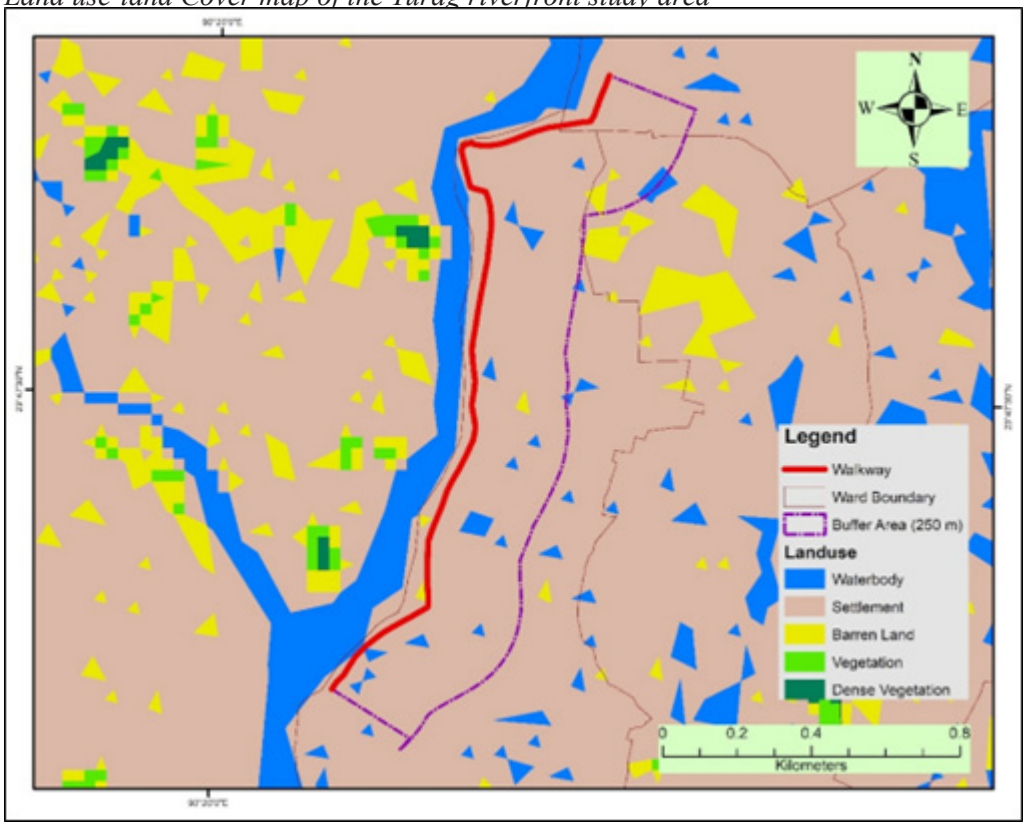


Note: The study area map showing four points for the study, developed by the Authors, 2024.

The study area covered a 2.15-kilometre stretch of the Turag River between the Gabtoli and Sinnirtek landing stations on the northern periphery of Dhaka. This segment was selected because it contains a mix of recreational, residential, and commercial activities and represents one of the most accessible yet environmentally vulnerable parts of the city's river system. Within this stretch, which starts at Gabtoli BIWTA Landing Station (23°47'5" N 90°20'12" E) and ends at Sinnirtek Landing Station (23°47'58" N 90°20'34" E), four observation sites were chosen based on their spatial diversity and activity intensity: Gabtoli BIWTA Landing Station, Bashertek Ghat, Palpara Ghat, and Sinnirtek Landing Station. These sites provided varied contexts ranging from dense ferry movement and informal trade to community gathering spaces and areas of ecological decline.

Figure 2

Land use-land Cover map of the Turag riverfront study area



Note: This study area map showing land use and land cover of the Turag waterfront, developed by the Authors, 2024.

The LULC status of the study area shows the area of water bodies, sparse vegetation, dense vegetation, settlements, and barren land. For LULC calculation, only a 250-meter buffer area is selected from the riverside walkway. Of the total measurements of 127.87 acres, the settlement zone occupied 95.62 percent of the area due to rapid infrastructure development in the area. The water bodies occupied only 4.43 acres, where barren land covered an area of 0.92 acres. On the other hand, the vegetation cover is not found within a 250-meter area from the walkway,

which is very alarming for the riverside development.

The analytical framework followed the three sustainability principles of environmental integrity, social equity, and economic vitality, which together guided data collection and interpretation. Primary data were collected during fieldwork conducted in September 2024 through three main methods. First, systematic field observation was used to document human activities, facility conditions, and environmental characteristics at different times of day to capture temporal variations. Second, a structured checklist survey recorded the presence and condition of basic amenities such as walkways, benches, lighting, toilets, waste bins, and access features for women, the elderly, and differently abled users. Third, semi-structured interviews were carried out with fifteen respondents, including twelve regular users and three community representatives.

These interviews explored insights into the accessibility, safety, environmental quality, and management challenges. Participants were informed of the study's purpose, and verbal consent was obtained to ensure ethical compliance and anonymity. The collected data were analysed using thematic analysis. Observations and interview responses were organised under the three sustainability principles to evaluate how environmental, social, and economic factors interact across different riverfront sections. The analysis combined qualitative interpretation with descriptive tabulation to compare spatial differences in activities and facilities. This process helped reveal how variations in physical infrastructure, community involvement, and management influence sustainability outcomes.

In summary, the methodology integrated observation, participation, and thematic evaluation to capture the multi-dimensional nature of sustainability at the Turag Riverfront. The approach ensured that the analysis not only reflected physical and environmental conditions but also represented the lived experiences and perceptions of those who depend on the river in their everyday lives. This integration of spatial and social realities forms the basis for interpreting the waterfront's prospects and challenges in the following sections.

Results and Discussion

Activities and Sustainability Dimensions

Observations along the Turag River waterfront revealed a diverse set of daily activities reflecting its multifunctional character. These activities illustrate how the riverfront acts as both a public space and an economic corridor. Morning hours were dominated by walking, bathing, and commuting, while midday and afternoon periods involved ferry services, trading, and small-scale vending. Evenings brought social gatherings, informal recreation, and cultural interaction. Such time-based variations indicate the waterfront's role as a continuously active urban landscape shaped by both livelihood and leisure.

The identified activities were categorised according to their alignment with the three sustainability principles: environmental integrity, social equity, and economic vitality. This classification provides a clear understanding of how people's interactions with the river contribute to or challenge its sustainable use. Activities such as bathing, swimming, and voluntary waste collection demonstrate strong human water connections but also expose the area's vulnerability to pollution and ecological degradation. Recreational uses like walking and community cleaning contribute positively to social cohesion but lack proper safety and inclusive measures. Meanwhile, commercial operations, including vending, ferry transport, and materials loading, generate local

income but occur without regulation or environmental safeguards.

Table 1
Activities Classified under Three Sustainability Principles

Sustainability Principle	Observed Activities	Interpretation
Environmental Integrity	Bathing, swimming, washing, waste collection by local committees, limited greenery, and erosion control works.	Reflects strong human-water interaction, but also pollution stress and a lack of ecosystem restoration.
Social Equity	Walking, jogging, gossiping, praying, recreation in the eco-park, resting, and community volunteer cleaning.	Demonstrates inclusive use but inadequate safety, lighting, and facilities for women, the elderly, and the disabled.
Economic Vitality	Street vending, blacksmithing, bamboo sales, restaurants, ferry transport, unloading goods, and construction material trade	Indicates a significant informal economy supporting local livelihoods, yet largely unregulated and lacking formal management.

Note. The table was formulated based on the field survey 2024 and thematically organised with respect to three sustainability principles.

The classification in Table 1 highlights how each sustainability pillar is represented in everyday riverfront practices. Environmental activities are often informal and reactive, focusing more on personal use than ecosystem care. Social activities reveal a strong sense of community but also expose gaps in accessibility and maintenance. Economic uses remain the most visible and dynamic, yet their unregulated nature threatens both the river's ecological balance and the public realm's quality.

Figure 3

Different activities along the waterfront

Note. The photographs were taken by the authors for validation of observation data during the field survey 2024.

Overall, these patterns confirm that the Turag waterfront is an active but imbalanced socio-environmental system. Environmental and social improvements are necessary to complement the existing economic vibrancy. Ensuring that all three dimensions progress together is essential for achieving a sustainable and resilient urban waterfront in Dhaka.

Facilities and Accessibility

Facilities along the Turag waterfront varied widely among the four observation sections, revealing distinct spatial and social disparities. Section 1 near Gabtoli displayed a mix of informal amenities that evolved organically, while Section 2 benefited from formal interventions by the BIWTA through its Eco Park initiative, offering structured recreation, seating, and waste facilities. Sections 3 and 4, located toward the peripheral stretch of Sinnirtek, remained largely neglected, showing poor maintenance, limited lighting, and minimal signage. The heterogeneity of infrastructure underscores the uneven implementation of sustainability goals across the study area. Such inconsistencies hinder the waterfront's ability to function as a continuous, inclusive public corridor, echoing challenges observed in other South Asian cities (Siddika, 2020; Salama, 2022).

Table 2

Facilities Present Across Waterfront Sections

Facilities	Section 1 Facilities Present		Section 2 Facilities Present		Section 3 Facilities Present		Section 4 Facilities Present	
	Yes (Number /Dimension)	No	Yes (Number / Dimension)	No	Yes (Number /Dimension)	No	Yes (Number /Dimension)	No
Waste bin		✓	✓		✓			✓
Seating facilities	✓		✓		✓			✓
Hotel		✓	✓			✓		✓
Restaurant		✓	✓		✓		✓	
Street Food	✓		✓		✓		✓	
Park/ Playground		✓	✓			✓		✓
Walkway Width	3.05 m		2.44 m		2.44 m		2.44 m	
Walkway Continuity	✓		✓			✓		✓
Lighting		✓	✓			✓	✓	
Elderly Facilities		✓		✓		✓		✓
Disable Facilities		✓		✓		✓		✓
Women Facilities		✓		✓		✓		✓
Toilet Facilities		✓	✓			✓		✓
Service Kiosk	✓		✓		✓		✓	
Information Signs	✓		✓		✓		✓	
Parking Lot		✓	✓			✓		✓
Boat Service/ Deck	✓		✓		✓		✓	

Note. The table was formulated based on the field survey 2024, which facilities currently present along the four sections of the studied Turag River.

The comparative facility survey reveals that the presence of amenities directly influences social and economic vibrancy. Where lighting, benches, and public toilets exist, the riverfront

attracts longer visitor stays and evening recreation; where they are absent, the space reverts to transient or commercial use only. This pattern reinforces that social equity in waterfronts depends not solely on open access but on the quality of infrastructure and its maintenance (Ragheb and El-Ashmawy, 2020; Weerakoon and Rathnaweera, 2022). Furthermore, the lack of features for elderly and differently abled persons highlights an urgent design gap in achieving inclusive urban environments.

Figure 4

Existing facilities at the waterfront

Note. The photographs were taken by the authors for the validation of observation data during the field survey 2024.

Sustainability Indicators

The sustainability assessment revealed that the Turag River waterfront shows uneven performance across the environmental, social, and economic pillars. Field observations indicate that although the area supports active human use and local economic activities, its ecological and social systems are under considerable strain. The collected data, classified according to the three sustainability principles of environmental integrity, social equity, and economic vitality, highlight both the achievements and the challenges that shape the overall sustainability of the waterfront.

Table 3
Observed Sustainability Indicators of the Turag Waterfront

Dimension	Strengths	Weaknesses
Environmental	Natural riverfront, tree-lined stretches, active water use	High pollution, no habitat restoration, poor waste management
Social	Accessible to diverse users, voluntary cleaning efforts	Poor safety at night, gender inequity, and inadequate public facilities
Economic	Active informal trade, local employment	No regulation, no reinvestment in maintenance, unplanned vending

The results presented in Table 3 show that the strongest aspect of the Turag waterfront lies in its social and economic activity. The continuous movement of people and small-scale trade creates a vibrant atmosphere and supports local livelihoods. However, environmental degradation and weak institutional management limit the long-term benefits of these activities. The environmental dimension is the weakest, with heavy pollution and a lack of ecosystem restoration reducing the river's resilience (Whitehead et al., 2018). Socially, the area provides open access for a range of users, but safety concerns and the absence of facilities for women, the elderly, and differently abled individuals prevent equitable use (Weerakoon and Rathnaweera, 2022; Salama, 2022). Economically, informal vending and small enterprises generate employment but contribute to disorganisation and waste accumulation in the absence of proper regulation (Ragheb& El-Ashmawy, 2020). To summarise the major findings, Table 4 below summarises the critical challenges constraining sustainability and the potential drivers that can enable transformation.

Table 4
Summary of challenges and potential drivers for Turag waterfront sustainability

Category	Challenges Identified	Potential Drivers for Improvement
Environmental	- Continuous industrial and domestic pollution - Riverbank erosion and loss of vegetation - Absence of systematic habitat restoration	- Implementation of *Bangladesh Delta Plan 2100* - Community-led clean-up and replanting programs - Integration of water-sensitive design
Social	- Lack of inclusive and gender-sensitive facilities - Inadequate safety and lighting - Limited public awareness	- Development of the BIWTA Eco Park model across sections - Community participation in maintenance - Awareness campaigns on river stewardship
Economic	- Unregulated vending and waste disposal - Informal economy without reinvestment - Poor coordination among agencies	- Formalisation of vendors through licensing - Microfinance and eco-friendly kiosks - Integration of local business taxes into maintenance funds

Institutional	- Fragmented governance among agencies - Weak policy enforcement - Lack of coordination between local and national bodies	- Policy synchronisation between BIWTA, RAJUK, and city corporations - Inclusion of sustainability indicators in urban planning - Top-down policy support and monitoring mechanisms

In summary, the findings indicate that the Turag waterfront remains a lively yet unbalanced urban system. Economic and social vitality coexist with significant ecological stress. Achieving sustainability will require coordinated actions that connect ecological restoration, inclusive design, and structured economic management. These integrated efforts can help transform the Turag Riverfront into a balanced and resilient urban landscape.

The findings reveal that sustainability along the Turag River waterfront is uneven and transitional, marked by dynamic human activity but severe ecological stress. The waterfront demonstrates active social and economic life yet struggles to achieve environmental stability, a pattern common to many Asian cities undergoing waterfront transformation (Evans et al., 2022; Tan, 2024). This imbalance underscores that sustainable development must harmonise environmental integrity, social equity, and economic vitality rather than treating them as separate dimensions.

From an environmental perspective, the Turag's ecosystem remains fragile due to untreated industrial discharges, household waste, and loss of vegetation (Whitehead et al., 2018). Despite periodic clean-up drives by residents and mosque committees, the absence of continuous restoration programs has prevented measurable ecological recovery. Similar conditions were reported in Jeddah, where uncoordinated management hampered waterfront rehabilitation (Zaki and Hegazy, 2023). Implementing water-sensitive urban design, native planting, and pollution control measures could align local restoration with the *Bangladesh Delta Plan 2100* and create a resilient ecological buffer (Pramesti, 2017; Salama, 2022; Shah et al., 2023).

The social dimension displays both vitality and inequality. The waterfront serves as an essential urban open space where people of various socio-economic backgrounds engage in recreation, prayer, and informal gatherings. However, poor lighting, insufficient safety, and a lack of facilities for women, the elderly, and differently abled individuals hinder equitable access (Weerakoon and Rathnaweera, 2022; Salama, 2022). Section 2, supported by BIWTA's Eco Park, shows that inclusive infrastructure encourages extended public use, while neglected sections remain underutilised. Co-management between community groups and local authorities could strengthen long-term stewardship, following successful models in Penang and Jeddah (Tan, 2024; Zaki and Hegazy, 2023).

Economically, the Turag waterfront sustains a dense network of informal vendors, ferry operators, and small traders, providing vital livelihoods. Yet unregulated vending and weak waste management degrade both the environment and aesthetics. Formalising these activities through structured vending zones, eco-friendly kiosks, and revenue-sharing maintenance funds could integrate economic vitality with sustainability goals (Ragheb and El-Ashmawy, 2020; Niemann and Werner, 2016). Successful international examples demonstrate that regulating informal economies fosters both order and opportunity (Evans et al., 2022).

The relationship between sustainability pillars is evident in facility distribution. Well-equipped zones, such as Section 2, with continuous walkways, seating, and waste bins, exhibit higher social participation and lower pollution, whereas neglected stretches show ecological and social decline. These contrasts emphasise that infrastructure equity is a prerequisite for

environmental and social sustainability (Hussein, 2014). Integrating inclusive facilities, ecological management, and livelihood structures within one governance framework can promote balanced progress across the entire corridor.

When compared with regional cases, the Turag's evolution remains largely community-driven rather than design-led. Cities like Penang and Chittagong implemented comprehensive plans emphasising ecological restoration and cultural continuity (Tasnim et al., 2024). Dhaka's organic progression demonstrates resilience but lacks institutional direction. Aligning local initiatives with national strategies such as the *8th Five-Year Plan* and *Delta Plan 2100* can help bridge policy and practice, ensuring coordinated long-term management.

Overall, the discussion underscores that the Turag Riverfront's sustainable transition depends on concurrent progress in ecological restoration, social inclusivity, economic formalisation, and institutional integration. The waterfront's current vibrancy demonstrates its latent potential; however, realising this potential requires a shift from reactive interventions to proactive, participatory governance. If the identified drivers are activated collectively, the Turag waterfront could evolve into a resilient, inclusive, and economically vibrant river corridor, a model for sustainable urban transformation in Bangladesh.

Conclusion

The study concludes that the Turag River waterfront reflects both the promise and the fragility of Dhaka's urban environment. The area exhibits strong social and economic activity, demonstrating its importance as a shared public and livelihood space. However, these functions are undermined by severe ecological degradation, inadequate infrastructure, and fragmented governance. The sustainability assessment shows that while community participation and informal economies contribute to local vibrancy, environmental neglect and social inequities threaten long-term resilience. To achieve balanced development, the waterfront must evolve from a reactive, use-driven landscape into a managed and inclusive urban ecosystem guided by the three sustainability principles of environmental integrity, social equity, and economic vitality. Such an approach would allow the Turag Riverfront to serve not only as a recreational and commercial zone but also as a model of integrated urban sustainability in Bangladesh.

The findings point to several practical steps that can help realise the potential of the Turag waterfront. Restoring riparian vegetation, controlling pollution, and strengthening water quality monitoring would support the river's ecological health. Designing the area with facilities that consider women, older adults, and people with disabilities, along with clear lighting and signage, would improve access and safety. Community involvement can be strengthened by turning existing voluntary efforts into formal partnerships among authorities, local organisations, and residents. Local vendors and small businesses would benefit from organised kiosks and better waste management, which would also keep the space clean and functional. Aligning future riverfront work with national development plans would help secure long-term policy and institutional support. With coordinated planning and community-focused management, the Turag waterfront has the potential to grow into a sustainable, inclusive, and economically vibrant urban space.

References

Evans, C., Harris, M. S., Taufen, A., Livesley, S. J., and Crommelin, L. (2022). What does it mean for a transitioning urban waterfront to "work" from a sustainability perspective? *Journal of Urbanism: International Research on Placemaking and Urban Sustainability,*

18(3), 349–372. https://doi.org/10.1080/17549175.2022.2142648
Giovinazzi, O., and Moretti, M. (2010). Port cities and urban waterfront: Transformations and opportunities. *TeMA Journal of Land Use, Mobility and Environment, 3*(3), 57–68.
Hussein, H. (2014). Urban waterfronts between unrealised potential and reality: A study on sustainable waterfront development in Egypt. *Procedia Environmental Sciences, 34,* 479–490. https://doi.org/10.1016/j.proenv.2016.04.043
Niemann, B., and Werner, T. (2016). Strategies for the sustainable urban waterfront. *WIT Transactions on Ecology and the Environment, 204,* 431–439. https://doi.org/10.2495/SC160371
Pekin, B. (2013). Revitalisation of urban waterfronts: A comparative study. *Middle East Technical University Journal of the Faculty of Architecture, 30*(1), 123–140.
Pramesti, R. E. (2017). *Sustainable urban waterfront redevelopment: Challenge and key issues.*Parahyangan Catholic University Repository. https://repository.unpar.ac.id/handle/123456789/3804
Ragheb, G., and El-Ashmawy, R. (2020). The role of waterfronts in urban life: An integrated approach for sustainable urban design. *Alexandria Engineering Journal, 59*(5), 3411–3424. https://doi.org/10.1016/j.aej.2020.06.020
Salama, S. W. (2022). Towards developing sustainable design standards for waterfront open spaces. *City, Territory and Architecture, 9*(1), 1–18. https://doi.org/10.1186/s40410-022-00172-3
Shah, D. N., Paudel, J., Tachamo-Shah, R. D., Dixit, K. M., and Sada, R. (2023). Wetland city accreditation in Nepal: An approach to wetland management for livable cities and urban resilience. *Banko Janakari, 33*(2), 61–75. https://doi.org/10.3126/banko.v33i2.62544
Siddika, T. (2020). Rethinking urban waterfront: A case study of Sylhet City, Bangladesh. *Scientific and Academic Publishing.* http://10.5923/j.arch.20201004.03
Tan, D. Y. S. (2024). Enhancing economic, social, and ecological resilience through sustainable waterfront development in Penang. *Journal of Urban Development and Management, 3*(3), 176–187. https://doi.org/10.56578/judm030303
Tasnim, S. T., Raisa, S. I., and Sagor, R. I. (2024). Manohar Canal of Chittagong, Bangladesh: Conceivable methods to rejuvenate a historic canal and improve the waterfront scenario. In *Advances in Science, Technology and Innovation* (pp. 229–247). Springer. https://doi.org/10.1007/978-3-031-47794-2_18
Üzümcüoğlu, D., and Polay, M. (2022). Urban waterfront development through the lens of the Kyrenia waterfront case study. *Sustainability, 14*(15), 9469. https://doi.org/10.3390/su14159469
Weerakoon, K. G. P. K., and Rathnaweera, D. U. (2022). Urban recreational waterfront development projects: Sustainability assessment. *Proceedings of International Conference on Real Estate Management and Valuation, 5.* https://doi.org/10.31357/icremv.v5.5640
Whitehead, P., Bussi, G., Hossain, M. A., Dolk, M., Das, P., Comber, S., … Hossain, M. S. (2018). Restoring water quality in the polluted Turag–Tongi–Balu river system, Dhaka: Modelling nutrient and total coliform intervention strategies. *Science of the Total Environment, 631–632,* 223–232. https://doi.org/10.1016/j.scitotenv.2018.03.038
Zaki, S. K., and Hegazy, I. R. (2023). Investigating the challenges and opportunities for sustainable waterfront development in Jeddah City. *International Journal of Low-Carbon Technologies, 18,* 809–819. https://doi.org/10.1093/ijlct/ctad062