Ci[ur]161 CUADERNOS DE INVESTIGACIÓN URBANÍSTICA

Climate vulnerable urban development in Bangladesh: Developing a framework for climate change resilient urban governance in intermediate cities

Maruf Hossain

Doctor Arquitecto

Este documento es un resumen parcial de la tesis doctoral: «Climate Vulnerable Urban Development in Bangladesh Developing a Framework for Climate Change Resilient Urban Governance in Intermediate Cities», dirigida por José Miguel Fernández Güell, defendida por su autor el 22 enero de 2025 en la Escuela Técnica Superior de Arquitectura de Madrid.

julio / agosto 2025

Realización y maquetación:
Diseño y maquetación: Mónica del Río

Contacto:
Dirección: Avenida Juan de Herrera 4, 28040, Madrid
Teléfono: 910675090
Email: ciur.urbanismo.arquitectura@upm.es
Web: https://polired.upm.es/index.php/ciur
Redes Sociales: @UPM_Urbanismo en Twitter

Maruf Hossain
Fecha de recepción: 01/07/2025
Fecha de aceptación: 01/08/2025
I.S.S.N. (edición digital): 2174-5099
DOI:10.20868/ciur.2025.161.5570
Edición bimensual | Año XIII | Núm. 161 | julio-agosto 2025 | 62 págs.
Edita: Departamento de Urbanística y Ordenación del Territorio. ETSAM. UPM.
Revista *Cuadernos de Investigación Urbanística*

Climate vulnerable urban development in Bangladesh: Developing a framework for climate change resilient urban governance in intermediate cities

Desarrollo urbano vulnerable al cambio climático en Bangladesh: desarrollo de un marco para una gobernanza urbana resiliente al cambio climático en ciudades intermedias

DOI:10.20868/ciur.2025.161.5570

KEY WORDS:

Climate change resilience / Urban governance / Foresight approach / Intermediate cities

DESCRIPTORES:

Resiliencia al cambio climático / Gobernanza / enfoque prospectivo / ciudades intermedias

ABSTRACT:

The rapid urbanization of Bangladesh, compounded by the effects of climate change, presents significant challenges for intermediate cities such as Khulna, Barisal, Rajshahi, Rangpur, and Sylhet. These cities face interconnected socio-economic and environmental stresses, including flooding, waterlogging, migration, and unemployment, which are exacerbated by poor governance, lack of transparency, and insufficient accountability. This research delves into the intersection of climate change, urbanization, and governance issues in Bangladesh's vulnerable cities. By employing a three-step methodology, the study analyzes urban systems and assesses vulnerability to climate impacts. A conceptual framework for climate-resilient urban governance is developed based on a thorough literature review. The findings emphasize the urgent need for inclusive, climate-resilient urban governance to address the compounded socio-economic and environmental impacts of climate change on city systems. The study suggests overcoming resource constraints, enhancing community engagement, and strengthening governance mechanisms are vital for building resilience and ensuring sustainable urban development in Bangladesh's vulnerable cities. This research aims to contribute to global efforts in creating sustainable, climate-resilient cities, offering a comprehensive governance framework that can be adapted for similar regions facing climate challenges.

RESUMEN:

La rápida urbanización de Bangladesh, agravada por los efectos del cambio climático, presenta desafíos significativos para ciudades intermedias como Khulna, Barisal, Rajshahi, Rangpur y Sylhet. Estas ciudades enfrentan tensiones socioeconómicas y ambientales interconectadas, incluyendo inundaciones, encharcamiento, migración y desempleo, las cuales se ven exacerbadas por una mala gobernanza, falta de transparencia e insuficiente responsabilidad. Esta investigación profundiza en la intersección del cambio climático, la urbanización y los problemas de gobernanza en las ciudades vulnerables de Bangladesh. Mediante una metodología de seis pasos, el estudio analiza los sistemas urbanos y evalúa la vulnerabilidad a los impactos climáticos. Se desarrolla un marco conceptual para la gobernanza urbana resiliente al clima basado en una revisión exhaustiva de la literatura, ejercicios de previsión con expertos e integración de indicadores de resiliencia climática y gobernanza urbana obtenidos de grupos focales y entrevistas. Los hallazgos enfatizan la necesidad urgente de una gobernanza urbana inclusiva y resiliente al clima para abordar los impactos socioeconómicos y ambientales combinados del cambio climático. El estudio sugiere que superar las limitaciones de recursos, mejorar la participación comunitaria y fortalecer los mecanismos de gobernanza son vitales para construir resiliencia y asegurar el desarrollo urbano sostenible en las ciudades vulnerables de Bangladesh. Esta investigación busca contribuir a los esfuerzos globales para crear ciudades sostenibles y resilientes al clima, ofreciendo un marco de gobernanza integral que puede adaptarse a regiones similares que enfrentan desafíos climáticos.

* Md. Maruf Hossain,
Ph.D., Escuela Técnica Superior de Arquitectura de Madrid (ETSAM), Universidad Politécnica de Madrid (UPM).
M. Engr, Gifu University, Japan.
B.Arch. Bangladesh University of Engineering and Technology (BUET).
md.maruf.hossain@alumnos.upm.es
ORCID: https://orcid.org/0000-0001-6710-3459 (Md. Maruf Hossain)

ÍNDICE

1 INTRODUCTION

1.1 Background and Context of Bangladesh

The worldwide pattern of living in small settlements underwent substantial transformation because of extensive rural-to-urban population movements across recent centuries. The UN World Urbanization Prospects reports that 4.3 billion people live in urban areas today with expected urban population growth to reach 68% worldwide by 2050. The urban population of Bangladesh reached 39.7% in 2022 due to poor urban governance and policy-induced centralized development (Rahman HZ, 2014). Disordered urban growth patterns developed because of these root factors which lead to major problems for Bangladesh.

The International Climate Index 2021 positions Bangladesh in the seventh position among countries most vulnerable to climate change hazards. The Friends of Earth (n.d.) report predicts climate change will lead to 30 million internal population migrations by 2050. Rapid urban population growth faces intensified difficulties from this substantial number of people displaced by climate change.

Urban planning has placed climate resilience at its core as cities address this urgent need for adaptation. Pelling M. (2003) advocated that climate-resilient cities are urban centers able to recover swiftly from both climatic disturbances and stresses. The key role of effective urban governance stands essential to reduce these current urban challenges. Fernandez-Guell (2006) demonstrates that good governance develops through government action supported by collaboration between public administration and institutional growth and citizen involvement. This study examines how urban governance functions as a main strategic decision-making instrument in strategic and spatial planning to prepare urban zones against future climate threats. The natural position of Bangladesh as a riverine country alongside its 720 km Bay of Bengal coastline makes it highly prone to climate risks which are further heightened by its geographical location between India and Myanmar as well as Nepal and Bhutan. The 164 million population of Bangladesh during 2016 lives within a densely populated area that experiences lasting demographic expansion (BBS, 2019).

1.2 Climate Change Impact in Bangladesh

Bangladesh shows dramatic climate diversification across its regions as rainfall amounts surpass between 1,500 and over 4,000 millimeters. Chittagong reaches its peak average wind speeds in April although Rangpur maintains the lowest average wind speeds in January. Annual precipitation reaches its maximum level in Dhaka and Khulna and Barisal where it ranges from 2,001mm to 2,500mm (Banglapedia, 2020).

Intermediate cities in Bangladesh face substantial environmental, socio-economic, and political challenges due to climate change. Government authorities need to recognize climate change continues as an unfolding reality which influences all aspects from conflict to governance to human rights (Hasan & Macdonald, 2021). The development process requires a locally guided and public health-focused strategy because climate variations

strongly affect populations who face vulnerability throughout these regions. The foundation of this approach requires learning from past experiences and small-scale interventions as well as their outputs toward reducing impact (World Bank, 2022).

Figure 1 shows the disaster-vulnerable districts of Bangladesh while providing an overview of their primary disaster risks. The map shows different natural hazards through color coding which includes red for cyclones and brown for floods and beige for droughts alongside light red for flash floods and blue for water logging. The areas affected by cyclones in Bhola Barguna and Patuakhali show red coloring on the map but Tangail and Faridpur's flood zones appear brown. Jessore stands out as blue because it is water-logged whereas drought-prone Rajshahi and Gaibandha appear beige on the map. The map incorporates detailed information about major rivers alongside United Nations International Children's Emergency Fund estimates for children at risk coupled with international boundaries. Effective disaster management strategies are essential for the coastal areas facing cyclones with other zones needing solutions to combat floods and droughts and water logging incidents.

1.3 Urbanization in Bangladesh

Historically, the population living in cities of Bangladesh has experienced rapid expansion throughout history. The urban population in 1970 represented 7.6% of the total population while the 2020 figure reached 38.2% makes up the population. The population trend forecasts that urban regions will house 56% of people in 2050 with an annual population increase rate of 3.17%. The World Bank (2021) reports that the urban population will grow dramatically from 64.8 million in 2020 to 118.2 million by 2050 which indicates continuous movement from rural to urban life.

The population density varies across different geographical regions as shown in Figure 1, Population density is shown through a color gradient on the map where dark brown areas represent densely settled human settlements located around Dhaka and Chittagong along with parts of Khulna. The population density of Rangpur division stands at lower to moderate levels and Rajshahi and Rangpur districts fall under the moderate category.

Various elements drive fast-paced urbanization together with swift population expansion. The higher birth rates in urban areas in comparison to rural areas result in population density concentrations within urban regions. The number of urban areas continues to increase as they expand toward land which used to be rural territory. A substantial number of individuals migrate from rural to urban sectors for access to superior employment opportunities and enhanced facilities including healthcare facilities and educational institutions along with basic amenities. The population data reveals that the total population increased by 1.1% annually between 2000 and 2020 while urban population growth rates exceeded rural population growth rates.

Various factors contribute to the ongoing process of urbanization. Urban regions experience higher birth rates that result in sustained population density across their territories. The growth of urban zones is driving the takeover of areas which were formerly designated as rural. Rural people conduct their migration to urban areas

because they seek improved access to jobs and educational facilities and healthcare services as well as fundamental public services. Since 1974 urban population numbers have progressively risen and surpassed 33.56 million in 2011. The process of industrialization together with economic development closely relates to urban expansion thus driving more people to settle in cities (Alidrisi & Islam, 2015).

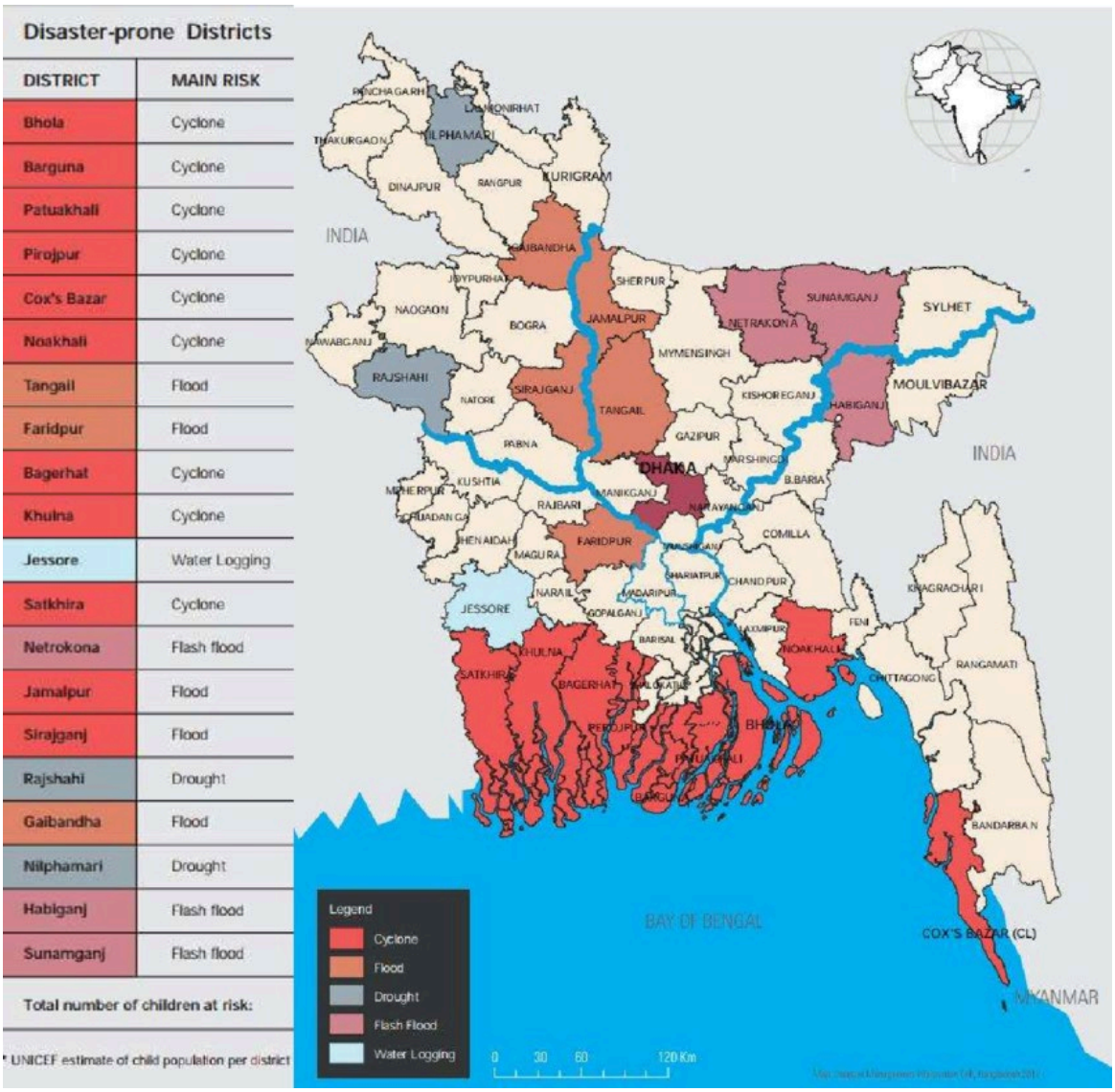

Figure 1: Disaster in different regions of Bangladesh
Source: Map: (UNICEF, 2019)

The process of urbanization triggers major land transformations because people convert agricultural and natural territories into urban developments. Driving land use transformation leads to urban sprawl causing various environmental side effects. The

conversion of open areas into built-up zones creates three main environmental effects: destruction of ecosystems, enhanced transportation through cars, and greater consumption of energy and air pollution. When urban sprawl occurs (Figure 2), it results in both social and spatial difficulties such as creating social divisions between communities as well as local informal settlement developments. The ongoing urbanization requires immediate implementation of land use policies which must strike a balance between urban expansion and protected natural resources. Effective disaster management strategies become essential for Bangladesh and its coastal regions that experience frequent climate-induced crises involving floods and cyclones and droughts.

The driving forces behind this urbanization are multifaceted. High birth rates in urban areas, when compared to rural regions, ensure that population density continues to rise in cities. Moreover, the expansion of urban areas is leading to the encroachment on previously rural territories. This migration from rural to urban centers is largely motivated by the pursuit of better employment opportunities, access to education, healthcare, and other essential services. This shift began in earnest around 1974 and has since seen a steady increase in the urban population, reaching 33.56 million by 2011. The growth of cities is also closely tied to industrialization and economic development, which further accelerates migration to urban areas (Alidrisi & Islam, 2015).

Urbanization is typically accompanied by significant land use changes, particularly the conversion of agricultural or natural landscapes into built-up areas. This transformation often results in urban sprawl, which brings about several environmental consequences. These include the loss of open land, ecosystem degradation, increased reliance on automobiles, heightened energy consumption, and rising air pollution. Additionally, urban sprawl often leads to socio-spatial challenges, such as social segregation and the development of informal settlements. As the urbanization process continues, there is a pressing need for effective land use policies to promote sustainable development that balances urban growth with the preservation of natural resources. The vulnerability of Bangladesh's coastal and flood-prone areas to climate-induced disasters—such as cyclones, floods, and droughts—further underscores the need for comprehensive disaster management strategies.

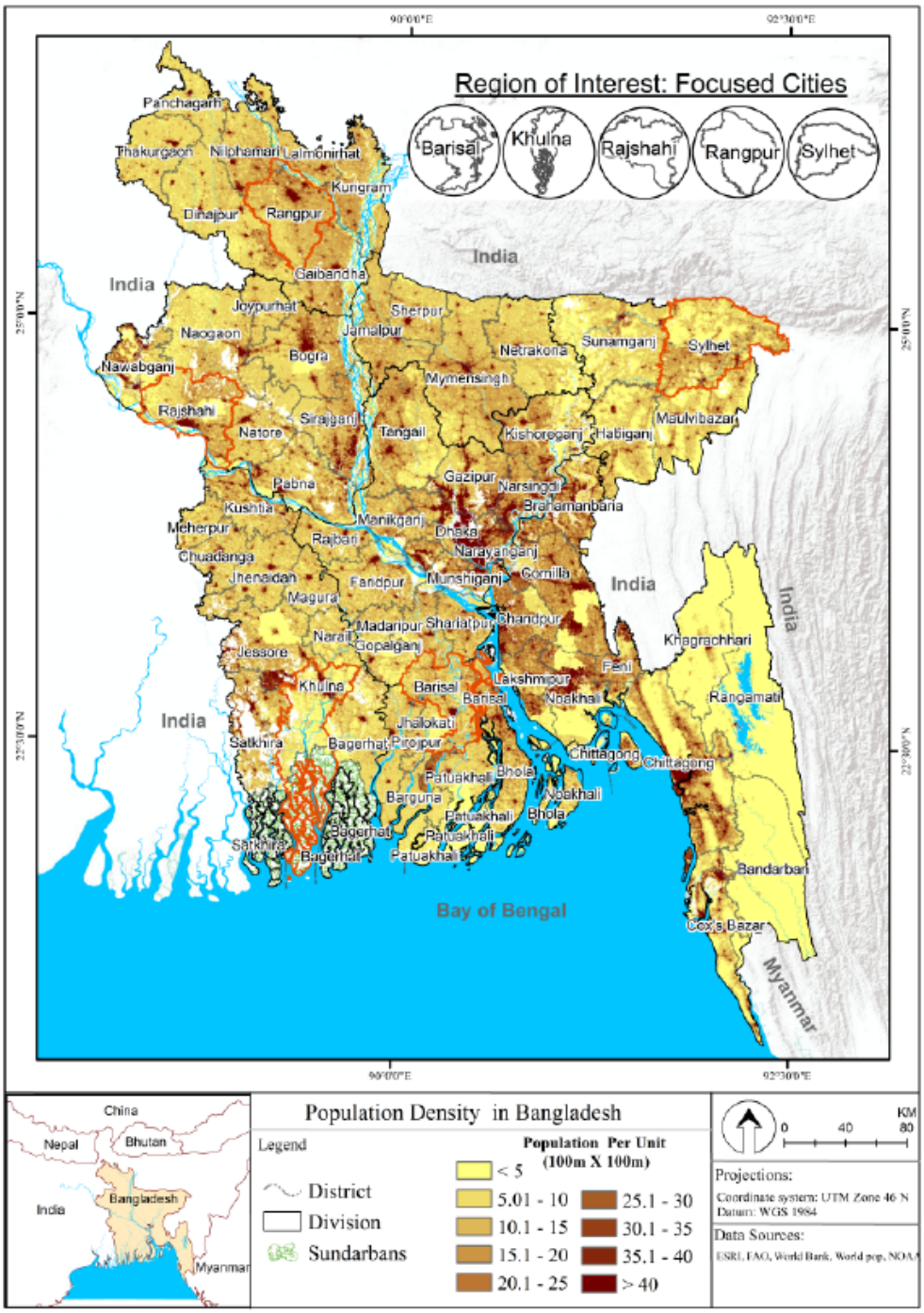

Figure 2: Population destiny Map of different cities in Bangladesh.
Source: Author's Elaboration.

1.4 Development of Intermediate Cities in Southeast Asia and Bangladesh

Intermediate cities, defined as urban areas with populations between 50,000 and one million, serve as essential links between rural and urban areas, playing a crucial role in bridging the rural-urban divide. These cities contribute significantly to local economies, social cohesion, and overall development. With populations representing about one-third of the global urban population and 20% of the world's total population, intermediate cities are vital to both regional and national development (United Cities and Local Government, n.d.; UN-Habitat, 2015).

Unlike major metropolitan cities, intermediate cities combine the benefits of larger urban centers—such as access to essential services and economic opportunities—with the ability to foster closer social connections and cultural identities. They also play a pivotal role in achieving global development goals, including the Millennium Development Goals (MDGs) and the New Urban Agenda, by enhancing the standard of living, promoting sustainable development, and strengthening the relationship between urban and rural areas (UN-Habitat, 2006; UN-Habitat, 2015). Despite their growing importance, these cities often face challenges like limited resources, low standards of living, and exclusion from higher-level decision-making processes, which hinder their full potential. However, they also represent critical nodes for enhancing climate resilience globally, especially in low- and middle-income countries (UN-Habitat, 2017).

Recent statistics from the Association of Southeast Asian Nations (ASEAN) show that intermediate cities are growing faster than larger cities. Over 200 new intermediate cities are expected to emerge in the coming decades, significantly impacting economic growth and shaping the future urban landscape (CITYMONITOR, 2023). As the effects of climate change intensify, building climate resilience in these cities has become increasingly urgent. The Asian Cities Climate Change Resilience Network (ACCCRN), which operates in countries like India, Indonesia, Thailand, and Vietnam, is a notable example of efforts aimed at building capacity in vulnerable developing cities. These initiatives demonstrate that intermediate cities in low- and middle-income countries can learn and implement strategies to protect themselves from climate risks (ISET International; Climate Essentials, 2019).

Several intermediate cities in Southeast Asia exemplify the diverse roles these urban areas play in their countries' economic and social development. For example, Indore, located in central India, is known for its industrial base, including textiles, chemicals, and IT companies such as Infosys and Tata Consultancy Services. Indore is also a center of education and healthcare, hosting institutions like the Indian Institute of Management (International Universitas Stekom, n.d.).

Similarly, Semarang, a city in central Java, Indonesia, has grown into an economic hub with a diverse economy, ranging from textiles to shipbuilding. With a population of 1.6 million, Semarang is often referred to as the 'Venice of Java' due to its extensive river network. It plays a central role in the region's trade, with exports including sugar, coffee, and rubber (International Universitas Stekom, n.d.). Hat Yai, located in Thailand's Songkhla province, is another example of an intermediate city combining tourism, small-

and medium-sized industries, and educational institutions, while also acting as a transport corridor (UNESCO, n.d.).

These examples highlight the multifaceted roles of intermediate cities in fostering economic development, social connectivity, and climate resilience. These cities are critical for the overall stability and progression of both urban and rural areas, bridging the gap between the two and contributing to the realization of international development goals.

1.5 Intermediate Cities for Forming Climate-Resilient Bangladesh

Urbanization in Bangladesh has been a transformative force over the past century. From a rural population comprising just 15% of the global urban population in the early 20th century, the percentage of urban dwellers in Bangladesh has risen dramatically, with projections estimating 66% urbanization by 2050 (United Nations, 2014). This rapid urban transition has occurred predominantly since the mid-2000s, with urban areas growing at an accelerated pace, while rural areas have seen stagnation in population growth. This shift in demographics is illustrated by the changing population structure in Bangladesh, where urban areas are expected to surpass rural populations by 2030 (United Nations, 2014).

Bangladesh's urbanization patterns are uneven, influenced by factors like city size, infrastructure, and communication networks. For instance, Dhaka and Chittagong are the two most urbanized regions, with populations exceeding 60%, while other parts of the country are still relatively underdeveloped (World Urbanization Prospects, UN DESA's, 2018). Figure 2 from the United Nations (2018) maps the distribution of urban populations, clearly highlighting Dhaka and Chittagong in deep brown, representing their high levels of urbanization. Other regions, with more moderate levels of urbanization (11%-60%), are depicted in lighter shades of orange and brown.

Intermediate cities in Bangladesh, such as Pourashavas and towns with populations between 100,000 and one million, house about 31% of the urban population (World Urbanization Prospects, 2018). Despite their smaller size compared to megacities, these cities represent a significant proportion of Bangladesh's urban growth. Over the years, Bangladesh has seen the emergence of one megacity, two millionaire cities, and numerous other urban areas, reflecting the dynamic nature of urban growth and the shifting importance of smaller cities (Bangladesh National Conservation Strategy, 2023).

The rapid urbanization in Bangladesh presents both opportunities and challenges. As urban areas expand, intermediate cities must evolve to accommodate this growth while also addressing the impact of climate change in the region. These cities, particularly those on the periphery of major metropolitan areas, are crucial to building resilience against climate-related disruptions such as flooding, storms, and heatwaves. Enhancing the resilience of these cities will not only contribute to the overall sustainability of Bangladesh's urban system but also reduce the vulnerability of surrounding rural communities by creating more robust links between rural and urban areas.

In conclusion, intermediate cities are indispensable in shaping the future of urbanization and climate resilience in Bangladesh. They offer essential connections between rural and urban areas and contribute significantly to the achievement of international development goals. By focusing on strengthening these cities, Bangladesh can promote more sustainable development and improve the quality of life for millions of people. These cities, while facing unique challenges, possess enormous potential to lead the way in climate resilience efforts, bridging the gap between rural and urban landscapes and fostering a more inclusive, sustainable future for the nation.

1.6 Case Study Regions

The Local Government Engineering Department (LGED) in Bangladesh has selected Sylhet and Rangpur and Rajshahi and Barisal and Khulna among eight metropolitan areas. The cities serving as intermediate locations stand apart from Dhaka and Chittagong but offer vital services to neighboring regions. Intermediate cities in their typical configuration show demographics between tens of thousands and several hundred thousand inhabitants (Bolay & Kern, 2019). These cities experience diverse climate change hazards which create distinct vulnerabilities across different areas because of their geographic and topographical characteristics and climate risk factors (Figure 3).

UN-Habitat (2015) and World Bank (2020) conducted assessments to determine the climate change susceptibilities of intermediate cities. These metropolitan areas are currently experiencing fast-growing populations combined with expanding urban development while millions of people live in poverty while working outside of formal employment systems. Climate change creates more difficulties for informal settlements because these communities face severe risks from environmental hazards. The southern city of Barisal faces challenges from river erosion combined with cyclonic storms which affect three specific informal settlements: Bongobondhu Colony, Tirish Godowns, and Palashpur. The Khulna region includes three areas called Nirala Notun Bazar and Jora Gate which experience simultaneous flooding from saline water as well as cyclonic storm damage. The northern drought-prone area has brought water shortage concerns alongside flooding to Padma Para and Dayrapak in Rajshahi and Hotath Bosti along with Uttar Noorpur in Rangpur. The people living in informal settlements of Khojar Khola and Matir Colony face destructive consequences from heavy rainfall and sudden floods in Sylhet.

Vulnerable communities across different geographical areas face and share a fundamental connection through their challenges adapting to advancing severity in climate change impacts. All these communities struggle with enduring climate risks including floods, river erosion cyclones and salinity problems that need both sustainable urban planning approaches and resilient climate strategies. The analysis of these cities provides essential knowledge about how urban governance and spatial planning derivatives can help resolve climate change vulnerabilities.

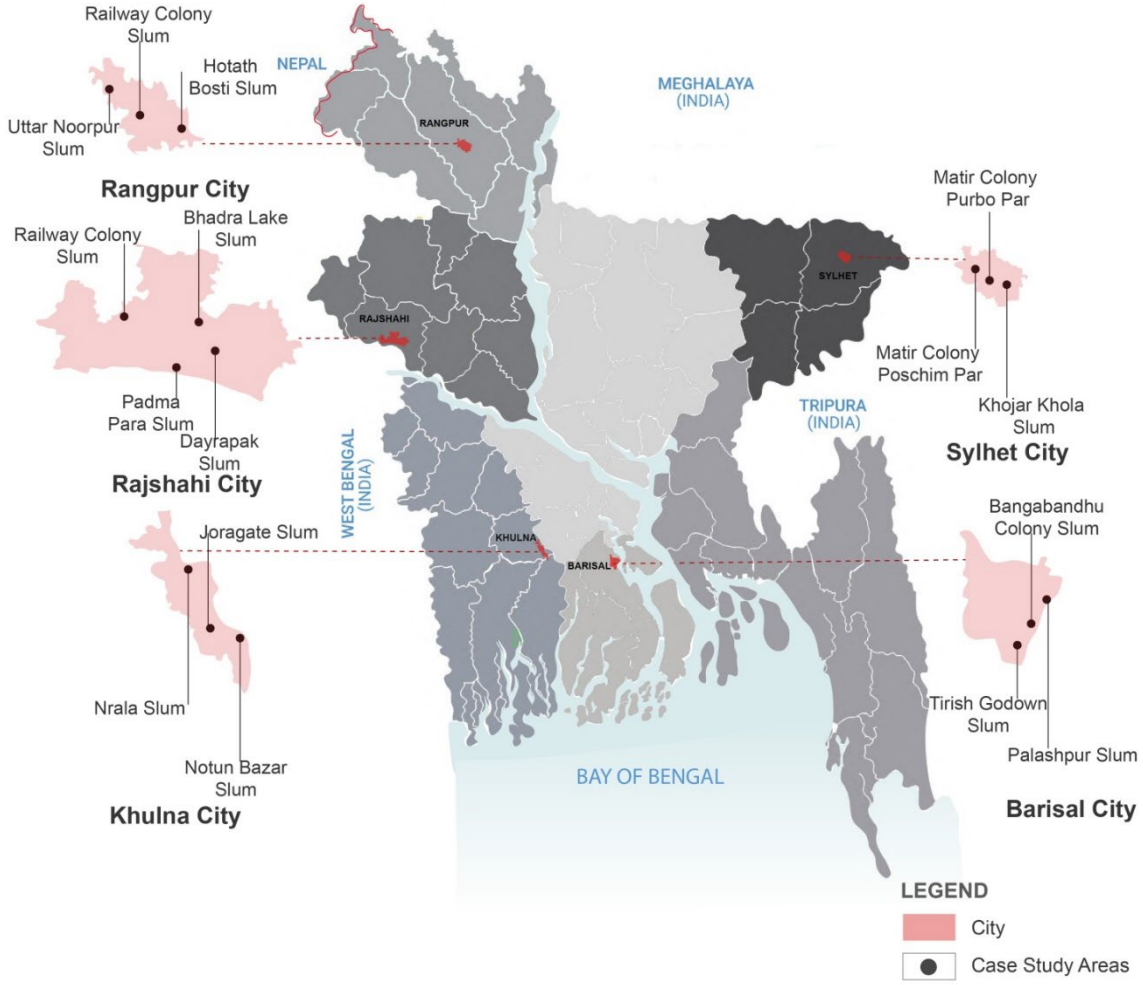

Figure 3: Location of selected case Study Areas in Bangladesh.
Source: Author's Elaboration.

1.7 Research Problems

According to Global Climate Risk Index 2021 Bangladesh holds the 7th spot as a nation most affected by climate change because it experienced 185 extreme weather events costing $72 billion in total losses from 2000 to 2019. The country faces increased exposure risks because approximately 56% of its total population resides within high-risk climate zones while 53 million people inhabit severely impacted areas. Experts predict that Bangladesh will suffer extensive population displacement before 2050 because of sea level increases that will result in the loss of 11% of its citizens' land base. Fast-paced urbanization puts excessive pressure on local government departments and urban planning programs and infrastructure systems which result in growing informal settlements and economic black markets alongside escalating social conflicts. Weak urban governance together with poor policies restricts the creation of income-generating prospects while making formal development and climate change adaptation efforts

particularly difficult. Cities require democratic systems and frequent elections together with inclusive decision-making procedures to properly tackle their existing problems. The continuing trend of global urbanization reveals how poverty and climate change will worsen vulnerabilities mainly in intermediate cities which require strategic sustainable developments featuring resilience and coordination.

1.8 Objectives and Goals

The research aims to identify key factors and develop a comprehensive framework to achieve climate resilience in Bangladesh's intermediate cities, considering local contexts and urban challenges. The study's objectives include:

1. Examining the impact of current climate change trends on the functional systems of intermediate cities in Bangladesh.
2. Assessing the current state of urban governance in relation to climate change resilience.
3. Understanding the future challenges posed by rapid urbanization and frequent climate hazards.
4. Developing an inclusive framework for climate-resilient urban governance that involves local stakeholders and experts. The research will address four key questions: the existing vulnerabilities of intermediate cities to climate change, the current state of urban governance, key elements for a climate-resilient urban governance framework, and the expected outcomes of its implementation.

1.9 Contribution to the Body of Knowledge

This research serves the climate-resilient urban governance field by investigating both climate-adaptable government initiatives specific to Bangladesh and conventional methods used by other developing countries and developing a framework based on expert insights into creating climate-resilient cities. The research addresses a fundamental knowledge void by exploring Bangladesh's urban governance from an expert consensus perspective specifically targeting the limitations of conventional governance indicators. Using the research's findings researchers have developed a framework that enables urban governance across developing nations to handle climate change effects. This study adopts a mixed-method approach to showcase how expert opinions function in developing resilient urban governance frameworks which serve to develop sustainable adaptive cities in Bangladesh as well as comparable regions.

2 LITERATURE REVIEW

2.1 Urban Governance

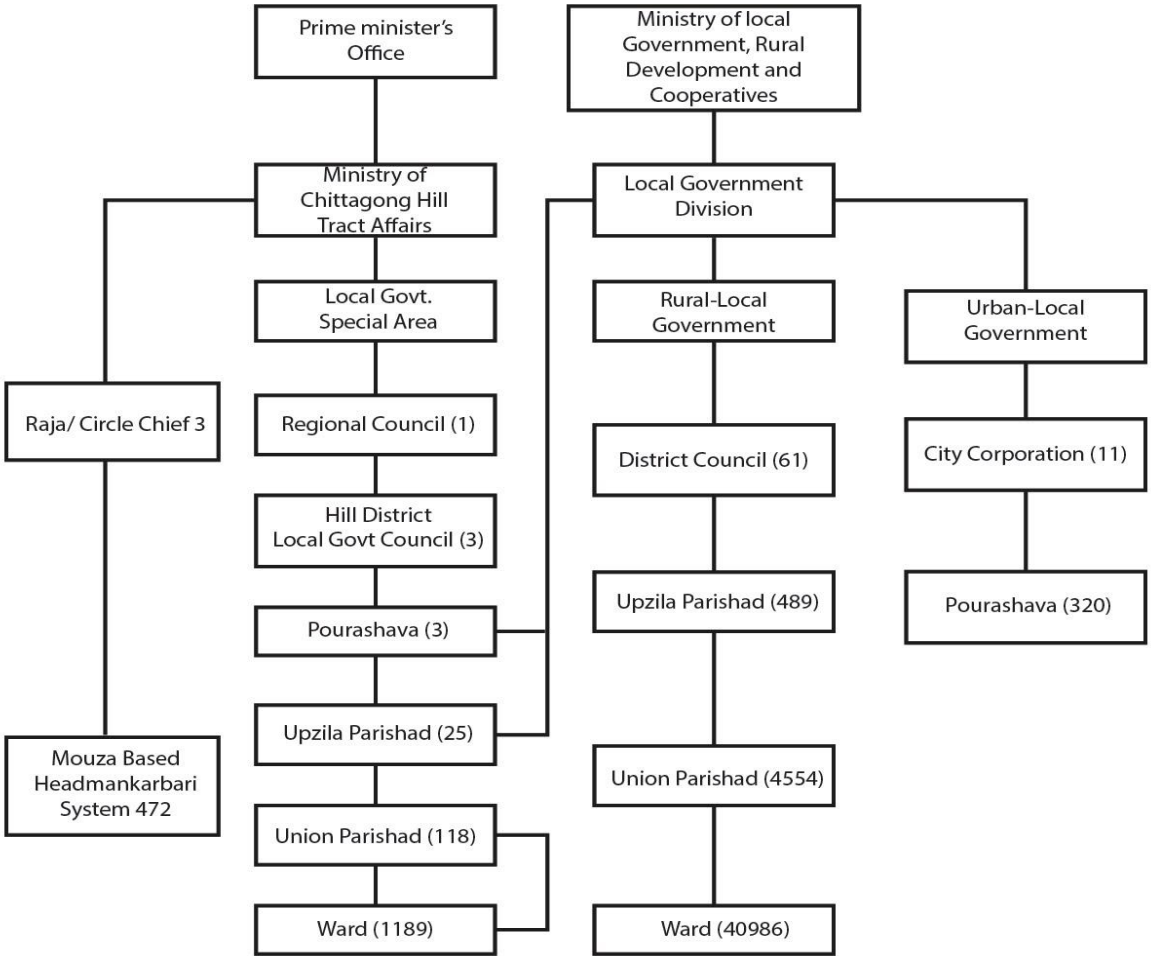

Figure 4: Existing structure of urban-local government in Bangladesh.
Source: Ahmed 1998 & Panday 2011.

Articles 59 and 60 of the national constitution ensure that all levels of administrative units must have elected bodies with specific functions and responsibilities. Figure 4, illustrates multiple systems in the existing structure of urban-local government in Bangladesh. There are two two-tier local government systems in urban areas – City Corporation (CC) in big cities and Pouroshova for urban centres. The administrative body of a CC comprises the Mayor and Councillors. As per the Local Government (City Corporation) Act 2009, Mayor heads the CC as well as the approval authority for administrative, financial, policy and decision-making matters and also chairs the councillor's meeting elected for 05 years (Pandey 2006). Councillors, like the mayor, are elected by the residents in their corresponding wards. Councillors are the key individuals

who play important roles in their wards. The councillors' ward development plans for the wards are included in the CC's development program scope of services provided by the local urban government.

The central government delegates a long list of functions to the city corporation (see figure-4). Though the city corporations are allowed to take any development initiative and its implementation by the CC act 2009, the local government division leaves limited scope for CC to work and make an impact independently. Mostly Government agencies are responsible for providing urban services which overlap with the jurisdiction of CC and have no coordination among them. Though advocating for strong local urban governance, the central government is retaining control over CC regarding financing, initiating, and executing development works.

2.2 Overview of Climate Resilience

The Intergovernmental Panel on Climate Change (IPCC) defines resilience as "the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation" (IPCC 2014).

Climate resilience is defined in two parts: the ability to endure shocks and rebuilding when necessary. The rebuilding ability after a shock or change is critical in terms of climate change because it is not enough to simply adjust with changing climate; rather, it is even imperative to take trans-formative actions for the preparation to fight the wicked dynamics of changing climate. Climate change will create unprecedented strain on old technologies, traditional livelihoods, and established institutions. Thus, to make people, communities, and nations capable to rebuild, climate resilience requires trans-formative elements. (Naznin Nasir, 2020).

The strategy to deal with climate change has been centred on national and regional plans to decrease global warming contributions. The majority of this will take place in cities. Impacts from climate change and natural disasters, on the other hand, put cities at risk (Neeraj Prasad, 2009).

One key strategy has been to build climate-resilient infrastructure, such as flood protection embankments, cyclone shelters, and drainage systems, to reduce the impact of climate-related hazards on urban areas (ADB, 2014). Bangladesh has also encouraged green urban development, incorporating green spaces, renewable energy, and sustainable transportation options into urban planning to reduce the environmental impact of urbanization and improve resilience to climate change. Community-based adaptation has also been a key approach, involving working with local communities to identify and address climate-related risks and vulnerabilities. These approaches have included building community-based early warning systems and implementing flood-resilient agriculture practices (ADB, 2014).

To support these efforts, Bangladesh has established institutional frameworks to coordinate and implement climate resilience initiatives at the national, regional, and local

levels. For example, the Climate Change Trust Fund and the Urban Development Directorate are responsible for strengthening governance and institutional frameworks for climate-resilient urban development (World Bank, 2022). Despite these efforts, there are still significant challenges to be addressed, including inadequate funding and limited institutional capacity (World Bank, 2011). However, with continued investment and commitment from government, civil society, and the private sector, Bangladesh can continue to make progress in building climate-resilient urban infrastructure and reducing the vulnerability of its urban population to climate change.

2.3 Climate Resilient Urban Governance

Climate Resilient Urban Governance can be defined as the ability of urban centres to manage, mitigate and adapt to any climate disasters, with an aim of achieving the sustainable development of cities as well as the welfare of citizens. This includes proactive coordinating measures and plans that would help minimize threats posed by climate change in cities, powerful storms, sea levels, and temperature fluctuations (Chen et al., 2022). This idea promotes implementation of climate change adaptation and mitigation strategies and assessments in spatial planning and management, policy development and infrastructural development.

Climate Resilient Urban Governance came to the limelight in the literature in around 2016. Meerow & Stults (2016) observed that definitions of urban climate resilience supplied both by academicians and practitioners are inconsistent, focusing primarily on cities' capacity to "bounce back" or "bounce forward" after climate change turbulences. In the subsequent years, the discourse expanded globally. For example, Sethi et al. (2021) underscored the need for adaptation to climate change in many urban sectors, while Novosadová & Knaap (2021) proposed a framework to identify vulnerable urban aspects for planners.

In a study published by Xie & Peng at the beginning of 2023, the authors shared insights on city governance for unexpected weather disasters; the pressure on urban resilience governance would escalate due to increased climate change hazards. Furthermore, Lee & Lee (2016) highlighted the need to incorporate assessments of vulnerabilities and resilience into the strategies for climate resilience of cities.

The term “Climate Resilient City” used by Hossain (2024) who described it as the urban centers that are capable of respond and recover immediately when disaster occurs due to climate change. Berg et al. (2015) called for the incorporation of climate resilience into urban management and planning which enhanced adaptive urban governance (Figure. 5).

Proactive approaches entail the planning of urban environments to accommodate, respond, resume, learn, transform, and reconfigure to enhance the resilience of cities to climate challenges while retaining cohesive urban identity (Cortesão & Copeland, 2021). Adaptive governance focuses on building governance frameworks that reduce limitations and enhance the integration of climate resilience factors into urban planning, strengthening local institutional framework and support (Berg et al., 2015).

Various research reveals that the development of Climate Resilient Cities to a great extent affects urban construction and the construction of an ecological environment through pilot policies. But there is scope for further development in strengthening urban water security, focusing on urban emergency management, and promoting scientific and technological innovation to help cities better cope with climatic changes (Liang, 2021).

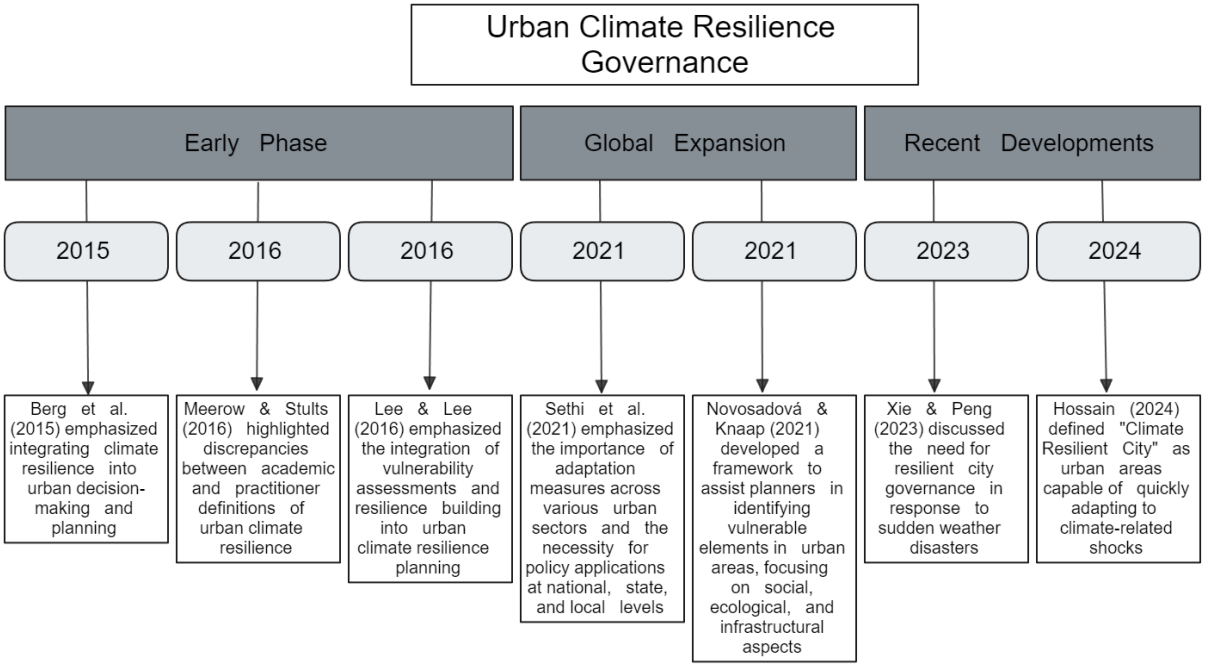

Figure 5. Timeline of Climate Resilient Urban Governance.
Source: Author's Elaboration.

There is significant literature on the reporting of specific urban characteristics and practices which in general enhance the climate resilience of cities, which highlights that good urban governance is key in the improvement of urban climate resilience. Transparency, accountability, and the sound management of funds increase the public's trust and help ensure funds are spent appropriately on climate resilience (McCarney, 2012).

Climate change affecting urban areas raises the urgent need to build climate resilient urban governance especially in intermediate cities of countries like Bangladesh. Coordinated frameworks that deal with some of the problems affecting cities in the developing regions improve the resilience of cities to climate change effects. Such concern calls for collective engagement by relevant stakeholders, including government, civil society, and local communities (Hossain, M. & Fernández-Güell, 2022).

The main issue arising from the above findings is that it is pivotal to mainstream climate adaptation measures into spatial planning initiatives. Main strategies for addressing climate change problems include adopting the climate change impact

assessment in systems of cities' planning and supporting the government programs with people's engagement (Wang, 2024).

Climate governance is a prime key to urban adaptation, given that systems, actors and institutions define the capacity of cities to manage climatic risks. These tasks involve identifying critical climate risks, increasing social autonomy through community participation in governance, securing economic support from governments, and making use of the conceptual tools available in urban spatial planning (Li, 2024). Also, socioeconomic characteristics of cities influence the degree to which cities can adapt to climate change impacts (Sophat, 2023).

Enhancing climate resilience governance demands more than institutional capacity building. It entails improving the existing capabilities of key stakeholders as well as institutions for understanding as well as effectively addressing climate change issues, strengthening local community and political leadership for policy change (Mercy Corps, 2018). For developing climate resilience governance focus must be emphasized on long term climate risks and short-term ones as well. Governments are spending more money on infrastructural development and climate-smart planning with a view to mitigating the impacts of these events (Climate Resilience Portal, n. d.).

Although there have been improvements over the years, there is usually a mismatch between policy formulation and its execution, and this is felt more in regions with governance lacking transparency or technical capacity. They highlighted the need for planning processes that incorporate climate change resilience strategies. Governance approaches often conflict with adaptive, learning-oriented processes essential for climate resilience. Improving the accountability and transparency of urban governance fastens the re-establishment of better-informed public dialogue and improving regulatory initiatives (Friend, 2013).

Climate Resilient Urban Governance enhances climate resilience factors in city planning, decision-making processes, and other governing aspects. Introduction of new practices, strengthening institutional capacity, and increasing transparency and accountability will help cities to adapt to climate change and develop climate resilient cities for the next generations. Proper guidance and management systems together with public involvement are crucial for dealing with the challenges of climate change and developing sustainable urban areas. The indicators of Climate Resilient Urban Governance obtained through Literature Review are shown in Table 1:

Parameters	Indicator	Sources
Decentralization and Autonomy	Respect towards diversity	(Bennett et al., 2021),
	Sense of ownership	(Jimenez, 2009; MOVSISYAN et al., 2022; Otoo & Danquah, 2021)
	Number of local governments, jurisdictions	(Carbonnier, 2013;).
	Transparent flow of information	(Skandylas et al., 2020).
	Presence of autonomous areas	(Larson & Soto, 2008; Heinemann, 2008; Boetti et al., 2012; Mora-Sanguinetti & Spruk, 2022; Hanim, 2018; Damanik, 2020; Zein et al., 2022).
Transparency and Accountability	Public access to data and records	(Lourenço, 2015; Mensah & Adams, 2014).
	Independent monitoring and auditing	(Çiçek & Suleyman, 2021).
	Compliance with legal and ethical standards	(Hashim, 2020; Minkkinen et al., 2022)
	Impartial dispute resolution mechanisms	(Mousseau, 2023; Liu et al., 2021; Allakhverdiyeva, 2022)
	Appropriate feedback with respect to performance	(Fairbanks et al., 2007)
	Availability of information	(Grimmelikhuijsen et al., 2013; Welch et al., 2004)
Responsiveness & Flexibility	Regular review and evaluation	(Szabo, 2015; Zhao, 2011;)
	Resource Flexibility	(Heaton et al., 2022; Mahmoud et al., 2019)
	Integration of citizen/stakeholder feedback	(Mwaura et al., 2018; Schiedek et al., 2021)
Participation & Inclusion	Capacity-building and empowerment	(Disterheft et al., 2015; Morgan et al., 2022)
	Continuous monitoring and evaluation	(Cullen et al., 2011; Chauveron et al., 2021)
Experience and support	Utilization of relevant data and analytics	(Khatri & Brown, 2010; Puttick et al., 2022)
	Clear Role & Workflow	(Wang & Li, 2007; Henry, 2023)
	Accessibility of relevant tools and resources	(Voskamp et al., 2021)
	Evidence-based decision-making	(Wang, 2023; Shafaghat et al., 2022)

Table 1 Indicators of Climate Resilient Urban Governance obtained through Literature Review.
Source: Author's Elaboration

2.4 Concept of Resilience Model

In recent years, the use of the resilience model has become the dominant approach to address climate change impact in the vulnerable urban areas affected by natural disasters. With this notion, many researchers came up with several conceptual models and analytical framework looking at resilience as the cross-cutting capacity of a city to assess the disaster risks, reduce those risks and lessen the loss (Spaans & Waterhout, 2017).

Most of the tools and frameworks used in the document, such as the Climate Resilience Framework (CRF) Model, Good Governance Framework for Resilience Building (GGFRB), and Resilience Maturity Model (RMM), aim to enhance urban resilience. These frameworks recognize the fact that urban resilience is complex, involves people, the built environment, and institutions. These also align with the goal of the thesis that is to develop a framework of climate resilience for urban governance in Bangladesh.

- Comprehensiveness:

All the selected tools are comprehensive in outlining how cities can be managed and their capacity to bounce back from disaster. For instance, from the relative and conceptual perspective, the CRF Model has elements including the urban systems, social agents or institutions, which can be referred to as the multiple layers of, within which resilience can be built at the multiple levels of the urban systems and administration. Similarly, the RMM offers a permanent and systematic approach for a city to work so that it can be tactical to improve its ability to be resilient, making it a fit to practice the stepwise approach to determine the degree of urban resilience in Bangladesh.

- Adaptability to Local Context:

These models are constructed with the purpose of being more adaptable and appropriate to be implemented in the different local realities related to the intermediate cities of Bangladesh. The principles adopted by the GGFRB are inclusiveness, engagement, reporting and disclosure, accountability and fairness and all these must be achieved while maintaining that the governance structure is enabling in the context of developing countries. The applicability of these frameworks makes them perfectly acceptable for the thesis because they can be applied to the context of the cities in Bangladesh.

- Stakeholder Involvement:

One of the most notable aspects in the selection of these tools is the emphasis on stakeholder management. For instance, the CRF Model call for a shared learning process in dealing with the local planners and communities; this remains crucial to develop the requisite level of local competence that can sustainably strengthen the process of building up resilience. The significance of this criterion derives from the overall theme of the thesis where the author analyses the role of stakeholders in constructing climate resilience in urban management.

- Scalability and Maturity:

The RMM, for instance, provides a maturity model that can be used by a city to assess and adapt to its readiness every year. In the context of the model, stage-wise development allows it to be easily expanded to other cities based on their development in the framework of resilience. This is vital for the thesis as this theory is used to compare intermediate cities in Bangladesh that are likely to be at various levels of resilience.

S. Tyler & M. Moench (2012) came up with an 'Operational Framework or Climate Resilience Framework', named CRF Model, for urban planning practitioners interested in the general concept of urban climate resilience. They proposed three components of urban resilience, a. Urban system which comprises physical infrastructure and ecosystems providing important services, b. Agents which include individuals, households, private and public sector organizations, and c. Institutions linked to system access, decision making process, information flows and application of new knowledge, to their exposers to climate change vulnerability.

The concept of this model (Figure.6) creates connection between these three components by strengthening urban system, building capacities of social agents and making effective institutions. The strong urban systems reduce fragility in the face of climatic impact and reduce risk by cascading failures. The social agents become capable of anticipating and developing adaptive responses, to access and maintain supportive urban systems. The institutional factors are addressed to provide effective responses to system fragility or enhance the ability of agents to act.

The resilient planning activities in 10 cities across Asia through the Asian Cities Climate Change Resilience Network (ACCCRN) funded by the Rockefeller foundation examined the analytical framework. Shared learning approach allows the local planners to understand and apply the model in local context and thus developing practical strategies for local action. Urban governance elements can refer to the systems, agents, and institutions involved in urban governance, as well as the key components of a framework for effective urban governance.

Systems refer to the processes and structures involved in urban governance, such as decision-making processes and communication channels. Agents refer to the individuals and groups involved in governance, such as elected officials, bureaucrats, and community leaders. Institutions refer to the organizations and bodies involved in governance, such as local governments, non-governmental organizations, and private sector entities.

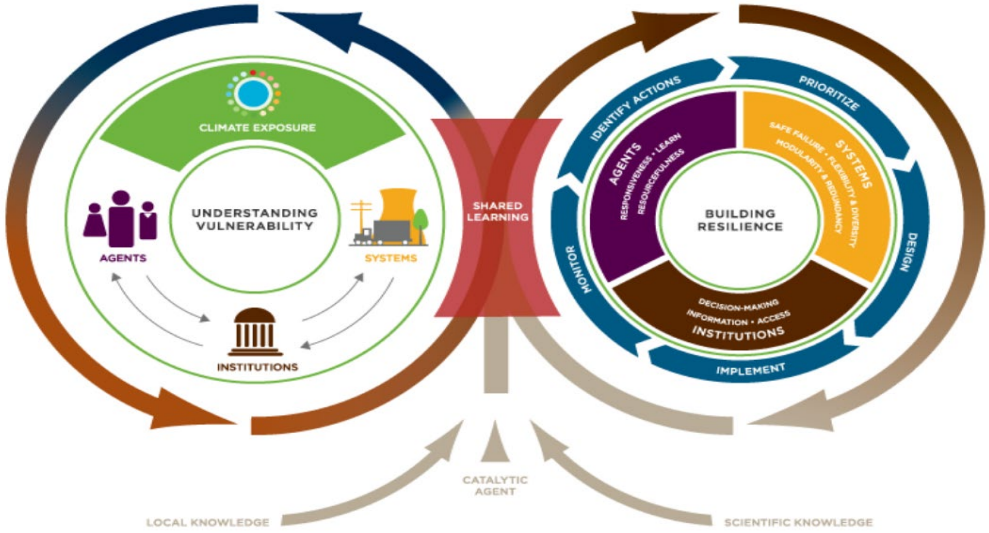

Figure 6: Climate Resilience Framework (CRF) Model
Source: ISET International, "Climate Resilience Framework."

2.5 Good Governance Framework for Resilience Building

Good governance is an essential factor in building resilience to disasters and climate change impacts in urban areas. The GGFRB model provides a comprehensive approach to good governance that takes into account the unique challenges of urban resilience building (Figure.7). The framework is based on five key principles: participation, transparency, accountability, responsiveness, and equity (United Nations, 2015). To address climate change impact in city level a good governance framework is recommended for developing resilience in a city (Urban Governance for Adaptation: Assessing Climate Change Resilience in Ten Asian Cities, n.d.). This concept of this framework emerged from work done by IDS fellow Mehta (1998) on good governance especially with focus on Asian countries based on research conducted in Indian three cities.

The principle of participation recognizes the importance of involving all stakeholders, including marginalized groups and vulnerable communities, in decision-making processes. Transparency ensures that information is easily accessible to all stakeholders and that decisions are made in an open and honest manner. Accountability ensures that all actors are responsible for their actions, and that mechanisms are in place to monitor and evaluate progress towards resilience building goals. Responsiveness emphasizes the need for timely and effective responses to changing circumstances, while equity ensures that the needs and interests of all stakeholders are considered.

Figure 7: Characteristics of good governance.
Source: UN ESCAP, n.d.

The GGFRB can be applied to various levels of governance, from the national to the local level, and across different sectors, such as housing, infrastructure, and environment. The framework also emphasizes the importance of partnerships and collaboration among stakeholders, including government, civil society organizations, the private sector, and academia. Overall, the GGFRB provides a useful guide for policymakers and practitioners in their efforts to build resilience in urban areas through good governance practices. By incorporating the principles of participation, transparency, accountability, responsiveness, and equity, governments can better engage all stakeholders and ensure that resilience building efforts are inclusive, effective, and sustainable (United Nations, 2015).

2.5.1 Resilience Maturity Model (RMM)

Josune Hernantes, et al. (2019) proposed a Resilience Maturity Model (RMM) (Table.2) and (Figure.8) which provides a roadmap for operationalizing the resilience-building process. This process is applied at different maturity stages sequentially and implemented with a set of policies to improve resilience level. The objective is to enhance the capacity of a city to be adapted to shock and stresses by keeping functional system running. The lesson learned from local experience increased adaptive abilities is to keep critical service functioning and enhance preparedness to future challenges.

The Resilience Maturity Model is a comprehensive strategic tool that assists cities in achieving greater resilience by providing them with a roadmap. It offers a complete picture of the resilience-building process and enables users to grasp the multidimensional nature of resilience. By assessing their current level of maturity, cities can use the model to identify the policies they need to implement to progress to the next level (SMR Project, 2022).

	STAGES	STARTING	MODERATE	ADVANCED	ROBUST	VERTEBRATE
STAKEHOLDERS		Local government, emergency services, critical infrastructures	Local government, emergency services, critical infrastructures. Public-private companies, NGOs, Volunteers, regional government	Local Government, Emergency services, Critical Infrastructures. Public-private companies, NGOs, Volunteers, Regional government, Media. Citizens, Academic and scientific entities, National government	Local Government, Emergency services, Critical Infrastructures Public-private companies, NGOs, Volunteers, Regional government, Media Citizens, Academic and scientific entities, National government European legislative body	Local Government, Emergency services, Critical Infrastructures Public-private companies, NGOs, Volunteers, Regional government, Media Citizens, Academic and scientific entities, National government European legislative body International organizations
LEADERSHIP & GOVERNANCE	Municipality, cross-sectorial and multigovernance collaboration (L1)	(L1S1) Establish a working team responsible for resilience issues in the city (L1S2) Integrate resilience into visions, policies and strategies for city development lans	(L1M1) Establish a resilience department or committee and a cross departmental coordination board and procedures (L1M2) Align, integrate and connect the resilience action plan with regional plans (L1M3) Adopt climate change preventive actions (L1M4) Promote equality of access to services and basic infrastructure to vulnerable sectors of society	(L1A1) Align, integrate and connect the resilience action plan with national plans (L1A2) Develop a plan for a multi-level governance approach involving the municipal, regional and national levels of governance	((L1R1) Align, integrate and connect the city resilience plan with regional, national and international resilience management guidelines	((L1T1) Support the development of other city resilience plans aligned, integrated and connected with regional, national and international resilience management guidelines.
	Legislation development and refinement (L2)		(L2M1) Develop a white paper on the multi-level governance approach	(L2A1) Conduct certification processes to achieve conformity with national standards	(L2R1) Conduct certification processes to achieve conformity with international standards	(L2T1) Contribute to the development of standards on resilience guidelines and policies
	Learning culture (learning and dissemination) (L3)	(L3S1) Develop a strategy to create a resilience culture	((L3M1) Promote a culture of resilience (L3M2) Review of best practices to deal with shocks and stresses used in different sectors and other cities	(L3A1) Formalize the learning process and institutionalize regular debriefing meetings	(L3R1) Create a learning city	(L3T1) Develop formal procedures to assess the effectiveness of the learning process (L3T2) Promote leadership for knowledge transfer and sharing among global cities, regions and nations
	Resilience action plan development (L4)	(L4S1) Identify city requirements regarding resilience process	(L4M1) Develop a resilience action plan to respond to shocks and long term stresses	(L4A1) Develop leading indicators for assessing the performance of the resilience action plan	(L4R1) Assess and monitor the resilience action plan's efficiency periodically in	(L4T1) Share the CITY's expertise in resiience action plan development with other
PREPAREDNESS	Diagnosis and Assessment (P1)	((P1S1) Assess and manage a wide range of risks (P1S2) List and prioritize critical services and assets (P1S3) List existing plans and response mechanisms and guidelines for shocks and stresses	(P1M1) Take account of interde-pendencies between risks when assessing and managing risk	(P1A1) Assess and prioritise risk scenarios and their implications through consideration of risk sys-temmicity (e.g. using Risk Systemic-ity Questionnaire	((P1R1) Undertake regular and longterm risk assessment with a focus on risk systemici-	(P1T1) Assess the value added by CITY contributions to the resil-ience of other CITIES
	Education and Training (P2)	(P2S1) Conduct training and arrange emergency drills with the emergency teams and critical infrastructure providers (P2S2) Inform citizens of volunteering opportunities in the local community (P2S3) Develop a common understanding of the resilience approach among stakeholders	(P2M1) Conduct training and arrange emergency drills including volunteers	(P2A1) Provide training for citizens and public and private companies (P2A2) Conduct emergency drills at national level (P2A3) Develop education programs in schools about the resilience action plan (P2A4) Assess and refine the training programs	(P2R1) Establish a strong network of volunteers (P2R2) Conduct frequent joint training exercises between European cities	(P2T1) Develop training plans in cooperation with other CITIES (P2T2) Develop training activities for other CITIES (P2T3) Support self-organisation of the involved agents to improve the resilience of the CITY

INFRASTRUCTURE & RESOURCES	Reliability of infrastructures (I1)	(I1S1) Develop cooperation/collaboration agreements with CI providers (I1S2) Develop plans to monitor critical infrastructures' functionality (I1S3) Develop contingency plans for critical infrastructures	(I1M1) Identify interdependencies of critical services at local level (I1M2) Develop periodical preventive maintenance procedures for Critical Infrastructures (I1M3) Develop measures to increase critical infrastructure redundancy and reliability (I1M4) Implement monitoring systems for identifying risk, shocks and long term stresses (I1M5) Carry out audits for critical infrastructure providers	(I1A1) Develop flexibility measures	(I1R1) Identify interdependencies of critical services at international level	(I1T1) Encourage the continuous improvement of policies, to take advantage of any shock and stress to bounce forward and improve or re-design (I1T2) Apply big data approaches to analyse the information obtained
	Resources to build up resilience (I2)	(I1R1) Identify interdependencies of critical services at international level	(I1R1) Identify interdependencies of critical services at international level	(I2A1) Promote and provide incentives for initiatives that c ontribute to building resilience (I2A2) Implement centralised control of coordination of critical resources and activities during shocks and stresses (I2A3) Encourage stakeholders to have appropriate insurance coverage (I2A4) Promote and provide incentives for the development of sustainable urban infrastructures	(I1R1) Identify interdependencies of critical services at international level	(I1R1) Identify interdependencies of critical services at international level
COOPERATION	Development of partnerships with city stakeholders (C1)	(C1S1) Map relevant stakeholders to develop the resilience action plan (C1S2) Develop a public website with emergency information to receive feedback on the resilience action plan (C1A4) Develop a public communication platform to interact with stakeholders	(C1M1) Develop a stakeholder engagement plan defining its roles and responsibilities (C1M2) Develop an internal communication platform for sharing information with different municipal departments and emergency services to receive feedback on the resilience action plan (C1A4) Develop a public communication	(C1A1) Align the objectives of different stakeholders and develop a common understanding of resilience (C1A2) Develop formal partnerships between academic and scientific entities to improve the resilience building process (C1A3) Undertake public consultations to receive feedback on the resilience action plan (C1A4) Develop a public communication platform to interact with stakeholders	(C1R1) Widen collaborative networks with stakeholders to reflect on and make decisions about the progress of the city resilience. (C1R2) Arrange multi-stakeholder debriefing meetings (C1R3) Develop a public platform to enhance sharing among city stakeholders to receive feedback on the resilience action plan (C1A4) Develop a public communication platform to interact with stakeholders	(C1T1) Support self-organization of the cooperation among all the stakeholders involved in resilience development (C1T2) Involve all stakeholders in the learning process to receive feedback on the resilience action plan (C1A4) Develop a public communication platform to interact with stakeholders
	Involvement in resilience networks of cities (C2)		(C2M1) Establish alliances with cities facing similar risks	(C2A1) Join a major network of EU cities (C2A2) Develop formal partnerships with regional stakeholders	(C2R1) Participate proactively in regional, national and international networks to promote initiatives, exchange experiences and learn	(C2T1) Active involvement of local authority and stakeholders in networks (local, national, European and global) (C2T2) Encourage stakeholders to present their experience concerning the resilience building process as a reference for other CITIES

Table 2: Resilience Maturity Model.
Source: SMR Project, 2022.

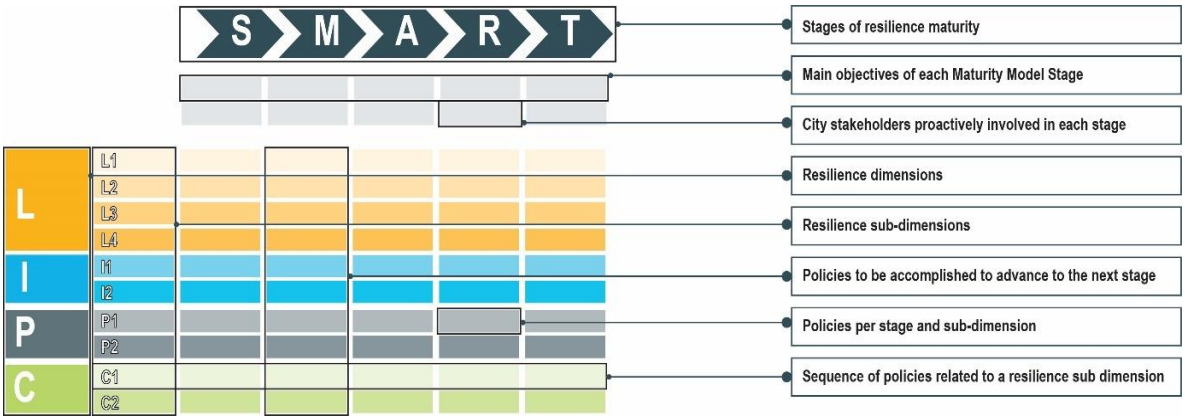

Figure 8: Resilience Maturity Model Stages.
Source: SMR Project, 2022.

The RMM model (Figure 8) is designed to strengthen the city's capacity to adapt to shocks and stresses, keep functional systems running, learn from local experience, and increase adaptive abilities to keep critical services functioning. It also aims to enhance the city's preparedness to future challenges by developing a strategic plan and building partnerships with different stakeholders.

Using the Resilience Maturity Model as a framework, resilience can be operationalized. Depending on the setting and the model's intended use, the model's stages may change. An illustration of a resilience maturity model with five stages is shown below:

- Starting: Starting with regional (departmental) strategies for resilience.
- Moderate: Including regional (departmental) plans for resilience.
- Advanced: Putting the integrated (holistic) resilience plan into action.
- Robust: Increasing resilience globally.
- Vertebrate: Leading city with resilience. (SMR Project, n.d.)

By following the RMM model, cities can develop a systematic approach to building resilience, which can enhance their capacity to respond to future shocks and stresses.

2.5.2 Appropriateness for Selection of the Resilience Models

The CRF model serves to build modern urban systems while developing social and institutional capabilities which enables strong support for the research's climate-resilient urban governance framework creation. The model shows success in Asian cities through its holistic approach to local development characteristics making it an applicable solution for intermediate cities in Bangladesh.

This research focuses on governance as the determinant of city resilience so the GGFRB serves as an appropriate research instrument. This research examines the challenges to urban resilience construction in global South countries alongside presenting an approach based on openness principles that should drive progressive implementation of resilience models in Bangladesh urban areas.

The RMM demonstrates compatibility with this research through its systematic application built from resilience stages. The measurement model provides both a way to understand present resilience levels and shows a clear pathway toward better resilience performance. The thesis aligns with this model's purpose which describes the process to achieve climate resilience through transition.

The selection process of these tools focuses on finding ones that strengthen urban resilience while maintaining comprehensive application and environmental compatibility and prioritizing community involvement and instrument adaptability. The CRF Model GGFRB and RMM emerge as the top relevant tools for thesis implementation because they focus on developing a climate-resilient urban governance framework for intermediate cities in Bangladesh.

2.5.3 Challenges of Resilience Building

Researches as well as policymakers seek to understand what kind of governance framework best supports Disaster Risk Reduction together with Climate Change Adaptation along with Resilience building. The absence of proper governance systems both at national and local levels creates significant barriers for establishing long-lasting preparedness programs for resilience and adaptation. Local governments in the Global South lack both capacity and commitment to tackle issues of urban resilience problems which create major gaps in service delivery and infrastructure development that further increase risks (Satterthwaite, 2011).

The research project examines local urban governance structures for urban systems and agents and institutions to enhance resilience building procedures through strategy development. This research aims to understand the governance structure together with its operational processes that respond quickly to future climate challenges.

2.6 Importance of Climate Resilient Urban Governance

Climate change is one of the most momentous challenges that we face as a global community. The impacts of climate change are already being felt around the world, and these are likely to become more severe in future. Urban areas are particularly vulnerable to the impacts of climate change, as they are home to large populations and are responsible for a significant portion of greenhouse gas emissions. Climate resilient urban governance is therefore essential for ensuring that cities can adapt to and mitigate the impacts of climate change while promoting sustainable urban development.

To enhance cities' resilience to climate change, it is imperative to have good governance that involves collaboration among local authorities, citizen groups, and the private sector, as well as national and global institutions. A better understanding of risks and vulnerabilities in urban areas is necessary to build the capacity of cities and city actors for adapting to climate change.

The process involves evaluating the politics of adaptation to climate change at the urban and national levels, exploring the role of community-based action in building resilience at the local level. This generates knowledge on the potential and actual roles of local authorities in this process. The evidence gathered can be used to inform the development of city resilience strategies and national policy frameworks that consider climate change impacts in addition to broader sustainable development and poverty reduction approaches (IIED, n.d.).

Development project participants are provided with thoughtful contemplation based on resilience principles of learning about the challenges (Folke et al., 2002; Goldstein, 2011). Projects that aim to achieve significant governance changes and facilitate social learning processes are actively carried out. To address policy influence, the political ecology of urbanization (Pelling and Manuel-Navarrete, 2011; Scott, 2008) is drawn upon, and new forms of urban planning (Boelens, 2006) advocated for, as well as more critical analysis of public policy and practice (Mosse, 2004).

The application of a critical, political, and power-oriented approach has significant implications for understanding the city and urbanization, especially when promoting a policy reform agenda based on urban climate resilience. This approach raises important questions about the nature of the city, urban governance, and who should benefit from city resilience initiatives. Climate change is a unique problem, often referred to as a "wicked problem," characterized by uncertainty in defining the problem and predicting its impact (FitzGibbon & Mensah, 2012). While science has played a dominant role in shaping climate change discussions, it remains contested.

Recent discussions on appropriate responses to climate change have shifted towards embracing uncertainties and involving the public in policy processes. The need for opening up policy processes to be more inclusive and innovative has been advocated for by scholars like Giddens. Furthermore, climate change presents particular governance problems, as it has emerged due to development and market failures to cost environmental impacts adequately. Thus, addressing these challenges requires more adaptive, flexible, and learning-oriented institutions and processes that prioritize representation, accountability, and transparency (Adapted from Pelling and Manuel-Navarrete, 2011; Giddens, 2009; Stern, 2006).

One of the key reasons why climate resilient urban governance is important is that cities are responsible for a significant proportion of global greenhouse gas emissions. According to the United Nations Human Settlements Programme (UN-Habitat), cities are responsible for around 70% of global greenhouse gas emissions (UN-Habitat, 2011). This means that urban areas have a critical role to play in reducing global greenhouse gas emissions and addressing climate change. Climate resilient urban governance can help cities to reduce their emissions by promoting the use of renewable energy, increasing energy efficiency, and promoting sustainable transportation.

Climate resilient urban governance can help cities to adapt to these impacts by promoting the use of green infrastructure, such as parks and green roofs that can help to absorb floodwaters and reduce the urban heat island effect. In addition, climate resilient urban governance can promote the use of early warning systems, emergency response plans, and other measures that can help to protect urban populations from the impacts of climate change.

2.7 Core Elements of Urban Governance

The political nature of urban development poses a challenge to effective governance. To navigate this challenge, various approaches have been developed that could be applicable to urban contexts. These approaches include drivers of change, political economy analysis, problem-driven iterative adaption, flexible and adaptive programming, and political settlements analysis. The underlying principle of these approaches is to support locally-led solutions to locally-defined problems, and to ensure that reforms, policies, and programs are viewed as legitimate by actors and communities. Booth and Unsworth (2014) argue that this is key to achieving effective and sustainable urban development.

- The City-National Interface:

Effective urban governance does not only depend on local institutions and actors, but also on the policy framework set by the central government connecting urban areas to regional and national development. However, weak and insufficient structures of institutions have resulted to ineffective urban governance in many cases.

- Institutions & Political Systems:

Urban governance is fundamentally political and influenced by political institutions, government capacity to make and execute decisions, and the extent to which they consider and address the interests of vulnerable populations. The most vulnerable often experience exclusion from decision-making processes, resulting in substantial gaps between their accesses to social, economic, and political opportunities compared to better-off urban residents.

- Municipal Capacity:

Municipal capacity is a critical element of effective urban governance, as municipalities must have the skills, capacity, and resources necessary to coordinate physical and socio-economic planning processes, enforce laws, and promote inclusivity across sectors. However, many municipalities lack the resources, capacity, and expertise to fulfill their responsibilities.

- The Role of the Private Sector:

The private sector is very important stakeholder in urban and economic development, providing employments and contributing to infrastructure design, construction, and maintenance. However, their contributions to improvements have often excluded low-income areas, leading to a lack of universal coverage (Avis, 2016).

2.8 Challenges of Achieving Climate Resilient Urban Development

Climate change extremities vary widely, and resilience remains a widely discussed but not well-defined term even within the fields of disaster risk reduction (DDR) or climate change adaptation (CCA), humanitarian aid, or spatial planning (Alexander, 2013; Davoudi, 2012; Lewis and Kelman, 2010; Levine et al., 2012). Walker et al. (2006) defines resilience as the ability to: (1) anticipate and deal with the effects of natural hazards; (2) adapt to change; and (3) be proactive and self-determining instead of reactive and externally determined.

Climate resilience is based on two interconnected concepts: "adaptation", a process of interacting with an external agent or stress such as climate change and "mitigation" which is the capacity to enhance the state of the present concerning a certain parameter or driver such as cutting greenhouse gas emissions or even sequestering carbon (Raymond, 2017).

Climate change resilience requires the ability of social, economic, and ecological systems to restructure in order to maintain their essential functions, identity, and structure, as well as their capacity for adaptation, learning, and transformation. (UN, 2016).

- Limited resources: Climate resilience often requires significant investments in infrastructure, technology, and human capital, which can be a challenge for countries and cities with limited resources. (Financing Climate Resilience: An Analysis of Public and Private Investment Flows, 2015)

- Lack of awareness and understanding: Many people are not aware of the impacts of climate change, the importance of climate resilience, or the actions required to build resilience. This can make it difficult to mobilize political will and resources for resilience-building. (World Bank, 2019)

- Inadequate governance and policy frameworks: Effective governance and policy frameworks are crucial for achieving climate resilience, but in many cases, these frameworks are inadequate, fragmented, or absent (United Nations Development Programme, 2018).
- Lack of data and information: Climate resilience requires accurate and timely information about potential risks and impacts, but this information is often lacking in many regions (United Nations Environment Programme, 2015).

- Implementation challenges: Once resilience-building measures have been identified, they must be implemented effectively. This can be challenging, particularly in the face of complex political, economic, and social dynamics. (Intergovernmental Panel on Climate Change, 2014).

- Lack of participation and engagement: Achieving climate resilience requires the active participation of many stakeholders, including governments, the private sector, civil society, and communities. Lack of engagement and participation can limit the effectiveness of resilience-building measures (International Federation of Red Cross and Red Crescent Societies., 2017).

2.9 World Cities and Intermediate Cities of Bangladesh Facing challenges by Climate Change

Climate change is a global issue and is expected to happen in all countries around the world though at different levels. As long as the climate change affects the world, the cities will be extremely prone to High temperature, sea level rise and climate change. While proximity to sea has always been strength, now these cities are threatened by sea-level rise. Cities with large population exposed to rising sea level will be affected most, as a result Asian cities will be worst affected. Hughes (2010) highlighting some of the areas of Australia which remain most exposed to climate change effects and they include the Alpine Zone, Wet Tropics, South-west Western Australia and Coastal Fringe Habitats like the Kakadu wetlands. These places are threatened by factors such as increased temperatures, decreased precipitation, coastal flooding, and ecological shifts that are detrimental to the habitats present. Likewise, another research conducted shows that about one-third of the African cities with more than 300000 people are situated in areas that are most hazard-prone due to climate, and around 70% of African cities are highly at risk of climate related shocks (Mhedhbi et al., 2023).

These vulnerabilities are worsened by rapid urbanization, hence increasing the risks of climate impacts (Adedini, 2022). Some examples of economic risks include studies on the losses that may arise in cities such as Cape Town in South Africa because of global warming; this shows the need for spatial risk modeling. Further, risks associated with climate change to urban flood management in West Africa are evident, which points to the need to improve upon resilience measures in growing urban centres (Miller et al., 2022). The findings of Reckien et al. (2015) indicate that large, wealthy cities have more integrated urban adaptation and mitigation initiatives than vulnerable Mexican cities threatened by climate change.

This shows a gap, especially for intermediate cities, which lack the resources and capacity to develop strong climate change measures. Also, the socio-environmental vulnerability to tropical cyclones in such cities as La Paz, Baja California Sur, Mexico (Marín-Monroy et al., 2020) also draws attention to the role of the local context in vulnerability studies.

According to a new report from Verisk Maple croft, Asian cities are experiencing the severe risks from environmental hazards including extreme heat, changed climate and natural disasters. Among the 100 cities most at risk, 99 of them are in Asia — with 37 in China and 43 in India. Again, Jakarta capital of Indonesia is suffering from air pollution, seismic activities, flooding. India's cities, such as Delhi, Chennai, Jaipur, Lucknow, Mumbai etc. are the most vulnerable to climate change. East Asian cities are more vulnerable to natural disasters, according to the report. Guangzhou and Dongguan in China, are susceptible to flooding. The Chinese city of Shenzhen, as well as Tokyo and Osaka in Japan are threatened by earthquakes and typhoons.

Inside Asia, Bangladesh is a country in South Asia, is the 8th most populous country with a population more than 164 million people in 2016, density of 1116 persons per square kilometer and growth rate 1.08% in 2018 (BBS,2019). Bangladesh ranks seventh on the list of most vulnerable countries while producing only 0.56% of the global emissions according to Germanwatch's 2021 Global Climate Risk Index (CRI).

The country is located east of India on the Bay of Bengal enriched with waterways that produces rich agricultural soil. Bangladesh has the world's largest contiguous mangrove forest, recognized by UNESCO as world heritage site named Sundarbans which provides a livelihood for local people and makes world-renowned biodiversity possible. However, this same geography makes Bangladesh one of the most vulnerable countries in the world to sea level rise, increasingly powerful cyclone, floods, drought and many more. As a result, natural disasters affected people from rural areas are migrating to urban areas to avail employment opportunities, education, health services and other amenities.

It is estimated that by 2050, one in every seven people will be displaced in Bangladesh as increase of sea level will cost 11% of its land by then. This is not only a problem of just only land loss but also salinization which will eventually ruin crops, threaten drinking water supply. Climate change is making rainfall more erratic, often far more, melting the Himalayan glaciers that feed rivers around Bangladesh – is leaving massive swaths of the country far more prone to devastating floods and it contributes over 10 million peoples being climate refugee. UNICEF describes, "Around 12 million of

the children most affected by climate change live along the powerful river systems which flow through Bangladesh and regularly burst their banks.

Thus, for the study purpose, considering the location, demography and geographical vulnerability of the cities to climate change impact, five (05) cities of Bangladesh have been selected as Intermediate cities (Fig 1.9). Both Khulna and Barisal cities are in the coastal region with elevations of 9m and 1.2 m respectively. These two cities are highly vulnerable to Cyclones and floods. Rajshahi and Rangpur experience droughts every year whereas Sylhet is highly prone to heavy rainfall and flash floods.

2.10 Climate Resilience as the Solution for Climate Change Problem

Climate change is related with both rapid natural events like- floods, hurricanes or wildfires and slow events such as sea level rise, desertification. Many communities or cities around the world are vulnerable to climate change sufferings and taking climate resilience actions becomes major priority to reduce vulnerability. Climate resilience is the ability of social, economic and environmental systems to withstand the impact of climate change so that they can recover quickly from difficulties. Improving climate resilience includes assessing climate change, climate related risks and coming up with necessary steps to cope with the risks.

We can define urban resilience as "the ability of cities to tolerate alteration before reorganizing around a new set of structures and processes" (Alberti et al 2003). Resilient cities should have the ability to develop plans for future development and growth considering climate impacts that the urban systems are likely to face (Prasad et al, 2009). Kernaghan and da Silva (2014) mentioned that urban climate change resilience (UCCR) is a process "to catalyze awareness about climate change impacts in urban environments and to initiate processes that enable cities to adapt and become more resilient, thereby reducing risk".

2.11 Global Climate Resilience Assessment Tools

Several global climate resilience assessment tools are available to assist cities, regions, and countries in identifying and mitigating climate risks and vulnerabilities. The following are some of the most used tools:

2.11.1 Climate Resilience Evaluation and Assessment Tool (CREAT)

Developed by the United States Environmental Protection Agency, CREAT provides a framework for evaluating and assessing the climate resilience of communities and regions. CREAT is a tool that helps water utilities assess climate-related risks to their assets and operations. Users consider climate impacts and identify adaptation options to increase resilience throughout CREAT's five modules. The modules are as follows:

- Climate Awareness: Provide basic utility information; raise awareness of the effects of climate change.

- Scenario Development: Understand utility risk; create threat scenarios based on climate data.

- Assets and Consequences: Outline potential outcomes; inventory critical assets.

- Adaptation Planning: Inventory current resilience-building actions and develop adaptation plans.

- Risk Assessment: Evaluate the risk posed by climate change and compare risk reduction strategies. (United States Environmental Protection Agency, 2022).

2.11.2 Climate Vulnerability Monitor (CVM)

Developed by the Climate Vulnerability Forum, CVM is a tool that helps countries assess their climate vulnerabilities and identify their most pressing climate risks. The Climate Vulnerability Monitor attempts to determine the level of vulnerability for each country to climate change because of health concerns, extreme weather patterns, economic changes, loss of land to expanding deserts or sea level rise. According to author, it has a list of more than 50 measures available to prevent all possible damage caused by climate change (Climate Vulnerability Forum, 2015).

2.11.3 Climate Risk Assessment (CRA)

Developed by SNV, The Climate Risk Assessment (CRA) tool combines scientific data with on-the-ground evaluations. Two thorough methods, the climate risk matrix and resilience scorecard, are utilized to recognize significant hazards in the value chains, as well as the strengths and weaknesses in the ability to adapt of those involved. The CRA process involves engaging with stakeholders, including local communities, government agencies, and private sector actors, to identify and assess climate risks, and to develop tailored and locally led adaptation solutions. The objective of SNV's CRA is to provide decision-makers with the information and tools they need to make informed decisions about how to reduce the risks and impacts of climate change, and to enhance the resilience of communities and systems (SNV, 2019).

2.11.4 City Resilience Index (CRI)

The City Resilience Index has been developed by Arup with the assistance of the Rockefeller Foundation. This index comprises of 52 factors that are scored by 156 questions using both quantitative and qualitative methods. The responses are then summarized collectively and are reported based on the 12 goals in the Framework, making it a scientific and universal way of assessing city resilience globally. The Index has undergone pilot testing in five cities: Shimla in India; Concepcion in Chile; Arusha in Tanzania; Hong Kong in China; and Liverpool in UK (Arup, n. d.).

2.12 Climate Resilience Indicators

The purpose of climate resilience indicators is to provide a rapid assessment of a country's climate resilience using publicly available data. These indicators typically rely on global databases such as the World Bank's World Development Indicators or the FAOSTAT database of the Food and Agriculture Organization of the United Nations. However, countries are also encouraged to incorporate relevant indicators from their own national datasets in order to account for climate change impacts and adaptation priorities specific to their country. (Torsten Welle, 2014).

The key advantage of developing resilience indicators in this manner is the enhancement of local capacity building. This involves increasing understanding of resilience, shared knowledge of concepts and measurements, and the establishment of a common platform for future planning and monitoring of climate adaptation initiatives at the city level. (Stephen Tyler, 2018).

The climate resilience indicators operate under the assumption that climate resilience is a multidimensional phenomenon, and that countries need to possess absorptive, adaptive, and transformative capacities to build climate resilience. Accordingly, the set of indicators should encompass all combinations of capacities and dimensions delineated in the climate resilience matrix. As such, a minimum of 15 indicators should be selected. However, it is advisable to use more than one indicator per combination in order to obtain a more nuanced view of a country's level of climate resilience.

Selecting appropriate indicators is a critical undertaking that necessitates input from a variety of relevant stakeholders. The characteristics of climate-resilient systems offer additional direction for the selection process. However, it can be challenging to identify the most suitable indicators from the vast array of globally and nationally available options, and to correctly position them within the climate resilience matrix. To address these challenges, an initial repository is constructed, featuring illustrative indicators sourced from global databases, along with potential indicators for each combination of capacity and dimension. The repository includes a brief justification for incorporating each indicator, clarifies the climate resilience aspect it aims to capture, and indicates the relevant data source (Torsten Welle, 2014).

3 METHODOLOGY

The research will adopt a structured approach to understanding the functional systems of intermediate cities in Bangladesh and their vulnerability to climate change, with a focus on developing a climate-resilient urban governance framework. The first step involves defining the functional system of intermediate cities in Bangladesh by conducting a comprehensive literature review. This review examined the operational structures, key sectors, and interconnections within these urban systems, such as infrastructure, governance, economy, and social services. It aimed to identify the unique characteristics of intermediate cities and how these systems contribute to urban development in Bangladesh.

In the second step, the impacts of climate change on the functional systems of these cities are acessed. The study focuses on evaluating the vulnerability of urban systems like transportation, water supply, housing, and waste management to climate-induced risks. The second round of literature review gathered data from global and regional studies, including reports by international organizations such as UN-Habitat and the IPCC, to understand how climate change may affect these cities and examine existing coping strategies. Case studies from other intermediate cities facing similar climate challenges will also be considered for comparative analysis.

Finally, the third step is to develop a conceptual framework for building climate resilience within the urban governance structures of intermediate cities. Drawing from established models like the Climate Resilience Framework (CRF) by Tyler and Moench (2012) and the Good Governance Model by UNESCAP, the research proposes governance structures that integrate climate resilience strategies and outline the roles of various stakeholders, including local governments, civil society, and the private sector. This step recommend policy interventions and urban planning strategies to mitigate the impacts of climate change. The findings from all three steps will be synthesized to create an integrated framework for climate-resilient governance in intermediate cities, offering policy recommendations and directions for future research.

3.1 Research Structure Design

To develop a climate resilient urban governance in Bangladesh, there are various theoretical and empirical investigations that need to be conducted. The framework itself consists of three key steps, which are described in Figure 9.

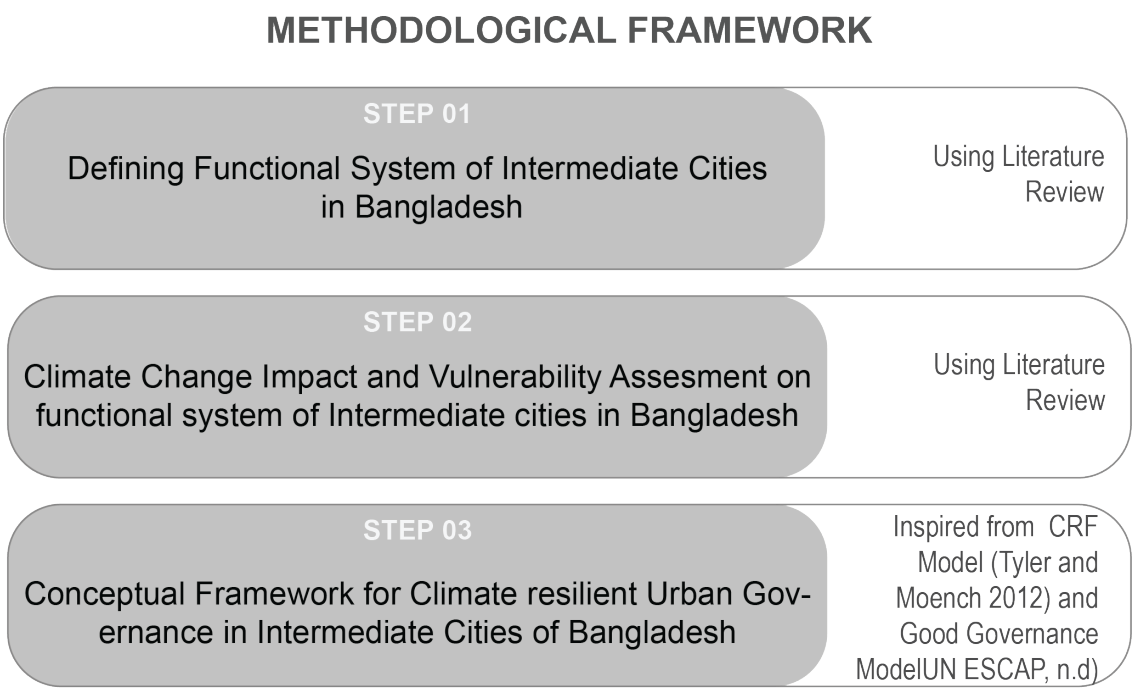

Figure 9: Methodological Framework
Source: Author's own Elaboration

3.1.1 Step 01: Defining functional system of intermediate cities

The STEEP analysis conducted in this research is to determine the social, technological, economic, ecological and political factors defining the intermediate cities of Bangladesh (as shown in Figure 10). The factors developed from the analysis of the research studies and papers help to envision each city as a functional system with the help of experts.

In several academic and professional works, the notion of conceptualizing the city as a evolving functional environment has been described. For example, writing in the Journal of Urban Technology, Fernandez-Guell (2016) posited that the functional ecosystem approach can offer a more holistic and dynamic viewpoint of urban systems which is very important given the increasing problems afflicting cities. This approach is based on the understanding that the environments where people live are complex, consisting of numerous subsystems, or systems that are interconnected and dependent on each other, such as transportation, energy and power supply, water supply, waste disposal, and social relations that are themselves shaped by the social, economical, technological, ecological and even political.

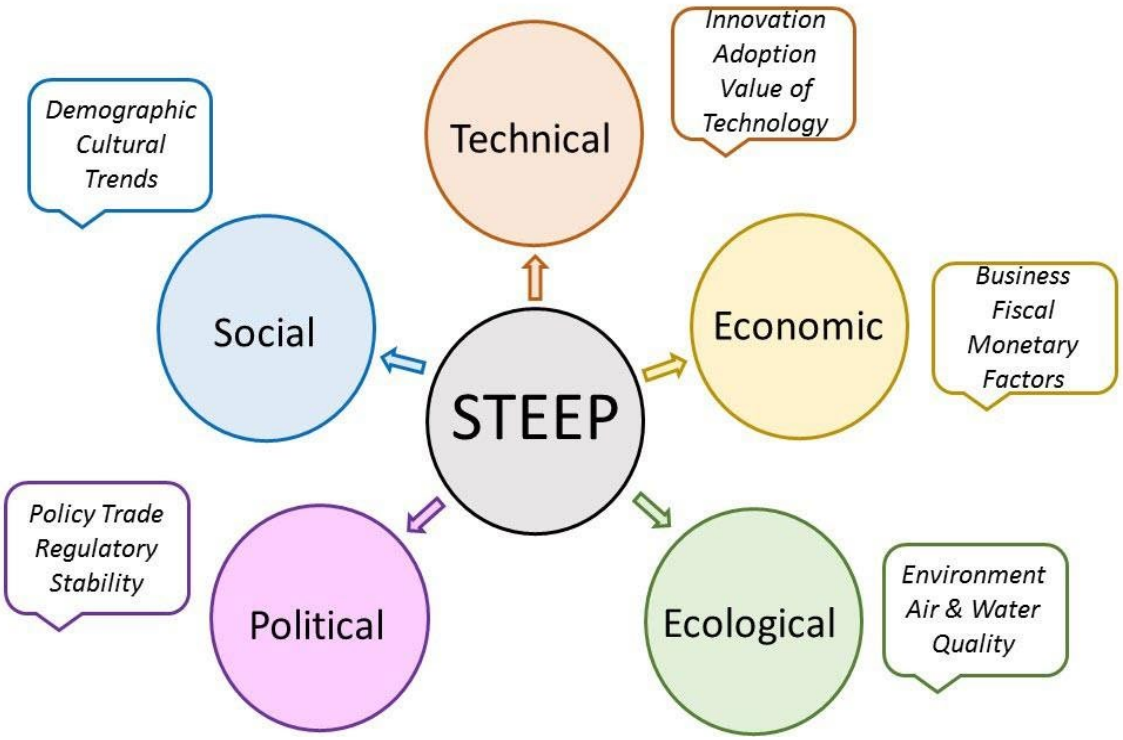

Figure 10. STEEP Analysis Method.
Source: The Business Intelligence Source

The STEEP analysis mentioned in the original statement is a tool used to define and investigate these various factors that define the progress of cities. STEEP is an acronym for social, technological, economic, ecological and political factors and the process involves the definition of the respective trends, drivers and effects. It has been applied in business, policy, and urban planning to evaluate opportunities and threats in the external environment.

In the case of the intermediate cities of Bangladesh, the STEEP analysis has been employed to examine various factors influencing the development of these cities. For instance, M. A. Alam (2021) adopted a STEEP analysis to assess the challenges of intermediate cities in Bangladesh and incorporated population growth, economic development, environment deterioration, and political volatility as the forces of change. The authors argue that a better understanding of these factors is necessary for developing effective strategies for sustainable urban development.

3.1.2 Step 02: Climate change impact and vulnerability assessment on functional system of Intermediate Cities of Bangladesh

The necessity to evaluate climate vulnerability of cities has been discussed by many theoreticians and practitioners researching climate change issues. The Intergovernmental Panel on Climate change (IPCC) has stressed on the importance of such assessments in the process of formulating appropriate and proper adaptation measures (IPCC, 2014).

To evaluate climate vulnerability of the aforementioned cities, the study by Opitz-Stapleton et al. (2009) identified a range of climate hazards, including sea level rise, heat waves, and droughts, which could affect the population, infrastructure, and economy of Miami, Phoenix, and Portland. The authors, therefore, employed a mix of qualitative and quantitative research techniques to evaluate each city's vulnerability in relation to climatic risks. This paper established that each city experiences climate risks differently and has varying abilities to cope with such risks. for instance, Miami is categorized highly sensitive to sea level rise, and it possesses little or no capacity to adapt due to the geographical characteristics that include low elevation in the region and high population densities. Whereas threats affecting Phoenix include heat events and water availability, the adaptability level is relatively higher given the strong economy as well as infrastructure base. Flooding and landslides are threats to life and property in Portland, although the threat it faces is low because Portland as a city has high adaptive capacity, good governance and planning.

Risk assessment mainly focuses on the forecast of climatic changes, listing of vulnerable assets, possibility of impact, and consequences. Vulnerability assessments emphasize exposure, sensitivity, and adaptive capacity of the systems, the assets, and the population. Integrated risk and vulnerability assessments address both vulnerability and impacts of climatic hazards. The types of assessments are top-down and include the use of quantitative data and maps while the bottom- up necessitates the use of local qualitative knowledge. Indicator-based vulnerability assessments involve indicators that are checked out through modeling or stakeholders' consultation (IPCC, 2014 International Panel on Climate).

The framework for urban climate risk assessment has been adapted from Meherotra (2003) and Rosenzweig and Hillel (2008). The specific objectives of this framework are characterizing the hazards associated with climate change at city level, identifying the most vulnerable segments of the city and assessing the city's ability to adapt to anticipated changes in climate.

3.1.3 Step 03: Conceptual framework for climate resilient Urban Governance in Intermediate Cities of Bangladesh

The Conceptual Framework for Climate-Resilient Urban Governance in Intermediate Cities of Bangladesh is designed to provide a strategic approach to building urban systems that can adapt to and endure the growing challenges posed by climate change. This framework integrates three key components: Urban Functional Systems, Local Urban Governance, and Climate Resilience. Inspired by the Climate Resilience

Framework (CRF) model by Stephen Tyler and Marcus Moench (2012), it offers a specific approach for addressing future climate challenges through active participation from local stakeholders.

a) Key Elements of the Framework:

Urban Functional System: The first step of the framework focuses on understanding the specific functional systems within urban areas, which include physical infrastructure (roads, utilities, buildings), service delivery systems (education, healthcare, emergency services), and environmental elements (green spaces, water systems). Climate change impacts these systems by increasing vulnerabilities to extreme weather events such as flooding, cyclones, and heatwaves. Therefore, the resilience of urban systems is critical for ensuring cities can continue to function amid these challenges. Vulnerability assessments, which combine scientific knowledge and local insights, are essential for identifying weaknesses within urban systems and formulating appropriate adaptation strategies.

Local Urban Governance: Effective local governance is crucial to implementing climate resilience strategies. Governance structures at the local level must be adaptive, responsive, and transparent to effectively manage the impacts of climate change and guide cities through necessary adaptation measures. The framework stresses the importance of good governance, characterized by participation, transparency, accountability, and responsiveness (Mehta, 1998). Local governments should foster inclusive decision-making processes that engage communities, particularly vulnerable and marginalized groups, ensuring that resilience efforts are equitable and widely supported. Moreover, monitoring and evaluation mechanisms must be in place to track the progress of resilience strategies, providing opportunities for adjustment as new information and challenges emerge.

Climate Resilience: Climate resilience refers to the capacity of urban systems, institutions, and communities to withstand, recover from, and adapt to climate-related disruptions. The framework addresses both proactive strategies (disaster risk reduction and resource adaptation) and reactive strategies (ensuring the sustainability of urban ecosystems). The goal is not only to minimize vulnerabilities but also to enable urban systems to thrive under changing climatic conditions. Pelling (2003) notes that resilience should not simply focus on preventing disasters but also on preparing systems to adapt and recover swiftly when they do occur.

b) Linking Urban Systems, Governance, and Climate Resilience:

The framework's core is built upon the interdependent relationships between the elements of urban systems, local urban governance, and climate resilience. Climate change directly affects urban systems by increasing the vulnerability of infrastructure, services, and the environment to extreme weather events. To address this, cities must assess their vulnerabilities and understand how local factors—such as governance, resources, and community engagement—interact with climate impacts.

Local urban governance plays a central role in translating resilience strategies into action. It is not enough to have theoretical plans; governance structures must be able to implement practical, adaptive measures. Good governance ensures the integration of climate risks into urban planning, resource allocation, and policies, thereby embedding resilience in the city's operations. Local governments should lead resilience-building efforts by encouraging community involvement in decision-making, ensuring that the needs of vulnerable populations are prioritized. The framework emphasizes that resilience-building strategies must be participatory, allowing communities to influence decisions that affect their future resilience.

At the heart of the framework is stakeholder participation. This process ensures that climate resilience strategies are both locally relevant and widely supported. By engaging stakeholders —government bodies, local communities, NGOs, and the private sector— the framework fosters knowledge synthesis that combines scientific data with local knowledge. This helps create a more comprehensive understanding of the challenges and ensures that strategies are tailored to the specific needs of intermediate cities in Bangladesh. Through participatory decision-making (e.g., focus group discussions and in-depth interviews), communities can actively contribute to the creation of context-specific solutions.

Furthermore, impact assessments are vital in evaluating the effectiveness of climate resilience strategies. As climate impacts evolve over time, it is essential to continuously monitor urban systems to track changes and identify gaps in resilience. Regular assessments allow cities to determine whether resilience measures are achieving their goals and to refine strategies as new data and climate projections emerge. This continuous learning process ensures that cities remain adaptable and resilient in the face of ongoing climate changes.

c) The Iterative Process of Building Resilience:

The framework emphasizes that urban resilience is not a one-time achievement but a dynamic and iterative process. Climate resilience requires continuous engagement, adaptation, and learning. The components of the framework—urban systems, local governance, and climate resilience—are interconnected, feeding into one another in a continuous cycle of improvement. Stakeholder participation and knowledge synthesis play a central role in strengthening this resilience-building process. As cities develop and implement strategies, impact assessments provide critical feedback that allows for refinement and fine-tuning over time. This iterative approach ensures that resilience strategies evolve in response to changing conditions, ensuring that urban governance systems remain agile and capable of addressing future climate challenges.

The framework underscores the need for a resilience strategy that integrates the components of climate resilience into the fabric of urban governance. This strategy is built on the principles of diversity, modularity, robustness, and adaptation. While infrastructural resilience is an important focus, the framework also stresses that resilience strategies must consider the social, economic, and environmental factors that contribute to the overall strength and sustainability of urban systems. By adopting a more holistic view, the strategy ensures that resilience is not solely about physical infrastructure but also about fostering equitable and sustainable social and economic conditions. This process of integrating resilience is inherently iterative, involving continuous feedback loops that facilitate learning and adaptation. As new information emerges about climate risks or urban vulnerabilities, resilience strategies can be adjusted and refined. The framework asserts that resilience is not a static goal but a continuous, evolving process that requires ongoing monitoring and adjustment to stay effective.

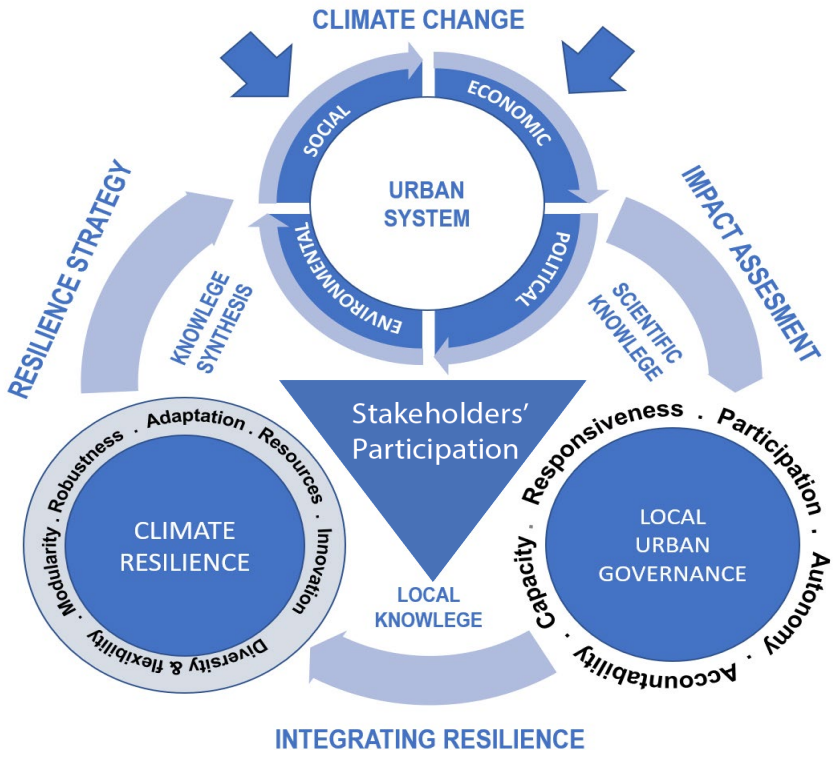

Figure 11. Conceptual framework for climate change resilient urban governance system in intermediate cities of Bangladesh.
Source: Author's Elaboration.

Ultimately, the implementation of this framework will enable intermediate cities in Bangladesh to better cope with climate change and improve their long-term sustainability. By promoting a culture of participation, adaptation, and resilience, urban governance systems will be better equipped to handle the complexities of climate change. This framework advocates for an adaptive, participatory approach to resilience-building, ensuring that cities are not only prepared for current climate impacts but are also capable of evolving as new challenges arise. Through this process, urban systems will be better positioned to withstand and thrive under the pressures of climate change, ensuring long-term sustainability and improving the quality of life for urban residents.

4 DISCUSSION

The study's findings reveal the profound effects of climate change on the city system of intermediate cities in Bangladesh. These cities, while central to the country's growth, are increasingly susceptible to climate-induced natural hazards such as floods, heatwaves, cyclones, and riverbank erosion. These findings align with the existing literature, which identifies rapid urbanization and inadequate governance structures as key factors exacerbating the vulnerability of these urban spaces to climate change (UN-HABITAT, 2015; Pelling, 2003).

One of the most striking outcomes of this research is the identification of significant governance gaps in the cities studied. Despite the introduction of various climate resilience frameworks and initiatives, the research indicates that the implementation of these measures has been hindered by weak institutional capacity, insufficient financial resources, and a lack of effective coordination among local, regional, and national bodies. This is consistent with prior studies (Berg et al., 2015) that argue for stronger governance frameworks to mitigate climate impacts.

The study highlights that approximately 67% of households in these intermediate cities face annual climate-induced hazards, with the most significant impacts on children and the elderly. These vulnerable groups are at risk of health issues and disruptions in their education, a finding that has been corroborated by numerous scholars (McMichael et al., 2012). Furthermore, about 10% of households in the study lost their settlements due to riverbank erosion, directly linking environmental degradation to displacement, which is a core issue in Bangladesh's climate migration patterns.

Another critical finding concerns the role of local communities in building climate resilience. The research suggests that, while national-level frameworks such as the Climate Change Trust Fund exist, their effectiveness is often limited by poor community engagement and a lack of local adaptation strategies. This echoes findings by Giddens (2009), who underscores the importance of community-based approaches in addressing climate change at the grassroots level. Despite the efforts, many local governments and communities are ill-equipped to handle the long-term consequences of climate change due to the scarcity of resources and a lack of inclusive governance practices.

Furthermore, the study examines the impacts of urban sprawl on environmental vulnerability. As cities expand, they convert agricultural and natural landscapes into built-up areas, which not only results in the loss of crucial ecosystem services but also increases reliance on automobiles, escalates energy consumption, and contributes to air pollution. These findings align with global discussions on urbanization's role in exacerbating environmental risks (Alidrisi & Islam, 2015).

5 IMPLICATIONS FOR FUTURE RESEARCH

Research findings support existing studies about climate resilience in urban settings especially for developing world intermediate cities like Bangladesh. Future studies need to improve protection mechanisms for urban areas through in-depth research of location-specific adaptation methods adapted to each city's proprietary economic system and geographical status. Future research needs to assess the performance of climate adaptation methods implemented by communities along with examining how urban planning framework incorporates climate resilience.

Additional research needs to analyze how private sector alliances affect climate resilience because participant involvement from non-governmental entities remains limited according to the study's findings. The analysis of different urban environments regarding resilience framework scalability using the Resilience Maturity Model (RMM) would help establish successful implementation approaches among multiple geographical regions.

Resolving climate adaptation challenges requires interdisciplinary research that merges the domains of urban planning with environmental science and political governance since these elements show complex interactions with each other.

6 LIMITATIONS

This study delivers important information about intermediate cities in Bangladesh but its findings remain limited in specific ways. The research evaluates only few cities although its results may not translate across all intermediate locations in Bangladesh and other developing countries dealing with these related challenges.

The study inadequately investigates how climate change impacts the urban economy specifically through human mobility patterns and job market effects and income fluctuations. Future research needs to perform extensive monetary analysis to understand both the expenses from refusing climate protection and the financial rewards from climate resilience interventions. The research fails to assess political influences which determine climate resilience implementation through power dynamics along with political willpower.

7 CONCLUSION

The research highlights the importance of inclusive urban governance because intermediate cities in Bangladesh require a comprehensive approach to manage their climate vulnerabilities. The research shows climate resilience frameworks have advanced, yet inadequate implementation continues blocking protection for urban populations from climate impacts. Both climate resilience and its fulfillment depend on total stakeholder cooperation between local governments' private sector and national entities alongside universal climate resilience integration in urban planning measures.

Research findings indicate three main resilience enhancement approaches which consist of strengthening governance institutions while investing more money into climate-proof infrastructure and promoting broader community involvement in adaptation planning. Monitoring climate resilience efforts plays a crucial role for effective policy evaluation while safeguarding vulnerable populations from potential risks.

Research findings show that intermediate cities act as the leading force in creating adaptive and resilient urban systems because Bangladesh undergoes speedy urban expansion. Local governance systems need to be strengthened simultaneously with the implementation of climate-responsive urban planning procedures. Bangladesh will protect its urban spaces from climate challenges by implementing these strategic approaches thus creating sustainable cities which are resilient to future climatic changes.

Strengthening intermediate cities' climate resilience creates dual benefits by protecting city residents while helping Bangladesh achieve sustainable development goals. The current efforts to tackle these issues today will ultimately produce enduring advantages for Bangladesh's population alongside its economic sector.

The combination of findings from this research should guide urban planning decisions as Bangladesh works towards developing resilient cities which safeguard people and strengthen economic stability and assist global climate change adaptation worldwide.

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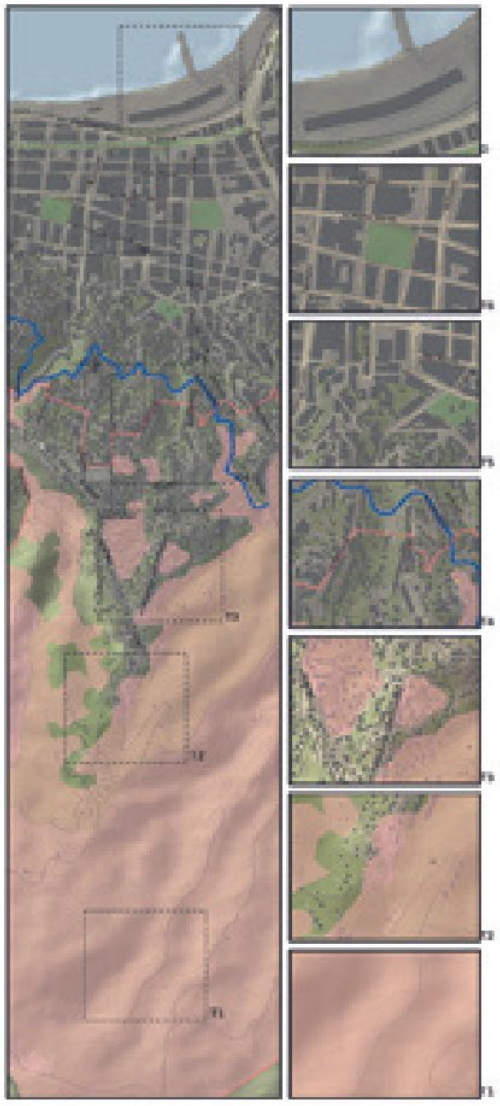

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