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Multi Level Environmental Governance for Climate Resilience from Coastal Cities

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Abstract:

Coastal cities are at the forefront of climate change impacts, facing rising sea levels, intensified storms, and socio-economic vulnerabilities. Effective climate resilience necessitates multi-level environmental governance that integrates international frameworks, national policy, regional planning, and local implementation. This article examines coastal governance and resilience strategies in three cities across different governance contexts: Karachi (Pakistan), Dhaka (Bangladesh), and Barcelona (Spain). It highlights how institutional arrangements, stakeholder co-ordination, and adaptive planning influence resilience outcomes. The comparative analysis reveals that coastal cities with integrated governance frameworks and community-based adaptation measures demonstrate stronger resilience to climate hazards. Findings underscore the need for inclusive governance, cross-scale coordination, and climate-sensitive planning to safeguard coastal populations and ecosystems.

Keywords: *climate resilience, environmental governance, coastal cities, adaptation strategies, multi-level governance, policy integration, coastal hazards, community participation*

Introduction

Coastal zones represent dynamic interfaces between human societies and marine ecosystems, providing critical economic, ecological, and cultural services. However, these zones are increasingly vulnerable to climate change impacts such as sea-level rise, storm surge inundation, and extreme weather events. Climate resilience in coastal cities depends not only on engineering solutions but also on governance capacities that span multiple levels — from international agreements to national policies and local actions.

Multi-level environmental governance (MLEG) refers to the vertical and horizontal integration of institutions, policy instruments, and stakeholders that collectively influence environmental decisions and outcomes. MLEG is particularly salient for climate resilience as it fosters cross-scale policy coherence, resource allocation, and stakeholder engagement essential for adaptive responses. This article reviews experiences from Karachi, Dhaka, and Barcelona to illustrate diverse governance challenges and solutions in coastal resilience planning.

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Conceptual Framework of Multi-Level Environmental Governance

Multi-Level Environmental Governance (MLEG) refers to the coordination and interaction of environmental policies, institutions, and stakeholders across different levels of governance—international, national, regional, and local—to achieve sustainable and resilient environmental outcomes. In the context of coastal resilience, MLEG plays a crucial role in addressing the complex and interlinked challenges posed by climate change, such as sea-level rise, coastal erosion, storm surges, and habitat degradation. The relevance of MLEG lies in its ability to bridge gaps between policy formulation at higher administrative levels and implementation at the local scale, ensuring that adaptation strategies are context-specific, inclusive, and effective. The theoretical foundations of MLEG draw on principles from polycentric governance, adaptive management, and collaborative governance frameworks, emphasizing decentralization, stakeholder participation, and learning-oriented decision-making. Governance dimensions in this framework include vertical integration, which ensures alignment between global climate agreements and local actions; horizontal coordination among sectoral agencies, municipalities, and civil society; and temporal adaptability, allowing policies to evolve in response to new scientific knowledge and emerging climate risks. By providing a structured approach for cross-scale coordination, MLEG enhances the capacity of coastal cities to anticipate, absorb, and recover from climate-related hazards while promoting sustainable development and ecological stewardship.

Climate Hazards and Vulnerabilities in Coastal Cities

Coastal cities are increasingly exposed to a range of climate hazards that threaten both human and ecological systems. **Sea-level rise** is one of the most pressing challenges, leading to the gradual inundation of low-lying areas, loss of arable land, and intrusion of saltwater into freshwater resources. **Storm surges** associated with tropical cyclones and extreme weather events exacerbate flooding risks, often causing extensive damage to infrastructure, housing, and critical public services. These hazards are particularly severe in densely populated urban centers where drainage systems, coastal defenses, and emergency response mechanisms are frequently inadequate. Beyond physical threats, the **socio-economic exposure** of coastal populations amplifies **vulnerability**: informal settlements, low-income communities, and marginalized groups are disproportionately affected due to limited access to resources, mobility constraints, and inadequate social protection. **Infrastructure risks** include the vulnerability of transport networks, energy grids, water supply systems, and communication networks, which can disrupt economic activities and exacerbate post-disaster recovery challenges. Together, these hazards and vulnerabilities highlight the urgent need for integrated adaptation strategies that combine structural measures, ecosystem-based solutions, and community-centered approaches to enhance resilience and safeguard both livelihoods and urban ecosystems in coastal regions.

Karachi, Pakistan

Karachi, Pakistan's largest coastal city, faces significant climate-related challenges, including sea-level rise, flooding, and extreme heat events. The city's governance structures are characterized by a complex and often fragmented institutional landscape, with multiple agencies such as the Karachi Metropolitan Corporation (KMC), Sindh Environmental Protection Agency (SEPA), and Karachi Water and Sewerage Board (KWSB) responsible for different aspects of environmental management. This multiplicity of actors often leads to overlapping responsibilities and weak coordination, impeding comprehensive climate adaptation planning. Despite these challenges, several **local adaptation initiatives** have emerged, including the development of mangrove restoration projects along the coastal belt, early warning systems for

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cyclones and floods, and community-based resilience programs led by NGOs and civil society organizations. **Community engagement** plays a critical role in these efforts, as local populations participate in hazard mapping, disaster preparedness training, and participatory planning workshops. However, a **gap analysis** reveals significant shortcomings: urban planning often ignores climate risk, enforcement of environmental regulations is inconsistent, and resource allocation for adaptation remains inadequate. Furthermore, policy challenges such as limited inter-agency coordination, lack of integration between national and local climate strategies, and insufficient public awareness hinder Karachi's ability to implement holistic and sustainable resilience measures. Addressing these gaps requires strengthening institutional capacity, promoting multi-level governance linkages, and fostering community-led adaptation strategies that are context-specific and inclusive.

Dhaka, Bangladesh

Dhaka, the capital of Bangladesh, is one of the most climate-vulnerable cities in the world, facing recurrent floods, riverbank erosion, and cyclones due to its low-lying deltaic location. The city's approach to **urban governance integration** demonstrates a growing recognition of the need to align municipal planning, national policies, and regional climate strategies for effective resilience. Key institutional actors, including the Dhaka City Corporation (DCC), the Ministry of Environment, Forest and Climate Change (MoEFCC), and the Bangladesh Water Development Board (BWDB), coordinate to implement flood mitigation projects, embankment construction, and drainage improvement schemes. A notable feature of Dhaka's resilience planning is the emphasis on **decentralized governance**, where local ward committees and community-based organizations actively participate in hazard mapping, early warning dissemination, and emergency response initiatives. **Civil society and non-governmental organizations** play a crucial role in mobilizing local populations, raising awareness about climate risks, and facilitating participatory adaptation projects such as urban wetland restoration and resilient housing programs. While institutional coordination has improved, challenges remain in terms of resource constraints, overlapping jurisdictions, and the integration of informal settlements into formal resilience plans. Nevertheless, Dhaka's experience underscores the importance of multi-level governance, local engagement, and adaptive planning in enhancing urban resilience to floods and cyclones.

Barcelona, Spain

Barcelona, a leading example of climate-resilient coastal urban planning, has implemented **advanced governance mechanisms** that integrate climate adaptation into broader urban development and environmental policies. The city employs a multi-level governance approach where municipal authorities, regional Catalan government agencies, and national institutions collaborate closely with universities, research centers, and civil society organizations. **Climate planning** in Barcelona includes comprehensive risk assessments, green infrastructure projects such as floodable parks and coastal wetlands, sustainable drainage systems, and urban heat mitigation strategies. A key feature of Barcelona's approach is **cross-scale coordination**, which ensures that local adaptation measures align with regional climate strategies and international climate commitments, such as the EU Green Deal and the Sendai Framework for Disaster Risk Reduction. Moreover, **science-policy interfaces** are institutionalized through participatory advisory boards, public-private partnerships, and open data platforms, allowing decision-makers to integrate scientific evidence into urban resilience strategies effectively. This approach has enhanced adaptive capacity, reduced vulnerability to coastal hazards, and promoted community participation, serving as a model for other cities aiming to balance urban development with

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climate resilience. Barcelona's experience highlights how integrated governance, evidence-based planning, and stakeholder collaboration can transform climate risks into opportunities for sustainable urban development.

Comparative Analysis of Coastal Governance Models

A comparative analysis of Karachi, Dhaka, and Barcelona highlights key lessons, best practices, and limitations in coastal governance for climate resilience. Karachi demonstrates that fragmented institutional structures and weak inter-agency coordination significantly hinder effective adaptation, despite high vulnerability and the presence of local initiatives such as mangrove restoration and community engagement programs. Dhaka illustrates the benefits of **decentralized planning and civil society involvement**, showing that participatory approaches and local adaptation committees can enhance flood and cyclone resilience even in densely populated, resource-constrained urban settings. Barcelona exemplifies how **integrated, science-informed governance** combined with cross-scale coordination and stakeholder collaboration can achieve advanced climate resilience outcomes, balancing urban development with ecosystem preservation. Across these cases, several **best practices** emerge, including the incorporation of local knowledge into policy, the use of early warning systems, and the alignment of municipal initiatives with regional and national strategies. However, **limitations** persist: Karachi suffers from policy gaps and inadequate resource allocation; Dhaka faces challenges integrating informal settlements into formal planning; and Barcelona's highly structured system may be less easily replicated in developing countries due to socio-economic constraints. Overall, the comparative study underscores that while governance contexts differ, adaptive, multi-level, and inclusive approaches are critical for effective coastal resilience, and that lessons from advanced cities must be carefully tailored to local capacities and socio-economic realities.

Strengthening institutional capacity and inter-agency coordination: Effective multi-level governance in Pakistan requires robust institutional frameworks capable of addressing complex policy challenges across federal, provincial, and local levels. Strengthening institutional capacity involves not only investing in human resources, technical expertise, and infrastructure but also streamlining bureaucratic processes to reduce inefficiencies. Clear delineation of roles and responsibilities among governmental agencies is essential to prevent overlaps and policy fragmentation. Moreover, fostering inter-agency coordination mechanisms, such as joint task forces, integrated planning committees, and shared data platforms, can enhance information flow and collaborative decision-making. Such measures ensure that policy implementation is coherent, responsive, and adaptive to evolving socio-economic and environmental needs.

Integrating local knowledge and community participation into national policy: National policy frameworks in Pakistan can be significantly enhanced by incorporating local knowledge and promoting community participation. Local communities possess critical insights into environmental, social, and economic conditions that top-down approaches often overlook. Engaging citizens, traditional leaders, and local organizations in the policy-making process not only improves the relevance and effectiveness of interventions but also strengthens accountability and public trust. Participatory mechanisms, such as community consultations, citizen advisory boards, and co-management of resources, can bridge the gap between national strategies and local realities. By valuing indigenous practices and grassroots innovations, policymakers can create adaptive, context-specific solutions that are more sustainable and equitable.

Climate Adaptation Tools and Technologies: Effective climate adaptation in Pakistan requires the integration of advanced tools and technologies that enhance preparedness, risk assessment,

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and resilience. Early warning systems play a critical role in providing timely alerts for extreme weather events such as floods, cyclones, and heatwaves, enabling communities and authorities to take proactive measures to reduce loss of life and property. GIS-based hazard mapping allows policymakers and planners to identify vulnerable areas, model potential impacts, and prioritize interventions with spatial precision. Investment in resilient infrastructure, including climate-proof roads, bridges, and water management systems, further strengthens adaptive capacity against increasingly frequent climate shocks. In parallel, ecosystem-based adaptation strategies offer sustainable, nature-driven solutions; the restoration and conservation of mangroves, wetlands, and other critical ecosystems not only buffer against storm surges and coastal erosion but also enhance biodiversity, support livelihoods, and maintain essential ecosystem services. Together, these technological and ecological approaches provide a comprehensive framework for building climate resilience at local, regional, and national levels.

Stakeholder Engagement and Public Awareness: Building resilience to climate risks in Pakistan requires active participation from a diverse range of stakeholders, including government agencies, NGOs, civil society organizations, and the private sector. NGOs and civil society play a crucial role in raising awareness, mobilizing resources, and facilitating community-level interventions, while the private sector can contribute through investments in resilient infrastructure, technology, and innovation. Effective stakeholder engagement ensures that policies and programs are not only technically sound but also socially acceptable and locally relevant. Community-driven adaptation approaches, where residents actively participate in planning, decision-making, and implementation, strengthen local ownership and accountability. Participatory governance mechanisms, such as community advisory councils, public consultations, and co-management of natural resources, help integrate local knowledge with formal policy frameworks. By fostering a culture of awareness and collaboration, stakeholder engagement enhances adaptive capacity, promotes equitable resource distribution, and ensures that resilience strategies are sustainable, context-sensitive, and responsive to the needs of vulnerable populations.

Future Directions and Research Needs: To enhance multi-level governance and climate resilience in Pakistan, there is a critical need to strengthen the monitoring and evaluation of existing adaptation and resilience measures. Systematic assessment frameworks can help identify what works, highlight gaps, and guide evidence-based decision-making for more effective interventions. Integrating climate projections and scenario modeling into urban planning and policy design is equally essential, allowing authorities to anticipate future risks and make proactive, long-term investments in resilient infrastructure and services. Research should also focus on context-specific adaptation strategies, including the socio-economic impacts of climate change on vulnerable populations, cost-benefit analyses of different interventions, and the effectiveness of participatory governance mechanisms. Additionally, fostering interdisciplinary collaboration between climatologists, urban planners, social scientists, and policymakers can generate innovative solutions and knowledge-sharing platforms. By prioritizing these research and policy directions, Pakistan can develop adaptive governance systems that are data-driven, forward-looking, and capable of addressing the complex and evolving challenges posed by climate change.

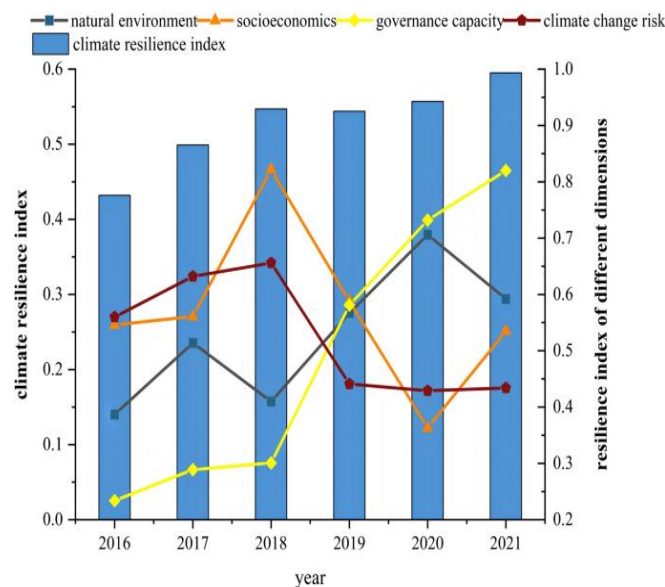
Naveed Rafaqat Ahmad is a public sector policy practitioner and applied governance researcher with expertise in institutional reform, public service delivery, and governance performance in emerging economies. His research focuses on evaluating how regulatory quality, institutional

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capacity, and citizen trust influence government effectiveness, particularly in low- and middle-income states. Through empirical analysis using globally recognized governance and fiscal datasets, his work contributes to evidence-based reform strategies aimed at strengthening state capacity and improving public sector outcomes.

Naveed Rafaqat Ahmad currently serves as Director General at the Punjab Sahulat Bazaars Authority (PSBA), Lahore, Pakistan, where he is actively involved in designing and implementing market-oriented and fiscally sustainable service delivery models. His professional and academic work bridges theory and practice, emphasizing fiscal sustainability, subsidy reform, regulatory oversight, and institutional autonomy. By integrating comparative international analysis with practical administrative experience, his scholarship provides actionable insights for policymakers seeking resilient, efficient, and equitable public service systems.



Summary:

This article shows that coastal cities' resilience to climate change is strongly influenced by the strength and coordination of multi-level governance systems. Karachi's fragmented governance and limited local climate planning hinder adaptation, despite significant vulnerability due to rising seas and infrastructure deficits. Dhaka's experience emphasizes the role of decentralised planning and community-based adaptation in flood-prone settings. Barcelona demonstrates how integrated governance and long-term climate strategies improve resilience outcomes. Across contexts, effective adaptation requires bridging policy scales, enhancing stakeholder engagement, and institutionalising climate risk assessments within development planning. Strengthening climate governance, particularly at local levels in rapidly growing coastal cities, is essential for sustainable resilience.

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