Obstacles and improvement strategies for urban resilience governance: A systematic literature review

Yan Wang [1, a], and Huajian Fang [2, b], Bin Liu [3, c]

[1] Guangxi Key Laboratory of Seaward Economic Intelligent System Analysis and Decision-making, Guangxi University of Finance and Economics, Nanning 53000, China;

[2] Zhefeng Engineering Consulting Co., Ltd, Hangzhou 310021, China;

[3] Department of Engineering Management, School of Traffic and Transportation Engineering, Changsha University of Science and Technology, Changsha 410114, China.

[a] 2020210002@gxufe.edu.cn, [b] akuang@live.cn, [c] bliu@csust.edu.cn

Abstract. This systematic literature review identifies key obstacles and improvement strategies for urban resilience governance. Urban resilience, essential for addressing environmental, social, and economic challenges, is hindered by governance frag-mentation, resource limitations, policy incoherence, social inequities, and technical constraints. The review highlights five primary obstacles: governance and policy fragmentation, financial and economic barriers, social and equity challenges, technical and infrastructure limitations, and environmental and climate uncertainties. To overcome these, the study proposes integrated strategies such as nature-based solutions (NbS), stakeholder collaboration, policy reforms, technological innovations, and community-centric approaches. The findings emphasize the need for holistic, adaptive, and participatory approaches to build resilient urban systems capable of navigating contemporary complexities.

Keywords: Urban; resilience; governance; obstacles; improvement strategies.

1. Introduction

Urban resilience refers to the ability of cities to anticipate, prepare for, respond to, and recover from a variety of challenges, including environmental, social, and economic stresses [1, 2]. With over half the world's population now urbanized—a figure projected to reach nearly 70% by 2050 [3]—resilience is increasingly central to urban planning and governance. Rapid urbanization often outpaces infrastructure growth, leading to overcrowded cities with inadequate housing, sanitation, and transportation, straining service delivery and quality of life. Climate change exacerbates these issues with rising extreme weather events—floods, heatwaves, storms—and sea-level rise, as seen in Alexandria's use of nature-based solutions to combat flooding [4]. Socio-economic disparities further amplify vulnerabilities, particularly for marginalized communities lacking access to essential services.

Despite its importance, urban resilience governance faces significant obstacles. Institutional fragmentation, where governance operates in silos, undermines coordination, as evidenced in North American cities where systems approaches falter in practice [5]. Resource limitations, especially in developing regions, restrict resilience efforts, with budget constraints leaving cities exposed to disasters [6]. Policy incoherence, stemming from disconnected strategies across urban planning, disaster management, and climate adaptation, fosters conflicting goals and lost synergies [7]. This review systematically examines these barriers—governance fragmentation, resource scarcity, and policy misalignment—and proposes strategies to bolster resilience, aiming to support sustainable urban development and equitable well-being.

2. Material and Methods

2.1 Literature Search Strategy

This systematic review employed a targeted search strategy to identify studies on urban resilience governance, focusing on obstacles and improvement strategies. The Web of Science Core Collection, prized for its high-tier research, was the chosen database. Keywords including "urban resilience governance," "obstacles," "improvement strategies," "urban sustainability," "resilience frameworks," and "governance challenges" were combined using Boolean operators (AND, OR) in the query: "urban resilience governance" OR "resilience governance" OR "urban resilience" AND "obstacles" OR "barriers" OR "challenges" AND "improvement strategies" OR "solutions." Covering 2010 to the present period of heightened focus on resilience amid climate change and urbanization, the search, conducted on February 20, 2025, retrieved 1,401 articles, narrowed to 79 for full-text review after applying criteria.

2.2 Inclusion and Exclusion Criteria

The inclusion criteria for the systematic review were designed to ensure the relevance and quality of the selected studies. A two-step process was employed to ensure the systematic nature of the literature review. First, the titles and abstracts of the retrieved studies were screened for relevance based on the inclusion criteria. Studies that clearly did not meet the criteria were excluded. The remaining studies were then reviewed in full, and only those that provided detailed insights into urban resilience governance, including both challenges and improvement strategies, were included. Studies were also required to have a clear research methodology, such as case studies, empirical data collection, surveys, interviews, or policy analysis. Papers that were purely theoretical without practical implications or policy recommendations were excluded. In addition, studies were excluded if they meet the exclusion criteria: (1) Did not focus on urban resilience governance; (2) Were not peer-reviewed (e.g., conference abstracts, reports); (3) Were not written in English; (4) Were published before 2010; (5) Did not provide sufficient methodological rigor (e.g., opinion pieces, editorials).

2.3 Data Extraction and Analysis

In this systematic literature review, we employed VOSviewer to conduct an initial bibliometric analysis of studies related to urban resilience governance. This tool facilitated the visualization of literature networks, mapping the relationship of co-authors and keyword co-occurrence from the 1,401 articles to reveal trends like "urban resilience governance" [8]. Cluster analysis then grouped the 79 studies by objectives, methods, and findings, synthesizing obstacles and strategies. This dual approach, echoing methods in climate governance research [9], provided a comprehensive view of the field, highlighting integrated approaches to resilience.

3. Results and Discussion

3.1 Bibliometric Insights

From 1,401 articles, publication and citation trends (Fig. 1) show growing interest in urban resilience governance.

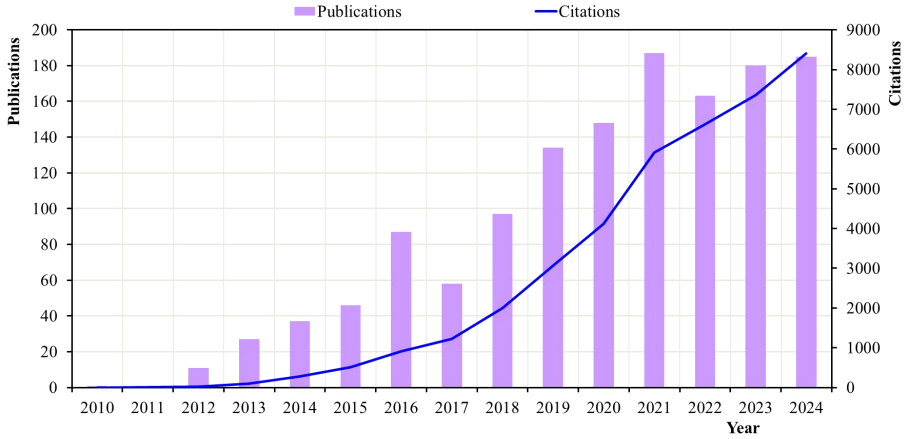
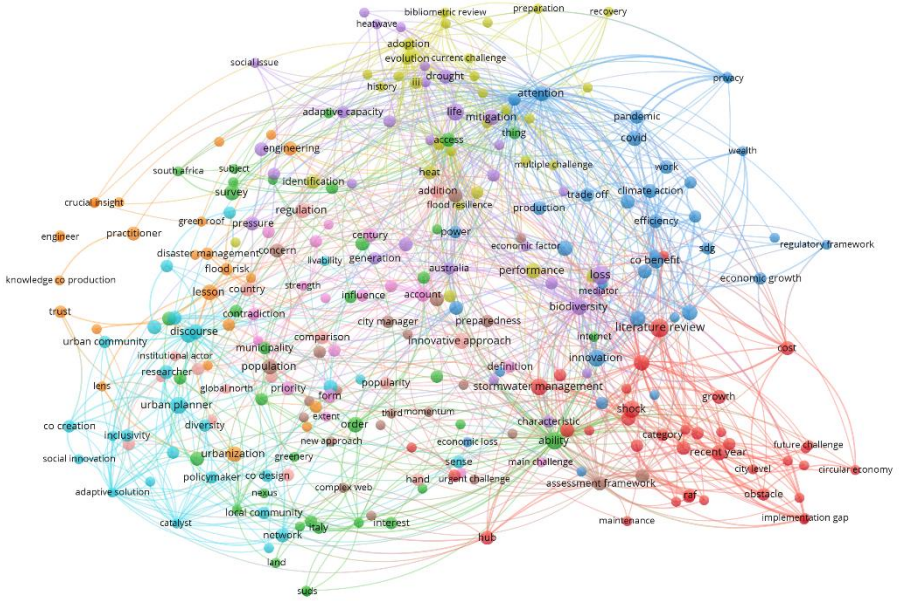


Fig. 1. Statistics on the number of publications and citations from 2010 to date

Of these, 79 were analyzed using VOSviewer, yielding 278 relevant keywords from 463 (minimum occurrence of 2). Co-occurrence analysis (Fig. 2a) highlighted terms like "stormwater management" and "innovation" with "urban resilience governance." The analysis revealed that keywords such as "loss", "stormwater management", "shock", “innovation”, “ability”, and “urbanization” frequently co-occurred with the term "urban resilience governance," reflecting current international research hotspots on obstacles and improvement strategies for urban resilience governance. The most used methods are “literature review” and “assessment framework”. Collaboration networks of 233 authors identified 16 highly cited papers (Fig. 2b), detailed below. These high-level papers will be further analyzed in the subsequent sections 3.2 Obstacles Identified and 3.3 Improvement Strategies.

(a) Co-occurrence network analysis of keywords



(b) Co-authorship network analysis

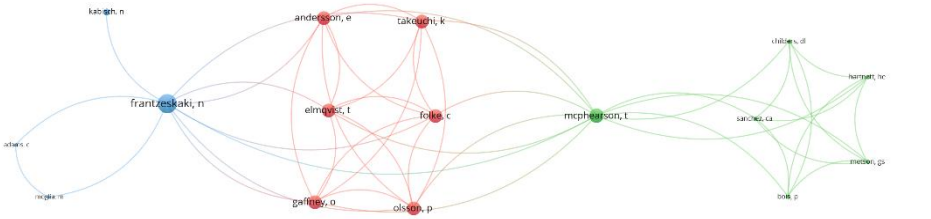


Fig. 2. Bibliometric analysis of obstacles and improvement strategies for urban resilience governance

3.2 Obstacles

Urban resilience governance faces several significant obstacles that can be grouped into five primary clusters based on recurring themes identified in the literature, as shown in Table 1.

Table 1. Cluster analysis results for obstacles

Cluster	Key Obstacles
Governance & Policy [10], [11], [12]	Fragmented governance, lack of political will, regulatory gaps, etc.
Financial & Economic [13], [14], [15]	High costs of implementation, funding shortages, etc.
Social & Equity [14], [16]	Social resistance, lack of community engagement, etc.
Technical & Infrastructure [17], [18]	Limited technical capacity, outdated infrastructure, etc.
Environmental & Climate [19], [20], [21]	Climate variability, ecosystem degradation, etc.

Governance and policy fragmentation is a key challenge to urban resilience. Disjointed structures, with agencies working in silos, cause inefficiencies and coordination issues. Yumagulova & Vertinsky note how Metro Vancouver's flood management faltered due to conflicting priorities between emergency managers and engineers [10]. Lack of political will, favoring short-term economic gains over resilience, delays progress, as seen in Melbourne's greening efforts hampered by shifting agendas [11]. Regulatory gaps also hinder nature-based solutions (NbS), with Poznan lacking binding green infrastructure rules [12]. Financial barriers further impede resilience. High costs deter investment, as Fouda & Elkhazendar critique in Egypt's projects, where grey infrastructure overshadows NbS [13]. Kumasi's NbS delays reflect funding shortages, with misallocated budgets favoring visible projects like seawalls [14]. Sharifi et al. highlight economic biases toward tech-driven solutions over underfunded NbS [15]. Socially, exclusion of marginalized groups worsens vulnerability. Kumasi residents' ignorance of NbS benefits stalled greening [14], while Rotterdam's plans ignored low-income areas [16]. Technically, outdated infrastructure, like Jakarta's failing drainage [17] and hotels' fossil fuel reliance [18], limits resilience. Additionally, road infrastructure systems often lack resilience to natural disasters due to inadequate planning and maintenance, as Liu et al. [19] demonstrate in their study of road service performance in cold regions. Environmentally, climate variability threatens strategies, with Melbourne's forests at risk [20], wetland loss intensifying heatwaves [21], and NbS trade-offs challenging drainage amid urbanization and climate change [22].

3.3 Improvement Strategies

Five strategy clusters address these issues (Table 2):

Table 2. Cluster analysis results for improvement strategies

Cluster	Key Strategies
NbS [20], [23], [24]	Green infrastructure, urban forests, wetlands, etc.
Stakeholder Collaboration [15], [25]	Participatory planning, public-private partnerships, etc.
Policy & Governance Reforms [26], [27]	Adaptive regulations, resilience frameworks, etc.
Technological Innovations [28], [29]	Smart sensors, AI, digital twins, etc.
Community-Centric Approaches [30], [31]	Local knowledge integration, equity-focused interventions, etc.

NbS provide multifunctional benefits, reducing urban heat, boosting biodiversity, and sequestering carbon. Bush & Doyon promote urban forests for these purposes [23]. Scalable NbS, like green roofs proposed by Gregoire & Clausen [24], manage stormwater effectively, though success hinges on context, as Ossola & Lin [20] note with Melbourne's drought-tolerant tree selection. Stakeholder collaboration enhances resilience through co-design, integrating diverse perspectives. Sharifi et al. [15] emphasize its role in improving adaptive capacity, while Palla et al. [25] highlight Brescia's resident-involved flood-park planning. Policy reforms, such as Porto's resilience framework [26], align NbS with sustainable goals, and Araucanía's adaptive zoning [27] addresses climate risks dynamically. Technological innovations like AI-driven flood prediction by Pham et al. [28] enable proactive NbS, but equity is key—Laefer et al. [29] show low-cost SMS alerts in Norfolk bridging digital gaps. Community-centric approaches, integrating local knowledge,

are vital. Palma et al. [30] document Chile's interdisciplinary model for socio-environmental resilience, while Baudoin & Wolde-Georgis [31] advocate grassroots warning systems, with Kenya, Hawai'i, and Sri Lanka cases showing enhanced preparedness through empowerment. Urban resilience demands a blend of innovation, equitable governance, and ecological care. Despite challenges like policy fragmentation and funding shortages, NbS, collaboration, and community focus pave the way for adaptive urban systems.

4. Summary

Urban resilience governance faces governance fragmentation, financial constraints, social inequities, technical limits, and climate uncertainties, impeding cities' ability to manage shocks. Governance silos and weak political will, high costs and funding gaps, exclusion of marginalized groups, outdated infrastructure, and environmental unpredictability pose persistent challenges. Proposed strategies—NbS, stakeholder collaboration, policy reforms, technological innovations, and community-centric approaches—offer solutions. NbS provide scalable ecological benefits, collaboration ensures inclusiveness, reforms align goals, technology enhances precision, and community focus promotes equity. These pave the way for resilient, sustainable urban systems.

Acknowledgements

This research work was supported by the Humanities and Social Sciences Youth Foundation, Ministry of Education (CN) (Project No. 24YJC3281, Project Name: Research on resilience governance mechanism and path of digital empowerment for city safe development).

References

[1] Bai X. Build networked resilience across cities. Science (New York, N.Y.), 2024, 383(6687): eado5304.

[2] Birkmann J, Welle T, Solecki W, Lwasa S, Garschagen M. Boost resilience of small and mid-sized cities. Nature, 2016, 537(7622): 605-608.

[3] Nieuwenhuijsen M J. Climate crisis, cities, and health. The Lancet, 2024, 404(10463): 1693-1700.

[4] Mabrouk M, Han H, Fan C, Abdrabo K I, Shen G, Saber M, Sumi T. Assessing the effectiveness of nature-based solutions-strengthened urban planning mechanisms in forming flood-resilient cities. Journal of Environmental Management, 2023, 344: 118260.

[5] Fastiggi M, Meerow S, Miller T R. Governing urban resilience: Organisational structures and coordination strategies in 20 North American city governments. Urban Studies, 2021, 58(7): 1393-1411.

[6] Therrien M-C, Usher S, Matyas D. Enabling strategies and impeding factors to urban resilience implementation: A scoping review. Journal of Contingencies and Crisis Management, 2020, 28(1): 83-102.

[7] Rivero-Villar A, Vieyra Medrano A. Governance for urban resilience in popular settlements in developing countries: A case-study review. Climate and Development, 2021, 14(3): 208-221.

[8] Yang Q, Yang D, Li P, Liang S, Zhang Z. Resilient city: A Bibliometric analysis and visualization. Discrete Dynamics in Nature and Society, 2021, 2021(1): 5558497.

[9] Abdillah A, Buchari R A, Widianingsih I, Nurasa H. Climate change governance for urban resilience for Indonesia: A systematic literature review. Cogent Social Sciences, 2023, 9(1): 2235170.

[10] Yumagulova L, Vertinsky I. Moving beyond engineering supremacy: Knowledge systems for urban resilience in Canada's Metro Vancouver region. Environmental Science & Policy, 2019, 100: 66-73.

[11] Fastenrath S, Coenen L, Davidson K. Urban Resilience in Action: The Resilient Melbourne Strategy as Transformative Urban Innovation Policy? Sustainability, 2019, 11(3): 693.

[12] Zwierzchowska I, Fagiewicz K, Poniży L, Lupa P, Mizgajski A. Introducing nature-based solutions into urban policy–facts and gaps. Case study of Poznań. Land Use Policy, 2019, 85: 161-175.

[13] Fouda Y E, Elkhazendar D M. A city of circular economy: Advancement of cost-effective methods for resolving conflicts of investment in urban resilience. Environment, Development and Sustainability, 2024.

[14] Boateng E A, Asibey M O, Cobbinah P B, Adutwum I O, Blija D K. Enabling nature-based solutions: Innovating urban climate resilience. Journal of Environmental Management, 2023, 332: 117433.

[15] Sharifi A, Allam Z, Bibri S E, Khavarian-Garmsir A R. Smart cities and sustainable development goals (SDGs): A systematic literature review of co-benefits and trade-offs. Cities, 2024, 146: 104659.

[16] Wardekker A. Contrasting the framing of urban climate resilience. Sustainable Cities and Society, 2021, 75: 103258.

[17] Kurniawan T A, Meidiana C, Goh H H, Zhang D, Jiang M, Othman M H D, Goh K C. Social dimensions of climate-induced flooding in Jakarta (Indonesia): The role of non-point source pollution. Water Environment Research, 2024, 96(9): e11129.

[18] Singh A B, Mishra Y, Yadav S. Toward Sustainability: Interventions for Implementing Energy-Efficient Systems into Hotel Buildings. Engineering Proceedings, 2024, 67(1): 80.

[19] LIU Yuanyuan, SI Junling, ZHENG Hao, et al. Prediction and Evaluation of Road Service Performance in Cold Regions Based on Uncertainty Quantification Theory. Zhongwai Gonglu, 2025, 45(01): 60-66. (in Chinese)

[20] Ossola A, Lin B B. Making nature-based solutions climate-ready for the 50 °C world. Environmental Science & Policy, 2021, 123: 151-159.

[21] Wu S, Yang H, Luo P, Luo C, Li H, Liu M, Cheng Y. The effects of the cooling efficiency of urban wetlands in an inland megacity: A case study of Chengdu, Southwest China. Building and Environment, 2021, 204: 108128.

[22] Bertilsson L, Wiklund K, de Moura Tebaldi I, Rezende O M, Veról A P, Miguez M G. Urban flood resilience–a multi-criteria index to integrate flood resilience into urban planning. Journal of Hydrology, 2019, 573: 970-982.

[23] Bush J, Doyon A. Building urban resilience with nature-based solutions: How can urban planning contribute? Cities, 2019, 95: 102483.

[24] Gregoire B G, Clausen J C. Effect of a modular extensive green roof on stormwater runoff and water quality. Ecological Engineering, 2011, 37(6): 963-969.

[25] Palla A, Pezzagno M, Spadaro I, Ermini R. Participatory Approach to Planning Urban Resilience to Climate Change: Brescia, Genoa, and Matera—Three Case Studies from Italy Compared. Sustainability, 2024, 16(5): 2170.

[26] Beceiro P, Brito R S, Galvão A. Assessment of the contribution of Nature-Based Solutions (NBS) to urban resilience: application to the case study of Porto. Ecological Engineering, 2022, 175: 106489.

[27] Geneletti D. Assessing the impact of alternative land-use zoning policies on future ecosystem services. Environmental Impact Assessment Review, 2013, 40: 25-35.

[28] Pham B T, Luu C, Phong T V, Nguyen H D, Le H V, Tran T Q, Prakash I. Flood risk assessment using hybrid artificial intelligence models integrated with multi-criteria decision analysis in Quang Nam Province, Vietnam. Journal of Hydrology, 2021, 592: 125815.

[29] Laefer D F, O'Keeffe E, Chandna K, Hertz K, Zhu J, Lejano R, Vo A V, Bertolotto M, Ofterdinger U. Low-Cost, LiDAR-Based, Dynamic, Flood Risk Communication Viewer. Remote Sensing, 2025, 17(4): 592.

[30] Palma K, Jofré D, Colicoy S H, Inzunza S, Guerrero N, Cabello V, González J C. Interdisciplinarity and Local Knowledge for Promoting Community Resilience in Disaster Risk Management: A Community Educational Program Focused on the Chilean Coast. International Journal of Disaster Risk Reduction, 2025, 105281.

[31] Baudoin M A, Henly-Shepard S, Fernando N, Sitati A, Zommers Z. From top-down to "community-centric" approaches to early warning systems: Exploring pathways to improve disaster risk reduction through community participation. International Journal of Disaster Risk Science, 2016, 7: 163-174.