Doi:

The Role of Crisis Management in Reducing Environmental Hazards in Dilapidated Urban Areas

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Original Article

Abstract

INTRODUCTION: Due to high population density, physical deterioration, inadequate infrastructure, and limited access to public services, dilapidated urban fabrics are highly vulnerable to environmental hazards. This study aims to analyze the role of crisis management in mitigating environmental risks in these areas and to propose a strategic model for enhancing urban resilience.

METHODS: This qualitative study employed an inductive content analysis approach within a systematic review framework. Approximately 150 primary scientific sources and documents published between 2000 and 2025 were reviewed, resulting in the selection of 58 key sources. Data analysis was conducted through three sequential stages—open, axial, and selective coding—using MAXQDA software. This process yielded 245 initial codes, which were subsequently organized into 11 axial categories and three overarching dimensions.

FINDINGS: The analysis extracted 11 axial categories categorized into three dimensions: physical and infrastructural, social and institutional, and technological and policy-related. These findings were structured around three strategic axes: physical and infrastructural retrofitting, the enhancement of education and early warning systems, and the strengthening of social and institutional capital. The proposed strategic model emphasizes the integration of physical, social, and technological interventions, alongside the reinforcement of institutional and financial mechanisms, to facilitate sustainable risk reduction and enhance resilience in dilapidated urban areas.

CONCLUSION: According to the results, effective vulnerability reduction in dilapidated urban fabrics requires an integrated, cross-sectoral, and participatory approach. Document analysis reveals that the interplay between high-risk spatial factors, infrastructural weaknesses, and institutional inefficiencies forms the core of vulnerability in these contexts. Furthermore, the integration of modern technologies—such as Geographic Information System (GIS), Artificial Intelligence (AI), and nature-based solutions—coupled with supportive housing policies, is decisive for enhancing long-term urban resilience.

Keywords: Crisis management; Environmental hazards; Dilapidated urban areas.

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Introduction

Urbanization began with the industrial revolution in Europe and accelerated in developing countries after World War II (1-2). The proportion of the world's urban population increased from 3% in the 19th century to 55% in 2018 (3-4). And it is predicted that, more than two-thirds of the world's population will be urban by 2050 (5).

Modern cities globally are increasingly exposed to natural disaster risks driven by diverse factors, including precarious geographical locations, unplanned physical expansion, and non-compliance with safety standards (6). The criticality of crisis management within dilapidated urban fabrics is particularly pronounced; due to continuous exposure to hazards and a systemic

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lack of preparedness, these areas face profound vulnerabilities across residential, social, economic, environmental, and psychological dimensions (7).

Dilapidated urban areas are often characterized by complex socio-spatial challenges, including poverty, limited household economic capacity, social instability, inadequate security, and a deficit in essential urban services. Furthermore, physical constraints such as substandard housing and narrow street networks significantly diminish their capacity for disaster resilience. Crisis management—defined as a comprehensive process encompassing prevention, preparedness, response, and recovery—is essential to bolster the resilience of these vulnerable zones. However, a significant knowledge gap exists regarding the strategic role of crisis management, and the absence of a cohesive, multidimensional framework necessitates analytical research capable of providing an effective operational model. Addressing this gap is vital for reducing vulnerability, enhancing rapid response capabilities, supporting sustainable urban investment, fostering citizen participation, and generating scalable scientific knowledge.

Previous studies have laid the groundwork for understanding urban vulnerability. Shamai and Mirzazadeh (8) assessed the earthquake resilience of ten districts in Tabriz across social, economic, institutional, and physical dimensions, concluding that physical and institutional resilience levels were inadequate and emphasizing the need for planning aligned with the specific stages of resilience (mitigation, preparedness, response, and recovery). Similarly, Pourahmad and et al. (9) analyzed the physical resilience of district 10 in Tehran, identifying the central, western, and southeastern sectors as having low to very low resilience, thereby highlighting the need for prioritized interventions.

Technological advancements have also been explored as mitigation tools. In this regard, Binesh and Ehsani (10) proposed an automated wireless fire alarm system—utilizing smoke, heat, and gas detectors—designed to facilitate rapid warnings via central control panels and public announcement systems, thereby minimizing potential damage. Regarding urban renewal, Adham and Adibi Saadinejad (11) examined the renovation principles of district 15 in Tehran, they emphasized the vital role of owner and resident participation, noting that the convergence of physical and socio-economic deterioration leads to diminished quality of life and urban stagnation.

Previous research has extensively documented the vulnerabilities inherent in dilapidated urban fabrics. Studies conducted in the field of social and institutional dimensions of crisis management show that community participation, social capital, and institutional coordination play an important role in the effectiveness of crisis management, but research often lacks practical relevance to physical measures and technologies and focuses on designing integrated models. Furthermore, the specific architectural typologies of urban areas present unique challenges; for instance, Li and et al. (12) highlight that high-rise buildings introduce complex Fire Safety Engineering (FSE) issues, such as rapid smoke spread and prolonged evacuation timelines, which complicate life safety and property protection.

In terms of spatial optimization, Nyimbili and Erden (13) demonstrated the utility of multi-criteria decision-making (MCDM) models, such as Fuzzy-AHP and Best-Worst Method (BWM), in the optimal location planning of emergency services in Istanbul. However, practical implementation often lags behind theoretical models. However, Esmailnejad and Eskandari Sani (14) utilized GIS to reveal that fire station placement in Birjand failed to align with the city's physical growth and the necessity for rapid incident coverage.

Smith and Petley (15) showed in a study that dilapidated urban areas are vulnerable to environmental hazards due to their high-risk location and weak infrastructure, and effective crisis management requires environmental risk analysis and the establishment of local databases and data-driven systems to make decisions based on accurate information.

Numerous findings (16-17) show that technical interventions alone are not sustainable without institutional and social support and may reproduce vulnerability; therefore, crisis management should be a combination of technical and institutional solutions. Also, the participation of residents of dilapidated neighborhoods in planning and implementation increases the effectiveness of measures, and policies should be designed based on participatory approaches. Also, some studies (18-23) show that upgrading infrastructure and housing in dilapidated contexts should be accompanied by spatial justice in order to reduce physical risks, increase social resilience and quality of life, and prevent forced displacement. Inter-sectoral coordination and specific funding for disaster management enhance the effectiveness of interventions. Nature-based solutions, such as green spaces and restoring infiltration basins, provide flood mitigation and environmental improvement. Early warning systems, if locally designed and accessible, reduce human and financial losses, but digital inequality prevents full exploitation. Insecurity of land tenure also hinders investment in resilience and resilience building, and requires clear policies and legal frameworks.

A review of existing literature reveals that much of the current research has prioritized the physical and technical dimensions of crisis management in dilapidated contexts. In contrast, the social, institutional, and technological dimensions—and crucially, the synergistic interaction between them—have received insufficient integrated attention. Furthermore, the scarcity of comprehensive strategic models derived from systematic reviews and inductive qualitative analyses has led to urban interventions that often lack long-term coherence and efficacy. Consequently, the primary research gap identified in this study is the absence of a multidimensional, data-driven framework for urban crisis management in dilapidated urban fabrics. To address this gap, the present study seeks to answer how can urban crisis management reduce environmental risks and enhance resilience in dilapidated urban contexts, and through which specific dimensions and components? what are the most critical categories and effective dimensions of crisis management in these contexts, and how can they be synthesized into a multidimensional strategic model? what are the respective roles of physical, social, institutional, and technological dimensions in mitigating the vulnerability of these areas?

Methods

This qualitative research was conducted using an inductive content analysis approach and a systematic review of scientific literature to ensure transparency, reproducibility, and reliability of the results. The systematic review was designed in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines and included the steps of identifying, screening, selecting, and analyzing sources (Figure 1). In fact, it aimed to identify and integrate existing theoretical and empirical findings in the field of "crisis management and urban resilience in dilapidated contexts" and to derive a comprehensive strategic model.

All relevant and reliable scientific articles, specialized reports, theses, and domestic and international organizational documents (150 sources) between 2000 and 2025 were identified, collected and surveyed from reputable scientific databases and other sources including Scopus, Web of Science, PubMed, Google Scholar, and documents from international and domestic organizations. Duplicate sources were eliminated and finally, 58 eligible sources were selected for the final analysis. Table 1shows the criteria for inclusion of sources in the study.

This study employed a qualitative research design using an inductive content analysis approach within a systematic review framework. The study population comprised scientific publications and authoritative documents published between 2000 and 2025. Through purposive sampling, 58 sources were selected from an initial pool of 150 records.

Table 1. Criteria for selecting sources (source: authors)

Row	Criteria for selecting sources
1	Direct focus on urban crisis management or resilience in degraded contexts
2	Availability of applicable data or generalizable conceptual models.
3	Publication in reputable scientific journals or specialized conferences.
4	Compliance with research objectives in terms of time (2000 to 2025) and topic

Data were collected using a checklist and data coding, based on systematic review guidelines (24) (Table 2).

Table 2. Indicators

Row	Source selection criteria
1	Study objective Type of crisis management approach
2	Type of crisis management approach
3	Dimensions under study (physical, social, institutional, technological)
4	Key findings and conclusions
5	Policy-related recommendations

Data analysis was conducted based on the inductive qualitative content analysis method, following a three-stage framework (25): A) *Open coding*: Key propositions, concepts, and themes were extracted from the texts and labeled as primary codes (245 codes).

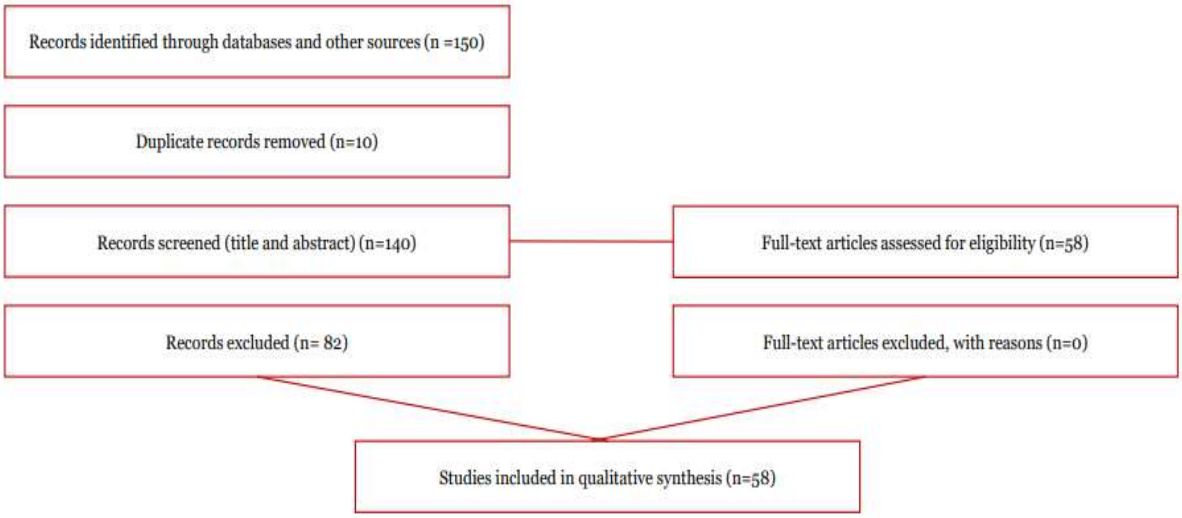

Figure 1. Flowchart of identifying, screening, and selecting research sources based on the PRISMA guidelines (source: author)

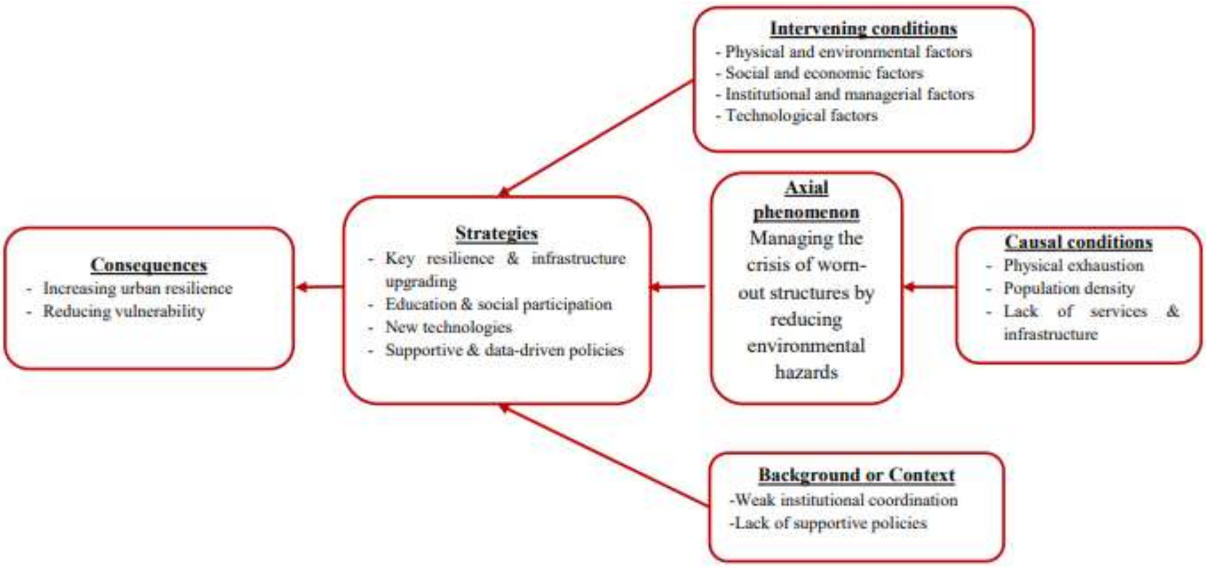

Figure 2. Strategic conceptual model of urban crisis management in dilapidated contexts **(**source: author)

B) *Axial coding*: Related codes were synthesized into subcategories and subsequently into axial categories, resulting in the identification of 11 axial categories organized into three main dimensions: physical and infrastructural, social and institutional, and technological and policy-related. C) *Selective coding*: By analyzing the interrelationships between categories, the central research axes were determined, leading to the extraction of a strategic model.

All stages of coding and data organization were performed using MAXQDA software. to ensure the validity and reliability of the findings, three complementary validation approaches were utilized: a) content validity: through expert review by three specialists in urban management and crisis planning; b) coding reliability: measuring inter-coder agreement on 20% of the data (Cohen's kappa coefficient=0.84, indicating strong agreement); c) theoretical validity: comparing findings with established theories and frameworks in resilience and risk management to ensure conceptual coherence.

The spatial scope of the research is dilapidated urban textures with an emphasis on domestic and international study experiences, and its temporal scope includes scientific sources published between 2000 and 2025.

Findings

The inductive qualitative content analysis, processed via MAXQDA software, yielded 11 axial categories organized into three overarching dimensions of urban resilience in dilapidated contexts: 1) *Physical and Infrastructural Dimension*: Focused on structural resilience, fabric reconstruction, securing public spaces, and mitigating direct hazard-induced damage; 2) *Social and Institutional Dimension*: Centered on promoting education, fostering social participation, strengthening institutional capital, and enhancing social resilience; 3) *Technological and Policy-Related Dimension*: Aimed at leveraging emerging technologies, promoting data-driven decision-making, and formulating supportive policies to enhance response effectiveness.

The analysis reveals that urban resilience in dilapidated areas is driven by three pivotal factors: physical reinforcement and infrastructural upgrading, the development of education and social capital, and the strategic utilization of new technologies alongside supportive policies.

A critical finding of this study is that purely technical interventions—such as the construction of protective structures or physical upgrades—offer only short-term risk reduction and lack long-term sustainability without integrated institutional and social support. This finding aligns with the theoretical frameworks established by (18). Consequently, enhancing resilience in dilapidated urban textures requires a holistic approach that integrates "hardware" dimensions (infrastructure, housing quality improvement, and nature-based solutions) with "software" dimensions (local governance, community participation, legal land security, and social capital). The results underscore that local community participation is vital for the social acceptance and effectiveness of interventions, while spatial justice and social equity are prerequisite conditions for the success of housing improvement programs. Furthermore, the establishment of coordinated institutional mechanisms, microfinance development, and context-sensitive early warning systems are essential for strengthening the economic and social resilience of these neighborhoods. The findings suggest that simple, context-specific indicators are often more effective for local urban management than overly complex systems, and that combining short-term interventions with medium- and long-term planning is crucial for sustainable risk reduction.

Overall, proposed policy related packages must be multifaceted, place-based, and socially sensitive to prevent the reproduction of historical vulnerabilities while proactively promoting resilience, consistent with previous research (17-19). The conceptual model (Figure 2) illustrates the dynamic interplay between physical, social, and technological strategies in reducing vulnerability and enhancing resilience.

Finally, a frequency analysis of the extracted codes indicated that while categories related to “physical resilience” and “infrastructure improvement” exhibited the highest coding frequency, categories such as “social capital” and “housing support policies” possess higher strategic importance for long-term sustainability despite their lower frequency. This distinction demonstrates that the conceptual weight of categories in crisis management is not merely a function of code frequency but is heavily dependent on qualitative interpretation.

Discussion and Conclusion

The findings of this research demonstrate that enhancing resilience is not achieved through isolated physical interventions alone; rather, it emerges from the synergistic interaction of three critical dimensions: physical/infrastructural, social/institutional, and technological/policy-related. The extraction and organization of 11 core categories into these dimensions provide an operational framework for understanding the mechanisms required to promote resilience and reduce vulnerability in dilapidated urban contexts.

A synthesis of the analyzed documents suggests that crisis management can only effectively mitigate vulnerability in degraded landscapes if it adopts an integrated, cross-sectoral, and participatory approach. Furthermore, the successful implementation of such management is contingent upon the integration of emerging technologies—including GIS and AI—alongside nature-based solutions and the development of supportive housing and land-tenure policies.

The results indicate that the heightened vulnerability of dilapidated areas to environmental hazards stems from the complex interplay between high-risk spatial factors, infrastructural fragility, and institutional inefficiencies. This finding aligns with previous studies regarding the role of location and infrastructure in the reproduction of risk (16,19). Additionally, the scarcity of accurate, systematic, and localized data was identified as a primary obstacle to the effective planning and execution of crisis management interventions.

Based on these findings, three strategic axes were identified as having the most significant impact on urban resilience: a)physical reinforcement and infrastructural upgrading; b) enhancement of public education and the development of early warning systems; c) fortification of social capital and institutional capacities. (Table3)

Table 3. Key categories of urban crisis management in dilapidated contexts (Source: Author)

Main dimension	The central category	Brief description
Physical-infrastructure	Physical reinforcement Infrastructure upgrade Securing public spaces Nature-based solutions	Increasing the safety of structures and buildings Improving water, electricity, and road networks Reducing risk in open spaces Reducing floods and environmental hazards
Social-institutional	Education and public awareness Social participation Social capital Institutional coordination	Increasing citizens' preparedness The role of the local community in crisis management Trust and local networks Coherence between devices
Technological– policy-related	New technologies early warning Housing support policies	GIS, Remote sensing, Artificial intelligence Reducing human casualties Security of ownership and risk reduction

Table 4. Strategic operational model of crisis management in dilapidated contexts (source: author)

Row	Strategic layer	Key actionable actions
1	Governance and institutional coordination	Creation of a special headquarters, unit command structure, interdepartmental coordination, risk database
2	Physical and infrastructure	Identifying high-risk areas, retrofitting, emergency routes, strengthening vital arteries
3	Social-participatory	Neighborhood volunteer groups, training exercises, local information and warning network
4	Technology	Risk GIS system, drone for monitoring, smart dashboard, alert and evacuation application
5	Emergency operation	Crisis scenarios, evacuation plans, safe spots, equipment and rapid response teams
6	Reconstruction and resilience	Resilient regeneration, public participation, sustainable financial models, continuous evaluation and improvement

Departing from much of the existing literature, which has predominantly focused on physical and technical dimensions, this study highlights the critical—yet often overlooked—importance of social capital, local education, and microfinance mechanisms as vital components of sustainable crisis management. To enhance resilience in dilapidated urban areas, it is recommended to establish comprehensive local databases and data-driven systems to monitor and identify high-risk zones; empower local institutions and neighborhood councils through the provision of financial, technical, and educational resources; prioritize the retrofitting of housing units and the reinforcement of emergency access routes; implement nature-based solutions, such as green space expansion and; ensure land and housing tenure security and design localized, accessible early warning systems; sustainable drainage system to strengthen social capital and public awareness through structured preparedness exercises and community workshops; develop microfinance mechanisms, including low-cost insurance and micro-loans tailored for low-income households; enhance cross-sectoral coordination by integrating short-term emergency responses with long-term strategic planning; and employ advanced technologies, such as remote sensing, Unmanned Aerial Vehicles (UAVs/drones), and AI-driven monitoring systems, in order to ensure ongoing evaluation (Table 4).

Compliance with Ethical Guidelines

There were no ethical considerations in this research.

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Author’s Contributions

This article is based on Mohammad Farajpour’s PhD thesis at Eslamshahr University, who was responsible for conducting the research, collecting, and analyzing the data; and the second author, Fatemeh Adibi Saadinejad, was responsible for supervision, and Azadeh Arbabi Sabzevari and Fereshteh Navidi Majd were responsible for the design and methodology. However, Mohammad Farajpour was responsible for correspondence and editing the final manuscript submitted to the journal.

Conflict of Interests

The authors declare no conflict of interest.

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