

Comparative study of global urban resilience frameworks and presentation of a context-based framework of resilience indicators for Iran

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Detailed abstract

Introduction

Urban resilience has increasingly become a strategic concern as cities face the simultaneous pressures of climate change, natural hazards, urban growth, and complex socioeconomic transformations. Although numerous international frameworks and indicator systems have been developed to assess and strengthen urban resilience, their concepts and indicators were largely formulated within particular institutional, economic, spatial, and governance contexts. Consequently, direct transfer of global frameworks to countries with different structural conditions may not adequately represent local vulnerabilities, capacities, and implementation constraints. This issue is particularly important in Iran, where cities are exposed to multiple natural hazards, infrastructure vulnerabilities, deteriorated urban fabrics, climatic pressures, and institutional constraints. The central problem is therefore not the absence of resilience indicators, but the systematic selection, prioritization, and contextual adaptation of existing indicators. This study aimed to comparatively analyze global urban resilience frameworks, identify their common and distinctive dimensions and indicators, and develop a context-based framework suitable for the institutional, social, environmental, spatial, and managerial conditions of Iranian cities. The study specifically sought to determine how global resilience knowledge can be integrated with expert assessment of its importance and applicability in Iran.

Materials and Methods

A mixed-method exploratory and validation-oriented design was employed. In the qualitative phase, relevant scientific studies and formal international frameworks were systematically identified and comparatively examined in terms of dimensions, components, indicators, areas of emphasis, and conceptual characteristics. The literature search was conducted in the Web of Science Core Collection using a search strategy focused on urban resilience frameworks, assessment frameworks, indicators, policy, and governance. From 93 initially identified records, successive screening procedures resulted in 43 scientific articles. To ensure coverage of formal international frameworks that may not be retrieved through academic database searches, 13 additional documents from international organizations and institutions, including UNDRR, UN-Habitat, ISO, and Arup, were purposively added.

Thus, 56 documents constituted the final qualitative evidence base. Qualitative content analysis was conducted in MAXQDA using the Strauss and Corbin three-stage coding approach: open, axial, and selective coding. The process identified recurring concepts and organized them into components and higher-order dimensions. The resulting indicators were then assessed quantitatively by 21 experts in urban planning, urban design, urban management, urban resilience, and disaster management. Experts evaluated 68 extracted indicators on two 10-point scales: their importance for enhancing urban resilience and their suitability for the Iranian context. Internal reliability was assessed using Cronbach's alpha. Content validity was reviewed by relevant experts, while agreement among experts was assessed using Kendall's coefficient of concordance. Descriptive statistics and the Friedman test were used to examine priorities, and the non-parametric Wilcoxon signed-rank test was applied to compare the paired assessments of indicator importance and contextual suitability. Finally, qualitative and quantitative evidence was integrated to construct the context-based framework.

Findings

Comparative analysis demonstrated substantial conceptual overlap among global frameworks, although their emphases and intervention logics differed. The Sendai Framework and the UNDRR Disaster Resilience Scorecard primarily emphasize disaster risk reduction, preparedness, response, recovery, and governance of risk. The City Resilience Framework and City Resilience Index adopt broader systems-oriented approaches incorporating social, economic, physical, infrastructural, environmental, and governance dimensions. ISO 37123 emphasizes measurable and standardized indicators, whereas participatory approaches such as CityRAP place greater emphasis on local capacity building, stakeholder participation, and action planning. Content analysis identified ten broad dimensions of urban resilience: monitoring and assessment; urban planning and policy; disaster risk management; environmental resilience; infrastructure; physical environment; economic resilience; social resilience; institutional capacity; and governance. Frequently recurring concepts included indicators, assessment, stakeholder engagement, transportation, recovery, evaluation, collaborative governance, disaster risk reduction, investment, education, institutional coordination, preparedness, performance, innovation, land use, density, public awareness, urban planning, monitoring, and housing. The qualitative results therefore confirmed that global urban resilience is multidimensional and extends beyond emergency response to include preventive, institutional, infrastructural, social, environmental, and developmental capacities.

The quantitative assessment revealed a statistically significant difference between the perceived importance of indicators and their suitability for Iran. The overall Wilcoxon test produced $Z = -3.783$ with $p < 0.001$, indicating a significant contextual gap. In all examined dimensions, suitability scores were lower than importance scores, demonstrating that indicators considered theoretically important in global frameworks cannot necessarily be transferred directly to the Iranian context. The Friedman test also showed significant differences among indicator priorities ($\chi^2 = 576.709$, $df = 67$, $p < 0.001$), while Kendall's $W = 0.410$ indicated a moderate level of agreement among the 21 experts. Among the highest-

ranked priorities were access to basic services, safety of buildings and critical infrastructure, compliance with strengthening standards in urban plans, and institutional preparedness for disasters. At the dimensional level, the physical dimension received the highest priority, followed by environmental resilience and overall urban resilience. Critical infrastructure, disaster risk management, physical environment, and environmental resilience consequently emerged as priority areas for Iranian cities.

The final framework was organized into three interconnected levels. The first level comprises priority dimensions and components, particularly the physical environment, environmental resilience, critical infrastructure, and disaster risk management. The second level includes supporting dimensions that facilitate resilience implementation, including urban planning and policy, urban governance, institutional capacity, and monitoring and assessment. The third level consists of developmental dimensions that sustain resilience over the long term, including economic diversity, social capital and citizen participation, social justice, innovation, and learning capacity. Indicator selection was based on three complementary criteria: conceptual prominence in global literature, importance according to experts, and suitability for Iranian conditions. Indicators with high importance and high suitability were treated as priorities; those with high importance but lower suitability were identified as requiring contextual adaptation; and indicators dependent on longer-term developmental capacities were placed within the developmental level.

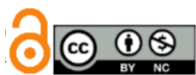
Discussion and conclusion

The findings demonstrate that urban resilience should be understood as a context-dependent and multidimensional capacity rather than as a universally transferable list of indicators. The significant gap between theoretical importance and contextual suitability provides empirical support for the need to adapt global resilience frameworks before applying them in Iran. The results also indicate that the priorities of Iranian cities are strongly associated with physical and infrastructural vulnerability, exposure to natural hazards, environmental pressures, and the capacity of institutions to manage risk. At the same time, governance, institutional capacity, participation, and monitoring remain essential supporting mechanisms because they create the conditions through which priority resilience measures can be implemented and continuously improved.

The proposed framework therefore does not reject international resilience knowledge; instead, it retains its core principles while reorganizing and prioritizing indicators according to local conditions. Its three-level structure provides a pathway rather than a simple classification: supporting capacities create the enabling conditions for priority operational capacities, while developmental capacities provide the basis for the continuity and sustainability of resilience. Continuous monitoring and evaluation can, in turn, feed back into policy adjustment and framework refinement. This integrated structure offers a systematic basis for urban policy-making and planning in Iran by distinguishing indicators that can be directly prioritized from those requiring adaptation or longer-term institutional and developmental investment. The study contributes a methodological pathway for moving from global resilience

knowledge toward a locally grounded framework through the combined use of comparative analysis, qualitative content coding, and expert validation. Its practical value lies in helping planners and policymakers identify contextually appropriate priorities rather than assuming equal applicability of all internationally recognized indicators.

Keywords: Urban resilience; context-based framework; comparative analysis; indicator localization; content analysis; Iran



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