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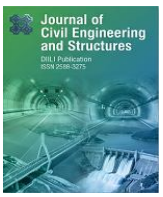

Original paper

Localized Resilience: A pathway to justice-based urban development

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ABSTRACT

Contemporary cities in Iran face a complex array of threats and challenges that are no longer merely natural or technical in nature, but are rooted in social, spatial, institutional, and environmental structures. Key challenges include increasing climate variability, the expansion of natural hazards such as floods, droughts, urban heat islands, and water crises, inequality in resource distribution, and the fragility of urban infrastructure. In such conditions, the concept of urban resilience has gained increasing importance as a theoretical and operational framework for assessing and enhancing cities' capacity to confront, adapt to, and recover from crises. This article, based on conceptual and empirical analysis, examines the status and quality of urban resilience in Iran. A significant portion of policymaking and interventions remains at the physical and infrastructural level, with weak connections to soft dimensions such as social participation, multi-level governance, and spatial justice. On the other hand, modern urban planning approaches emphasize the need for integration between resilience, urban health, and spatial justice. Resilient cities must not only withstand hazards but also possess the ability to reconstruct structures, maintain quality of life, and ensure equitable access to key resources such as green spaces, public transportation, health-oriented infrastructure, and opportunities for social participation. In this regard, attention to neighborhood scale, strengthening local institutional capacities, and utilizing multidimensional data in decision-making can play a crucial role in enhancing the quality of resilience.

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1. Introduction

The vital systems of cities are complex networks that collaborate across interdisciplinary components to ensure their long-term survival [1]. These systems are designed to meet societal demands by providing essential services such as shelter, energy, water, heating, cooling, transportation, and communication, while simultaneously safeguarding the integrity and functionality of the community [2]. Moreover, these systems strive to preserve their biological structure when confronted with various threats, including natural disasters, accidents, cyberattacks, terrorism, sabotage, criminal activities, and negligence. Consequently, ensuring the resilience of key systems through reliable assessments and established frameworks is crucial for the survival and sustainability of society.

1.1. The Concept of Resilience

Resilience first emerged in the built environment in the late 1990s and gained popularity following a series of disasters [3-5]. It aims to develop systems that are more flexible, safer, and more adaptive. Resilience strategies adopt an integrated approach to the physical and technological components of a city's key systems, as well as their socio-ecological and technological dimensions [6-9].

The ability of a city and its systems to prevent and recover from adverse outcomes by reducing the time required to eliminate a specific shock or threat is defined as resilience [10-12]. Urban resilience encompasses social, environmental, physical, economic, and policy dimensions. It is composed of complex and interconnected systems [13-15].

Social activities such as community coordination and social networks are vital for intervention and recovery, especially after a major tragedy [15-17]. Services and interventions related to green infrastructure and ecosystem protection are essential for urban resilience, as they support climate change mitigation, water management, and biodiversity. Moreover, technological advancements enhance the robustness of vital systems that constitute the city, making monitoring, intervention, and recovery processes more efficient [18-20].

Economic resilience promotes social sustainability by creating conditions for the preservation and continuity of resources [21]. Resilient resources and infrastructure from regional to neighborhood levels have become a political issue. In the face of multiple crises, resilient social and spatial structures are prerequisites for crisis management and mitigation, affordable housing, access to public/private infrastructure, and flexible

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forms of mobility (such as promoting non-motorized and active transportation). Targeted strategies to enhance urban health and resilience with the necessary robustness and adaptability are essential in the pursuit of spatial justice [21].

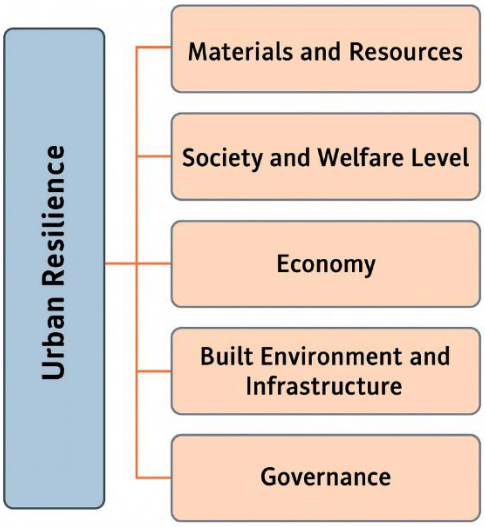

Fig 1. Characteristics of Urban Resilience.

1.2. The Concept of Localization

According to Saskia Sassen, industrialization and globalization have led to an ongoing shift toward standardized global architectural models, often resulting in the loss of local identities and the dominance of homogenizing approaches [22]. This transformation has created a significant gap in understanding how traditional and indigenous practices can respond to modern urban challenges. In fact, today's problem lies in the lack of comprehensive knowledge on how to effectively integrate these historical practices into contemporary urban design.

Nevertheless, recent years have witnessed renewed interest in indigenous urbanism due to its environmental and cultural significance. As Paul Oliver emphasizes, indigenous urbanism rooted in flexibility, creativity, and contextual integration can make a substantial contribution to contemporary urban design [23]. Cities around the world now face unprecedented challenges stemming from rapid urbanization, environmental changes, and cultural homogenization [24]. The value of indigenous urbanism lies in its ability to address these issues through long-standing solutions that are physically and socially aligned with their surroundings [25].

Unlike modernist approaches that prioritize efficiency and standardization, indigenous urbanism promotes sustainable living and climate-responsive design elements that can strengthen cultural identity and improve urban quality of life [26]. As Baker notes, these perspectives are based on the premise that indigenous urbanism offers valuable solutions to contemporary challenges in sustainability, resilience, and cultural preservation [27].

1.3. Dimensions of Localization in Urban Resilience

1.3.1. Environmental Drivers

Local climatic conditions, topography, and access to natural resources determine the form, materials, and orientation of indigenous urban fabrics. Climate-responsive design is emphasized because it enhances environmental adaptation while promoting comfort and sustainability. Key elements include proper building orientation for natural ventilation, daylight penetration, passive cooling, and reduced heat absorption through materials in extreme weather. Techniques such as thick walls, internal courtyards, and reflective white roofs help regulate temperature. Integrated water management using rainwater harvesting systems and natural drainage through environmentally sensitive landscape design reduces surface runoff and prevents flooding [26]. For example, in hot and dry regions, traditional buildings feature thick walls and small windows to maintain cool interiors, while in hot and humid climates, elevated structures and open plans enhance airflow and reduce humidity [22].

1.3.2. Socio-Cultural Drivers

Community-based design refers to urban planning approaches that prioritize residents' needs, values, and social interactions. This design philosophy fosters public spaces such as squares, markets, and gathering areas that strengthen social bonds and community cohesion. It also supports mixed-use development (residential, commercial, recreational), which boosts local economies and reduces long-distance travel [28]. Active community participation in design and planning ensures that cultural traditions are reflected in urban spaces. This model is common in traditional villages and towns, where central squares serve as hubs for markets and social interaction [23].

To counter cultural homogenization in the modern world, cultural diversity and traditional practices must be integrated into contemporary urban design. Thus, modern urban development plans can incorporate indigenous architectural principles to preserve architectural heritage and reinforce historical continuity. As highlighted by UN-Habitat, valuable traditional elements should be included in design to preserve the unique aesthetics that distinguish a city from global trends. Moreover, indigenous practices are deeply tied to regional and cultural contexts, each tailored to local conditions. This approach utilizes traditional techniques and materials to respond to the unique characteristics of different environments [24].

1.3.3. Economic Drivers

Access to affordable local materials, local labor, and reduced transportation costs enables low-cost construction methods. These approaches provide basic housing in low-income areas and support small-scale industries, thereby enhancing local economic prosperity and household financial sustainability.

1.3.4. Political and Institutional Drivers

Policies that mandate or encourage the use of traditional materials and techniques in public and private construction projects can significantly promote indigenous styles. Encouraging the use of local materials and traditional construction methods in contemporary architecture not only reduces environmental impacts but also revives indigenous techniques. Certification programs for green building practices rooted in traditional methods can attract developers' interest.

Governments can allocate funds for the restoration and maintenance of traditional buildings to ensure their preservation for future generations. Heritage conservation programs are essential for safeguarding and revitalizing indigenous architecture. These programs aim to preserve traditional construction methods, materials, and cultural expressions embedded in architectural forms. Such initiatives ensure that the rich heritage of indigenous architecture continues to inspire sustainable and culturally grounded development. Subsidies and financial incentives play a crucial role in promoting the revival of indigenous architecture by reducing economic barriers for communities, builders, and artisans. These supports make the use of traditional methods in contemporary contexts more accessible and sustainable.

Integrating indigenous architecture into urban planning requires policies that protect cultural heritage, promote sustainability, and adapt traditions to contemporary urban needs. These regulations ensure that indigenous architectural features coexist with modern urban development, making projects both environmentally sustainable and culturally appropriate. Incorporating indigenous principles into urban development codes ensures that cities maintain a balance between modernity and cultural heritage [29].

1.3.5. Materials

Using locally available materials not only reduces environmental impacts but also supports the local economy. This approach favors materials such as local stone, clay, wood, or bamboo that are likely available in the region. Traditional construction methods that leverage the inherent properties of these materials are also emphasized. These techniques reduce energy consumption and greenhouse gas emissions from material transport, lowering the project's environmental footprint [27]. For instance, in clay-rich regions, techniques like rammed earth are used, while in forested areas, wooden structures are more common [24].

1.3.6. Sustainability

Sustainable design focuses on optimal resource use, reduced energy and water consumption, and long-term ecological balance. This includes passive solar design, natural ventilation, and effective waste management. It also emphasizes the durability and adaptability of structures to maintain functionality over time. Strategies for reducing construction waste and reusing or recycling materials are part of this framework. While many modern buildings rarely prioritize sustainability, traditional structures often feature green roofs, natural cooling through water evaporation, and the use of recycled or local materials demonstrating a commitment to environmental stewardship [25].

2. Justice-Based Urban Development

2.1. The Concept of Justice-Based Urban Development

Organizations such as the United Nations have played a key role in promoting the global resilience agenda. Similarly, the Rockefeller Foundation's "100 Resilient Cities" (100RC) initiative has supported cities in developing resilience strategies and plans [30,31]. Cities are increasingly focusing on resilience, yet it remains unclear who truly benefits from these efforts. Currently, resilience is distributed unequally across communities. Numerous studies have shown that hazards disproportionately affect low-income and minority groups, who receive fewer resources for recovery, and disruptions often exacerbate existing inequalities [32].

Therefore, for a city to be genuinely resilient, it must address all forms of social inequality. The 100RC initiative promises to "make cities better for all citizens, especially the poor and vulnerable, in good times and bad" [33]. Similarly, UN-Habitat states that "global agendas that consider resilience as a key concept will ensure that the call for sustainable and resilient cities leaves no one behind" [24]. These statements highlight that resilience programs and policies must be socially just.

The concepts of social justice and equity have evolved over time. Historically, the focus was primarily on distributive justice how resources, services, and opportunities are allocated among individuals. Over time, this definition has expanded to include active citizen participation in decision-making and the recognition of cultural, social, and historical differences as essential elements of justice.

Accordingly, this study adopts a three-dimensional framework of social justice [35], which includes:

- Distributive Justice: Fair distribution of resources, services, and opportunities
- Recognitional Justice: Acknowledgment of cultural, historical, and social differences among groups
- Procedural Justice: Ensuring equal and meaningful participation of all individuals in decision-making and policymaking processes

Each of these dimensions and especially injustice within any of them plays a critical role in shaping the resilience of communities. In other words, urban resilience cannot be inclusive or sustainable without considering justice at all three levels [34].

2.2. Dimensions of Justice

2.2.1. Distributive Justice

Political theorists have traditionally defined justice in relation to the distribution of goods and liberties. John Rawls describes justice as "a criterion for evaluating the distributive aspects of the basic structure of society." Advocates of distributive justice define fair outcomes as the equitable allocation of material resources among all members of society.

Importantly, distributive justice is not synonymous with absolute equality (equal distribution for all). In some cases, social resources must be allocated in ways that specifically improve the welfare of marginalized groups [35]. In urban resilience planning, distributive justice means fair access to goods, infrastructure, environmental amenities, services, and economic opportunities. Conversely, the distribution of undesirable urban land uses (such as pollution or industrial zones) is also critical and has long been a concern of environmental justice advocates.

In a study with a descriptive-analytical approach, the historical context around the "Gap" Bridge in the historical city of Khorramabad in western Iran was examined, and the complex restorations carried out in the aforementioned context and its role in the revival and reintegration of the architectural ensemble were examined [36].

Recent studies have raised concerns about distributive inequalities in resilience projects. These studies show that trade-offs are inevitable in implementation, and vulnerable groups often benefit the least [37,38]. For example, land-use planning distinguishes between "active measures" that impose negative consequences (such as forced displacement) on marginalized groups, and "passive measures" where these groups are excluded from the benefits of resilience [39].

2.2.2. Recognitional Justice

While distributive justice is essential, it alone is insufficient for achieving equitable resilience outcomes. Social justice scholars like David Schlosberg emphasize the need to identify the underlying social structures that lead to unequal distribution. A sole focus on optimal distribution models may overlook cultural, social, and institutional contexts [40]. Many distributive inequalities stem from a lack of social or political recognition—manifested through various forms of insult, devaluation, and marginalization at individual and cultural levels [35].

Recognitional injustices involve institutions such as beliefs, norms, culture, and language that shape group differences and determine unequal distribution. Recognition is a "social relationship" and a "norm embedded in social practice," and cannot be reduced to a subset of distribution. In contrast, recognitional justice means equal respect and acknowledgment of diverse identities and social positions.

In resilience planning, recognitional justice includes:

- Identifying intersecting identities (e.g., race, gender, class, age)
- Understanding how these identities are shaped by historical injustices and affect vulnerability, resource access, and decision-making capacity
- Promoting respect for group differences [34]

Efforts to enhance recognitional justice must focus on identifying and transforming social and cultural factors that undermine group dignity and hinder full societal inclusion. For example, calls for formal recognition of Indigenous nations and greater respect for specific cultural traditions are examples of struggles for recognitional justice.

Additionally, Mitin emphasizes that "identity, place, and social context together shape the reality that influences how individuals perceive themselves and how policymakers treat them" [44].

2.2.3. Procedural Justice

The third dimension of social justice focuses on decision-making processes those that determine resource distribution and formal recognition. Procedural justice refers to "fair and equitable institutional processes at the governmental level" [35].

In resilience planning, procedural justice means equal participation in decision-making processes. This includes public involvement in plan development, efforts to increase ongoing citizen engagement in urban governance, and targeted outreach to marginalized groups who are often excluded from traditional public participation mechanisms.

Procedural justice is closely linked to both recognitional and distributive justice. A person's or group's inclusion in decision-making is essential for fair resource distribution. Without recognition, one cannot participate in society, and without participation, one's specific needs cannot be identified. Recognitional justice can foster more inclusive, participatory, and democratic governance that better understands and responds to diverse needs and solutions [41]. It also helps identify historical inequalities and prevents the continuation of unjust resource distribution and social neglect [42].

Recent studies emphasize the importance of participatory and inclusive processes in resilience planning [37,39,43,44]. For example, Mitin and colleagues note that "ample evidence highlights the need for diverse social groups to participate in decisions that affect resource distribution and human-environment relations" [44].

However, Anguelovski and colleagues have shown that climate adaptation planning often framed as resilience planning has failed to meaningfully include marginalized groups in practice [39]. In response to these concerns, Siğfogel proposes the concept of "negotiated resilience," which adopts a fully procedural approach to resilience [43].

Unlike many conventional resilience models, the concept and process of negotiated resilience do not predefine what resilience can or should be. Instead, it emphasizes creating space for discursive dialogue and negotiation around the interests, values, and experiences of diverse groups, including marginalized populations. The focus on "negotiation" as a verb highlights the process-oriented nature of resilience. Resilience is not something that "exists" or can be uniformly defined or implemented, but rather a continuous process of defining or redefining its meaning through diverse actors and interests across regions and scales.

Crucially, these negotiations can only be fair and inclusive if all participants have equal access to relevant information. Moreover, they require processes that continuously support meaningful participation. The negotiated resilience process necessarily involves deliberation, consultation on trade-offs, prioritization of interests, and critical evaluation and redistribution of benefits and burdens leading to an iterative process of repositioning.

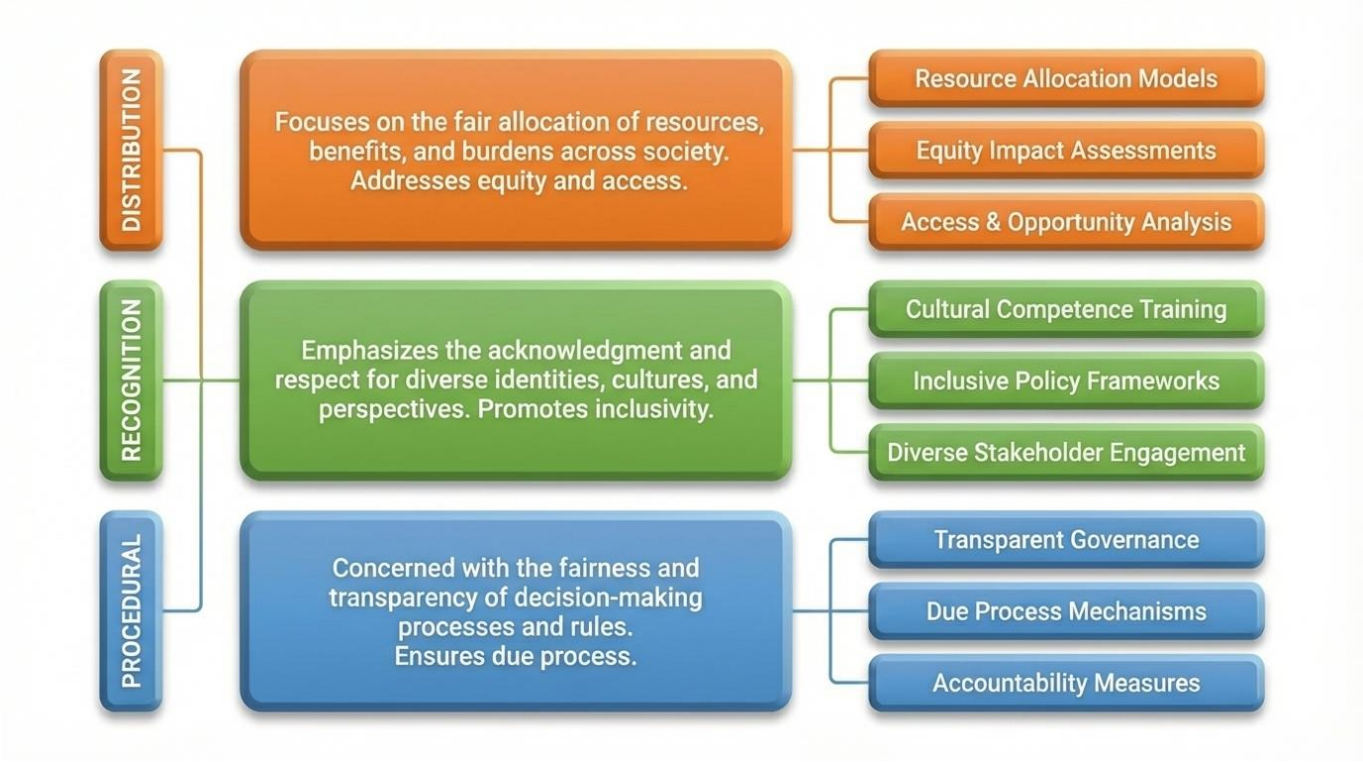

Fig 2. Dimensions of social justice in urban resilience [37].

3. Urban Poverty

Macro and micro-level urban policies have clearly failed to address pressing issues such as social justice, urban poverty alleviation, and conflict reduction. Efforts by relevant institutions in urban management have generally not led to significant achievements in reducing urban poverty, structuring urban morphology, improving socio-economic relations, or promoting civic culture beyond the basic expectations of urbanization [45-49].

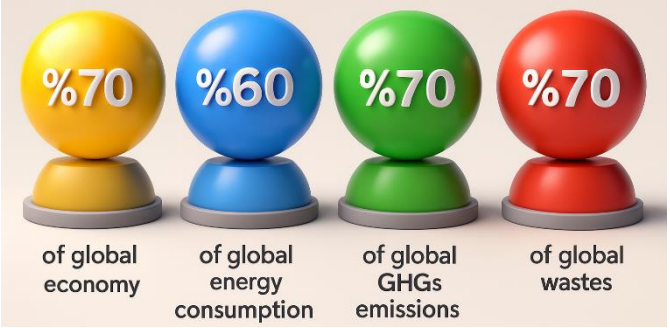

Fig 3. Economic and environmental share of cities in the world.

Figure 1 illustrates the share of the global economy and the environmental impact of cities. Although cities occupy only about 2% of the Earth's surface, their socio-economic influence, resource consumption, and contribution to various forms of pollution are substantial and growing [50]. From every perspective, decisions made by urban managers, architects, and mayors significantly shape the landscape, culture, economy, and ecology of cities and the planet.

In contemporary terms, citizenship is defined as a relationship between the individual and society, which can be categorized into four dimensions:

- Political/legal
- Social
- Cultural
- Economic

The economic dimension of citizenship pertains to the relationship between individuals, the labor market, and livelihood. It encompasses the right to work, access to minimum subsistence, and opportunities for education and professional skill development. Without realizing this economic dimension, citizenship remains unfulfilled in practice [51].

In recent decades, development institutions have been tasked with planning for "deprived areas," yet a precise definition of urban poverty remains elusive. According to the Ministry of Cooperatives, Labor, and Social Welfare, only 8% of poor households reside in rural areas, indicating that poverty is predominantly an urban phenomenon.

From the perspective of urban livelihood, access to land and housing is a prerequisite for realizing citizenship. Expecting responsible behavior from urban dwellers who are deprived of basic rights in this domain is illogical. Rights and responsibilities only gain meaning through reciprocal interaction; citizens deprived of fundamental rights may comply with laws, but they will lack a sense of belonging and responsibility.

Land ownership remains the primary indicator distinguishing the poor from the affluent worldwide. As noted in the report on housing for the poor in Asian cities (2018): "More than anything else, access to secure land is the factor that differentiates the poor from the non-poor. Without addressing the issue of land, no meaningful solution to the housing problem of the urban poor can be found."

3.1. Key Mechanisms of Urban Spatial Inequality

3.1.1. Spatial Division and Control

Major crises such as war, earthquakes, or climate change often prompt governments to exert greater control over public spaces and urban lands. This control can lead to the exclusion of poor populations from urban spaces. In recent years, some Iranian cities have witnessed rapid land-use changes in public areas as a hasty response to housing crises.

3.1.2. Inequality in Urban Reconstruction

Post-crisis investments typically target areas with higher economic returns, while low-income or marginalized neighborhoods are often neglected, exacerbating structural inequality.

3.1.3. Urban Poverty and Spatial Polarization

The phenomenon of "urban compartmentalization" refers to the creation of enclosed and controlled spaces accessible only to specific social groups. This trend intensifies socio-economic segregation. Examples include the emergence of gated communities in Tehran and other major cities.

3.1.4. Security-Oriented Urbanism in Times of Crisis

Crises often serve as pretexts for increased security and surveillance measures in cities, which disproportionately affect vulnerable groups. For

instance, during the Rio Olympics, impoverished neighborhoods were marginalized to enhance the city's visual appeal.

According to the International Labour Organization and the United Nations (2024), the informal economy encompasses activities that fall outside legal and formal frameworks. This form of economy thrives under conditions of poverty, gender inequality, and job insecurity, and tends to intensify during periods of crisis. The ILO asserts that unless the informal economy is formalized, the realization of social justice and citizen equality will remain an illusion.

In both developed and developing countries, market-driven urban economies have concentrated wealth in specific urban zones, pushing poor populations into deprived neighborhoods. These areas suffer from weak infrastructure, inadequate education, poor health services, and social stigma, thereby widening the gap between affluent and impoverished urban districts.

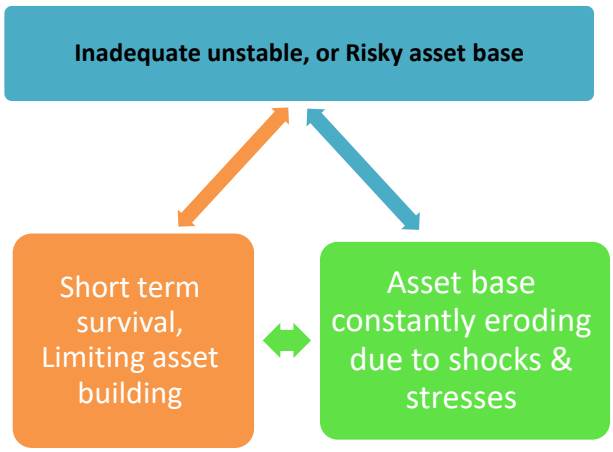

Fig 4. Cycle of urban poverty renewal.

3.2. The Cycle of Urban Poverty Intensification

Research indicates that urban poverty evolves through a reinforcing cycle, where each stage exacerbates the next:

- Insufficient and Unstable Asset Base: The assets of poor populations—especially in housing and land—are limited and insecure, fostering economic instability.
- Asset Collapse Due to Economic Shocks: Recurrent economic crises erode assets and reduce the resilience of the poor to fluctuations.
- Short-Term Survival Strategies: Due to asset instability, the poor prioritize immediate needs over long-term investments in skills or sustainable assets, hindering economic advancement.

This process ultimately leads to the formation of urban poverty traps that are difficult to escape.

Grant (2010) emphasizes that urban poverty has a spatial dimension intertwined with social, economic, and institutional processes. Local governments play a pivotal role in attracting investment, developing skills, mitigating climate crises, and supporting the poorest communities. His research underscores the need for strategic and sustainable policymaking to address urban poverty and warns that neglecting these issues may lead to the proliferation of "new spatial poverty traps" and deepen urban inequalities.

4. Experiences of Cities Rebuilt After Disasters Utilizing a Resilience-Based Approach

4.1. Lisbon (Portugal) Enlightenment Urbanism and a New Civic Order

Lisbon was one of the first cities to be rebuilt under Enlightenment ideals through a comprehensive modern plan, initiated in the 18th century by the Marquis of Pombal. On November 1, 1755, the city was struck by a devastating earthquake, followed by aftershocks, a tsunami, and fires, destroying between half and two-thirds of the city. Over two centuries later, on August 25, 1988, another disaster struck: a massive fire ravaged the Chiado district one of Lisbon's most iconic areas, which had also been severely damaged in the 1755 quake. Its reconstruction turned Chiado into one of the city's most charismatic and beloved neighborhoods.

The 1755 disaster had a profound impact on international discourse, leading to the development of civil protection systems and a uniquely strategic reconstruction plan in Portugal—rare even by European standards. It marked a turning point in urban planning and architecture, whose influence remains under recognized globally.

The Pombaline plan, implemented in 1758, was the first in history to be fully designed and executed with legal, urban design, and financial frameworks. It introduced a rational grid of longitudinal and transverse streets, replacing the medieval layout with a pragmatic and logical urban structure. Key innovations included:

- Earthquake- and fire-resistant construction
- Sanitation and circulation networks
- Prefabricated, standardized building components (e.g., window frames, stonework, railings)

This plan also introduced a new urban unit that shaped architectural dominance at the city scale. It embodied Enlightenment rationalism, rejecting ornamentation and grandeur in favor of simplicity, standardization, prefabrication, cost-efficiency, and urban growth forecasting. The need to centralize public services, banks, corporate offices, department stores, and modern commerce alongside the introduction of new transport systems like trains, trams, and elevators fueled the modernization of Baixa, both in public spaces and private buildings.

4.2. San Francisco (USA) From Ruin to a Modern Metropolis

The 1906 earthquake and fire dramatically reshaped San Francisco, destroying buildings and rendering neighborhoods unrecognizable. Reconstruction began almost immediately, with a strong emphasis on speed. City officials feared that without projecting strength and control, they would lose the foreign investment crucial for rebuilding. While the city looked outward, rapid reconstruction deeply altered residents' lives and inspired awe with new sights, technologies, products, and architecture.

Visible changes included the rebuilding of commercial and residential structures. Initially, the homeless were housed in refugee camps and later in earthquake cottages, which were eventually replaced by permanent buildings. Some surviving structures were repurposed, and others were designed to impress such as the New City Hall, completed in 1915. It became the tallest building in the city and a powerful symbol of San Francisco's rebirth.

Smaller changes reflected a shift toward technological optimism. Just eight days after the quake, streetcars resumed service, and soon electric trams replaced slower cable cars. Many cable routes were abandoned and rebuilt. Household technologies also advanced.

Interestingly, this period marked the first widespread use of paper money in San Francisco. California had long resisted paper currency, favoring metal coins for their stable purchasing power. Even during the Civil War, paper money was rare in the state. After the quake, the city's mint survived but became unusable due to gas infrastructure damage. Banks were also affected and remained closed for six months.

Post-quake San Francisco underwent a profound transformation in lifestyle and urban form. Rising from the rubble, the city embraced innovation and adaptability a spirit that endured for decades. This transformation was evident not only in grand architecture and modern infrastructure but also in the adoption of new technologies, social change, and a redefined urban identity from gas stoves to electric trams, from symbolic civic buildings to a new generation of architects and citizens, the city chose not just to survive, but to thrive.

4.3. Christchurch (New Zealand) Community-Led Urban Regeneration and Innovation

On September 4, 2010, a magnitude 7.1 earthquake struck the Canterbury region of New Zealand, centered near Darfield, about 40 km west of Christchurch. While damage was significant, there were no fatalities. However, this was only the beginning of a devastating sequence. On February 22, 2011, a shallow 6.3 aftershock struck directly beneath Christchurch's central business district during lunchtime, causing extreme

ground acceleration among the highest ever recorded in urban areas and widespread destruction.

In this alternate timeline, Christchurch adopts a radically different recovery strategy focused on community-based design, environmental sustainability, and innovative urban planning rather than the centralized, conventional approach that was actually implemented.

First, under intense public pressure and a series of community forums envisioning the "future city," the national government enacts legislation to establish a participatory governance model. This model grants equal power to local stakeholders, the Christchurch City Council, and central government representatives. For the first time in post-disaster recovery, this structure enables broad public participation through citizen assemblies with real decision-making authority.

Second, international reconstruction experts persuade New Zealand's leaders that the earthquakes present a unique opportunity to rethink urban development. Prime Minister John Key embraces this vision, declaring in a historic speech: "We will not merely rebuild Christchurch we will make it the most innovative and sustainable city of the 21st century."

By early 2012, the CRC facilitated an unprecedented public consultation process involving over 150,000 people (about 40% of Christchurch's population) through digital platforms, neighborhood meetings, and citizen assemblies. The resulting "Christchurch 2050" framework outlines principles that diverge sharply from the actual "Blueprint" plan:

- Prioritizing walkable, mixed-use neighborhoods over single-use zones
- Creating a low-traffic city center with extensive public transport
- Developing self-sufficient neighborhoods with daily needs within a 15-minute walk
- Integrating natural systems and ecological restoration throughout the urban fabric
- Preserving heritage alongside innovative architecture

Global Impact and Recognition By 2025, Christchurch will become a global model for post-disaster recovery and sustainable urban development. The "Christchurch Principles" for participatory recovery are adopted by the UN Office for Disaster Risk Reduction. The city receives numerous international awards, including:

- World Green City Award
- C40 Cities Climate Leadership Award
- UNESCO commendation for heritage innovation

Urban planning schools worldwide incorporate Christchurch case studies into their curricula, and several major cities launch exchange programs to learn from its recovery approach.

4.4. Cape Town (South Africa) A Valuable Experience in Managing "Day Zero"

Prior to the COVID-19 pandemic, Cape Town faced a major crisis known as "Day Zero"—the projected day when municipal taps would run dry, and residents would have to queue at approximately 200 distribution points to receive their daily ration of 25 liters of water.

The term "Day Zero" emerged in 2017 and 2018. Initially, it was predicted to occur in May, then moved to late April, until Deputy Mayor Ian Neilson announced on January 23, 2018, that Day Zero would fall on April 12, 2018. He urged everyone to join "Team Cape Town" and reduce water consumption.

At the time, reservoir levels had dropped to 27.2%, and only about 41% of residents were actively conserving water. The city's daily consumption remained at 586 million liters still 86 million liters above the target.

Fortunately, April 12 never arrived. A combination of collective public effort and winter rainfall helped avert the shutdown of the city's water supply. This experience permanently changed public attitudes and habits regarding water use, and many residents became familiar with the concept of "greywater."

Seven years later, Cape Town shared the lessons it had learned:

- Zahid Badroodien (Council Member): Water consumption was reduced by 40% during 2017–2018, equivalent to 32 billion liters.
- Jay Bhagwan (Executive Director of Water Use and Wastewater Management): We realized the need to diversify water sources and not rely solely on dams.
- Emphasis on demand reduction and citizen cooperation—no solution was sufficient without public participation.
- The importance of clear communication and accurate information in managing water scarcity crises.

To enhance water security, Cape Town launched the "New Water Program," which includes the following components:

- Water Reuse: Daily production of up to 70 million liters of potable water, starting March 2025
- Desalination: In the planning phase, a multi-stage technology to remove salt and contaminants
- Removal of Invasive Plants: Annual release of 55 billion liters of water in catchment areas
- Groundwater Utilization: Supplying over 100 million liters per day.

Table 1. Cities Reconstructed After Disasters with a Resilience Approach.

City	Type of Disaster	Response Strategies	Urban Innovation	Mental and Social Transformation	Global Impacts
Lisbon	Earthquake, Fire (1755)	Military Government; Centralized Reconstruction; Elimination of Aristocratic Privileges	Network Design; Resistant Buildings; Modern Infrastructures	Rationalism; Order in Urban Planning; Priority of the Middle Class	A model for modern urban planning Europe
San Francisco	Earthquake and Fire (1906)	Rapid Reconstruction; Reduction of Building Code Regulations; New Urban Plans	Reinforcing Concrete; Zoning; Mechanized Transport	Acceptance of Technology; Urban Optimism; birth of Earthquake Engineering	Influence on building regulations and construction culture; Technological innovation
Christchurch	Series of Earthquakes (2010-2011)	Social Participation; Creative Projects; Flexible Urban Planning	Temporary and Creative Spaces; Smart Technologies; Participatory Design	Social Cohesion; Collective Ownership; Urban Innovation	A global exhibition for urban innovation and public participation
Cape Town	"Day Zero" Water Crisis	Daily 25-Litre Water Ration; Enforcement of Consumption limit; Public Awareness	Education on Water Use; Digital Monitoring of Household Consumption	"Water Justice" Movement; Access Equality; Widespread Awareness about Water Crisis	A global model for cities facing water scarcity and demand management

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4.5. Comparative Reflections on Urban Resilience and Justice

The reconstruction of Lisbon after the 1755 earthquake exemplifies the necessity of integrating urban justice alongside structural reinforcement. Although the Pombaline grid plan strengthened the city's physical foundations, social cohesion was not achieved until institutional reforms and standardized construction were accompanied by genuine citizen participation.

In Christchurch, New Zealand, the involvement of over 40% of the population in shaping the "15-Minute City 2050" vision symbolized procedural justice and the recognition of intersecting identities. This experience combined disaster-resilient technologies with ecological restoration and heritage preservation, creating an innovative model that ensured both environmental sustainability and cultural solidarity.

San Francisco's post-1906 earthquake and fire reconstruction prioritized speed and foreign investment, enhancing the city's physical and economic capacity. However, the lack of distributive justice and effective participatory mechanisms widened social gaps. While innovations such as electric trams and the adoption of paper currency reflected citizen adaptability and creativity, the neglect of vulnerable groups underscored that true resilience is only realized when all segments of society benefit.

Cape Town's "Day Zero" experience demonstrated that urban resilience cannot rely solely on physical infrastructure. Citizen participation, demand reduction, and accurate communication helped avert a complete water shutdown. This event permanently transformed public consumption habits and highlighted the importance of justice in access to vital resources.

5. Conclusion

Urban resilience extends beyond physical and structural dimensions; it cannot be achieved through purely infrastructural measures. The sustainability of cities in the face of natural, economic, and social crises results from the interplay between robust infrastructure and empowered citizens. Building capacity among residents through the expansion of justice across distributive, recognition, and procedural dimensions alongside strengthening social and economic foundations and enhancing public awareness and responsibility, forms the core of a resilient city. Resilience is a concept that transcends structural reinforcement and requires the integration of four essential elements: participatory governance, social capital, equitable access to resources, and environmental adaptability. Global experiences show that multi-level and participatory governance enables procedural and recognition justice; the use of local materials and the revival of green infrastructure enhances environmental flexibility; strengthening social ties and cultural capital ensures social resilience; and fair distribution of urban resources and services realizes distributive justice and boosts economic resilience.

These international historical experiences also affirm that managerial neglect and the abandonment of vulnerable groups by national and local policymakers create significant gaps in the multifaceted structure of urban resilience during crises.

Conflict of interest

There is not conflict of interest.

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