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Explaining the strategies for achieving resilience in deteriorated urban fabrics (case study of region 4 of tehran municipality)

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Abstract

Resilience of deteriorated fabrics is important in urban planning. Deteriorated fabrics are parts of city that reduce resilience, and policies used in such fabrics, which also contain historic buildings, are more evident. The present study analyzes the state of resilience in deteriorated fabrics in Region 4 of Tehran Municipality. The research is applied in terms of purpose, exploratory in nature, and employs a qualitative-quantitative methodology. The data collection method is library-based.

The statistical population consisted of 80 experts from the Municipality of Region 4, urban planning professors, and doctoral students. A non-probability snowball sampling method was employed to gather responses, using a closed-ended questionnaire for data collection. A Delphi panel of experts was utilized to analyze the data. The experts evaluated various indicators—physical, environmental, social, economic, and managerial—extracted from theoretical foundations and relevant documents related to the studied area. The results of data analysis revealed the unfavorable status of 20 managerial-political criteria in three indicators "laws and regulations," "education,' and "support and supervision". The status of 20 economic criteria in four indicators "facilities and infrastructure," "activity and employment," "ability to compensate for damage," and "ability to return to suitable condition" was unfavorable. The status of 20 physical-environmental criteria in four indicators "deterioration," "accessibility," "vulnerability," and "resistance" was unfavorable. The status of 25 socio-cultural criteria in five indicators "security," "services," "tradition and culture," "participation and solidarity," and "awareness and education" was unsatisfactory. The study concluded that the deteriorated fabrics in Region 4 of Tehran Municipality have low resilience in all the aforementioned dimensions.

Keywords

Deteriorated Fabrics
Region 4
Organizational Approach
Resilience
Tehran

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1. Introduction

Rapid urbanization and uncontrolled city growth have led to many consequences, including deteriorated urban fabrics. These areas lag behind the development of other parts of the city and are cut off from the city's active life cycle. Deteriorated fabrics have formed over time due to the failure to implement organized plans and the neglect of resilience strategies. Once these fabrics met residents' needs; however, they can no longer perform the same role, either structurally or functionally (Kamanrodi et al, 2022: 3). Such fabrics have decreased resilience in physical, environmental (i.e., in natural disasters, including floods and earthquakes), social, and economic aspects.

Resilience refers to the capacity of social, economic, and environmental systems to withstand hazardous events by reorganizing to maintain core functions and structure while having the capacity to adapt, learn, and transform (Datala, 2023: 104). Analyzing resilience in deteriorated fabrics is crucial. Addressing disasters in these areas and planning to withstand them and mitigate their impacts are vital, given the significant human and financial damage caused by disasters and the higher costs of recovery compared to prevention (Zamani, 2024: 121). Moreover, deteriorated urban fabrics are more vulnerable than newly constructed ones, due to the age of buildings, narrow passages, limited access, lack of open and public spaces, and inadequate green urban areas, making it essential to take preventative measures before a disaster occurs (Sadeghi et al, 2020: 72).

The responsibility of urban management agencies in organizing old areas over time has evolved over several decades. The reconstruction approach was proposed in the 1950s to rebuild old city areas based on approved urban plans (comprehensive plan). The desired scale in this approach was the regional level, and national and local governments were considered stakeholder groups (Cesarona, 2024: 24). In the 1960s, the rehabilitation approach emerged. This approach, in addition to continuing the goals of the 1950s, focused on peri-urban areas development at the regional scale, considering the public sector as a stakeholder group. The attention shifted to a renovation approach in the 1970s, focusing on realizing programs at the neighborhood level and attracting the private sector participation, in addition to developing the peri-urban areas (Rasouli, 2022: 51). The redevelopment approach regained attention in the 1980s, with a focus on large-scale projects in both city centers and peri-urban areas at the neighborhood scale. The private sector and civil society organizations were considered stakeholder groups. In the 1990s, the regeneration and resilience of deteriorated urban fabrics across all dimensions (environmental, physical, economic, social, and managerial) garnered attention, aiming to implement urban plans in an integrated manner at the neighborhood scale. This approach revised strategies, presented new perspectives, and considered the public sector a stakeholder (Izadi & Hanachi, 2014: 11). The same evolution in approach to organizing deteriorated fabrics from the 1950s to the 1990s was also visible in many Iranian cities.

Unfortunately, the planning for deteriorated urban areas in Iran and improving their resilience has lacked a comprehensive, integrated view of all physical, environmental, economic, social, and managerial factors. Many Iranian metropolises, including Tehran, have extensive deteriorated areas. Tehran is being divided into poor and affluent neighborhoods, which is also evident in the deteriorated fabrics. Such structures are mostly concentrated in the city center, particularly affecting lower-income residents. Due to the low resilience of these structures in Tehran, especially in the central areas, many could be destroyed in the event of disasters such as earthquakes, floods, or fires, and providing post-disaster relief would be impossible due to the impenetrability of these structures. Additionally, the deterioration of water, gas, and electricity network infrastructures significantly increases risks during emergencies (Estelaji, 2017: 105).

In some neighborhoods of Region 4 of Tehran, the characteristics of a deteriorated fabric are evident. The most deteriorated neighborhoods are Shemiran-e-No and Kazemabad. The deteriorated neighborhoods in Region 4, characterized by their unresisting houses, narrow alleys, and dense population, were located outside the city boundary before the revolution. One notable feature of these areas is their potential to attract residents from lower socioeconomic backgrounds, as well as immigrants. To address their housing needs and generate income, many residents engage in unauthorized construction. They build their houses without a plan or regard for construction principles and standards. Unprincipled and irregular construction, narrow traffic passages, unattractive neighborhood appearances, a lack of various services, and vulnerability to disasters have contributed to lower land and housing prices as well as rents in these areas. As a result, people from lower social and economic classes are drawn to them again. These

factors have led to disarray in these neighborhoods, highlighting the need for organization and improvement. If this trend continues and resilience solutions are not implemented, the unique identity of some of these neighborhoods may be lost. Despite their current condition, these deteriorated areas possess the potential for integration and interaction across environmental, physical, social, economic, and managerial dimensions. With increased attention and effort from the management and municipality of Region 4, it is possible to create spatial integration throughout all neighborhoods by using established patterns of deteriorated structures and implementing resilience solutions (Municipal documents of Region 4, 2021). Therefore, the primary question of the research is "What factors affect the deteriorated fabrics of Region 4 in Tehran Municipality, with an emphasis on resilience?"

2. Research Background

Resilience of deteriorated urban fabrics is a crucial topic in urban planning and management, both at the macro and micro levels. These fabrics are a part of modern cities, distinguishable from other urban areas in terms of their construction and function. Policies aimed at enhancing urban resilience are particularly relevant in these zones, as they often contain historical monuments that require preservation efforts. The perception and approach to resilience in these deteriorated urban areas significantly influence our understanding of their current conditions and underlying causes, informing all related policies and planning efforts (Datala, 2023: 109).

Several works have been conducted in the form of articles, theses, and reports on resilience and deteriorated fabrics, as follows.

Suarez et al. (2016) presented a framework for measuring urban resilience, identified urban resilience indicators, and applied them to Spanish provincial centers as a case study. The results indicated that most cities are not resilient; therefore, to achieve urban resilience, it is essential to implement measures such as reducing resource consumption, promoting local trade, creating opportunities for citizen participation, and diversifying the local economy in the areas studied. In an article titled "Providing housing design solutions in a dilapidated urban context with a resilience approach," Omara (2022) concluded that, based on review studies, the resilience dimensions in deteriorated urban contexts are not in a desirable state across physical-environmental, social, organizational-institutional, and economic dimensions. The study presented design solutions in such contexts based on the research findings. In line with Omara's study, Datala (2023), in his article "Implementing urban resilience in urban planning: A comprehensive framework for urban resilience evaluation," critically reviewed and analyzed different resilience approaches and multiple definitions of urban resilience in scientific and operational fields to identify dimensions, multifaceted features, and key factors for evaluation in a program. Recent studies, such as Zhang et al. (2024) in "The effects of long-term policies on urban resilience: A dynamic assessment framework," highlighted that with the increasing hazardous events resulting from complex interactions among climatic, environmental, and socio-economic dimensions of urban systems, local governments must enhance urban resilience to address these risks.

Since 2011, domestic research has mainly focused on enhancing the resilience of deteriorated fabrics. Lali et al. (2018), in "Developing a conceptual model for assessing urban resilience with a strategic approach," analyzed various theories, conceptual models, and city experiences, reviewing literature on natural hazards and urban resilience. Their proposed framework and conceptual model were divided into two parts: strategy development and environmental assessment. Similarly, Estelaji et al. (2021) concluded in "Social resilience assessment of the deteriorated urban fabric of district 7 of Tehran" that social resilience is not well-established in this area, and the social interactions, sense of belonging, and social participation are among the social resilience variables that are in a worse state, playing a greater role in overall social resilience. Therefore, improving social and cultural resilience in this area requires attention to these factors among residents. Regarding physical resilience, Lotfi et al. (2022), in "Analysis of erosion and physical resilience factors in the worn-out fabric of Ilam city," found that most of Ilam's deteriorated urban fabric, especially in the city center, has very poor resilience due to unsustainable materials and residents' limited financial ability to improve buildings. Rezvanian-Amrei et al. (2023), in "The comprehensive model for assessing urban resilience in crisis management," concluded that their model, based on human, activity, and space variables, is reliable for assessing human resource resilience and can provide valuable insights for urban managers. The practical implications demonstrated significant progress in resilience assessment, offering valuable insights to researchers and urban managers

into the complexities of individual resilience and its implications for social and urban resilience. Considering the studies conducted, the present study is distinctive in several ways:

First, the researchers did not examine the concepts of resilience and deteriorated fabrics for Region 4 of Tehran Municipality. Thus, this study stands out as the first to investigate the concepts of resilience and deteriorated fabrics in this spatial area.

Moreover, unlike previous studies that relied mainly on data analysis and scores assigned to variables by citizens of the study area, this research employs the Delphi technique (expert team) to score and prioritize variables, ensuring that the results align with local reality.

Finally, physical, environmental, economic, social, and managerial factors affecting resilience in Region 4 are analyzed based on the opinions of experts. This approach helps identify the most influential factors, enabling targeted improvements to enhance resilience in the area.

3. Theoretical foundations

Deteriorated urban fabric: Over time, urban neighborhoods transform, during which some areas deteriorate or are destroyed, failing to improve or develop. Most fabrics in these neighborhoods are considered deteriorated. Conversely, many neighborhoods not only avoid deterioration during change and development but actually improve. Although there is no exact definition of deterioration and deterioration of old fabrics, generally, deteriorated fabrics are those characterized by a lack of sustainability, microlithic, and impermeability (Norodin, 2024: 135). The concept of fabric deterioration arises when social, economic, and physical conditions are undesirable. Additionally, when life in the parts of a city stagnates, their fabrics degrade (Dezhban, 2024: 5). Affected by environmental, economic, and social factors, the physical structures of city areas gradually deteriorate, leading to reduced living conditions for residents and decreased safety against natural disasters. In such cases, rehabilitation, reconstruction, and renovation measures are necessary to enhance the resilience of these degraded fabrics (Hashrmi, 2021: 601).

Types of deteriorated fabrics: Deteriorated fabrics generally share common features in terms of damage but differ based on the factors that cause them. These differences categorize fabrics into three groups:

1- Fabrics with urban heritage: Degraded fabrics that, despite their deterioration, contain valuable urban buildings, spaces, facilities, and equipment, or a combination thereof. Recognizing these elements allows us to consider these heritages and their role in identity-building during the intervention process. It is essential to understand that distinguishing heritage fabric from other fabrics, due to their significance, does not mean they should be excluded from intervention plans. This distinction instead highlights the imperative for collaboration and oversight by the Cultural Heritage Organization to ensure the rational preservation and protection of valuable heritage within these contexts (Dorodi, 2014: 5).

2- Fabrics without urban heritage: Deteriorated fabrics found within the inner city layers, either remaining in the core of old fabrics or resulting from settlement by marginal groups on vacant urban and suburban lands that have since merged with the city's expansion. Despite their potential for development, these fabrics hold less value because they are outside the active urban life cycle (Jahanian, 2011:93).

3- Marginal fabrics (informal settlements): Degraded fabrics developed informally on the outskirts of cities due to the mismatch between income levels and living costs. Inhabitants are mostly job-seeking migrants who settle in the cities with high employment capacity and services (Hataminejad, 2021:57).

Urban resilience: The system's ability to respond and recover from disasters, encompassing the inherent capacity to absorb impacts and adapt through reorganization, change, and learning. Disaster resilience focuses on enhancing the system's ability to withstand damage and recover quickly without external aid. This process strengthens disaster management capabilities for resistance and recovery as well as search for policy options, to mitigate disaster effects by learning from experience and adapting to regional conditions (Keating et al., 2017: 68).

Resilience approaches can be summarized into three perspectives. A common aspect across all perspectives is the ability to resist and respond positively to changes or tensions.

The concept of stability and sustainability in resilience: This approach, often derived from early ecological studies, enables the system to return to pre-disaster conditions, with a stable condition achieved before an incident or change occurs (Birkmann, 2013: 13; Wu, 2013: 200). Some scholars have identified a specific threshold for the resilience of a society's system and

its return to its original functioning. The resilient societies are characterized by a high threshold, protecting against changes and tensions before disasters can damage the system's performance and ability.

The concept of recovery in resilience: This approach focuses on how efficiently a community system can return to its original state or baseline conditions after a change. Here, resilience measures the time it takes for an urban system to revert to its pre-change condition. A resilient community can recover quickly, while areas of the city that are less resilient may take a longer time to return to their previous state (Burton, 2014: 67).

The concept of transformation in resilience: In this approach, resilience is more influenced by social factors; the goal shifts from returning to initial conditions to transforming and achieving new resilience. In such a situation, the urban system is more sustainable, as it can accept and respond positively to new changes. This approach demonstrates the most useful resilience of societies that adapt to new conditions rather than changing under pressure (Matyas, 2015: 14).

In addition to these approaches, we can mention organizing deteriorated fabrics to promote resilience.

Urban regeneration is an integrated approach to problems, opportunities, strategies, and actions concerning the physical, environmental, social, and economic domains. Roberts describes regeneration as an integrated and comprehensive approach, as well as a set of related actions that resolve urban problems, aiming to sustainably improve the economic, social, physical, and environmental conditions of the changing area (Roberts, 2000: 17).

Adopting an integrated approach to regeneration, Parkinson underscores the importance of social, economic, and environmental objectives (Parkinson, 2007: 109). In addition to protecting, rehabilitating, and reusing historic buildings, as well as paying attention to cultural, artistic, and sports events, alongside various leisure activities, paying attention to quality and creativity in new designs, and highlighting increased cooperation and collaboration among all stakeholders, this approach places special emphasis on enhancing employment opportunities, reducing poverty, alleviating social deprivation, and fostering social participation as an important part of the regeneration process (Kamanrodi et al., 2022: 5).

Zhou et al. argue that improving resilience in deteriorated urban areas requires attention to four areas:

1- Biophysical attributes in resilience: The biophysics of the system are examined, including A) bio-functional diversity and B) dynamics and creativity. A system becomes resilient when it progresses through rapid growth and exploration, protection, pressure or liberation, and revitalization or reorganization.

2- Social characteristics in resilience: The response of societies to changes, organizations, and the impact of economic factors is examined by analyzing the organizational, social, and economic factors in both spatial and non-spatial modes.

3- Ecological and social system features in resilience: Four critical factors are important in building resilience: A) Learning to improve living conditions when change occurs, B) Increasing learning capability through increased diversity, and C) Combining different types of knowledge and learning.

4- Attention to specific areas' features in resilience: It is achieved by combining three factors: creating opportunities for self-organization through strengthening community-based management, creating cross-scale management capabilities, strengthening organizational memory, and fostering organizational learning and participatory management (Zhou, 2010: 21).

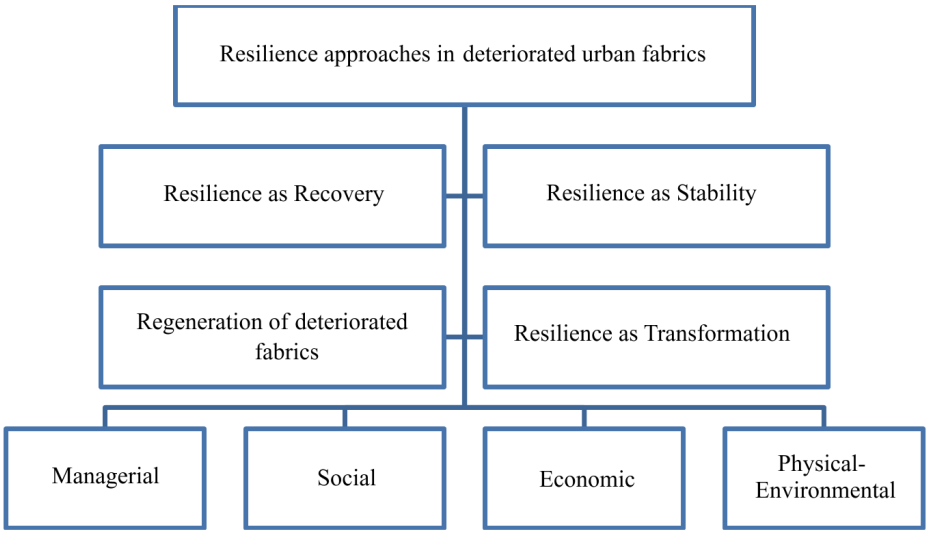

Figure 1. Theoretical model of the research

4. Methodology

The research was applied in terms of purpose and followed a mixed method (qualitative-quantitative) approach. The statistical population consisted of 80 specialists from the municipality of Region 4, professors in urban planning, and doctoral students in urban planning. Non-probability and the snowball method were used for sampling. For data collection, a library-based survey method was conducted using documents, theses, and articles. The desired data were extracted for quantitative analysis and were rated by experts through a closed questionnaire. To analyze the resilience of deteriorated fabrics in the region under study, a Delphi panel was used to score environmental, physical, social, economic, and management indicators extracted from theoretical foundations and documents of the studied area. The indicators obtained in the first step were provided to the panel team members through a semi-structured questionnaire for initial examination. This questionnaire covered 35 socio-cultural criteria grouped into 8 indicators, 30 economic criteria grouped into 7 indicators, 30 environmental-physical criteria grouped into 6 indicators, and 25 managerial-political criteria grouped into 5 indicators. After collecting and summarizing the responses and suggestions from the first round, the information was categorized, leading to the creation of a second questionnaire. This revised version included 25 socio-cultural criteria grouped into five indicators, 20 economic criteria grouped into four indicators, 20 environmental-physical criteria grouped into four indicators, and 15 managerial-political criteria grouped into three indicators. The composition and number of participants in the Delphi panel are outlined in Table 1.

Table 1. Composition and number of the delphi panel team

	Group	Number	Education	Employment period
1	Experts from the Municipality of Region 4	25	Masters and PhD	15
2	Experts from the Neighborhood Development Offices of Region 4	15	Masters	5
3	Managers in related organizations	10	Masters and PhD	10
4	Scientific experts and university professors	15	PhD	25
5	Urban planning agents	5	Masters	10
6	PhD students	10	PhD	4
7	Total	80	-	69

4.1. Study area

Region 4 of Tehran, as one of the 22 administrative regions of the city, is the largest in both area and population, comprising nine districts and 20 neighborhoods. The extensive highway network, vast green spaces, and vast protected lands are the key features of this region. Although Region 4 is newer compared to other regions of Tehran, it is home to a

diverse mix of cultural, social, and economic groups. Thus, if we consider it a metropolis with its unique needs and requirements, that perspective is not misplaced.

However, due to its marginal location, this region experiences significant challenges, including uneven development, which is further highlighted by the presence of several unsustainable neighborhoods. This region is bordered by Region 1 to the north; by Region 1 in Langari Street to the west; by Region 3 in Pasdaran; by Regions 3, 7, and 8 in Resalat Highway to the south; by Region 13 in Damavand Street; and by Region 4 to the east. Thus, Region 4 shares borders with Regions 1, 3, 7, 8, and 13, and extends to Region 1 to the north.

Covering an area of 61,288,367 square kilometers, Region 4 constitutes nearly 11 percent of Tehran's total land area. Approximately 11 percent of Tehran's total population resides in this region (Tehran Region 4 Municipality, 1400). Characteristics of the districts and neighborhoods within Region 4 are detailed in Table 2.

Table 2. Area and population of zones in region 4 of tehran municipality (Tehran District 4 Renovators Company, 2021)

Zone	Zone area	Zone population
1	3.5	62672
2	3.3	78827
3	12.1	114665
4	3.2	74345
5	4.1	114013
6	5.3	173590
7	11.8	118054
8	8.5	57663
9	9.6	71117
Total	61.4	864946

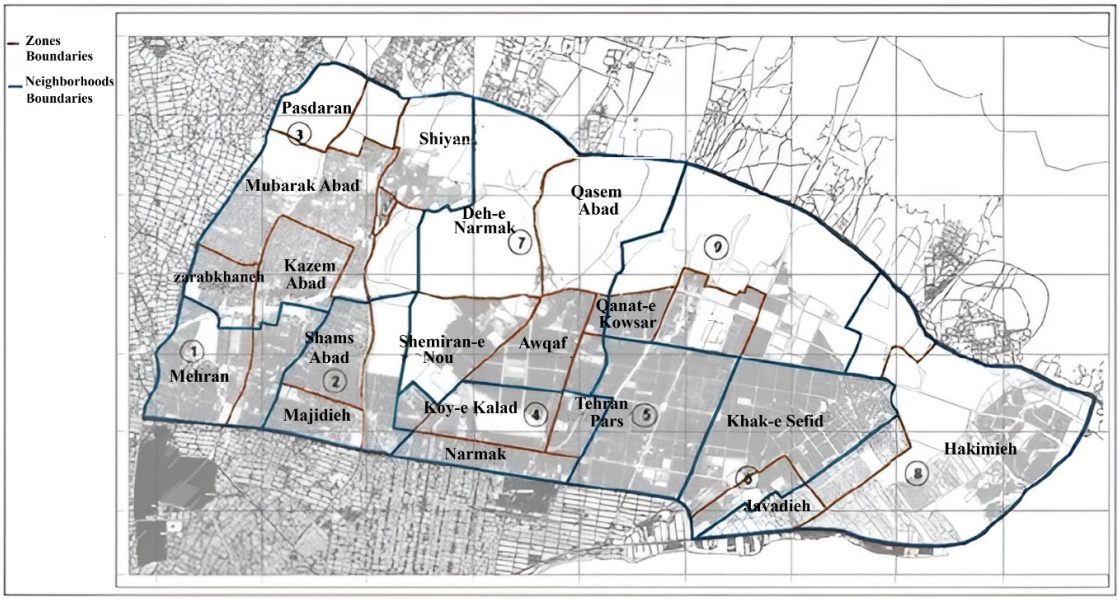

Figure 2. Zones and neighborhoods boundaries in region 4 of tehran municipality (Tehran District 4 Municipality, 2021)

Features of deteriorated and resilient fabric in Region 4 of Tehran Municipality

In Region 4 of Tehran Municipality, Zone 6 covers the largest area of deteriorated fabric with 3,473,243 square meters of unsustainable fabric, and Zone 5 covers the smallest area of deteriorated fabric with 131,406 square meters of unsustainable fabric.

Regarding the resistance, 86 percent of the residential units in the region are built with reinforced concrete or metal systems. Thus, this region ranks eighth in terms of resistance of residential units. Also, 24.4 percent of the residential units in the district are newly built (less than five years old), and 1.8 percent are old-built (over 40 years old). Accordingly, Region 4 ranks eighth in the share of newly constructed residential units, placing it in the upper middle tier. However, in terms of older residential units, it ranks sixteenth, categorizing it among the lower middle regions. Regarding fire incidents, Region 4 is ranked twenty-first, indicating it has one of the lowest numbers of fires per year (Tehran District 4 Municipality, 1400). The deteriorated fabrics of Region 4 in Tehran are illustrated in Table 3 by the neighborhood.

Table 3. Deteriorated fabrics of region 4 of tehran by neighborhood (Tehran District 4 Renovators Company, 2021)

Neighborhood	Number of deteriorated parcels	Area (hectares)	Percentage
Golshan	200	1.44	3.33
Javadieh	233	2.67	6.19
Lavizan-Shiyan	674	8.81	20.39
Shamiran-e Nou	1429	11.45	26.50
Shamsabad-Majidiyeh	485	6.47	14.97
Kazim Abad	961	12.36	28.60
Awqaf	2	0.01	0.03
Total	3984	43.2	100

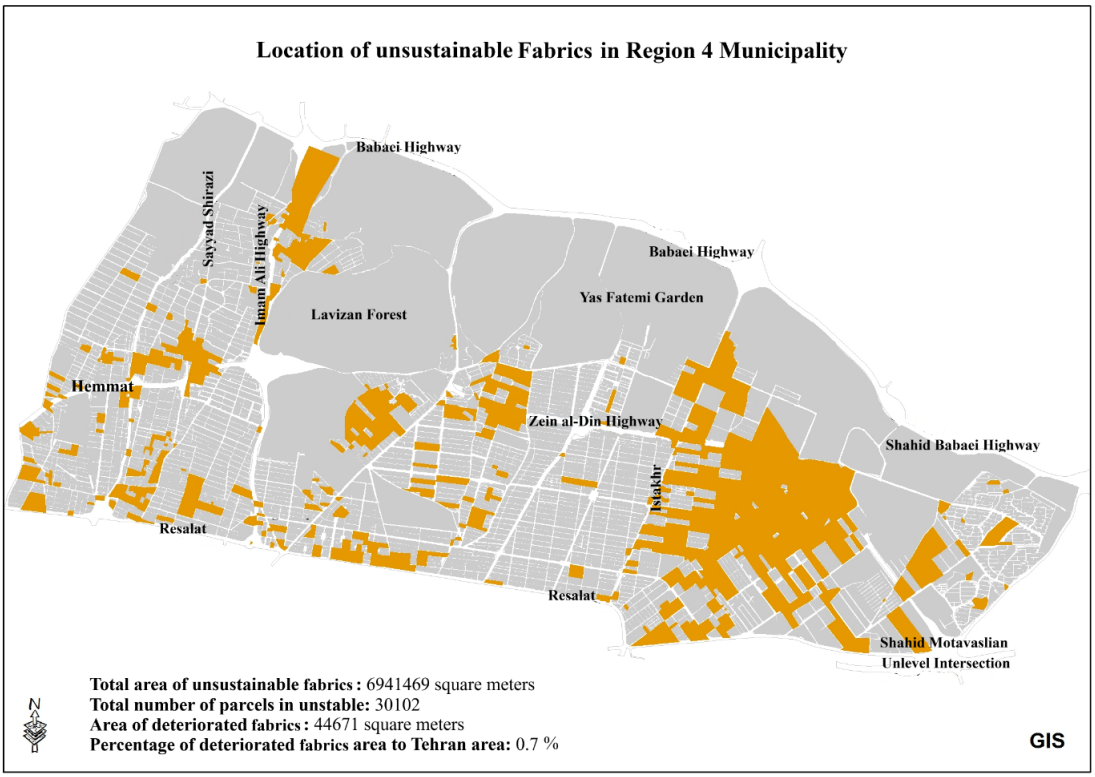

Figure 3. Status of inefficient fabrics in region 4 of tehran municipality in 1400 (Tehran District 4 Municipality, 2021)

5. Data Analysis

The three-stage Delphi method

First Delphi stage: The initial indicators obtained in the first stage, through a literature review of variables and indicators and field visits, were provided to the panel members in the form of a semi-structured questionnaire for initial review. After receiving and summarizing the responses and suggestions from the first round, the information was categorized, and the second questionnaire was prepared.

Second Delphi stage: The questionnaire was distributed among the members in a structured and tabulated form. The members were asked to indicate the degree of indicator's correlation with the criteria, the degree of indicator's correlation with the research topic, and the degree of importance of evaluating the indicators to improve resilience of deteriorated structures of Region 4 of Tehran using a 1 to 5 Likert scale (Table 4), as well as to state the indicators that may not have been mentioned in this study, and finally, to identify the criteria and indicators that were similar to each other or overlapped with each other.

Table 4. Likert scale

1	2	3	4	5
Very poor	Poor	Average	Good	Excellent

Third Delphi stage: To summarize the respondents' opinions, the mean and standard deviation of each indicator for each calculation step were provided to the Delphi members. The team was asked to review the responses received, revise their opinions and judgments, if necessary, and state their reasons in cases of disagreement. The goal of the third stage or any subsequent stage was to reach consensus or stability among the group members. When consensus or stability was achieved, the Delphi method was completed. Therefore, given the consensus among the Delphi members, i.e., their opinions converged, there was no need to repeat the survey in the third stage, and this stage was chosen as the final stage.

Developing and validating socio-cultural dimension indicators

In the socio-cultural criteria, during the first Delphi stage, 35 criteria were provided to the panel members within eight indicators. Based on the scores, corrections, and integrations performed by the panel members in the second and third Delphi stages, 25 criteria were measured and evaluated by the members within 5 indicators.

Table 5. Scoring of socio-cultural indicators by the delphi panel team

Indicator	Social criteria	Mean	Standard deviation	Coefficient of variation	Status
Security	The level of satisfaction of residents of deteriorated fabric with security	84.2	1.39	0.49	-
	The level of interaction and coexistence of people within the studied area	3/9	0.98	0.25	+
	The level of social and cultural security at the time of the incidents	2.84	1.39	0.49	-
	The level of sense of belonging to the place among residents	2.84	1.29	0.43	-
	The presence of social disorder and the level of security in the deteriorated fabric	2.93	1.21	0.41	-
Services	Health and medical services in the neighborhoods of Region 4	2.61	1.1	0.51	-
	Recreational and sports services in the neighborhoods of Region 4	3.48	0.93	0.26	
	Educational services in the neighborhoods of Region 4	2.29	1.07	0.47	-
	Residents' access to services in the deteriorated fabric	2.16	1.07	0.49	-

Indicator	Social criteria	Mean	Standard deviation	Coefficient of variation	Status
Tradition and Culture	The extent of cooperation and assistance of neighbors to each other in crisis times	3.39	0.99	0.29	
	The solidarity of residents with city managers in crisis times	2.87	1.15	0.4	-
	The possibility of the complete departure of the indigenous population and the entry of the immigrant population	2.61	1.17	0.455	-
	The extent of trust in neighbors, local institutions, representatives, and laws that establish order in crisis times	2.97	1.45	0.49	-
Participation and Solidarity	The level of citizen participation in organizing deteriorated fabrics	3.13	0.88	0.28	
	The level of social unity in the region	1.71	0.9	0.53	-
	The level of residents' participation in local institutions in decision-making for the neighborhood	2.16	0.97	0.45	-
	The level of residents' participation with each other and with relief organizations during a crisis	3.26	0.85	0.26	
	The existence of NGOs and social networks related to crisis management and relief in the region	3.1	0.91	0.29	
Awareness and Education	How organizations provide citizens with the necessary training to respond appropriately during an incident	4.61	0.67	0.14	
	Measures to organize deteriorated fabrics to promote resilience	2.32	1.19	0.51	-
	The extent of acquiring skills in reactions and appropriate behavior during a crisis	3.54	0.72	0.21	
	The extent of citizens' awareness of natural and man-made disasters	.4.48	0.81	0.18	
	Participation and cooperation of residents of deteriorated neighborhoods in educational programs	3.09	0.72	0.21	
	The extent of using the experiences of other countries in organizing deteriorated fabrics and promoting resilience	84/2	73/0	0.26	-
	The state of citizens' awareness of the institutions related to crisis management	87/3	88/0	0.23	
Total		84/75	34/25	8.98	(+)11 (-)14

Most criteria received a score below the average of three. Therefore, the status of socio-cultural criteria in five indicators "security," "services," "tradition and culture," "participation and solidarity," and "awareness and education" regarding resilience in the deteriorated fabrics of Region 4 of Tehran Municipality is undesirable. In total, out of 25 criteria, 14 are in an unfavorable state and 11 are in a favorable state. The criterion "The level of interaction and coexistence of people within the studied area" (3.9) in "security" indicator, the criterion "Recreational and sports services in the neighborhoods of Region 4" (3.48) in "services" indicator, the criterion "The extent of cooperation and assistance of neighbors to each other in crisis times" (3.29) in "tradition and culture" indicator, the criterion "The level of residents'

participation with each other and with relief organizations during a crisis" (3.26) in "Participation and solidarity" indicator, and the criterion "How organizations provide citizens with the necessary training to respond appropriately during an incident" (4.61) in "Awareness and education" indicator obtained the highest scores.

In the economic criteria, during the first Delphi stage, 30 criteria were provided to the panel members within seven indicators. With the scores, corrections, and integrations made by the panel members in the second and third Delphi stages, 20 criteria were measured and evaluated by the members within four indicators.

Table 6. Scoring of economic indicators by the delphi panel team

Indicator	Economic criteria	Mean	Standard deviation	Coefficient of variation	Status
Facilities and infrastructure	The level of access of residents of the region to relief from the Water, Electricity, and Gas Organization during a crisis	0.03	1.33	0.44	-
	The level of access of residents of the deteriorated area to the Internet	4.58	0.76	0.17	+
	The level of access to water, electricity, and telecommunications services in the deteriorated area	3.3	0.98	0.29	+
	The level of vital infrastructure (oil, gas, electricity, fiber optic, and water pipes) in the neighborhoods	2.39	0.99	0.41	-
Activity and employment	Land value in parts of the deteriorated area	2.42	1.12	0.46	-
	Financial ability of residents of the deteriorated area for reconstruction and renovation	2.32	0.96	0.43	-
	Economic efficiency and willingness to invest in a deteriorated area to promote resilience	2.87	1.06	0.27	-
	Allocating organizations' budget to organize the deteriorated areas to promote resilience	2.9	0.94	0.32	-
	Employment status and income level of the people in the neighborhood	2.93	0.85	0.29	-
	Economic returns after organizing deteriorated areas	3.74	0.85	0.23	+
Ability to compensate for damage	Existence of financial or technical incentives for readiness through partnership with the municipality and other organizations for housing renovation	2.16	0.97	0.45	-
	Status of neighborhood residents covered by health insurance	2.9	1.04	0.26	-
	Compensation for damages caused by the crisis, according to the financial capability of citizens	2.1	1.01	0.48	-
	The level of use of bank loans and facilities to strengthen housing and its renovation	2.23	1.05	0.47	-
	The presence of volunteer groups in the neighborhood to provide relief	4	0.97	0.24	+
	The level of financial support from the government and local organizations for the victims	3.58	0.99	0.28	+
Ability to return to a suitable condition	Ability to recover a suitable job after a crisis	3.8	0.98	0.26	+
	Retrofitting of renovated and newly constructed buildings	3.9	0.98	0.25	+
	Amount of disaster-resistant assets (savings, stocks, etc.)	2.9	1.22	0.42	-
	The level of citizens' adherence to legal guidelines (construction laws, etc.) to prevent a crisis	2.84	1.37	0.48	-
Total		57.89	21.89	6.9	(+)7 (-)13

Most criteria received a score below the average of three. Therefore, the status of economic criteria in the four indicators "Facilities and infrastructure," "Activity and employment," "Ability to compensate for damage," and "Ability to return to suitable condition" in the deteriorated areas of Region 4 of the municipality is unfavorable. In total, out of 20 criteria, 13 are in an adverse state and seven are in a favorable state. The criterion "The level of access of residents of the deteriorated area to the Internet" (4.58) in "The facilities and infrastructure" indicator, the criterion "Economic returns after organizing deteriorated areas" (3.74) in "The activity and employment" indicator, the criterion "The presence of volunteer groups in the neighborhood to provide relief" (4) in "The ability to compensate for damage" indicator, and the criterion "Retrofitting of renovated and newly constructed buildings" (3.9) in "The ability to return to suitable conditions" indicator obtained the highest scores.

In the environmental-physical criteria, in the first Delphi stage, 30 criteria were provided to the panel members within 6 indicators. With the scores, corrections, and integrations made by the panel members in the second and third Delphi stages, 20 criteria were measured and evaluated by the members within 4 indicators.

Table 7. Scoring of physical-environmental indicators by the delphi panel team

Indicator	Physical and environmental criteria	Mean	Standard deviation	Coefficient of variation	Status
Deterioration	The extent of measures taken to rehabilitate, reconstruct, renovate, and regenerate deteriorated fabrics	2.16	0.93	0.43	-
	Narrow passages and poor permeability within deteriorated fabrics	3.6	0.89	0.29	+
	The extent of protection of deteriorated historical monuments as cultural heritage	2.48	0.96	0.29	_
	The extent of runoff absorption during floods and water pipe breaks	2.06	0.89	0.43	_
	The extent of impermeability, microlithic, and unsustainability of fabrics	3.97	0.91	0.23	+
	Environment, air, and noise pollution	2.39	0.91	0.23	_
Accessibility	The ease of access to the main road network	2.97	1.45	0.49	-
	The extent of residents' access to public open spaces during a crisis	2.39	0.92	0.38	_
	The extent of residents' access to all urban services, including medical, educational, recreational, etc.	3.77	0.8	0.21	+
	Access to relief centers throughout the region	2.45	1.21	0.49	-
Vulnerability	The share of green space and natural elements within and around the region	3.9	0.94	0.24	+
	The balance between the function of the residential neighborhood and some of the activities in the fabric	3.03	0.87	0.29	+
	Preventing a crisis through the reconstruction, renovation, and regeneration of deteriorated areas	2.61	1.33	0.51	-
	The role of workhouses and warehouses in the occurrence of a crisis	3.84	0.82	0.21	+
	The extent of attention to the region's climate in Constructions	3.13	0.88	0.28	+
	Buildings over 30 years old	4.55	0.72	0.16	+

Indicator	Physical and environmental criteria	Mean	Standard deviation	Coefficient of variation	Status
Resistance	Buildings over 4 or 5 stories	2.52	1.06	0.42	-
	Age and fragility of buildings and risk of collapse in a crisis	3.77	0.8	0.21	+
	Quality (adequacy) of public service robustness	2.54	1.21	0.49	-
	Number and capacity of shelters in the area	1.9	0.91	0.48	-
		60.32	17.84	6.53	(+)9 (-)11

Most criteria received a score below the average of three. Therefore, the status of physical-environmental criteria in the four indicators "Deterioration," "Accessibility," "Vulnerability," and "Resistance" in the deteriorated areas of Region 4 of the municipality is unfavorable. Out of 20 criteria, 11 are in an adverse state and nine are in a favorable state.

The criterion "The extent of impermeability, microlithic, and unsustainability of fabrics" (3.97) in "Deterioration" indicator, the criterion "The extent of residents' access to all urban services, including medical, educational, recreational, etc." (3.77) in "Accessibility" indicator, the criterion "Buildings over 30 years old" (4.55) in "Vulnerability" indicator, and the criterion "Age and fragility of buildings and risk of collapse in a crisis" (3.77) in "Resistance" indicator obtained the highest scores.

In the political-managerial criteria, in the first Delphi stage, 25 criteria were provided to the panel members within five indicators. With the scores, corrections, and integrations made by the panel members in the second and third Delphi stages, 15 criteria were measured and evaluated by the members within three indicators.

Table 8. Scoring of managerial indicators by the delphi panel team

Indicator	Political-Management Criteria	Mean	Standard Deviation	Coefficient of Variation	Status
Laws and Regulations	Flexibility in approving and changing laws to regenerate deteriorated fabrics	2	0.68	0.24	-
	Level of support for the participation of residents in reconstructing and renovating buildings and preventing crises	2.81	0.98	0.35	-
	Existence of appropriate control tools to retrofit buildings	2.61	1.31	0.5	-
	Organizational integrity and coherence in preparing and implementing programs to regenerate deteriorated fabrics	4.9	0.4	0.08	+
	Existence and enforcement of strict laws in protecting historical monuments	3.16	0.82	0.26	+
Education	The extent of use of new resistance and relief methods during crises	2.61	1.23	0.51	_
	The extent of interaction between management organizations and residents of neighborhoods	2.52	1.41	0.56	-
	The type of planning by organizations responsible for urban services in establishing environmental security and providing services	3.1	0.83	0.27	+
	Training of specialized human resources in crisis prevention and relief	2.84	1.37	0.48	-

Indicator	Political-Management Criteria	Mean	Standard Deviation	Coefficient of Variation	Status
Support and Supervision	The extent of use of media and advertising centers to raise citizen awareness	1.74	0.85	0.49	-
	The existence of financial incentives for the realization and implementation of new ideas	2.16	0.93	0.43	-
	The extent of creating opportunities for participation of the private and public sectors alongside the government to support regeneration measures	2.64	1.23	0.5	-
	The extent of support for the activities of non-governmental organizations active in organizing deteriorated fabrics and resilience	2.13	0.88	0.41	-
	The degree of coordination and integration between institutions and organizations	2.58	1.41	0.54	-
	The degree of supervision over the proper implementation of programs related to regeneration and resilience	2.42	1.1	0.47	-
total		68.22	15.53	6.04	(+)3 (-)12

Most criteria received a score below the average of three. Therefore, the status of political-managerial criteria in the three indicators "Laws and regulations," "Education," and "Support and Supervision" in the deteriorated areas of Region 4 of the municipality is unfavorable. Out of 15 criteria, 12 are in an adverse state and three are in a favorable state.

The criterion "Organizational integrity and coherence in preparing and implementing programs to regenerate deteriorated fabrics" (4.9) in "Laws and regulations" indicator, the criterion "The type of planning by organizations responsible for urban services in establishing environmental security and providing services" (3.1) in "Education" indicator, and the criterion "The extent of creating opportunities for participation of the private and public sectors alongside the government to support regeneration measures" (2.64) in "Support and Supervision" indicator obtained the highest scores.

6. Conclusion

Resilience is a key research topic in organizing deteriorated urban fabrics. It is a multifaceted concept that includes economic, social, physical, environmental, and management aspects. Among various perspectives on resilience, the focus is on the transformation variable, with an emphasis on social factors in resilience, where urban systems adapt to change rather than revert to their original state, aiming for sustainability after disasters. The transformation perspective is influenced by concepts "renovation", "rehabilitation", and "reorganization". In this context, "regeneration" represents a comprehensive and integrated perspective that is vital for promoting resilience and organizing deteriorated fabrics. In addition to physical criteria, regeneration also considers social, economic, environmental, and political criteria, ensuring content integrity. Additionally, the approach considered in the target neighborhood regeneration model is participatory, meaning that all stakeholders have the right to participate in organizing deteriorated urban fabrics from the bottom up.

The results of analyzing data on the resilience status in deteriorated fabrics of Region 4 reveal that socio-cultural criteria are unsatisfactory in five indicators. Out of 25 criteria, 14 are in an undesirable state, while 11 are desirable; most experts scored indicators with an average below three.

Economic criteria are unsatisfactory in four indicators, with 13 out of 20 criteria in an undesirable state and seven criteria in a suitable state; most experts scored indicators with an average below three.

Environmental-physical criteria are undesirable in four indicators, with 11 out of 20 criteria in a poor state and nine criteria in a suitable state; most experts scored indicators with an average below three.

Managerial-political criteria are undesirable in three indicators, with 12 out of 15 criteria in an unsatisfactory condition and three criteria in a desirable state; most experts scored indicators with an average below three.

Overall, socio-cultural criteria in security, services, tradition and culture, participation and solidarity, and awareness and education scored a total of 75.84.

The economic dimension scored 57.89 across facilities and infrastructure, activity and employment, ability to compensate for damage, and ability to return to a suitable condition.

Physical-environmental criteria scored 60.32 in deterioration, accessibility, vulnerability, and resistance; and managerial-political criteria scored 68.22 in laws and regulations, education, and support and supervision.

Among all, socio-cultural criteria scored the highest, indicating a relatively better situation.

Comparing with international and domestic studies, Suarez et al. (2016) presented a framework for assessing urban resilience. They defined urban resilience indicators and their application in Spanish provincial centers, focusing on socio-economic factors such as reducing resource consumption, promoting local trade, creating opportunities for citizen participation, and diversifying the local economy. Omara (2022), in "Providing housing design solutions in a dilapidated urban context with a resilience approach," examined the dimensions affecting the resilience of deteriorated structures, highlighting the physical, economic, and social indicators, which were not optimal. In an article titled "Social Resilience Assessment of the Deteriorated Urban Fabric of District 7 of Tehran," Estelaji et al. (2021), with a focus on social indicators, concluded that social resilience in the deteriorated context of District 7 was in a state of disarray. Lotfi et al. (2022), in "Analysis of Erosion and Physical Resilience Factors in the Worn-Out Fabric of Ilam City," with a focus on physical indicators, revealed that the central part of deteriorated fabrics in Ilam has very poor resilience.

Therefore, prior research on resilience and deteriorated fabrics failed to comprehensively examine all physical, environmental, economic, socio-cultural, and managerial indicators in an integrated way. This study assessed the resilience of deteriorated fabrics in Region 4 of Tehran municipality based on all these indicators, utilizing expert scoring to ensure realistic results.

The findings suggested that municipal programs in the municipality of Region 4 primarily studied the current situation and the share of deteriorated structures in Region 4, neglecting future-oriented strategies, such as regenerating deteriorated structures and enhancing their resilience. Moreover, there was little coordination or public participation in these efforts. The findings indicated that among the factors affecting the resilience of deteriorated urban areas in Region 4 of Tehran Municipality, all the analyzed criteria in the physical, environmental, economic, social, and managerial dimensions are in an unfavorable state. The study highlighted the imperative for authorities to pay more attention to the resilience of these structures in preparing and implementing plans and programs, and to coordinate efforts across organizations, involving various stakeholders, such as government, private sector, civil society, and the public.

7. Suggestions

- Work division between the organizations in charge of regeneration programs for target neighborhoods in Tehran Region 4, with an emphasis on promoting resilience towards inter-sectoral cooperation at the provincial and local levels and realizing integrated urban management;
- Promote and develop a culture of public participation in the process of improving the economic, social, cultural, and environmental conditions of target neighborhoods in Tehran Region 4 with an emphasis on promoting resilience;
- Participation of all stakeholders, including the government, municipality, neighborhood development offices, public organizations, and residents of Tehran Region 4, in preparing programs for the regeneration of target neighborhoods with an emphasis on promoting resilience;
- Optimal use of material and spiritual resources aimed at preparing and implementing regeneration programs for target neighborhoods in Tehran Region 4 with an emphasis on promoting resilience;
- Improve the quality of life of residents in the target neighborhoods through the reorganization of deteriorated residential, commercial, administrative, and medical structures with an emphasis on promoting resilience;
- Expand facilities and create economic and job opportunities for residents in the target neighborhoods for regeneration, reducing the social issues stemming from unemployment.
- Address social challenges, improve the negative reputation of certain neighborhoods in the region, and enhance overall social security.
- Decrease environmental pollution, such as air, noise, water, and soil pollution, in the target neighborhoods, with a focus on promoting resilience.

Authors' contributions

The authors' contributions were equal.

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Conflict of Interest

The author of this article has no conflicts of interest.

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