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# Process of Vision Development with a Resilience Approach for Earthquake-stricken Neighborhoods of Shiroodi and Fooladi after Sarpol-e Zahab Earthquake in 2017

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**Original Article**

## Abstract

**INTRODUCTION:** The rapid population growth and fast-paced development of urban texture have given rise to unwise decisions which can be only prevented by strategic management of city neighborhoods based on a vision in accordance with the common values of society. The vision development aims at determining the position a neighborhood strives to reach. In the meantime, disaster-stricken areas have a special position, considering reconstruction as a golden opportunity. The present article aimed to develop a vision for Shiroodi and Fooladi neighborhoods in Sarpol-e Zahab after the 1396 earthquake in Kermanshah province.

**METHODS:** The present applied research was conducted based on a descriptive-analytical design. To this end, situation assessment was firstly performed in both strategic and local domains based on urban systems. For each system, the table of strengths, weaknesses, opportunities, and threats (SWOT) was prepared. Moreover, combining different layers, a vulnerability map and an integrated SWOT analysis map were obtained. Finally, based on these maps, field observations, interviews with residents, and expert opinions, a vision statement was presented and the necessary policies were formulated.

**FINDINGS:** Based on the obtained results, the strengths, and opportunities, such as quick access to the main artery and the presence of barren lands, have a resilient state in response to disasters. On the other hand, weaknesses, and threats, such as construction on agricultural lands or the narrow passages, are among the factors that highlight the need to select a vision with a resilient approach to future disasters.

**CONCLUSION:** As evidenced by the research of the study, the first stage of visioning must be based on urban systems, such as land use, movement and access, physical form, and landscape urbanism. In this regard, a vision needs to assess resilience at different physical, environmental, social, and economic levels. Furthermore, this vision should lead to the presentation of some instructions, such as the obtainment of a checkered texture, expansion of green spaces, reduction of enclosures, as well as safety in infrastructure and networks, to increase the resilience of the target neighborhood after the earthquake.

**Keywords:** Neighborhood; Resilience; Sarpol-e Zahab Earthquake; SWOT; Urban Systems; Vision.

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## Introduction

Planning for a city and its urban management complex is a complicated issue with a long history. The city is a complex and dynamic phenomenon undergoing ongoing physical, social, economic, political, and cultural changes. The tremendous growth of cities has posed daunting challenges to urban management due to the absence of resources and time needed to respond to the growing needs of citizens. These serious problems can be only tackled by the adoption of new solutions (1). There is nothing permanent about a city. Like living organisms, cities are in a constant state of flux. A city in decline needs a clear

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purpose and vision of its future identity, with people at its heart, to turn that decline around (2).

Cities are currently facing numerous challenges which threaten their sustainability and need to be addressed in general (3). The increase in natural and man-made disasters around the world on a city-wide scale has caused various problems which can be tackled only by new management methods, as well as urban and neighborhood planning. Neighborhood planning is a new tool which allows communities to exert greater control over the type, location, size, and speed of development in their area.

Neighborhood planning provides a legal right for residents and employees in the neighborhood to plan for the future of their place of residence in a sustainable manner (4). The comprehensive planning model emerged after World War II and the need for post-war reconstruction. Nonetheless, from the outset, it went under bitter criticism due to its inflexibility, and excessive focus on physical dimension, and neglect of socio-economic issues (5). Numerous experts have recently highlighted the need to move from traditional methods of planning and devote more attention to new approaches to planning (6).

Strategic planning is one of the effective ways to overcome the limitations of comprehensive plans. Strategic planning is defined as the process of recognizing the external and internal environments of the organization, deciding on the vision and mission, developing overall goals, creating and selecting general strategies to pursue and allocate resources to achieve organizational goals. Strategic planning aims to align the activities of an organization with its environment and guarantee its survival and effectiveness (7). The goal of strategic urban planning is to improve the performance of the city and ensure future planning and accountability (8).

Every city needs to develop its own competitive strategies since vision development for cities is inherently a competitive dimension that can be recovered and lead to prosperity. The vision of cities and neighborhoods plays a vital role in the determination of economic, social, and physical destiny. In the current situation, the development and implementation of a vision for cities and neighborhoods is not only a "choice" but also a "necessity". This has made visioning a special and important stage in the process of strategic urban planning and design so that "visioning" may be considered the "heart" of the process (9).

The vision is an intellectual journey from the known to the unknown, creating an image of the future based on existing facts, dreams, hopes, dangers, and opportunities (10). This vision does not reflect the perspective of one individual or just one group, rather it represents the consensus of a group of people of all ages and genders who are interested in issues related to their community. The community should be aware of the issues for which a vision has been developed (11).

The development of a vision for a city actually means the presentation of a goal to the residents of the city for all their efforts and description of what they are likely to achieve in the future. The vision is a position the city and community strive to achieve in the future. It provides a visual perspective beyond the foreseeable future and beyond existing trends, demonstrating people's long-term shared understanding of their goals (12). The process of vision development for a disaster-resistant community can assume greater importance, as compared to the statement itself

This process provides residents with a realistic view of their community and enables the authorities to identify strengths, weaknesses, opportunities, and threats. Moreover, it is of great help in the development of a vision statement, policies, and executive plans (13). Values and beliefs are the most fundamental component of the vision. In the process of the vision development, the values are clarified and agreed upon before the determination of the mission. The mission reflects the philosophy of an organization explained in the form of a statement. Goals are articulated more clearly and determine what needs to be prepared to achieve the vision.

Depending on different priorities highlighted by the society, there may be one or more goals for each element of the vision. Careful policies and measures can then follow these goals (14). A set of values for a society in an ideal situation can be education, prosperity, diversity, heritage, shelter, safety, efficiency, and order (15). Each community can have different values depending on its circumstances. For instance, in a society that needs reconstruction after a disaster, values are manifested in the form of better reconstruction, sustainable reconstruction, or resilience to future disasters.

Post-disaster reconstruction is a significant



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phase in disaster management which provides opportunities for communities and nations (16). Seismic vulnerability of housing textures and patterns in cities and villages of the country, along with the absence of a plan, model, and written approach to post-disaster reconstruction in the country, has highlighted the importance of addressing the practical principles of recovery as one of the four major pillars of crisis cycle (17). Vision development with a resilient approach in a disaster-stricken community improves the resilience of the community to future disasters.

Moreover, it lifts people's spirit by their involvement in decision-making and the development of an atmosphere for a positive outlook on the future. Based on the evidence, if managers and disaster planners have relevant scientific backgrounds, they save financial and organizational resources for crisis management. In addition, the results of response and reconstruction operations will seem more successful from the users' point of view (18). Disaster resilience refers to the community's ability to predict disaster and, if possible, prevent or minimize potential harms.

Resilience empowers the society to cope well with the negative effects of a disaster, maintain some basic functions and structures during a disaster, and adapt to the resulting changes. Nowadays, in studies on resilience, the social dimension has received more attention, while limited attention has been paid to technical or environmental dimensions. The concept of resilience in the social dimension, both at the collective and individual level, seems to be a challenge arising from the shift of focus from technical features (engineering resilience) to social features of resilience (19).

Since disasters and their consequences are different and each requires a special approach, it is relatively impossible to adopt a single reconstruction approach and policy in all post-disaster projects. Therefore, any decision should be made in consultation and cooperation with disaster victims and according to the characteristics of the affected area (20). In the meantime, developing a vision for areas that are destroyed by natural and man-made disasters and need reconstruction can largely control policies and measures adopted during reconstruction and guide them aligned with the goals of vision.

A 7.3-magnitude earthquake, which stroke on November 12, 2017, in Kermanshah province, claimed the lives of 20 people and left about 70,000 people homeless. Among the various areas of a city, the older neighborhoods, which are usually inhabited by the poor, suffer the most during the disaster. The studied area in the present research is a residential neighborhood in Sarpol-e Zahab with an area of nearly 35 hectares and consisting of two parts called Shiroodi with high-rise apartments and Fooladi with a traditional and organic texture.

In previous studies, vision presentation on a neighborhood scale has been neglected, and the majority of studies have focused on the city scale. There are also a few vision statements for disaster-stricken neighborhoods that are in the process of being rebuilt. Moreover, these studies only considered the physical dimensions, while other aspects were neglected. Therefore, in light of the aforementioned issues and the importance of strategic and local planning, the present study aimed to develop a vision for the study area with a resilience approach to future disasters.

This resilience encompasses various physical, environmental, social, and economic dimensions and will lead to quality improvement at different levels, and ultimately, a better response to possible future disasters. The chaos surrounding the society after a disaster highlights the necessity of vision development in order to manage the disaster and prevent personalized policies. The vision is developed to help the society to reach the position it intends and plays a vital role in determining the economic, social, and physical destiny of neighborhoods.

Based on the aforementioned theoretical foundations, reconstruction can be used as a golden opportunity. Therefore, the present study aimed to create a distant and favorable future for Shiroodi and Fooladi neighborhoods by vision development. Moreover, it strived to control the policies and measures during reconstruction and guide them aligned with the aims of the vision.

## Methods

This applied research was conducted based on a descriptive-analytical design. Library studies were used to collect the needed data. To this end, books, reliable articles, and documents (especially the comprehensive plan of Sarpol-e Zahab city) were studied to obtain more information about the region. The general algorithm of the leading

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research consisted of four main steps which are referred to here:

1. First stage: recognition and definition of the study area and the 2017 Sarpol-e Zahab earthquake

2. Second stage: Situation assessment of strategic and local domains and preparation of strengths, weaknesses, opportunities, and threats (SWOT) analysis tables.

3. The third stage: the vulnerability assessment of local domain and integrated SWAT analysis

4. The fourth stage: vision development

In the situation assessment stage, functional, aesthetic, and environmental components were analyzed using SWOT analytical technique and placecheck technique. Land-use systems, movement and access, urban facilities and equipment, as well as public activities and experiences, were examined in the functional component section. The aesthetic component included the assessment of physical form systems, the structure of public spaces, and landscape urbanism. Moreover, natural environment, climatic characteristics, and environmental pollution were analyzed in the environmental component section.

In order to gain a thorough understanding of various dimensions of a component, some systems, such as movement and access systems, were examined both in the local and strategic domains. For each of the systems investigated in the present study, SWOT tables were developed to identify strengths, weaknesses, opportunities, and threats. Thereafter, by juxtaposing the produced maps, the vulnerability map of the local area was prepared in order to identify the weakest areas of the neighborhood and design measures to strengthen those areas.

The scores of 0-10 were assigned to the degree of effectiveness of each factor in this map (10=too much impact and 0=no effect). Each factor was assigned a weight using the expert opinions of professors and Ph.D. students of Disasters and Reconstruction Department, Faculty of Architecture and Urban Planning, Shahid Beheshti University. The statistical population of specialists included four professors, six Ph.D. students and graduates, and a number of specialists from the Red Crescent and Sarpol-e Zahab Housing Foundation.

The research questionnaires have two characteristics of validity and reliability. According to the conducted studies and the expertise of professors in the field and confirmed validity of the questionnaires by the statistical community (scientific and experimental experts) and comparison with previous studies, the validity of the questionnaire was confirmed. The reliability of this questionnaire can be confirmed by considering the predominance of the factors that do not change much over time. Finally, an integrated SWOT analysis map was developed to identify opportunities and plan to strengthen the weaknesses and eliminate threats. Finally, based on the research findings, a vision statement was prepared with a neighborhood resilience approach to future disasters.

In addition, the policies needed to implement the vision goals in various physical, environmental, economic, and social dimensions were presented. It is noteworthy that among the policies considered by researchers, those policies that were selected by experts on this subject were developed for each component of resilience.

## Findings

(First stage): Recognition and definition of the study area and 2017 Sarpol-e Zahab earthquake

The study area of the present study was Shiroodi and Fooladi neighborhoods in Sarpol-e Zahab in Kermanshah province. As displayed in Figure 1, Kermanshah province has 14 cities, and Sarpol-e Zahab is located 147 km west of Kermanshah province (21).

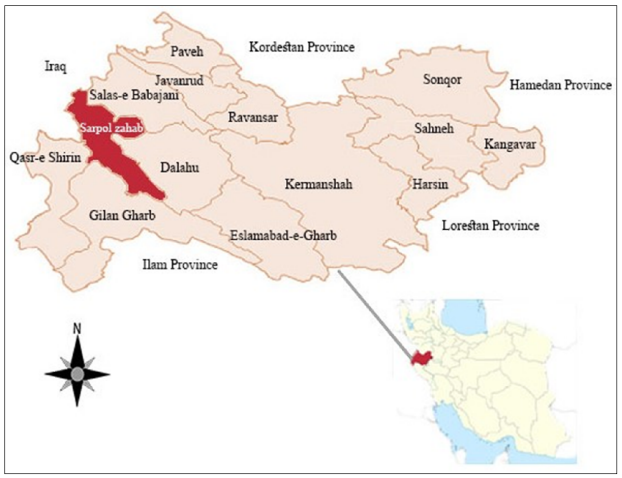



**Figure 1.** Location of Kermanshah province in Iran and Sarpol-e Zahab in Kermanshah province (Source: Google Camp)

According to Figure 2, Shiroodi and Fooladi



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neighborhoods are located in the southwest of Sarpol Zahab, on the road of Karbala to Qasr-e Shirin. The residents of this place are among low-income groups. From the outset, this neighborhood was built on land with alluvial soil and in the vicinity of a river channel. This part of the city contains a landfill for construction debris from the




**Figure 2.** Right: Sarpol-e Zahab (strategic domain), Left: Shiroodi and Fooladi neighborhood (local domain) (Source: Google Map)

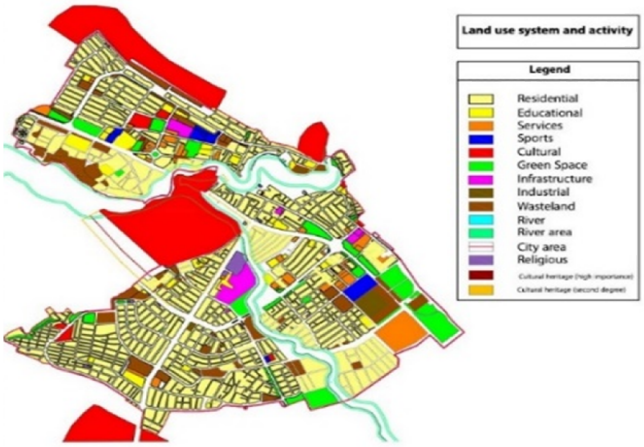



**Figure 3.** Land use system and activity

Iran-Iraq war, and pieces of sacks, bricks, and glass can be found during demolition. The majority of buildings in the neighborhood are residential, and cheap houses and lands have attracted numerous immigrants from the surrounding town and villages.

The earthquake caused the most extensive damage to this neighborhood due to its location, compared to other residential areas in the city. The structural elements of apartments constructed in Mehr housing project were not seriously damaged, and walls and non-structural elements suffered the most damage. Fooladi neighborhood, where most of the buildings lacked structure, was destroyed. . The Housing Foundation declared the need for renovation of residential buildings in the whole neighborhood, except for some apartments constructed in Mehr Housing project.

***(Second stage): Assessing the situation of strategic and local domains***

The situation assessment of operational, aesthetic, and environmental components in the second stage is one of the most basic steps in vision development. Situation assessment helps clarify the essential needs of neighborhood residents. The recognition of the values and needs of the disaster-affected community can be of great help in taking advantage of the reconstruction as an opportunity to improve the conditions and the quality of life. Situation assessment also helps the authority to come up with great innovation in response to a disaster and discourages passive decision-making for the city and neighborhood.

Thereafter, the situation was assessed in strategic and local domains, respectively. The SWOT table was presented for each domain. The operational component in the strategic domain examines land-use systems, movement and access, as well as city facilities and equipment. According



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to Figure 3, residential lands are concentrated in the south and northwest. Public spaces, such as stadiums, are limited to only three areas of the city. Factories, workshops, and warehouses are concentrated in the East. There are three historical areas, marked as red in the south, north, and northwest. In Figure 4, a cross-shaped path forms the main highway of the city, the main roads, and the connection of the city

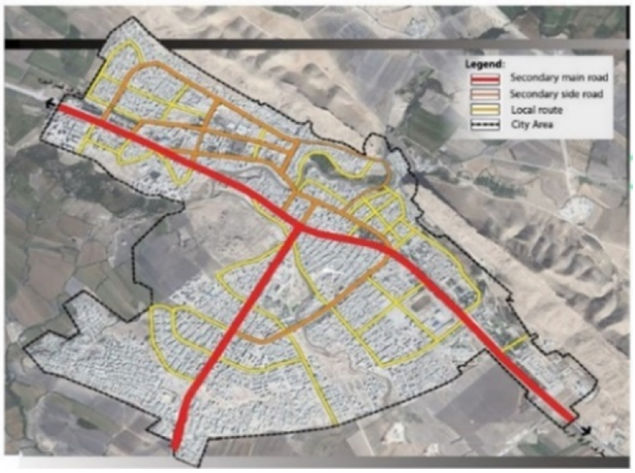



**Figure 4.** Movement and access system

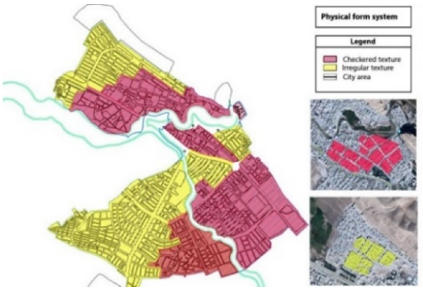



**Figure 5.** City texture

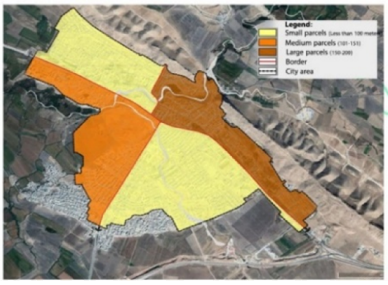



**Figure 6.** Gradation

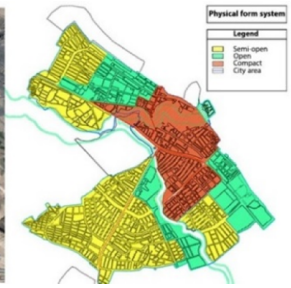



**Figure 7.** Texture compression

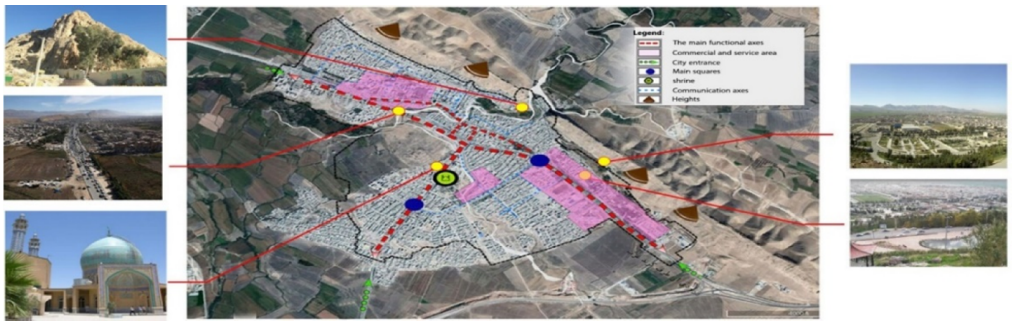



**Figure 8.** Structure of public spaces and urban landscape

with the outside. The central point of this collision can be considered the densest area in the city. In the operational component, the urban form is associated with the density, the type of city texture, and the size of the parcels.

According to Figure 5, Sarpol-e Zahab has an organic and irregular texture in its central core, while the newly renovated parts at the western and southern ends are regular with a checkered texture. According to Figure 6, the northeastern part of the city has large parcels. The map in Figure 7 displays that the central part of the city has the highest density. Moreover, the lands in the residential area are semi-open, and other areas of the city are considered completely open. The public space structure system aims to assess the relationship of important urban functions and the spatial integration of the main structure of the city



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with different functions.

In the map in Figure 8, the main axis marked as red demonstrates the connection among the main spaces. The busiest buildings are located along this axis. Commercial complexes as one of the urban land uses along these streets strengthen this connection. The urban vision system is one of the key issues affecting citizens' satisfaction, objective aspects, and individuals' mentality. Figure 7 illustrates some places that citizens have a common experience with. This experience is created through human activities throughout history and is interpreted in the minds of citizens.

Table 1 examined the strengths, weaknesses,

**Table 1.** Investigate strengths, weaknesses, opportunities, and threats in the strategic field

| Components | Systems | S | W | O | T |
|---|---|---|---|---|---|
| operational | Land use and activity | Proper distribution of educational spaces<br>Location of the functional zone along the main route of the city | Shortage of medical spaces<br>Long distances between spaces with similar uses in the city | Possibility to use barren lands in crisis situations<br>Possibility to use parks in crisis situations | Worn-out texture of the city<br>Proximity to high-risk land uses and residential areas |
| | Movement and access | Direct connection of main routes to local accesses<br>Growth of city in the direction of the main access | Accumulation of land uses along the main street<br>Long distance between the main access and some areas of the city | Direct connection to neighboring cities through the main artery of the city<br>Possibility of widening the passages in civil engineering projects | Lack of open space adjacent to main streets<br>Narrow passages |
| | Physical form | Gridiron-road network in newly built areas<br>Low building density | High density in old residential areas<br>Density of commercial spaces | Ability to monitor new constructions according to density and space | Expanding the influence of incompatible uses<br>High density of land uses in the city center |
| Aesthetic | Structure of public spaces | Existence of a strong connecting path | Lack of open spaces near urban squares | Existence of open spaces for public uses | Possibility of breaking the connection between public spaces due to disaster |
| | Landscape urbanism | Old age of the buildings in the region<br>Favorable landscapes due to the slope to agricultural lands | Lack of green space<br>Worn-out and semi-finished facades | Existence of Alvand river for landscape design<br>Use of the ancient hills | Destroying the landscape if high-rise constructions continue<br>Ignoring the historical identity of some neighborhoods and places |
| environmental | Natural environment form | Water retention due to slope | Restriction of the city from the north | Possibility of city expansion to the west | Construction on loose agricultural land |
| | Climatic geography | Proper rainfall throughout the year<br>Mild climate | Dehydration in summer<br>Existence of four faults in the province | Possibility of transferring the surface waters of the city by creating drainage networks to Alvand river | Rising river water and flooding |

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| | | | | | |
|---|---|---|---|---|---|
| | environmental pollution | Fresh Air<br>Clean and healthy water | Sewage accumulation in some southern parts of the city | Possibility of widening and strengthening water and sewage transmission channels | High groundwater level and the possibility of contamination |

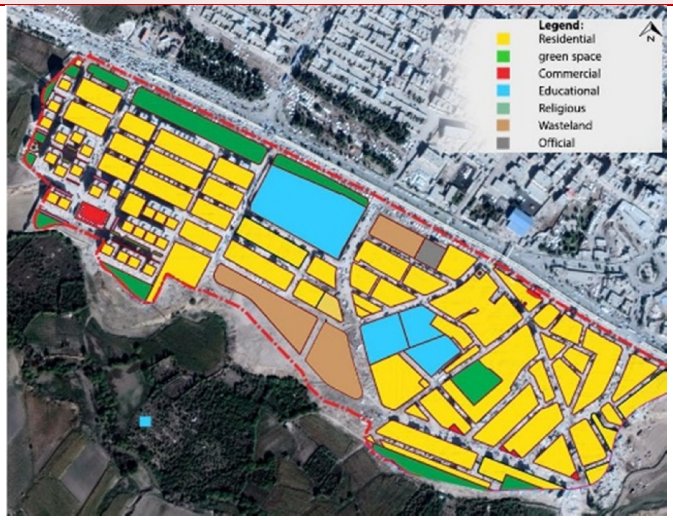



**Figure 9.** Land use in the local area

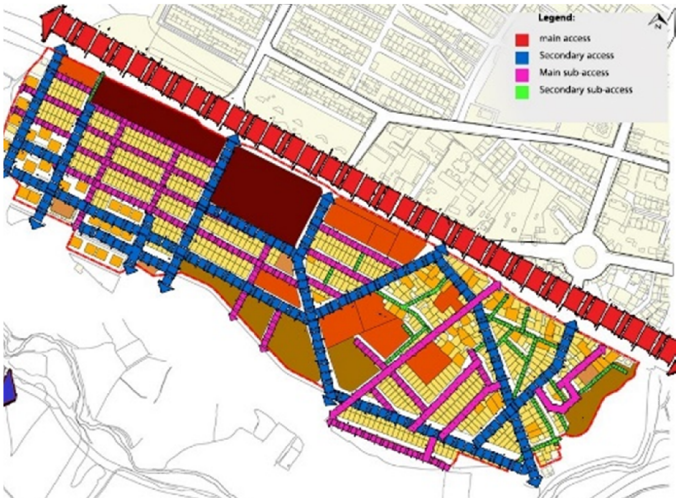



**Figure 10.** Movement and access system in the neighborhood

opportunities, and threats in the strategic domain. The regarded components are assessed in Table 1, and finally, the extent of mutual effect and affectability between the two strategic and the local domains is expressed. Regarding the impact of the two domains on each other, it can be observed that this area has attracted the poor due to its proximity to the city outlet, the old texture, and unsuitable land for construction. Therefore, people have moved to this region from all around the city to buy cheap apartments. The apartments in Mehr Housing Project, which were usually constructed in remote parts of the city due to cost-effective lands, confirm this argument. Since there is no cultural, educational, and recreational land uses in this neighborhood, there is no interaction between strategic and local domains, while the residents of the neighborhood need to leave the neighborhood to meet all their needs. This neighborhood has no effect on urban public spaces and is completely separated from the urban structure. After situation assessment of the strategic domain, the local area was investigated to identify the values and needs of neighborhood residents. According to Figure 9, except for educational spaces, a mosque, and a shop, other spaces are residential. The green s paces in the northern part of the neighborhood



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were. designed, and other spaces were developed organically. Barren lands in the southern part of the neighborhood have no useful land use. Based on Figure 10, the neighborhood has a main artery that runs from the north. The main entrances are also from this direction. Moreover, access is easier on the right due to the type of texture. There are narrow alleys on the left side of the neighborhood which is older. There are narrow alleys on the left side of the neighborhood which is older.

The neighborhood residents were interviewed on their experience of public spaces and the system of activity. The results of these interviews pointed to some concerns about security in public spaces, especially due to abandoned spaces in the southern part of the neighborhood. In general, the residents consider the northern part of the neighborhood less dangerous than the southern part. Since all the land uses which are active 24 hours, such as mosques and commercial uses, are closer to the external front, they do not actually increase the security of this urban texture.

In the urban form system, as displayed in Figure 11, most land uses have an area of less than 100 meters. The largest area can be observed in the vocational school and the main park in the neighborhood. According to the map in Figure 12, most of the buildings in Fooladi neighborhood lack structure, while on the left, the apartments of Mehr Housing project have steel or concrete structures. In general, it can be argued that Fooladi neighborhood which is older has an organic texture with irregular apartments next to each other. On the other hand, the left side of the neighborhood, which has renovated apartments, has a checkered texture.

According to Figure 13, the structure of important neighborhood functions is illegible and intermittent. The north street is the only major road, and the routes that are considered entrances did not lead to a specific inflection point and were abandoned at the end despite their potential to continue this connection. Since the neighborhood does not have any neighborhood centers, the inflection points displayed on the map are the regions which have turned into a series of gathering places due to the connection of several streets. Another factor that affects the structure of the neighborhood is the degree of enclosure. As demonstrated in Figure 14, in this neighborhood, the amount of enclosure increases by moving from east to west.

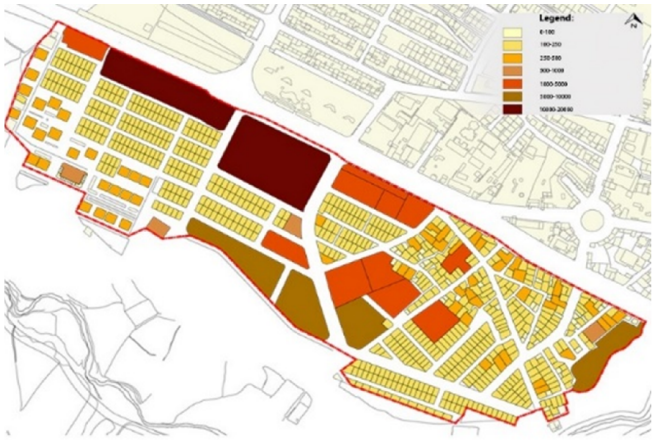



**Figure11.** Gradation of the local domain




**Figure 12.** Technology of local domain construction

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**Figure 13.** Structure of public spaces in the local domain




**Figure 14.** Types of enclosures in the neighborhood

**Table 2.** Investigating strengths, weaknesses, opportunities, and threats in the local domain (Source: Authors)

| Components | Systems | S | W | O | T |
|---|---|---|---|---|---|
| operational | Land use and activity | Existence of an active market in the area as a commercial part of the neighborhood<br>Existence of educational uses for children of different ages | Shortage of service uses in proportion to the number of residents<br>Failure to meet some basic needs of residents, such as pharmacies | Possibility to increase micro-commercial uses at the domain level<br>Using barren lands to create essential uses | Lack of economic justification for the construction of any non-residential activity<br>Distance between the hospital and the neighborhood |
| | Move and access | Gridiron-road network of Shirodi neighborhood<br>Many entrances into the neighborhood | Uncertain end of streets<br>Organic texture and difficult access to the steel neighborhood | Possibility of widening the passages in civil operations<br>Possibility to strengthen public transportation | Excessive number of motorcycles and cars in Fooladi neighborhood<br>Widening the passages and destroying the historical texture |
| | Public activities and experiences | Strong neighborhood relationships and high social capital in most places<br>Background and historical identity | High unemployment among young people<br>Lack of recreational facilities<br>Low levels of household income | Utilization of open spaces to develop public space<br>Increase population | Excessive barren lands and the creation of criminal spaces<br>Lack of monitoring over entrances<br>New generation detachment from neighborhood identities<br>Intra-city migration to this neighborhood |
| Aesthetic | Physical form | Uniform gradation in old texture<br>Variety of organic and checkered texture | High density of residential uses<br>Difference in height of buildings | Residents' collective tendency to renovate worn-out apartments<br>Creating an appropriate skyline in new constructions | Construction of high-rise buildings inconsistent with the historical texture of the region<br>Uncertainty of the boundaries between some buildings |
| | Skeleton of public spaces | Excessive commercial activities in the main route<br>Existence of such places as mosques to maintain public spaces | Shortage of public spaces for social interactions<br>High enclosure of corridors<br>Discontinuity of landmarks | Proximity to the city park<br>Barren lands and the possibility of conversion into public spaces | Irregular construction and the possibility of ignoring the key elements of the neighborhood<br>Continuation of construction of high-rise buildings and more enclosure<br>Decreased eligibility due to discontinuity of landmarks |
| | Landscape urbanism | An organic texture with identity<br>Persian architectural design in Fooladi neighborhood<br>Favorable agricultural landscape of the south side | Lack of green space<br>Lack of visual corridors in nodes<br>Lack of diverse landscapes | Designing landmarks at landmarks<br>Use area-specific vegetation for more landmarks | Growing trend of high-rise constructions and reduced visibility to the surrounding plains<br>Visual pollution due to worn-out elements and components |

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| Environmental component | Environmental pollution | Healthy and clean air in the neighborhood<br>Garbage collection from the northern front by municipal forces<br>Existence of canals and ditches to collect surface water | Lack of a place for garbage collection in the neighborhood<br>Noise pollution due to the location of the main street of the city on the northern front | Possibility to use the slope of the land to transfer runoff water<br>Considering public toilets in the region | Shallow depth of water transmission channels<br>Negligence of the authorities to provide appropriate and sufficient services |

In order to assess the urban vision system, nodes, edges, busy roads, and signs that were important to the residents were examined. The neighborhood lacks clear and sensitive nodes that can create a space for social interaction. Except for the vocational school, mosque, and park which are confined to the north front of the site, there is no indication effective in the identification of different parts of the neighborhood. The neighborhood lacks vitality and public spaces for social interactions.

It is noteworthy that Fooladi neighborhood is considered a region with historical identity; nonetheless, inattention, negligence, and poverty of its inhabitants have detached it from its historical potential. Since the systems form of the natural environment and climatic geography have the same conditions in both strategic and local domains, only the system of environmental pollution was assessed to avoid repetition. Table 2 presents the strengths, weaknesses, opportunities, and threats of each layer based on the maximum weights assigned by experts in the questionnaires.

***(Third stage): Assessing the vulnerability of the local domain and integrated SWOT analysis***

According to the findings of the study, after the earthquake, the residents of the neighborhood faced many problems regarding the mentioned systems. In terms of land uses systems, the massive destruction forced the residents to build shelters in barren lands and green spaces. All public land uses, such as schools and mosques, that had the potential to be used as a residential place, were destroyed or in need of repair. As illustrated in Figure 15, most of the shelters were set up on the north front since disaster victims needed to go out of the neighborhood to meet their needs. Regarding the access system, as displayed in Figure 16, the most important issue was the lack of access to earthquake victims in the eastern part of the neighborhood with narrow intertwined streets that did not allow the passage of ambulances. Disaster is one of the events which provide a good assessment of the system of activities and public experiences. The promotion of social capital among the residents and strong neighborhood relationships not only increased the victims' sense of security but also provided opportunities for participation. On the other hand, the presence of strangers and living in tents that are not sufficiently confined reduced the security of victims.

A noteworthy point in the urban form system is that despite the low height of buildings and favorable enclosure of Fooladi neighborhood, it suffered huge losses due to high building density, poor construction technology, and dilapidated buildings. The interesting thing about the structure of public spaces is the establishment of emergency and temporary shelters in the regions which evoke collective memories. In the urban vision system, the road as one of the effective factors was completely blocked in Fooladi neighborhood. The edges were completely destroyed, except for the green edge of the park.

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**Figure 15**. Temporary accommodation on the north side (Source: Authors)



**Figure 16.** Access Blocked (Source: Authors)



**Figure 17.** Unfavorable health conditions (Source: Authors)



**Figure 18.** Clogging of water in canals (Source: Authors)

Educational spaces and commercial land uses were completely destroyed, and only the mosque and vocational school remained. It seems that after the disaster, the urban vision system lost its objective dimension and dealt with the separation of spaces with a greater emphasis on the subjective dimension, as well as past experiences and memories. Regarding environmental pollution, as displayed in figures 17 and 18, we can refer to the shortage of toilettes in the neighborhood in proportion to the population, lack of proper facilities and infrastructure for the establishment of toilettes, water cut-off, lack of easy access to drinking water, as well as improper waste disposal and garbage dumping into the streams which led to the retention of water and sludge production in canals.

It is noteworthy that the noise pollution caused by the settlement in the vicinity of one of the main arteries of the city created unfavorable psychological conditions for disaster-stricken people. The performance of each urban system in the neighborhood after the disaster was examined in order to identify the most vulnerable areas and provide effective solutions to address them. All systems, such as the age of existing buildings, construction density, population density, and vulnerable passages, were examined, leading to the preparation of the map displayed in Figure 19 as a local vulnerability map. It is worth mentioning that the effectiveness of each layer was determined based on the weights assigned by experts.

According to Figure 19, Fooladi neighborhood has the highest vulnerability due to the higher floor area ratio, age of residential buildings, and buildings with masonry materials. It is noteworthy that the vulnerability is higher on the right part of the neighborhood and the three-five story apartments of Mehr Building project which were severely damaged despite the use of new structures. This can be attributed to high population density, narrow streets, and an increase



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in floor numbers. On the other hand, buildings higher than five floors constructed in Mehr Housing project are more resistant due to the use of steel or concrete structures.

Despite the destruction of non-structural elements, the main structure of the buildings remained intact and did not collapse. It is worthy to note that areas that were built on barren lands in recent years were identified as the regions with moderate vulnerability due to their location on loose soil of agricultural lands despite strong construction. These maps for the neighborhood are of great help in the identification of the vulnerability of different areas before any planning and development of policies based on such zoning. In addition to the identification of vulnerable areas, the recognition of the potentials, strengths, weaknesses, and threats of an area can prevent the wrong decisions and guide the most effective measures.

Therefore, the map in Figure 20 shows an integrated SWOT analysis of the local domain. Based on this map, reconstruction can be used as an opportunity, such as the conversion of vacant lands into essential uses of the neighborhood, widening of narrow streets, and improving the layout of apartments. Moreover, many threats, such as construction on agricultural land, construction of high-rise buildings inconsistent with the physical texture of the neighborhood, and the destruction of existing green spaces due to misuse, can be prevented.



**Figure 19.** Local domain vulnerabilities

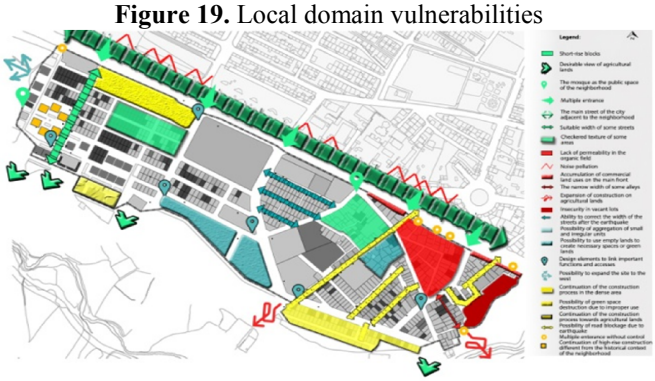


**Figure 20.** Integrated SWOT analysis

***(Fourth stage): Vision development and presentation of policies***

Based on the information obtained from the maps, field observations, and conducted interviews, the present study ultimately aimed to provide a vision considering resilience to future disasters. It has been attempted to develop a vision which brings the neighborhood a comprehensible and distinctive image and guides future decisions. Table 3 presents the intended goals and policies to

**Table 3.** Objectives and policies to create a resilient neighborhood (Source: Authors)

| Value: | Macro goals | Micro-goals | policies |
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| | | | |
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| Resilience | Physical resilience | Disaster-resistant construction | Providing new building instructions and close monitoring of their implementation<br>Using the experiences of structure behaviors in previous disasters<br>Strengthening the foundation of the building and improving the existing loose soil<br>Strengthening the existing housing using new technologies |
| | | Optimal neighborhood access | Regulating the backlog of buildings and creation of integrated passages<br>Adaptation of main passages and streets for the movement of the disabled<br>Quick access to public spaces for residents in different areas of the neighborhood<br>Attractive pedestrian lanes with active fronts, as well as secure and direct communication between shops<br>Defining hiking and biking lanes |
| | | Neighborhood Facility Network | Security of electricity and telecommunication network<br>Improving the network of collecting surface water and making canals along the passages and providing the required slope<br>Sustainable drainage systems for the neighborhood |
| | | Attractive, high-quality landscape of the neighborhood | Optimal enclosure in passages and public spaces<br>Increasing the number of statues and landmarks adds to the beauty of the city<br>Using more colors in public open spaces and cultural-recreational spaces to increase the attractiveness of the city<br>Public open spaces and numerous parks to involve residents in urban affairs |
| | | Resistant neighboring apartment | Enough open space and green space between the apartments<br>Creating a new social center for safe and comfortable interaction<br>Placement of plenty of new housing close to renovated activity centers that have good access to services and transportation |
| | | Upgrading the services required by the neighborhood | Activating the local store and integration of existing uses<br>Improving the quality of education through rehabilitation of facilities and construction of schools and kindergartens<br>Improving health facilities through the establishment of small clinics in the neighborhood<br>Creating cultural and artistic centers in the neighborhood in proportion to population<br>Placement of offices, medical centers, and office uses next to public transportation and away from existing residential streets |
| | | safety and security | Suitable lights in passages to provide adequate lighting at night<br>Ability to monitor and respond faster and more effectively to emergencies<br>Further development of locations away from the existing residential area<br>Determining the neighborhood growth boundary in order to determine the constraints for neighborhood development |
| | | Climatic design | Using materials and technology appropriate to the climate and context of the design<br>Creating green roofs<br>Avoiding excessive glass surfaces in the facades of buildings |

**Table 3.** Continued

| | | | |
|---|---|---|---|
| Resilience | Environmental resilience | Quality environment | Upgrading waste management system<br>Implementing community demands and environmental sustainability through participatory design<br>Multi-purpose urban green space design while combining diverse user perspectives<br>Innovative design to maximize green space in crowded neighborhood environments |
| | | Climatic comfort | Shading in the passages<br>Using fountains to adjust the temperature<br>Creating a parkway to obtain comfort temperature |
| | Social resilience | Providing the services needed by residents and employees in the neighborhood | Consolidation of barren and green areas that can pave the way for the creation of a neighborhood center<br>Construction of cultural spaces in the pathway for the interaction of the city with the neighborhood<br>Establishment of training centers to adapt current knowledge and skills to the skills required by the neighborhood<br>Promotion of the existing cultural and artistic infrastructure considering the young population |
| | | Vitality of the neighborhood | Development of appropriate tools to facilitate youth participation in neighborhood planning and design<br>Adding various sports-recreational activities to add a special attraction<br>Creating cultural cooperation centers in the neighborhood for exchanging thoughts and ideas of residents<br>Holding numerous local and indigenous exhibitions |

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| | Social capital | Encouraging the presence of women in neighborhood-related decisions and affairs<br>Getting help and assistance to the neighboring country at the time of the disaster<br>Change from a bottom-up approach to a bottom-up approach and the actual use of local community participation<br>Creating a "teamwork" called a resilient neighborhood to achieve the desired neighborhood goals<br>Searching for skilled people and supporting them |
| Economic resilience | Increasing the economic benefits of the tissue | Development and attention to the historical texture in order to attract tourists and bring prosperity to the neighborhood<br>Providing housing for low-income families through public housing projects<br>Providing investors with a clear direction about the preferred places to invest |
| | Maintenance of Livelihood in the neighborhood | Creating employment opportunities for residents through the use of local forces in executive measures<br>Empowerment of residents by providing low-interest loans<br>Strengthening the structure of local retail markets |

obtain resilient neighborhoods. In this table, resilience is examined as the value and belief of neighborhood residents at different physical, environmental, social, and economic levels.

The policies on each of these layers were graded based on a questionnaire answered by disaster experts, and the items that weighed the most were listed in the article. In 1410, Shiroodi and Fooladi will be dynamic neighborhoods with a strong physical structure resistant to disasters, suitable urban infrastructure, an access network, and active passages. The resilience against disasters differentiates between this neighborhood and other neighborhoods. Resilience is achieved by strengthening the physical, environmental, social, and economic dimensions.

Physical resilience is achieved by the elimination of incompatible land uses and replacing them with a diverse range of uses needed by the neighborhood. Passages, access quality, and texture permeability have been improved. The physical structure of the neighborhood improves visual coordination by the enhancement of vision corridors. Moreover, it improves the eligibility and spatial organization, enabling the neighborhood to cope and be rebuilt in the shortest possible time. In the environmental dimension, the improvement in the quality of surface water collection and increase in green space per capita will create a favorable environment for residents.

The social dimension increases multi-functional public spaces which contribute to social solidarity and are used as residential places in times of crisis. Moreover, the enhancement of economic benefits of the texture, such as the presence of investors and the implementation of civil engineering projects in the neighborhood, has led to the economic resilience of the neighborhood.

## Discussion and Conclusion

Shiroodi and Fooladi neighborhoods in Sarpol-e Zahab are full of subjective and objective characteristics that highlight the importance of this place and the need to protect them on both local and city scales. After the November 2017 earthquake, Fooladi neighborhood suffered the heaviest losses in the city. According to the findings, the uncontrolled increase in the density of apartments, the existence of buildings without structure, lack of strengthened infrastructures, insufficient capacity of the road network to provide services to residents, and lack of service land uses, such as pharmacies and clinics, presented the residents with numerous problems.

Lack of supervision over the entrances and distribution of donated items in the neighborhood led to the arrival of people who increased traffic and brought insecurity to this place. The present study which aimed to provide a vision with a resilient approach made use of reconstruction as an opportunity to manage policies, preserve identity, improve the quality of urban structure, restore the collective memories of neighborhood residents, and display a bright future for the neighborhood.

In general, a resilient neighborhood can be achieved by the following measures: the use of earthquake-resistant construction methods, emphasis on seismic design, improvement of access network, provision of the services needed by residents after the disaster, provision of security, enhancement of residents' social life, increase in economic benefits, favorable vision, coherent urban form, and eligibility of the texture. The proposals presented in the existing detailed plan of Sarpol-e Zahab do not take into account

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the issues related to disaster resilience. Therefore, it seems that consideration of different physical, environmental, economic, and social aspects of resilience in this plan will be one of the most essential measures to improve decision management and control of pre-and post-disaster policies.

The implementation of the proposed policies on the target vision provides a bright image of Shiroodi and Fooladi neighborhoods in 1410. In this image, the juxtaposition between new buildings with valuable restored buildings has created diverse and beautiful visions. Optimal quality, as well as beauty and comfort of new buildings, will prevent the retrieval of bitter memories of residents and make them trust the strength of their apartments. Furthermore, indoor and well-equipped halls, green spaces, and squares of the neighborhood are lively and multi-functional spaces that are full of children, women, and men of different ages. They are engaged in sports, games, conversations, and various activities, and all these strong relationships among people will boost their sense of belonging to their neighborhood.

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## Conflict of Interests

Authors declared no conflict of interests regarding the publication of the present study.

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