

Evaluation of the Urban Form Resilience of the Residential Neighborhoods; Case Studies: Oudlajan and Sangelaj Neighborhoods in the Historical Texture of Tehran*

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ABSTRACT

In today's world, the early impact of the changes in the cities can considerably improve the design and planning in urban resilience. Urban form-based resilience in the residential neighborhoods and historical textures, in particular, can protect the cells of the social communities against the sudden changes in forms. The current research aims to evaluate the resilience in the neighborhoods of the historical texture, such as Oudlajan and Sangelaj neighborhoods located in District 12 of Tehran. The research method is an analytical-descriptive and comparative study. The data were collected using the library and survey studies. Given the research problem and its purpose, the indicators and parameters of the evaluation were extracted by investigating the theoretical foundations and research background. The metric calculations method was applied to evaluate the physical aspect, and a number of researcher-made questionnaires based on the Likert scale in the interval scale were used to measure the local society aspect. In a pre-test, the AHP method in the urban social area with the academic experts' panel was used to determine the relative significance of the components affecting the urban form resilience. In the following, the urban form resilience from the optimal level for both neighborhoods was obtained using the optimal distance method. The results indicate that despite some exceptions, the urban form in both neighborhoods is not resilient and has an undesirable distance from successful global experiences. Considering the analysis of the indicators and calculating the ARI, the neighborhoods have 0.57 and 0.65 optimal distance, respectively, and social resilience in the Oudlajan neighborhood is higher than in another one. Finally, it must be considered that improving the depth of the recognition and involving the responsible organization for plans along with the re-definition of the social aspects of the life of the citizens will lead to the increase in the urban form resilience of these neighborhoods and will manifest a better prospect of the future of the cities.

Keywords: Urban Resilience, Historical Texture, Urban Form Resilience, Optimal Distance.

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1. INTRODUCTION

Every year, natural disasters cause extensive damage, especially in developing countries, and the available evidence shows a steady increase in the types of natural crises in terms of severity and frequency. There are few countries in the world where natural disasters have not occurred or are safe from natural disasters. However, the harmful effects of these disasters vary from country to country and from level to level. In the course of the urban revolution, cities face fundamental challenges in their form structures, so that after the arrival of modern thinking, urban textures that had an organic organization and at the same time an integrated network, have been torn in all their dimensions (Pelling, 2003, p. 248). The growing dimensions of the cities' vulnerability, which has been due to the occurrence of disasters in recent decades, led to changing the implementation of one-dimensional measures, such as strengthening single-story buildings to reduce the damages and casualties by the occurrence of incidents in the cities and settlement. Thus, these measurements were changed into comprehensive approaches to comprehensively stabilize the life of urban communities in physical, economic, social, and cultural aspects.

The social aspect is one of the aspects of resilience, resulted from the difference of the social capacity among the communities (Ramezanzadeh Lesboubi, 2013, p. 76). However, most of the intervention approaches not only did not reconstruct the previous efficiency of the texture but also have gradually destroyed the social infrastructures physically formed. The current research attempts to answer questions that are mainly based on "how". Therefore, the main research questions are as follows:

1. How is the appropriate model and pattern of the resilience in the residential neighborhoods located in the historical texture?
2. By which indicators and aspects, the components of the urban form resilience in the residential neighborhoods are evaluated and analyzed?
3. By which method, the urban form resilience of the residential neighborhoods of the historical texture can be evaluated regarding the determined indicators?
4. What are the general results of the resilience of residential neighborhoods in the historical context in the conceptual dimension? Therefore, in explaining the research structure, the principal purpose lies in

reviewing up-to-date sources and extracting the optimal model from the attitude of the urban form resilience. Thus, it can analyze residential neighborhoods in the historical context in the most appropriate way at a comparative level with the successful global example and lead strategies to present urban plans.

2. RESEARCH LITERATURE

Resilience is both normative and conceptual concept (Speranza et al., 2014, p. 114). Currently, there are various definitions of this term, and resilience means a way to improve the communities using their capacities (Kärrholm et al., 2014, p. 121). In the 1990s, after rising the resilience concept for the first time, this term was introduced in urbanism, and yet it lacks a clear definition over time. It is mentioned in facing all the crises that occur in cities, including cultural, technological, globalization, and economic changes (Lu & Stead, 2013, p. 201). Cities are subject to gradual and sudden change. Early detection of these changes and their effects on the city and design and planning based on this diagnosis can significantly increase the resilience of the city to these changes (Desouza & Flanery, 2013, pp. 93-94). On the one hand, resilience detects a system that must be resilient, and on the other hand, detect the type of crisis that system must be resilient facing, based thereon, it has various spatial, livelihood, institutional, social, and physical aspects (Lu & Stead, 2013, p. 201).

2.1. Resilience Measurement Indicators

Despite the lack of a codified framework and indicators, only based on the theoretical consensus of the scientific community, resilience is a multifaceted concept with social, economic, institutional, and physical dimensions (Rezaei, Rafieian, & Hosseini, 2015, p. 615). A variety of indicators are defined and used around the world for resilience, and little research is being done to determine these indicators on a regular basis (Berke & Glavovic, 2012). Criteria expressing these indicators to date are trust or reliability, leadership, collective efficiency, collective capital, social solidarity and sense, social participation, criteria, attitudes, existing values, and communication and information (Rafieian et al., 2012, p. 29). Table 1 shows the classification of resilience indicators of the urban system separately for each of the dimensions.

Table 1. Classification of the Resilience Measurement Indicators of the Urban System Per Resilience Aspect

Resilience Aspects	Resilience Indicators
Social Resilience	Adaptability or compatibility, relationship or connection (i.e., various parts of the social system), Vulnerability, household health and the population of the culture service, reduction in violence and insecurity and urban crime, capacity for learning and awareness, various social classes, innovation and creativity, capability and ability of the human resources, on-time accountability, social capital.
Economic Resilience	Livelihood and livability, strategies, and policies of the urban economy, the relationship indicator with different parts of the economic system, wealth and employment, economic diversity.

Resilience Aspects	Resilience Indicators
Environmental/ Urban Infrastructure Resilience	Diversity, the relationship index with connection (i.e., various parts of the environmental system) the health of the water, air, and soil, adaptive design (i.e. the quality of the urban environment through design role and space organization), urban infrastructure, ecosystem service, modularity of measurability, strength (the strength of the physical components and elements of the city such as roads, buildings), the adaptability or compatibility, redundancy, sustainability, natural capital.
Institutional and Organizational Resilience	Institutional structures and skills, decision making and decision taking policies, integrated management, variety in the organizational levels and inter-organizational communications, relationship with connection (i.e., different parts of the organizational system and institutes), adaptability or compatibility, on-time accountability.

(Gharai, Masnavi, & Hajibandeh, 2018)

2.2. Urban Resilience

Urban resilience includes a wide range of methods, and urban changes expand over the various stripes of time. Many years of studies on urban resilience reveal that in some cases, such as sudden form changes such as earthquakes, storms, terroristic attacks (Pelling, 2003; Savitch, 2008; Coaffee, 2009), and the processes of evolution in the economy, society, and environmental contexts, these concepts enjoy a considerable significance in the urban structure (Muller, 2010). Change can have alternating impacts in various types, which often includes spatial scales and social organizations that include no specific scale. (Muller, 2010, p. 5). He argues that investigating the urban features and the dimensions of a region is very complicated and intricate. Therefore, it is necessary to apply flexible analytical methods on various scales. It is clear that urban resilience may be a feature of the relationship between spatial, physical, social and cultural, environmental and economic aspects of the city, which is classified and described in various patterns; however, resilience dimensions such as "economic resilience", "social resilience" or "environmental resilience" is more fully overshadowed by the centralized achievements of resilience, durability, and adaptability in certain aspects of the city.

2.3. Resilient Urban Form

The urban form is formed by all the visible elements of the city, whether natural or artificial, and the spatial

and formal reflection of the activities of the urban community. Urban form, with its three-dimensional nature, is also embodied in volume in addition to the surface. This composition includes the artificial elements of humans, buildings, road networks, open spaces, urban facilities, and natural elements such as topographic elements, water currents, and vegetation. Each element is considered an urban cell with its particular form, leading to the emergence of the urban form. In a general perspective, the urban form is a composition of the factors that are associated with the urban land use pattern, urban transportation system, and urban design (Handy, 1996, p. 154). In this regard, density is the most influential factor in resilience. Its positive form is less energy consumption and emissions of greenhouse gases, resulting in less need for trips that lead to pollution, that results in the reduced pressure on green areas and optimal use of efficient technology in cooperation with the dense urban form (Jones & MacDonald, 2004, p. 4).

It can be concluded that the urban form is the result of the convergence of many urban elements and concepts. International Seminar of Urban Form (ISUF) states three principles of form by a morphological analysis:

1. The urban form consists of three main elements: building, its open space, and the streets.
2. Urban form can be investigated in the scales of building/plot, street/block, and city and region.
3. Since the constituent elements of the urban form change over time, the urban form is only comprehensible by a historical approach (Moudon, 1997, p. 4).

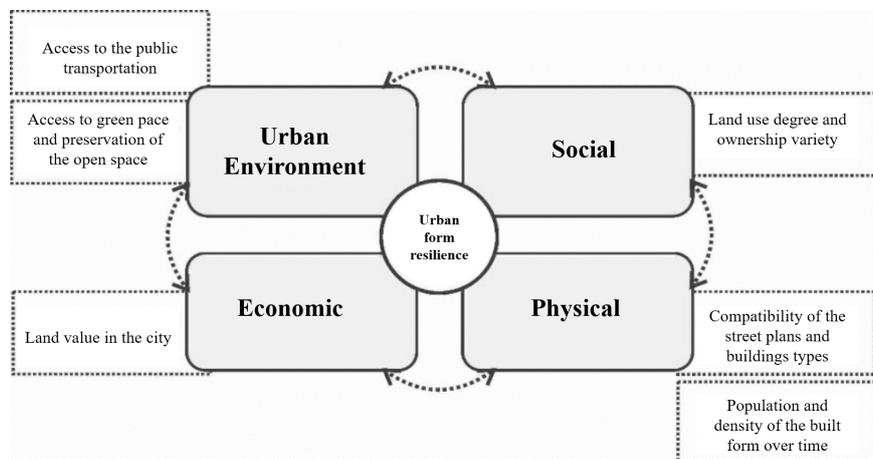


Fig. 1. Quadruple Aspects in the Conceptual Framework of Urban Form Resilience

Therefore, according to the concepts above, the conceptual model is presented in Figure 2 to achieve a proper method to evaluate the urban form resilience. In the conceptual model, the flexibility in physical dimensions in criteria such as population, density, and adaptation, environmental, in the accessibility criteria, in social and economic dimensions, the degree of land use, and the diversity of residence and property value are explained respectively. Also, the sustainability

approach has been considered in interpreting the flexibility of the urban form (Fig. 2). Therefore, the main purpose of explaining the structure of research lies in examining the sources of emergence and extracting the optimal model of resilience in the urban form. Thus, it can analyze residential neighborhoods in the historical context in the most appropriate way at the level of comparison with successful global examples and propose strategies to present urban plans.

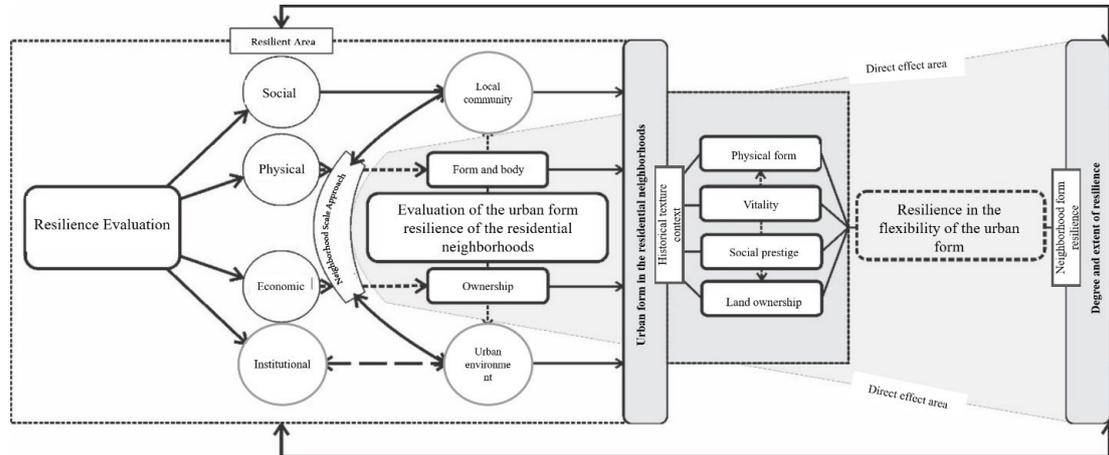


Fig. 2. Conceptual Model of Research for Evaluating the Resilience of Residential Neighborhoods in the Historical Context

3. RESEARCH BACKGROUND

Recently, different studies with various approaches have been conducted on the resilience that has been considered often on macro scales and with systemic approaches in the urban regions. In most of these studies, the plan-centered research method was used to study the samples, and the results were presented. However, some examples can be mentioned, along with the current research. Also, the novelty of the research method and subject can be presented:

In a study entitled *Urban Resilience: an idea for the regeneration of the future cities*, published in the resilience institute Europe of the European Union, Frantzeskaki et al. (2016) addressed resilience at the macro scale and analyzed its aspects in the development process of the European cities with the approach of sustainability, which is more focused on the scale of the urban regions. In this study, which is conducted analytical-descriptive and exploratory, the resilience aspects were physical and social, and the institution and economy have been considered as the corresponding branches of the above components. In the domestic studies, in a paper entitled *Evaluation of the Resilience Capacities in the Urban Complex of Qazvin* with the approach of resilience in the regional and urban scale, Dadashpour and Adeli (2015) evaluated the resilience and its optimal distance using the modeling of the similar studies in California and Tokyo by studying the physical, institutional, social, and economic aspects of the resilience in the urban complex of Qazvin. Eventually, using a questionnaire

and random sampling of the statistical population, each indicator of the resilience aspects was mentioned in the process of planning (Dadashpour & Adeli, 2016).

In a paper entitled *Evaluation of the Social Resilience in The Urban Regions of Isfahan*, Delake et al. (2017) studied the urban resilience in the social and economic aspects in the regions, and they stated the social capital to structure the urban resilience in Isfahan City. The results showed that the regions with historical-religious centers, public health, and proper transportation have higher security and allocated more score in the ranking of the social resilience considering the studied criteria and indicators (Delakeh, Samare Mohsen Beigi, & Shaivandi, 2017).

In a study entitled *the evaluation of the physical resilience against the earthquake hazards with the approach of achieving sustainable management*, Ziari et al. (2018) also analyzed the physical resilience in District 1 of Tehran city analytically and descriptively and investigated the research indicators regarding the natural hazards such as earthquake. In this study, physical resilience was frequently mentioned as an approach against the danger that considered policymaking in urban management in the approach of sustainability (Ziari, Ebadollahzadeh Maleki, & Behzadpour, 2018).

In a general view, the studies mentioned in the focus of the present research can be evaluated in several cases, so that most of the mentioned research: 1. Have studied The dimensions of resilience in metropolitan and regional scales, while the neighborhood scales were in this research were in large-scale; 2.

Dimensions of resilience have been considered more in approaches such as physical, social and economic, which have been evaluated more in dealing with risk, and 3. In an innovative form, concepts such as physical organization in the branches of form and body system, land use and ownership and environment, etc. have not been proposed to be able to study the issue of resilience in more practical cases not only in the planning and management structure but also in the dimensions of urban design. As a result, the concept of urban form has been selected in evaluating the resilience in the current study considering its place in the urban system.

4. RESEARCH METHOD

The current research method is descriptive-analytical and is applied in terms of purpose. Since the previous studies have not explained the evaluation model of the resilience in the residential neighborhoods of the historical texture, this study is exploratory as well. Data collection methods are library (i.e., statistics and documents) and survey (i.e., questionnaire). In the present study, the measurement calculations were used in the form of maps and tables for the physical aspect, and a researcher-made questionnaire based on the Likert ranking scale was used to study the social aspect and the flexibility of the local society. The sample size was determined based on Cochran's formula at the error level of 5% (confidence level of 95%). Considering the mean population of two neighborhoods of Oudlajan and Sangelaj, a random sampling method was used, and 331 questionnaires were distributed among them and were accepted. By entering the obtained data into the SPSS software, the Cronbach's alpha coefficient for 30 questionnaires was calculated as 0.934, indicating its high reliability. Elites and experts confirmed the validity of the research questionnaires. During these steps, the triple phases of regulation and analysis were done. Also, the results were presented after codifying and setting the questionnaire and the structure of items. As a pre-test to determine the relative importance of the components affecting the resilience of urban form using AHP technique in the field of urban social sciences using a panel of academic experts, especially in the fields of urban planning and social sciences including 8 professors and management, urban planning and design professors of the faculties of architecture and urban planning of the University of Tehran, Iran University of Science and

Technology and Shahid Beheshti University, who have more experience in conducting similar research as a specialty, have been selected and conducted, reviewed and approved. Eventually, the average total distances of optimal limits¹ was used as one of the most appropriate methods to study the ideal distance from the model's resilience. The numerical value of each index was in percentage, and the evaluation of the urban form resilience in the above neighborhoods requires a definition of the optimal limit for each index. By studying the resilience of the neighborhoods of Chamisso in Berlin, Mayfair and Belgravia in London, and Opera in Paris in the experiences of the urban form in Europe² which are as the example neighborhoods morphologically and as a proper database for Tehran, the optimal level was obtained by dividing the optimal limit of each index by the determined optimal limit. In calculating the RFI (Resilience Factor Index), the level of desirability obtained from European experiences for each index will be the actual percentage/rate of each index and vice versa for the inverse indices. By summing the distances obtained in each index of the optimal value of each dimension of resilience, it is possible to determine the resilience distance of urban form of Oudlajan and Sangelaj neighborhoods and calculate the amount of resilience in the four dimensions of urban form, including CRI formula and final resilience with ARI formula.

$$CRI \text{ (Component Resilience Index)} = \sum_1^n \frac{RFI}{n}$$

$$ARI \text{ (A Resilience Index)} = \sum_1^4 \frac{RFI}{4}$$

In the present study, considering the type of problem and the considered purpose, the scale of the evaluation of urban form is mentioned at the residential neighborhood dimension, and extracted and considered dimensions and indicators were presented in Table 2 along with the indicators and measurement metrics. These indicators were obtained after reviewing the similar experiences mentioned in the research background. Then, given the local data, the final indicators were selected among the obtained data and were employed in the research. The reasons for selecting the indicators and dimensions are based on the existing texts and their relevance to the resilience, availability, sensitivity, power, ability to reproduce, range, the cost of achieving them, simplicity, and their interrelationships and with other subjects (Ainuddin & Routray, 2012).

Table 2. Operational Explanation of the Indicators and Criteria Related to the Evaluation of the Resilience Aspects of the Neighborhoods in the Historical Texture

Aspect	Criteria	Indicator	Metric of Measurement
Physical	Physical form	Density	Population density in each hectare (calculated in the map), area and the ground floor ratio (calculated in the map)
		Street Layout and Type of Building	Sections of buildings and street (graphic- Delphi), ground floor plans (graphic, Delphi)
Urban Environment	Vitality	Access to Public Transportation	Public transportation stations (calculated in the map)
		Green Space	Area of green space (calculated in the map)

Aspect	Criteria	Indicator	Metric of Measurement
Social	Social Prestige	Social Capital	Neighborhood link (questionnaire), social trust (questionnaire) social institutions and networks (questionnaire)
		Tenure Right	Tenure right of housing (statistics)
Economic	Land ownership	Public Land Value	Housing price since 1992 (statistics) traditional prices (field study)
		Property Value in the Texture	Range of urban housing value (calculated in the map)

5. STUDY AREA

Oudlajan and Sangelaj neighborhoods located in District 12 of Tehran city, are two of the five historical neighborhoods of old Tehran. In the present study, these neighborhoods were based on considering the difference in three criteria of spatial scale, time interval, and type of land ownership. Oudlajan neighborhood is limited to Amirkabir street from north, Rey street from east, Naser Khosrowstreet from the west, and 15 Khordad street from the south, and its area is approximately 35 hectares. Sangelaj neighborhood is limited to Amirkabir street from the north, Moulavi street from the south, Vahdat-e Eslami street from the west, and Khayyam street from the east. Moreover,

this neighborhood is adjacent to the Oudlajan neighborhood and Bazaar. Oudlajan and Sangelaj are one of the five neighborhoods in the Safavid era along with other neighborhoods, such as Arg, Chale Meidan, and Old Bazaar of the city. In the early of the Pahlavi reign, the Oudlajan neighborhood located adjacent to the Bazaar and the government center had a very significant residential role. Also, various classes of people, the rich and nobles, in particular, lived there. (Motamedi, 2011). Given the age and history of these two neighborhoods in Tehran city, they were selected as the case studies. Figure 3 presents the location of the studied neighborhoods in District 12 of Tehran Municipality.

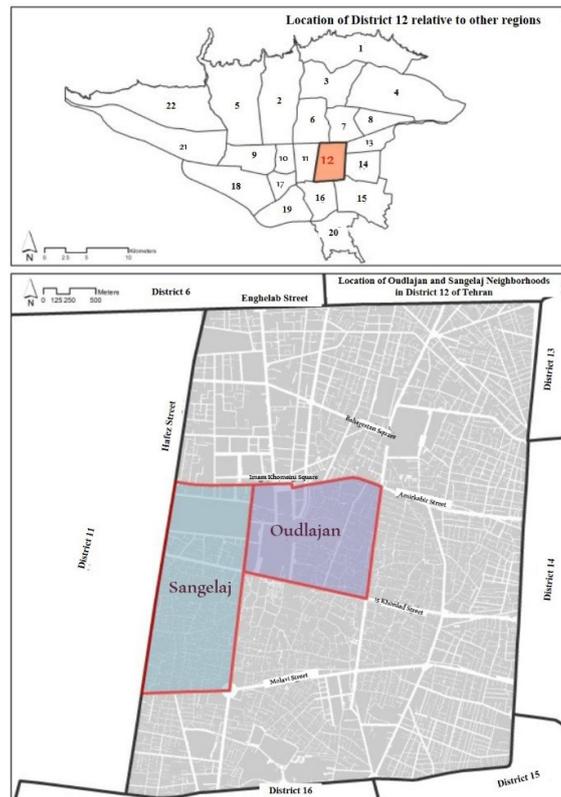


Fig. 3. The Location of the Neighborhoods Understudy

6. RESEARCH FINDINGS AND DISCUSSION

In studying the indicators of the urban form resilience, the distance of each indicator from the optimal limit

was obtained, after the numerical calculation of the mentioned equations and extraction of the optimal limit of the indicators. Naturally, the total optimal of resilience equals 1 or 100. Also, the value of each indicator will lead to the evaluation of its resilience.

In the calculation of this value for the Oudlajan neighborhood, the physical resilience had a 59% distance from the optimal value, the environmental resilience had a 54% distance from the optimal value. Moreover, social resilience had a 22% value, and economic resilience had a 52% distance from the optimal value. Besides, these values for the Sangelaj neighborhood were obtained as 17%, 35%, 44%, and 35%, respectively. By comparing the results, it can be concluded that the social resilience of the Oudlajan neighborhood and the economic resilience of the Sangelaj neighborhood had the best situation among the other aspects of resilience. In a general view, it

can be perceived that the maximum distance in these two neighborhoods is allocated to the physical and economic aspects and these calculations are available in percentage.

On the criteria and indicators of each dimension, results can be obtained from the details of the analysis. Thus, in physical form, indicators of density and street layout and type of building, in terms of vitality, indicators of access to public transportation and green space, and in terms of social credibility, indicators of social capital and tenure, and finally in economic terms, indicators of the value of the public property and texture value was calculated according to Figure 4.

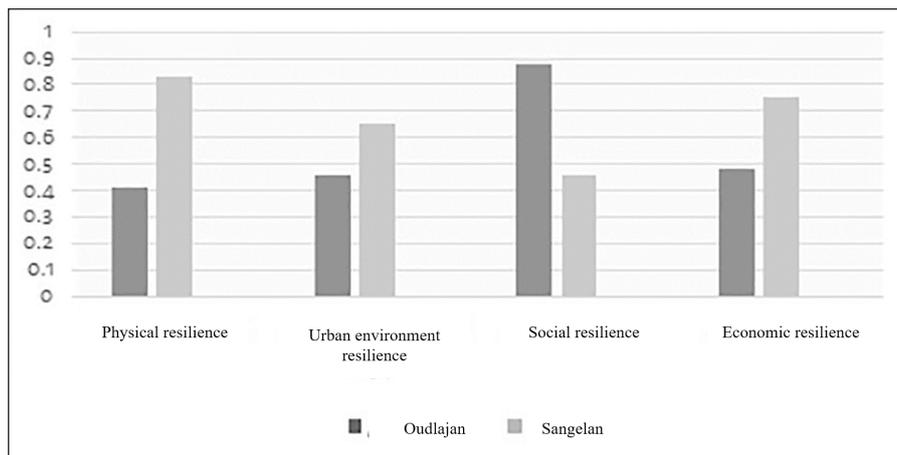


Fig. 4. Resilience Aspects of Oudlajan and Sangelaj Neighborhoods in the Historical Texture of Tehran

By analyzing the components and calculating the metrics of urban form resilience criteria, the results shown in Figure 5 indicate that there is a large difference in the optimal distance between the two neighborhoods that rarely metrics such as neighborhood linkage and

building and street sections have values higher than the optimal limit. Also, most metrics have an unsatisfactory condition and more than the optimal distance according to the urban form resilience criteria.

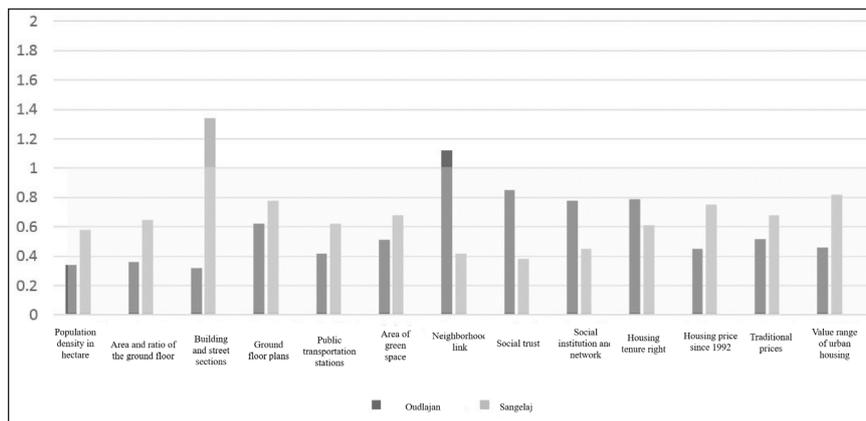


Fig. 5. The Metrics of the Standard Indicators in the Resilience Aspects of the Oudlajan and Sangelaj Neighborhoods in the Historical Texture of Tehran

According to Table 3, the following can be mentioned among the metrics of each criterion in the urban resilience aspects:

- Among the indicators of the physical form of the resilience, the metrics of the population density per hectare for two neighborhoods were calculated 68%

and 66%, respectively. Also, the metric of the area and the ground floor ratio was calculated 64% and 35% distance from the optimal limit, indicating inappropriate density and loading in both of the urban textures. This is because of the dense granularity and microfracture and the lack of a proper plan for the development.

The indicator of street layout and the building was also calculated 68% for the Oudlajan neighborhood. However, this indicator was calculated higher in the optimal limit for the Sangelaj neighborhood. This neighborhood is at a more desirable level due to the location of the neighborhood and the urban planning interventions.

- Among the indicators of the urban environment resilience, the metrics of access to public transportation had 58% and 38%, respectively, distance from the optimal limit for both neighborhoods. Also, the metric of the green space was calculated 49% and 32%, respectively. Generally, the lack of proper green space per capita and the lack of transportation-centered development can be perceived in the texture as well as the physical growth of the constructivism approach in the city. Therefore, the interventions and changes in the land use of historical context that led to the commercialization of land and its conversion into commercial uses can be considered in its analysis.

- In the index of social capital and tenure right, which is one of the main cases in planning and design in the formation of a resilient urban form, the analysis of the neighborhood link metric in the Oudlajan neighborhood has one of the most considerable results. That is, although this neighborhood has a large distance from the optimal limit in terms of standard indicators of physical form,

a percentage higher than the optimal limit has been calculated in this metric. It is because of the existence of social relations, and the type of population loading of this type of neighborhood is not predictable. In the social trust metric, 15% and 62% were calculated for both neighborhoods, respectively, which is significant considering the type of immigration of the residents of the Oudlajan neighborhood. Similarly, in the metrics of social networks and institutions, the distances were 22% and 65%, respectively, which clearly shows the difference between the two neighborhoods in terms of social resilience.

- In the public land value index, for both neighborhoods in the land price metric from 1991, 55% and 25% were calculated, respectively. For traditional and customary price metrics, 48% 32% were calculated, respectively, which indicates the relatively newer type of neighborhood valuation and its blocking in the Sangelaj Neighborhood, which is weaker in comparison with the Oudlajan neighborhood. Finally, in the land value index in the texture and metric of the urban housing value range, 52% and 18% of the optimal distance has been calculated for both neighborhoods, respectively. It can be acknowledged that the greatest impact in this regard is extracted more from the index of the land value and the public attitude towards the type of tenure and personal interests.

Table 3. The Standard Metrics in the Resilience Aspects of the Oudlajan and Sangelaj Neighborhoods in the Historical Texture of Tehran

		Land Ownership			Social Prestige			Vitality		Physical Form				
		Land Value in Texture	Public Property Value	Tenure Right	Social Capital	Green Space	Access to the Public Transportation	Street layout and Building Type	Density					
		Urban housing price range	Traditional prices	Land value since 1991	Housing tenure right	Social networks and institutions	Social trust	Neighborhood link	Area of green space	Public transportation stations	Ground floor plans	Street and building sections	Area and ground floor ratio	Population density per hectare
Optimal Limit Percentage	Oudlajan	52	58	48	85	83	89	52	76	62	75	69	76	85
	Sangelaj	95	82	86	72	55	46	52	75	79	85	72	73	81
Distance from the Optimal Limit Percentage	Oudlajan	54	48	55	21	22	15	-	49	58	38	68	64	68
	Sangelaj	18	32	25	39	65	62	58	32	38	22	-	35	66
RFI	Oudlajan	0.46	0.52	0.45	0.79	0.78	0.85	1.12	0.51	0.42	0.52	0.32	0.36	0.34
	Sangelaj	0.82	0.68	0.75	0.61	0.45	0.38	0.42	0.68	0.62	0.87	1.34	0.65	0.58
CRI	Oudlajan		0.48				0.88			0.46			0.41	
	Sangelaj		0.75				0.46			0.65			0.83	
ARI	Oudlajan							0.57						
	Sangelaj							0.65						

The urban form resilience of the Oudlajan neighborhood to the Sangelaj neighborhood can be mentioned in comparison with the neighborhood resilience. According to the analysis of the indicators and calculation of the ARI, the neighborhoods have 0.57 and 0.65 distance from the optimal limit, respectively. It indicates that the social aspect of the resilience in the Oudlajan neighborhood is higher than the other neighborhood. There is high social solidarity in this neighborhood considering the age and originality of the urban texture in this neighborhood, the type and extent of the social capital, and the establishment of the social networks and institutions. Therefore, to answer the research question, it must be mentioned that the proper model and pattern for the resilience of the residential neighborhoods requires consideration of all resilience aspects, and the mere attention to one or two aspects cannot provide the required answer to this question. Given the obtained results from the research, the significance of the economic, institutional, social, and physical aspects in the urban form resilience of the historical textures can be emphasized. Also, and the manifestation of the obtained results can be seen in these neighborhoods. Finally, to answer the extent of the urban form resilience in the residential neighborhoods of the historical texture, the relationship between its components resulted from the research and the relationship between the social networks and the formation of the urban form and a two-way relationship can be mentioned.

7. CONCLUSION

Nowadays, the analysis of human settlements resilience has become an influential factor in planning. To achieve this purpose, considering the micro-scale, such as neighborhoods along the resilience at the macro scale has drawn more attention. Accordingly, the urban form, which is considered the basis of the city body is significant to make the urban form resilient. Therefore, resilience can prove the impact of the studied indicators due to the overlaying of the studied indicators, which were often in the same structure and also can be equivalent in the middle and macro aspects. Given the distance from the optimal limit method and calculation of the urban form resilience from the optimal level, two neighborhoods of Oudlajan and Sangelaj can be considered with low resilience in the urban form. One of the significant reasons is the population density, lack of green space, and access to the proper transportation. Some recommendations can be suggested to increase the urban form resilience in the neighborhoods, which leads to the urban form sustainability by increasing the knowledge and the investigation and comprehensive analysis of all the neighborhoods in calculating the resilience and take measures for its application. As previously mentioned in the research background, in a general view, the stated studies investigated the

resilience aspects in the metropolitan and regional scales while the scale of the neighborhood has been in the macro-scales in these studies. Also, the aspects of resilience were considered more in the economic, social, and physical approaches and have been more analyzed against the occurrence of the hazards. Moreover, in an innovative way of the concepts such as physical organization as a branch of the form and physique system, the land use, ownership, and environment have not been proposed. Thus, resilience can be studied in more practical examples, not only in the planning and management structure but also in the dimensions of urban design. For instance, Dadashpour et al. followed the example of previous researches, and Dalakeh et al. only studied social resilience, especially in the dimension of social capital, and finally found out that areas with a religious and historical background can perform better in the field of social resilience. In the present study, resilience has been studied and reviewed by examining only a specific dimension and in terms of urban form. The present study with the subject of urban form is more in an attempt to evaluate the dimensions of resilience. The analytical structure is proposed and calculated based on the indicators and metrics extracted from the study of the theoretical foundations in sources of occurrence and intervention in the type of approach and also the conceptual model in Oudlajan and Sangelaj neighborhoods located in the 12th district of Tehran. The results indicate that the resilience of the urban form of Oudlajan and Sangelaj neighborhoods has an inappropriate distance from the optimal level and is practically not resilient in general while among indicators such as social capital in Oudlajan neighborhood and street layout and type of building in metrics, the value was calculated higher than the optimal limit, which is significant.

In comparing the resilience of neighborhoods, the urban form resilience of the Oudlajan neighborhood was compared with the Sangelaj neighborhood. According to the analysis of indicators and calculation of ARI of neighborhoods, 0.57 and 0.65 distance from the optimal limit was obtained, respectively, and the Oudlajan neighborhood has a better resilience in terms of social aspects. According to the age and originality of the urban context in this neighborhood and the type and extent of social capital, and the formation of institutions and social networks, the high social solidarity in the neighborhood can be perceived. Finally, by codifying the principles and policies of resilience in the urban form, a better perspective for the future of the country's cities, especially the metropolis of Tehran due to the unstable textures, can be developed. Finally, researchers interested in urban resilience are suggested to study the urban form in terms of urban design qualities and resilience analysis of these qualities in the middle and micro level of such textures in residential neighborhoods.

END NOTE

1. The average method of distance from optimal limit is presented by Seyyed Ainuddin, The professor of Geography at The University of Pakistan in the evaluation of the resilience of two provinces of Baluchistan. The extracted paper was published in Natural Hazards Journal in 2012. DOI 10.1007/s11069-012-0201-x.
2. According to the recent report of the London School of Economic and Political Sciences (LSE) in 2017, the neighborhood above has the highest resilience in the European urban neighborhoods.

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