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Research Paper

Investigating the Components Affecting the Quality of Residential Space Design in Inefficient Middle Fabrics; Case Study: Oman Samani Neighborhood*

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ABSTRACT

Designing quality housing provides a favorable atmosphere for residents by creating a balance between architecture and the environment. Inefficient fabrics, due to some problems, require more attention to factors affecting the quality of housing design to solve existing problems in them to prevent these areas from depopulation, in addition to solving the problems in it, by creating quality residential space. The present study aims to investigate various common interventions applied in the design of housing in the inefficient middle fabric of Isfahan City (i.e. Oman Samani Neighborhood) to identify the most important factors affecting the quality of residential space design in inefficient middle fabrics. It is descriptive-analytical research carried out in two stages. The first stage includes data collection and the explanation of the theoretical research framework, including examining the approaches to housing design in inefficient fabrics as well as determining the quality components of residential space, by library studies, reviewing previous research, interviews, and observations. The second stage includes the prioritization and weighting of the components according to the experts' opinions and using a questionnaire. The results indicated that, nowadays, due to the main problem of inefficient middle fabric, which is the presence of small plots (whose areas<200m2), in most cases, the aggregation (integration of lands) is utilized as a way to solve the housing renovation problem. Moreover, the neighborhood scale with the highest weight, in addition to clarifying the importance of six components of accessibility, physical continuity, diversity of uses and services, adjacency to compatible uses, identity, and social continuity, reveals the need for the accurate recognition of the fabric characteristics before housing design. The "density" component, as the most important component at the three main scales, shows the need to pay attention to fabric capacities in the neighborhood to prevent the overflow of the population of other areas to the consolidated areas while retaining their old inhabitants.

Keywords: Inefficient Fabric, Inefficient Middle Fabric, Aggregation, The Quality Components of Residential Space, Housing Design.

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1. INTRODUCTION

Proper housing, as the space with which they have the most interaction, is especially important to all people in a society. Rapaport, in his essays on housing and architecture, stresses that housing is not a structure but an institution created due to social changes and the type and form of spaces in them depend on cultural, social, and economic factors (Rapaport 2005). Today, architects don't define desirable housing just physically and believe that the spirit of space and users' satisfaction with their housing indicate their success in housing design. So, in addition to quantitative features and factors such as desirable housing form, housing strength, and housing equipment, qualitative components of design and factors such as culture of users, climate, and context are effective in the housing design quality. To design housing in inefficient fabrics, it is required to consider their specific problems, along with the abovementioned qualitative factors. Identification of these features is necessary to achieve the right design criteria and provide physical structures for residents to do their activities in accordance with their lifestyles and livelihoods. The adverse effects of inefficient and worn-out fabrics include a great number of weak buildings and small plots, physical deterioration and being vulnerable to earthquakes, relief problems in times of crisis, lack of proper access to the fabric, the presence of narrow passages, high population density, poverty of the residents and their unwillingness to rebuild, and thereby, becoming abnormal urban areas (Hosseini 2008, 57). However, it is possible to provide suitable housing for residents by planning and using the potential of the fabric itself, resulting in the avoidance of spending large sums to create new residential areas by the government. Planning and designing inefficient fabrics bring vitality to cities. Successful interventions enhance residents' satisfaction with their housing and environment and create belongingness, encouraging residents to protect their environment and preventing these areas from being depopulated. Oman Samani neighborhood is located in Municipal District 14 of Esfahan City. Due to having the largest area of deteriorated fabrics in Esfahan, this area has always been a priority in renovation programs. However, there is not yet a successful architectural model for it. What makes studies on efficient fabrics important and necessary is the lack of studies about the qualities of architecture and the role of architects in the regeneration of inefficient fabrics, even in relevant rules (Jafari Ghavam Abadi 2015). The present study seeks to answer the following questions: Which quality components of residential space are more important for housing design in inefficient middle fabrics? and what interventions are common in housing design in the inefficient middle fabrics of Isfahan?

The present study is organized into five main sections. After the introduction of the case study and its features, the research process is described in the "Methodology" section. Next, the "Literature review" section presents the theoretical foundation and describes how to extract components and indicators from the results of previous research. In the "Research findings" section, the results of analyzing the outputs of the questionnaires and the results of the interviews with residents are presented and examined, which provide a clearer view of the mentioned issues. Finally, in addition to the main results and research limitations, the research questions are answered in the "Conclusion" section.

2. INTRODUCTION OF THE CASE STUDY

Among the 15 municipal districts of Isfahan, Municipal District 14, which includes 2 zones of inefficient fabric with an area of 312 hectares, has the largest part of newly identified deteriorated fabrics in Isfahan. These zones with the neighborhoods located in them are presented in Figure 1.

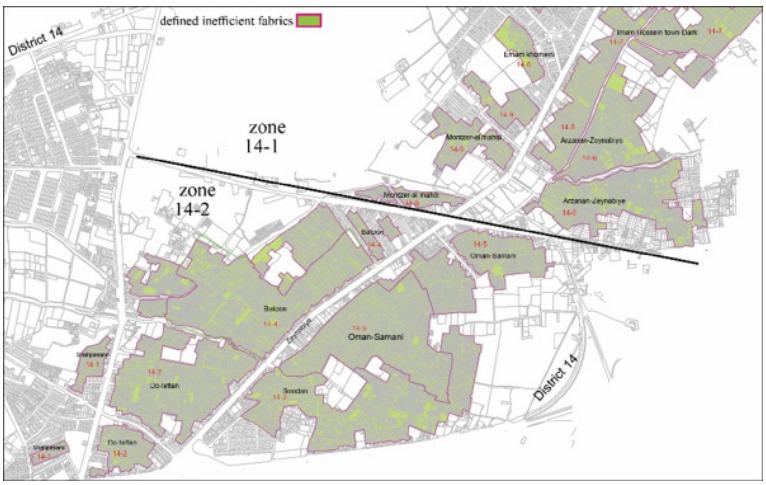

Fig. 1. The Zoning of the Inefficient Fabric in Municipal District 14

Zone 1-14 is located in the northern part of Municipal District 14, northeast of Esfahan. It includes Arzanan, Zeynabiye, Imam Hossein town, Dark, Imam Khomeini town, and Montazer Al-Mehdi town. It is considered a peripheral worn-out fabric (Naqsh-e Jahan-Pars Consulting Engineers 2013, 120). Zone 2-14 is the largest worn-out fabric in the north of Esfahan city. It is located in the southern part of Municipal District 14. It includes 2-Tiflan, Baton, Sudan, Oman, and Shahpasand neighborhoods. In fact, it includes the neighborhoods surrounding the central neighborhoods of the city. Among these neighborhoods, the Oman Samani neighborhood has the highest frequency of weak houses and the largest population. This zone has an irregular texture, and one can see the organic texture in some parts of it. It is considered an inefficient middle fabric. The survey of the area shows that residential land use accounts for 49% of uses in it. The share of basic services is about 3.6 percent in this area, and the share of barren and abandoned lands is about 7.84 percent. In this zone, most paths have a width < 6 meters or are dead ends, and out of 55 investigated blocks, 49 blocks have a penetrability coefficient < 30 percent, and only in six blocks, it is above 30 percent.

The distinctive feature of this zone is the presence of paths with a width < 6 meters. Above 99 percent of the residential buildings have one or two stories and the residential building density is estimated as 73.5% (Ibid, 125). The presence of residential units with an area < 200 m2 (small plots) is the other distinctive feature of this zone. Figure 2 shows the limits of the Oman Samani neighborhood.

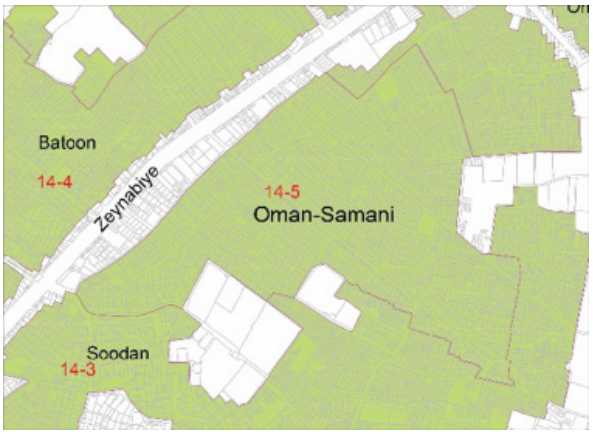

Fig. 2. The Limits of the Oman Samani Neighborhood

3. METHODOLOGY

This study is descriptive-analytical applied research. In such research, the researcher needs strong reasoning support to explain and justify the reasons. This support is provided by reviewing the literature, theoretical topics, and general theorems such as laws and theories (Hafeznia 2018, 71). First, the theoretical foundation, including the review of approaches and interventions used for design in inefficient fabrics, was presented, and the quality components of residential space were identified by library studies and a review of the literature. The research components were extracted at three main scales: residential unit, complex (block), and neighborhood. Next, the required data on the status quo of the Osman Samani neighborhood in terms of renovation, its characteristics, and the problems in it were collected through interviews with residents and experts such as the employees of Isfahan Urban Renewal Organization, and Isfahan municipality, and academic professors, field studies, observation. In the next step, a questionnaire was used to weigh and prioritize components. The questionnaire was designed based on the 5-point Likert scale and it included final components and their sub-components in three parts (three scales studied (residential units, complex, and neighborhood).

The sample size was considered 30 persons including architecture and urban planning professors. The validity of the questionnaire was confirmed according to architectural and statistical experts. The experts answered the questions considering the most important problems faced by inefficient middle fabric and the Oman Samani neighborhood, as described in the introduction of the questionnaire.

After collecting the questionnaires, the weights and priorities of sub-components, components, and the three main scales were obtained by averaging in SPSS software.

4. LITERATURE REVIEW

Low-quality buildings and the problems of inefficient fabrics have caused designers to consider only a few quality components which are the most important issues in their opinions. So, to improve the quality of housing design and address all the factors affecting the quality of architecture, this section reviews the

literature on the research subject and relevant topics and examines the concept of quality from the view of researchers to collect the relevant components and then, determine and prioritize the final components considering the problems of inefficient fabrics according to the experts. The different stages of this section are described below.

4.1. Residential Space Quality

The quality of residential space is an objective, subjective, and hierarchical subject explained by several scales (Pol 2011, 48). The physical structure of housing includes significant dimensions. The physical indicators of residential units can be investigated in economic, social, cultural, and technical aspects. In addition, they have a direct relationship with the space beyond a residential unit, neighborhood, and city. There is also a wide range of these indicators.

Einifar and Aghalatifi, in their article "Concept of Territory in Residential Complexes ", said that in general, three major scales are considered in the study of residential complexes. First, on a macro scale, the relationship of the complex with its surrounding environment is considered. on this scale, the most important issue is to create continuity and physical-social connection with the surroundings.

On the next scale, the relationships between the buildings in the complex are considered. These relationships are important to create a balance between privacy and social interactions to establish security is important. Finally, it is important to consider the residential unit and the relationship between the interior of the housing and the residents' culture and tradition of residence (Einifar and Aghalatifi 2011).

Also, Einifar (2000) and Pourdeihimi (2015) stated that there are three arenas (scales) concerning the quality of the residential environment: 1. Private arena: It is within each residential unit and provides the necessary space for each family; 2. Semi-private-semi-public arena: it refers to the space where internal connections between complexes or the connection of the complex with the neighborhood (connections outside residential units) occur. This arena includes the internal passages between the units, such as stairs, and elevators, with common ownership; and finally, 3. Public arena: It refers to the space where the external connections of residential complexes with the surrounding environments and the city take place. It includes the spaces surrounding residential complexes. In general, it includes urban paths connecting the complexes to public communal spaces (Pourdeihimi 2015; Einifar 2000). The result of this agreement on the quality of residential space is shown in Table 1. This table shows the importance of evaluating the components of the residential space on three separate scales considering the scope of the housing issue.

Table 1. The Assessment Scale of Residential Space Quality

		The Quality of Residential Space
Scale	Neighborhood	Public arena/ external connections of residential complexes with the surrounding environments
	Complex	Semi-private-semi-public arena/ internal connections between complexes or connections outside residential units
	Unit	Private arena/ within residential units, connections between the interior spaces of housing

There are many studies on the qualitative components of residential space, as summarized in Table 2.

Table 2. The Quality Components of Residential Space

Author (Year)	Title	Quality Components of Residential Space
Ghelichkhani et al. (2019)	The relationship between effective components on housing prices and quality components of housing	Design and form, connection with nature, design context, access
Ebrahimzadeh and Ghader Marzi (2015)	An analysis of the quality of housing in urban districts, a guideline to improve the quality of citizens' life; Case study: Dehgolan districts	The function of the interior, building form, connection with nature, and security
Golkar (2001)	Components of Urban Design Quality	He classified the quality components into three functional, aesthetic, and environmental categories and placed many components in each category, some of which are safety, security, quality of the physical environment, climatic comfort, etc.

Author (Year)	Title	Quality Components of Residential Space
Ibem and Amole (2013)	Subjective life satisfaction in public housing in urban areas of Ogun State, Nigeria	The components of the residential unit include infrastructural services, including the variety of uses and services, income level, materials, the area of the residential unit, connection with nature, and building form.
Dadashpour and Roshani (2013)	Identification of factors affecting the quality of the residential environment in old neighborhoods (Case study: Sanglaj Neighborhood, Tehran)	Residential land per capita, area of the residential unit, number of rooms, building density, penetrability, structure quality, children's play area, open space of residential environment, and green spaces.
Rezaei Khoboshan and Nemati Mehr (2015)	Quality assessment of residential environment with quality of life indicators (Case study: Mehr housing complex in Pardis New Town)	Building density, number of floors, mass and space organization, landscape, ease of access, security, residential area, lighting, and building facilities.
Einifar (2008)	Human-environmental factors effective in the design of residential complexes	Physical-social continuity of the complexes with the surrounding environment, creation of local identity and identifiers, privacy and social interaction, how to communicate to create a sense of security in residential complexes, pedestrian access, vehicular access, internal composition of residential units, the spatial layout within residential units, climate and economy saving energy.

The following includes various theories on the quality of urban design by urban designers. These theories are effective in determining the components at the neighborhood scale and some components at the complex (block) scale, a summary of which is listed in Table 3.

Table 3. The Quality Components of Residential Space from the View of Urban Designers

Research	Quality Components of Residential Space
Jacobs, Jane (1961)	Mixed uses, paying attention to the street element, penetrability, flexibility and social mixup, compatible neighborhood
Lynch, Kevin (1981)	Vitality, meaning, compatibility, access, control and supervision, efficiency, and justice.
Bentley, Ian (1985)	He introduced the criteria of penetrability, diversity, legibility, flexibility, visual compatibility, richness, and customization. Then, in 1990, in an article, he added three new criteria to complete the abovementioned set of criteria: efficiency in terms of energy consumption, cleanliness (delivering at least air pollution, etc.), and supporting nature and wildlife.
Coleman (1987)	Historical preservation and urban restoration, design for pedestrians, vitality and diversity of uses, cultural context and environment, natural context and environment, and attention to the architectural values of the environment.
Carmona, Matthew (2003)	physical component, perceptual or semantic component, social component, visual component, functional component, and time component.
Jacobs and Appleyard (1987)	Access to opportunities, imagination and happiness, livability, identity and control, community and common life, authenticity and meaning, inclusiveness of the environment, urban self-sufficiency
Trancik , Roger (1986)	Maintaining the sequence of movements, enclosure, continuity of edges, controlled axes and perspectives, and intermingling of inside and outside spaces.

4.2. Inefficient Fabric

Inefficient fabric refers to the inefficiency of a fabric compared to the efficiency of other urban fabrics, due to its age or lack of development plan and monitoring of its formation (Lee 1996). When the life of an area of the city stagnates, the urban fabric of that area is in the process of inefficiency (Rosemary, Tallon, Thomas 2005, 9). According to the abovementioned, inefficiency can be considered a result of the weakening of each of the physical, economic, and social dimensions in the living environment, eventually leading to the declined quality of other parts and the physical and functional separation of that area from other urban settlements (Andalib and

Ebrahimi 2018, 68).

Inefficiency and deterioration of fabrics are characteristics that are sometimes considered equivalent to each other and sometimes, distinguished from each other. After proving the ineffectiveness of the three indicators of instability of structures, smallness of plots, and penetrability in diagnosing deteriorated fabrics and the inappropriateness of this view to sustainable development, in a meeting on the re-evaluation of the three indicators abovementioned, dated 9/17/2013, the Superior Council of Urban Planning and Architecture of Iran approved to change the approach from deterioration to inefficiency and from rehabilitation and renovation to urban regeneration, causing inefficiency to become significantly different from the concept of decay, which is specific to the physical structure (Shafaee 2018, 68-69).

In order to be consistent with this new literature, the word inefficient is used in this study[1], but it is considered equivalent to the word deteriorated. In the guidelines for the basic requirements and guiding principles of design in regeneration programs set by the Urban Regeneration Corporation of Iran in Spring (2017), the inefficient areas of Iran are separated into four groups in this new literature: 1. Historical fabrics, 2. Inefficient middle fabrics, 3. Informal settlements, and 4. Urban areas with a rural core (Urban Regeneration Corporation of Iran 2017).

The inefficient middle fabrics, which are the case study of the present research, receive fewer services than other urban areas, due to being within the limits of the city. However, being within the limits of the city makes these areas in better conditions than peripheral fabrics.

The main problems of these fabrics are the presence of small plots and inappropriate roads such as passages and dead ends with non-standard widths, which are not in compliance with new urban rules (Mohrehkesh 2013, 24). High population density and lack of services are other problems in this fabrics.

Regarding inefficient middle fabrics, the most important problems in the physical and housing dimensions are as follows:

a. Lack of beautiful facade and housing form;
b. Non-compliance with quantitative standards;
c. Non-application of engineering procedures in the design;
d. Lack of proper (building, population, and perception) density;
e. Presence of aesthetic, security, and environmental psychological issues;
f. Lack of environmental diversity in access to open spaces and green spaces; and
g. Lack of a proper access network.

The results of field studies confirmed the presence of the abovementioned problems in the Oman Samani neighborhood. Figures 3 and 4 show the facades of the houses in the Oman Samani neighborhood.

Fig. 3. Oman Samani Neighborhood

Fig. 4. Facade of Houses in Oman Samani Neighborhood

In recent years, governments have used different strategies to regenerate inefficient urban structures. These strategies, which are derived from intervention theories, are used according to the type of fabric. The methods of intervention are shown in Table 4.

Table 4. The Methods of Intervention Applied in Inefficient Fabrics

Methods of Intervention	Definition	Actions	The Context of the Intervention	The Level of Loyalty	Aim
Rehabilitation	All actions are in harmony with the basic pattern in the physical field to preserve and maintain the fabric and its elements/ In the non-physical field, all actions are taken to raise the inner life	1. Before being damaged: support, maintenance, care, and protection 2. After being damaged: Reunification, revival, and repair	Urban fabric public space, single buildings, a group of buildings, and residential complexes	Loyalty to the past is considered a principle and full protection of everything is performed.	To improve the status quo of the fabric and its elements

Methods of Intervention	Definition	Actions	The Context of the Intervention	The Level of Loyalty	Aim
Renovation	Preservation of the nature of form (physical dimensions) and being per modern life standards (behavioral dimensions)	Renewal, revitalization, revival, adaptation, conversion, and transformation	Urban fabrics, public spaces, single buildings, a group of building	Loyalty to the past is allowed if the old values are not damaged (whether modern techniques are used or not).	To regeneration and contemporize the fabric and its elements
Reconstruction	Creating new conditions in the fabric, or its elements by dismantling the works of the past and building new ones	Destruction, cleaning, and rebuilding	Urban fabric public space, single buildings, a group of buildings, residential complexes	Loyalty to the past has no precedent, wherever it is necessary, it is done through destruction	To fully change the fabric and create new conditions

(Andalib 2013)

Table 5 presents the types of intervention applied in different types of inefficient fabrics, which are extracted from the interviews with experts and the review of sources in this field. It was also found that the final decision on the intervention in the Oman Samani neighborhood is the aggregation pattern, because of the greater contribution of the presence of small plots.

It is worth mentioning that the items listed in the below table are recommendations usually suggested according to the most important problem in any type of fabric, but the final decision on the intervention in an area is made by carefully examining its characteristics.[2]

Table 5. Types of Intervention in Different Types of Inefficient Fabrics

Type of Inefficient Fabric	Type of Intervention	Reasons
Historical Fabrics	Protection	Preservation of Historical Value
Urban Middle Inefficient Fabrics	Aggregation	Presence of Small Plots
Urban Areas with a Rural Core	In-Situ Reconstruction	Plaques are Large and the Main Problem is Impenetrability
Informal & Peripheral Settlements	Reconstruction (Re-Subdivision)	Being Illegitimate, Reconstruction according to Standards

4.3. Aggregation

The policy of aggregation is based on deconstruction and renovation. In inefficient middle fabrics, due to the smallness of plots and non-standard and unsafe passages, it is necessary to use the aggregation model as a way for redesigning and standardizing the fabrics and changing social conditions in them. This policy is recommended only when the buildings in the fabric have no historical value. As a result, the ruined areas with no value in the fabric are possessed, assembled, and then, designed and renovated as an integrated set. Integration of lands is done at micro, meso, and macro scales.

The main purpose of aggregation is to create fundamental changes in inefficient fabrics to reform residential lands, improve the street network, provide public services in the fabric, and generally, remove small plots, improve living conditions, including urban security, and the comfort of citizens, and develop urban spaces (Keshavarz 2013, 72). Considering aggregate as a key stage in the development and construction process, it can be broadly defined as:

- Taking land ownership from the owners;
- Land preparation;
- Planning of streets, green spaces, and services;
- Planning the final form of the fabric;
- Subdivision of merged lands into smaller lands with proper sizes;
- Giving planned lands to builders.

So aggregation is a special case of land readjustment through which two or more plots adjacent to each other are merged into a larger plot of land owned by one or more people by removing the boundaries of ownership, (Keshavarz 2013, 72). In inefficient fabrics, due to the low price of land, there is a good opportunity to provide housing for the residents of these areas, which mainly include low-income people (Khaleghi 2015, 22).

5. SELECTION OF COMPONENTS

Figure 5 shows how the final components are selected. Considering the most important problems

in inefficient middle fabrics in the physical dimension, as described in the previous section, the final components were selected. It is noteworthy that enforcement of national building regulations, especially specialized civil ones, will enhance the quality of buildings in strength to the standard level. These regulations cover the problems related to the vulnerability of buildings against natural disasters, especially earthquakes, so, this quality component is removed from the list of final components, due to the presence of a solution for it.

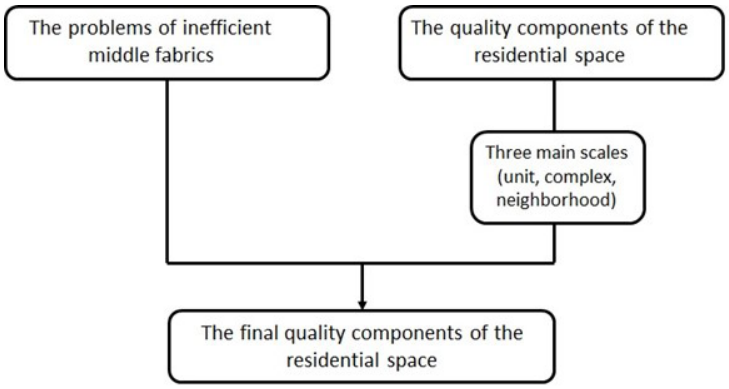

Fig. 5. The Procedure of Selecting the Final Components of Residential Spaces

In this stage, the components irrelevant to the problems and features of the middle inefficient fabric were reviewed several times and then, deleted. Figure 6 shows each of the problems of the inefficient fabric is related to which quality component.

Also, Table 6 shows these components by scale. Each scale is defined by one or more sub-components. After classifying the components to find an answer to the research question: "Which quality components of residential space are more important for housing design in inefficient middle fabrics?", a questionnaire was used, and the results of its analysis are given below.

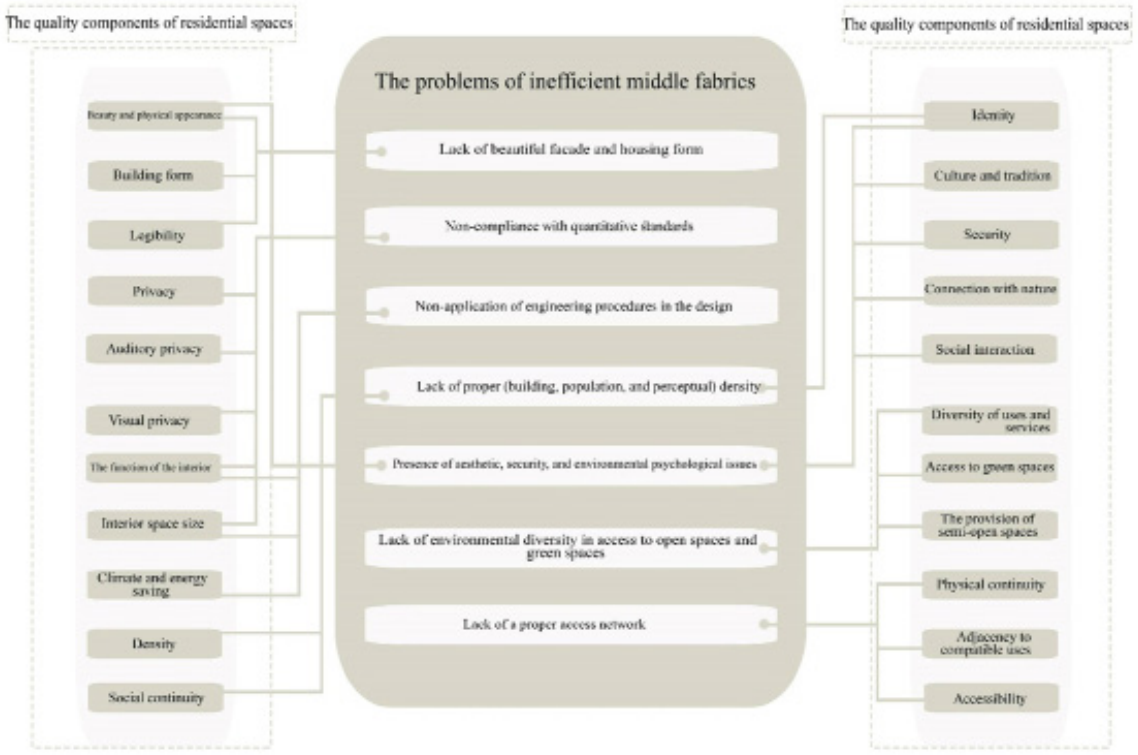

Fig. 6. The Relationship between the Quality Components of Residential Spaces and the Problems of Inefficient Middle Fabrics

Table 6. The Final Quality Components of Residential Space

Residential Unit Scale					
Component	Sub-Component	Component	Sub-Component	Component	Sub-Component
The Function of the Interior	Observability and suitable placement of the entrance of residential units	Interior Space Size	The areas of spaces per the quality standards and principles	Auditory Privacy	The right placement of the internal functions of the residential unit relative to the neighboring unit
	Simple Plan		Number of rooms and restrooms		Creating sound insulation, use of partitioning walls and multi-glazed windows (prevention of noise pollution)
	Separating spaces into private, semi-private, and public ones		Considering the human scale	Visual Privacy	Preventing the view to the adjacent private open spaces through the careful placement and design of the window
	Flexibility in the use and arrangement of spaces		Land subdivision and site planning for the optimal use of sunlight		Using portable obstacles such as vertical and horizontal canopies for windows and openings and the appropriate use of transparent surfaces
	Horizontal and vertical collection of W.C., bathroom, kitchen, etc.	Climate and Energy Saving	Optimal lighting of spaces	Access to Green Spaces	Providing vegetation in the form of gardens, flower and plant boxes, green walls, and green roofs
	Suitable light for spaces		Controlling unfavorable winds and using favorable winds	Providing Semi-Open Spaces	Providing balconies, small balconies, terraces, and porches
	The proper placement of stairs, elevators, and escape stairs and in a proper number		Providing canopies for openings	Culture and Tradition	Providing opportunities for making changes in and adding something to the housing plan by the residents themselves according to the cultural habits and the traditions of residence
	Considering the possibility of being used by all people with different physical abilities		Suitable and climate-compatible building materials		

Complex Scale (Block)					
Component	Sub-Component	Component	Sub-Component	Component	Sub-Component
Density	Building density (built area/total land area ratio(	Building Form	Variety of form	Legibility	Separating different scales of complexes from each other and the diversity of the building form
	Population density (number of people/ unit area ratio)		Proper building orientation		Specified entrance
	Perceptual density (people's resilience against apartment living)	Connection with Nature	Providing open spaces (yard)		Visibility of pedestrian and vehicular access
	Providing windows for the surveillance of public and semi-private spaces		Providing vegetation in the form of gardens, flower and plant boxes, and green walls	Social Interaction	Providing open and communal spaces for people
Security	Adequate lighting of entrances, access, and pausing areas	Beauty and Physical Appearance	Creating diversity with details and preventing repetition in the design of building forms and details		Providing crossing and pausing spaces
	Providing a proper form for green spaces in landscaping to prevent the access of intruders		Examining facades in terms of color and materials	Privacy	Providing a defined hierarchy of public, semi-private, and private open spaces

Neighborhood Scale					
Component	Sub-Component	Component	Sub-Component	Component	Sub-Component
Accessibility	Proper connection of access in the complex with the passages of the neighborhood	Identity	The amount of ideation in the use of symbols or patterns	Physical Continuity	Connection with the existing physical texture
	Attention to the security of access in the neighborhood, attention to the bridge, highway (entrance from the primary and secondary streets)		Providing spaces derived from culture and tradition to do activities, paying attention to the sense of belonging or sense of place	Social Continuity	Consultative and collaborative approaches to design
Diversity of Uses and Services	Providing commercial, cultural, and service spaces	Adjacency to Compatible Uses	Lack of proximity to the highway, industrial uses, stations with noise pollution, such as train stations, etc.		

6. RESEARCH FINDINGS

One of the important steps in multi-criteria decision-making is weighting. Weighting determines to what extent each research criterion is important relative to other ones according to the respondents. Various weighting methods can be used to prioritize indicators and components (Ghodsypour 2019). In this research, the expert weighting method was used. University professors according to the importance of each sub-component considering its importance. The weight of each sub-component is obtained by averaging the scores given by all thirty respondents.

6.1. The Weights of the Components in the Residential Unit Scale

Out of the 22 components and 49 sub-components in three scales, the residential unit scale includes 8 components and 23 sub-components. The weight of the components is shown in Table 7. The sub-components are the criteria for evaluating each component. To make the importance and priority of sub-components clearer, they were listed in descending order.

Table 7. The Weights of Sub-Components in the Residential Unit Scale

No.	Component	Sub-Component	Sub-Component Weight
1	The Function of the Interior	Separation of spaces into private, semi-private, and public ones	36.4
		Suitable light for spaces	4.20
		Observability and suitable placement of the entrance of residential units	86.3
		Considering the possibility of being used by all people with different physical abilities	76.3
		The proper placement of stairs, elevators, and escape stairs and in a proper number	23.3
		Flexibility in the use and arrangement of space	3.10
		Horizontal and vertical collection of W.C., bathroom, kitchen, etc.	93.2
		Simple Plan	2.30
2	Interior Space Size	The areas of spaces (including rooms, kitchen, dining room, restrooms, vertical and horizontal connecting spaces such as staircases and corridors) per the quality standards and principles	13.4
		Considering the human scale	3.60
		Number of rooms and restrooms	73.2
3	Auditory Privacy	The right placement of the internal functions of the residential unit relative to the neighboring unit	33.4
		Creating sound insulation, use of partitioning walls and multi-glazed windows (prevention of noise pollution)	96.3

No.	Component	Sub-Component	Sub-Component Weight
4	Visual Privacy	Preventing the view to the adjacent private open spaces through the careful placement and design of the window	3.70
		Using portable obstacles such as vertical and horizontal canopies for windows and openings and the appropriate use of transparent surfaces	36.3
5	Climate and Energy Saving	Optimal lighting of spaces	23.4
		Land subdivision and site planning for the optimal use of sunlight	3.80
		Suitable and climate-compatible building materials	3.50
		Providing canopies for openings	46.3
		Controlling unfavorable winds and using favorable winds	36.3
6	Access to Green Spaces	Providing vegetation in the form of gardens, flower and plant boxes, green walls, and green roofs	3.70
7	Providing Semi-Open Spaces	Providing balconies, small balconies, terraces, porches	16.4
8	Culture and Tradition	Providing opportunities for making changes in and adding something to the housing plan by the residents themselves according to the cultural habits and the traditions of residence	06.3

As seen in Table 7, the analysis of the "function of the interior" component shows that the subcomponents of "separation of spaces into private, semi-private, and public one" and "simple plan" obtained the highest and lowest weights, respectively. Among the sub-components of the "interior space size" component, the "areas of spaces" subcomponent was found to be more important than the other two sub-components. The "auditory privacy" component was assessed with two sub-components, the first one (i.e. The right placement of the internal functions of the residential unit relative to the neighboring unit), which is mostly considered in the primary stages of design, was found to be more important. The closeness of the obtained weights for the sub-components of climate and energy saving, which were obtained above average, implies their great importance in the design. The weights of residential unit scale components are listed in Table 8. Figure 7 presents the weight of each component in a bar chart. In this scale, the most important component is the "providing semi-open spaces" component, followed by the components of auditory privacy and access to green spaces, respectively.

Table 8. The Weights of Components in the Residential Unit Scale

Components	The Function of the Interior	Interior Space Size	Auditory Privacy	Visual Privacy	Climate and Energy Saving	Access to Green Spaces	Providing Semi-Open Spaces	Culture and Tradition
Weight	3.47	3.49	4.15	3.53	3.67	3.70	4.17	3.1

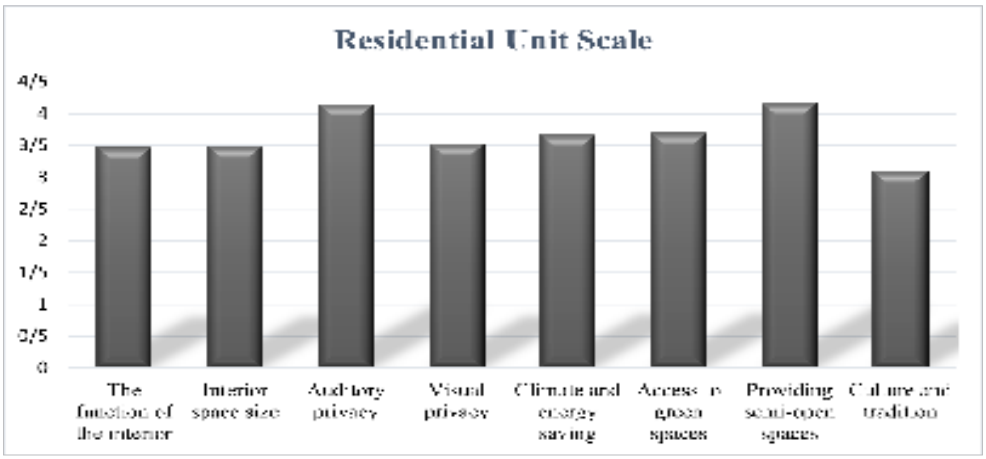

Fig. 7. Comparison of the Weights of Components in the Residential Unit Scale

6.2. The Weights of the Components in the Complex Scale

This scale consists of the components of building form, connection with nature, density, privacy, social interaction, security, legibility, and beauty, and physical appearance. Table 9 presents the weights of the sub-components of the mentioned components.

Table 9. The Weights of Sub-Components in the Residential Complex Scale

No.	Component	Sub-Component	Subcomponent Weight
1	Building Form	Proper building orientation	4
		Variety of form	3
2	Connection with Nature	Providing open space (yard)	4.26
		Providing vegetation in the form of gardens, flower and plant boxes, green walls	3.7
3	Density	Building density (built area/total land area ratio(	4.4
		Population density (number of people/ unit area ratio)	4.13
		Perceptual density (people's resilience against apartment living)	4.03
4	Social Interaction	Providing open and communal spaces for people	4
		Providing crossing and pausing spaces	3.1
5	Security	Providing windows for the surveillance of public and semi-private spaces	3.5
		Providing a proper form for green spaces in landscaping to prevent the access of intruders	3.43
		Adequate lighting of entrances, access, and pausing areas	3
6	Legibility	Visibility of pedestrian and vehicular access	4.33
		Specified entrance	4.03
		Separating different scales of complexes from each other and the diversity of the building form	3.56
7	Beauty and Physical Appearance	Creating diversity with details and preventing repetition in the design of building forms and details	3.56
		Examining facades in terms of color and materials	3.6
8	Privacy	Providing a defined hierarchy of public, semi-private, and private open spaces	3.80

As seen in this table, analyzing the "building form" and "connection with nature" components shows the high importance of the "proper building orientation" and "providing open spaces" sub-components in the design. The weights of the sub-components of density indicate the importance of all three sub-components from the view of respondents and the highest importance of the building density. Table 10 shows the final weights of the components in this scale. Figure 8 compares the priorities of these components.

Table 10. The Weight of Components of the Complex Scale

Components	Building Form	Connection with Nature	Density	Privacy	Social Interaction	Security	Legibility	Beauty and Physical Appearance
Weight	3.5	3.98	4.18	3.80	3.55	3.31	3.97	3.58

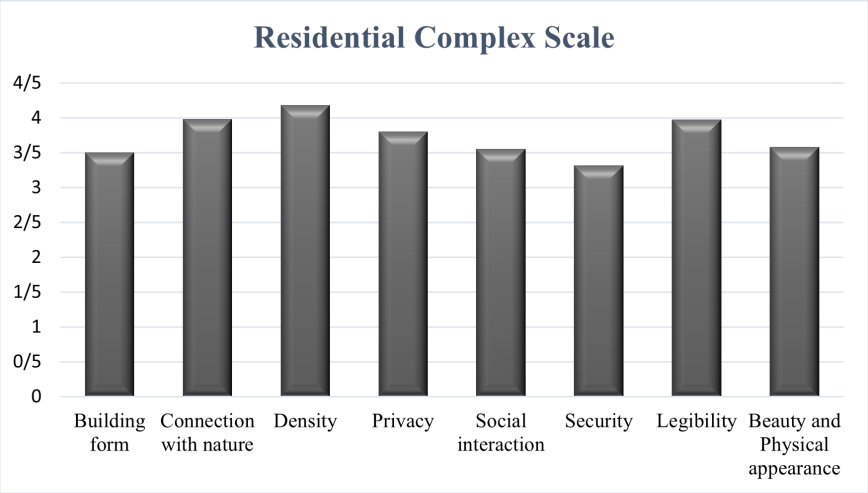

Fig. 8. Comparison of the Weights of Components in the Residential Complex Scale

6.3. The Weights of the Components in the Neighborhood Scale

The neighborhood scale includes the components of physical continuity, social continuity, identity, diversity of uses and services, accessibility, and adjacency to compatible uses. Table 11 shows the weights of the sub-components of the mentioned components. The obtained weights show the importance of the sub-components in this scale.

Table 11. The Weights of the Sub-Components in the Neighborhood Scale

No.	Component	Sub-Component	Subcomponent Weight
1	Accessibility	Proper connection of accesses in the complex with the passages of the neighborhood	4.36
		Attention to the security of access in the neighborhood, attention to the bridge, highway (entrance from the primary and secondary streets)	4.26
2	Identity	Providing spaces derived from culture and tradition to do activities, considering the sense of belonging or sense of place	3.6
		The amount of ideation in the use of symbols or patterns	3.56
3	physical Continuity	Connection with the existing physical texture	4.23
4	Social Continuity	Consultative and collaborative approaches to design	3.60
5	Diversity of Uses and Services	Providing commercial, cultural, and service spaces	4.10
6	Adjacency to Compatible Uses	Lack of proximity to the highway, industrial uses, stations with noise pollution such as train stations, etc.	4

Table 12 and Figure 9 show the weights of components in this scale. As seen in Figure 9, the "accessibility" component obtained the highest importance, followed by physical continuity, diversity of uses and services, and adjacency to compatible uses.

Table 12. The Weights of Components in the Neighborhood Scale

Components	Physical Continuity	Social Continuity	Identity	Diversity of Uses and Services	Accessibility	Adjacency to Compatible Uses
Weight	4.23	3.60	3.65	4.10	4.23	4

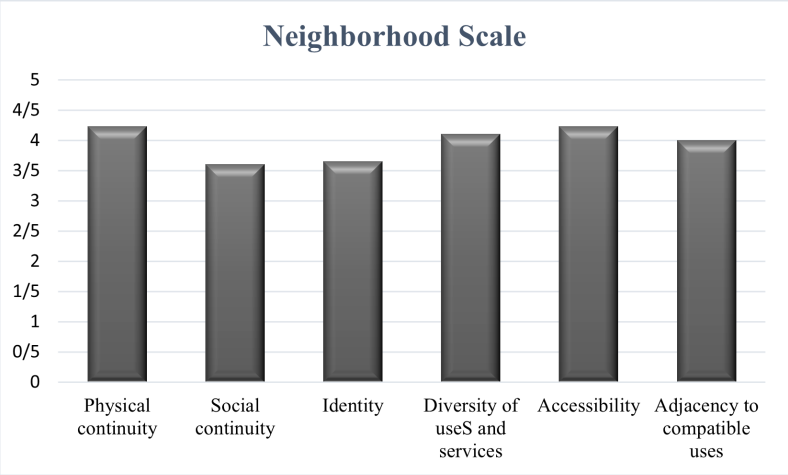

Fig. 9. Comparison of the Weights of Components in the Neighborhood Scale

6.4. Comparison of the Weights of the three Main Scales

Finally, to know the priorities of these three scales for housing design in inefficient fabrics, their weights were calculated. As seen in Table 13 and Figure 10, the neighborhood scale with the least number of components obtained the highest importance, indicating the higher importance of the components of this scale than those of the other two scales. So, they should receive more attention in housing design in inefficient fabrics.

Table 13. The Weights of the three Main Scales

No.	Scale	Weight
1	Neighborhood	3.98
2	Complex	3.70
3	Residential Unit	3.50

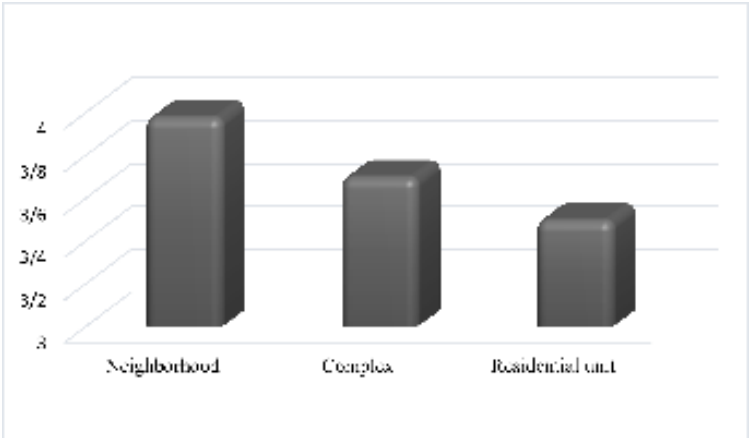

Fig. 10. Comparison of the Weights of the three Main Scales

6.5. Interview with Residents

Considering components such as social continuity and social interaction and the key role of residents in improving inefficient fabrics, the residents of the studied neighborhood were interviewed to know their culture, wants, and concerns to meet their needs. Of course, finding a suitable way to encourage them to participate in the aggregation process was what the interview sought. In the interview with residents, questions concerning their jobs, housing ownership, willingness to cooperate with governmental organizations, and the current problems of their

housing units were asked. Table 14 shows the extent (in percent) to which the residents tend to participate in the aggregation plan. Moreover, the following includes the most frequently mentioned items by the residents: the small sizes of houses, the very close distance between neighboring houses and lack of privacy, disturbance in traffic and noise pollution, lack of suitable parking, narrow alleys, and residents' constant concern for their vehicles, dilapidated houses and their need for repairs, lack of green spaces, lack of suitable and safe space for children, and the lack of adequate shops in the neighborhood. At the same time, they mentioned their close and long-term relations with their neighbors, the holding of ceremonies on different occasions in their alleys and dead-ends, and their desire to maintain these.

Considering the characteristics of the neighborhood and obtained results on the high importance of the density component (building, population, and perceptual), it was decided to keep the population density (people per hectare) unchanged[3]. Of course, according to Table 14 and the percentage of owners who are willing to participate (35%), the phased implementation of the aggregation plan was found to be the best solution. Therefore, choosing a part of the neighborhood, that includes a block of 25 to 30 plots, would bring the possibility of participation of the owners[4].

Table 14. The Willingness of the Owners to Cooperate in the Aggregation Plan in the Oman Samani Neighborhood

Ownership		The willingness of the Owners to Cooperate	
The Owner	The Tenant	Lack of Willingness or Moderate Willingness	Full Willingness
% 67.85	% 32.14	% 64.28	% 35.72

7. CONCLUSION

Considering the investigations carried out in this research to know the existing interventions and the status quo of housing in inefficient fabrics, one can conclude that in most projects, profitability and multiple returns of investment for the decision-makers are the core issues in all actions, and inattention to the quality components would result in the deterioration of housing. Despite having the largest area of inefficient fabrics, the highest percentage of unstable units, and the largest resident population, the Oman Samani neighborhood doesn't take advantage of the cycle of effective regeneration. This is considered a threat to the health and safety of residents.

The analysis of the results showed that for designing in this type of fabric, the components of "providing open spaces, auditory privacy, and access to green spaces" at the residential unit scale, the components of "connection with nature, legibility, density, and privacy" at the complex scale, and the components of "accessibility and physical continuity" at the neighborhood scale are of the greatest importance. Considering these components is subject to the observance of their sub-components. Considering these components in housing design can bring acceptable quality for housing through the aggregation plan because the aggregation plan can be an effective solution to regeneration, standardization, and securitization of inefficient fabrics through the removal of small plots, the control of the merged area, and destruction and renovation. Comparing the three scales showed that the neighborhood scale gained the highest weight. The high importance of the components of this scale revealed the need to accurately recognize the status quo of the fabric, its weaknesses, residents, and opportunities. In addition, the highest importance of the "density" component revealed the need to know the capacity of the neighborhood to serve the appropriate population. This component was placed in the complex scale, but neglecting it greatly influences the quality of residential spaces at the unit and neighborhood scales. Since, in the present study, the effective components were identified by reviewing other researchers' up-to-date studies and examining the content on the combination of the two issues of the quality of the residential space and inefficient fabric, and then, prioritized through the survey of the expert, one can say that the set of components can be generalized if the designers add the components specific to each project to this set and in case of implementation and operation of aggregation projects, the results of projects are investigated in all dimensions.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

ENDNOTE

1. These fabrics have been mentioned with various titles such as undeveloped fabric, inefficient fabric, and unstable urban fabric in architecture and urban planning. All of these titles can be true because basically, these fabrics, with any title, are lagging behind the urban development process. Worn-out fabric can be introduced with equivalents such as Blight area, Depressed urban area, Deteriorated urban, Decay texture, and Twilight area (Andalib 2010; Habibi and Maqsoodi 2007; Kamanroudi 2007; Tehran City Renewal Organization 2006). For inefficiency, there are the equivalents of urban blight, obsolescence, and urban decay (Urban Regeneration Corporation of IRAN).
2. Like the Municipal District 3 of Isfahan, where aggregation was performed through the participation of residents and the preservation of the values of the neighborhood, despite the presence of inefficient historical fabrics in it.
3. Instead of increasing density, it was decided to design 28 units for the 28 plots selected in this area, along with other facilities and common areas for the users. Increasing building density would result in increased population density and decreased perceptual density. In addition, the surveys of the Oman Samani neighborhood showed that this neighborhood also has poor performance in providing services to its residents. So, keeping building density unchanged is a way to balance the existing situation. It is a solution that, after being raised, encouraged 71% of the residents to participate in the aggregation process to meet their needs.
4. According to the percentage listed in Table 14, Out of about 7000 plots in the Oman Samani Neighborhood, above 1000 owners are willing to participate. Therefore, it would be possible to attract the residents to participate in the design of a block or blocks with the size of 30 plots using conventional methods applied by the municipality, such as purchase or exchange.

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