Explanation of Factors Affecting Informal Human Settlements in terms of Objective and Subjective Qualities[1]

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Abstract
Development and increase of informal residential spaces in cities and especially metropolitan areas, provides a concept of quality of urban life which needs to be upgraded and reconsidered. In this regard, Present study focuses on informal communities and identify the quality components related to the built environment in terms of objective qualities and subjective qualities in relation to residents' satisfaction with the settlement in the form of physical–spatial characteristics with their irreplaceable roles in determining the residents' lifestyle. In this research, to achieve the goal, both qualitative research method and survey strategy are applied. Data collection is done through literature review, and also field impression of space users along with survey analytical method of Fuzzy Delphi and Entropy Shannon Technique. In the part of documentary study, 33 quality components are achieved and evaluated from the perspective of "improving the quality of informal settlements" via Delphi Method. Through initial screening, 9 components and in the following according to experts' consensus 3 more components are removed from the list. As a result, the study attains 21 qualitative components which are categorized into 2 main dimensions of objective and subjective qualities and 7 thematic categories in following. Finally, findings from analyzing the indicators using Shannon Technique show that the dimension of "Residential Satisfaction" and the category of " safety and security" are having the most impact on enhancing the quality of informal settlements. As well, among single indicators, "crime prevention", "accessibility and permeability" and "facilities and infrastructure" are the highest influencers in the list. The analysis also concludes that the category of "function" is the least effective one between categories.

Keywords: Informal Human Settlements, Quality Factor Explanation, Objective Quality, Subjective Quality.

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Introduction and Problem Statement

With the rapid speed of urbanization globally, both housing demand and pressure in expanding urban areas of economic activities are increasing (Zakerhaghigh et al.,2014: 2). Nowadays, informal accommodation is regarded as one of the absolute phenomena especially in Iran which is making urban areas unstable (Tavallaei et al., 2014: 43). Shortage of housing in urbanized areas, is getting more and more acute since more people are being drawn to urban areas for better job opportunities (Devi et al., 2017: 58). Governments around the world have established various policies to meet the needs of low-income people living within cities who are essential for the urban economy (Jones, 2014: 50). In fact, urbanization provides a variety of facilities for citizens, but on the other hand, it causes a lot of issues such as overcrowding, pollution, limitations, and the lack of environmental and economic qualities (Hosseini & Chinichian, 2011). In other words, one of the most problematic issues which our cities are facing is the growth of population and migration and also the formation of delicate areas in the form of informal settlements that is more highlighted in the developing countries such as Iran (Ziyari et al., 2019: 110). As migration to cities grows, the population of people who live in informal settlements will be expected to reach 1.4 billion in 2020 (Cohen, 2006: 70; UN-Habitat, 2006). According to researchers' estimation, 10 percent (at least) and 50 percent (at the most) of people in the central cities of Iran's provinces are living in informal settlements, although there are no official statistics based on national studies (naghdi, 2010: 13).

Under these circumstances, dividing urban areas into surroundings and centers causes a huge difference between the quality, lifestyle and housing standards in the main fabric of cities and *marginal areas* so-called *"down town"*. Overall, such settlements have been regarded as a clear example of urban poverty which is spontaneously formed and resided by a mass of people with low incomes and poor quality and quantity of life without any constructional permits issued by Urban Development Plans (Najafi et al., 2015: 79) and this is the very phenomenon which is called *"marginalization, spontaneous settlements, disorganized settings, uncontrolled residential settings, slum areas and so on"* (Sarrafi, 2008: 50). While the overall goal of improving the living conditions for informal settlement dwellers is indisputably favored (Abbot, 2002), some have suggested that there may be global environ-mental trade-offs associated with raising standards of living in informal settlements (Jorgenson, Rice & Clark, 2010: 193). In this sense, recognizing the quality components which can be involved in informal fabrics throughout both objective and subjective dimensions, would be the very first steps toward assessment and improvement.

Many studies have been carried out on the relevant issues of informal settlements up to now, but none of them could provide a clear solution or most of the practical plans have failed due to the high costs of implementation or ignoring the residents during the process of development Therefore, the scope of this study is to identify effective components for the improvement of informal settlements in terms of objective and subjective qualities.

Theoretical Framework

Informal Settlements refer to a wide range of residential areas formed of communities housed in self-constructed shelters that are perceived as informal on the basis of their legal status, their physical conditions or both (Wu et al., 2020). These areas are facing some issues including illogical paradoxes in land uses, being distant from urban areas, spatial limitations, social problems, and so on. (Shamai & Pour Ahmad, 2005: 215). Until the early decade of 1970s in which liberal views used to prevail in the world, the government had the minimum intervention in the urban housing and it was believed that there was a hidden agenda of the housing market to keep the balance which led to the lack of attention and support for these areas to develop (UN_HABITAT, 2011: 587). Although the documents relating to the empowerment and organization of the informal settlements show the sign of poverty in such residence on a large and continual scale, they also reflect the shortages and governmental and official housing market's failure (Irandoost, 2009: 183). The residents of these settings live their lives at a low level due to infrastructural defects and poor urban services (Lombard, 2014). In the meanwhile, one of the most important and critical challenges at the stages of improving the quality of life in informal settlements is to encourage the residents to accept changes and to be the

parts of the changes (Khalil et al. 2016: 23). Since establishing relationships between the residents and the created settings as the basis of the environmental elements and especially physical features in the space can serve as the indexes of creating the quality of space, existing research literature on the residential environments on the community level mostly focuses on two aspects as objective living conditions and the residents' subjective feelings and levels of satisfaction towards the environment. Therefore, using these indexes can partly lead to powerful and meaningful relationships between the residents and their residential settings (McCrea et al., 2006: 85). Such relationships can play a fundamental role in the cycle of creating motivation and quality at higher levels of the residents' needs and consequently the quality of life (Gholamalizadeh et al. 2019: 6). Hence, considering the purpose of compiling the theoretical foundations for the present study that includes accessing the indexes and standards to improve the quality of informal settlements in order to increase the satisfaction of the residents from the residential spaces, the principles and foundations which are propounded by the theorists have been assessed and as a result, along with the purpose of the study, the ultimate standards of the effective elements in improving these settlements in terms of objective and subjective qualities in these areas were propounded. The objective and subjective quality in urban context which pertains to a complex integrated of functional, spatial and cultural factors (Oktay, 2012: 6). In this sense, it can be said that There are many various views in the formation of the quality in urban spaces. Actually, it changes according to users' functions of the places and of their different specific uses, and moreover, they may change by times and with the applied culture, habits, tastes and considerations in a specific area; it is then a common value so that it cannot be easily defined and cannot be fixed once for all in particular (Sung, Lee, & Cheon, 2015: 122). Since there is no universal standard that explains the human informal settlement at present, and the determination of what dimensions and factors are affecting these area, varies widely, this study established a system by summarizing factors selected by recent literature. Therefore, based on the theory of the Sciences of Human Settlements, this paper summarizes an index from the perspectives of the housing conditions, the public supporting facilities, the ecological environment, the social relations, and the psychological experience that takes into consideration the residential, supportive, natural, social, and human systems (Kamalipour, 2020: 11). To define a series of parameters for quality explanation of an urban area, it is needed to study the approaches of different scholars along with the criteria of successful urban space which was done by the group of "projects for public space". As a result of review on urban space quality, the different principles that are developed by urban design theorists are summarized in Table 1.

Table 1: Review on Urban Space Quality

C. Sitte (1889)	**J.Jacobes (1961)**	**C.Alexaander (1979)**	**K.Lynnch (1981)**	**Bentley (1985)**
Artistic principles	Democracy	Timeless principles	Vitality	Personalization
Human scale	Eyes on the street	Piecemeal growth	Sense of place	Robustness
Enclosure	Continues users and activities	Larger whole	Fit	Richness
originality & meaning	Vitality	Visions	Access	Legibility
performance	Human scale	Positive urban space	Control	Variety
contextual	Sense of place	Construction	Legibility	Permeability
compatibility	Safety	Formation of centers		Visual appropriateness
justice	Child use	emotional wellbeing		
city view	Contact			
A.Jacobes D.Appleyrad (1987)	**w.whyte (1988)**	**F.Tibbalds (1988)**	**P.P.S (2000)**	**M.Carmona (2008)**
Diversity	Visual quality	People friendly	Access	Accessible
Publicness	Access	Pedestrian freedom	Climatic comfort	Attractive
Spontaneity	Sittable places	Access	Sociability	Comfortable
Livability	Natural context	Mixed using	Uses/activity	Inclusive
Adequate sun Light	originality & meaning	Adoptable	Efficiency	Vital
Clean air	space enclosure	Long lasting	Justice	Functional
Trees	compactness	Changeable	phantasm	Distinctive
Vegetation	hierarchy	greenery		Safe
Gardens				Robust
Cleanliness	**S.M.Habibi(1999)**	**H.Bahreini(2003)**	**K.Golkar(2007)**	Green /unpolluted
Safety				Fulfilling

Designed buildings Human scale Open space Mixed use Compatibility Comfort Democracy Mixed user control, monitor & care quality of life social wellbeing	Variety Safety & security Compatibility Legibility Detail design Human scale Flexibility Cleanliness Memorability Distinction Continuity Control & monitor	Exciting spaces Livability High density in public spaces Street activities emotional wellbeing performance efficiency attachment privacy social wellbeing	Permeability Safety Flexibility Mixed use Mixed forms Visual characteristics Legibility Quality of public spaces Cleanliness Comfort richness	Clean and Tidy Natural context Control space enclosure environmental appearance phantasm
qualities in common:	Environment Characteristics- Originality & Meaning- diversity- Appearance of (built) environment- Control, monitor and care- Security system- Security system- Social well-being- performance- contextual compatibility- Space enclosure- Quality of life- Efficiency & justice- Continuity & attachment- Climate comfort- Efficiency of primer services- City view- Crime Prevention- permeability - Risk of natural disaster- Legibility- Flexibility- Mixed use- Accessibility- Variety- Scales & proportions- Facilities & Infrastructure- compactness- Phantasm- Hierarchy-Privacy- Cleanliness/unpolluted			

The investigation on the frequency of the qualities can show the importance of each component from the viewpoint of the related experts.

Materials and Method

To achieve the main purpose of the study, an analytical descriptive approach along with content analysis of the questions, interview and documents has been used to obtain the qualitative components using some library reference books, survey analytical methods and direct observations about the space in order to collect and analyze the required data about the research. Moreover, the methodology developed in this study synthesizes theoretical and conceptual aspects of urban quality in terms of personal values in which objective and subjective qualities emerges. As it is shown in Figure1, these two dimensions of quality refers to situation of living in urban context and residents' satisfaction. In this sense, Fuzzy Delphi method employed in order to focus on the most significant quality components in informal settlements and also the Shannon Entropy Technique was used for the final weighting and prioritizing of the components and qualitative indexes obtained from the Delphi Questionnaire. Delphi method is used for structuring a group communication process, effective in allowing a group of individuals, as a whole, to deal with a complex problem (Linstone et al., 1975: 88). The components were determined through the Logical Reasoning Method during the initial stage. Then in the second and third stages, the Indirect Survey Approach based on elites' opinions has been used through the Closed Questionnaire Technique in accordance with the literature review and the elites' opinions about the subject of the study.

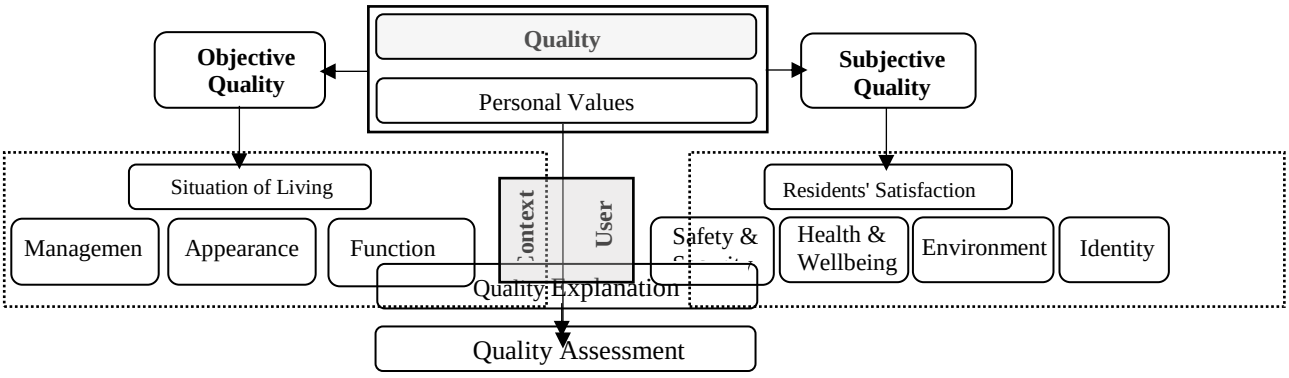

Figure 1: Conceptual Model of the Study

The statistical population of the research is composed of two groups of experts and the residents of informal settlements in which both groups' opinions have been assessed. The first group of the experts, as indicated in Figure 2, includes the professors in architecture, urban design, and social science and the second group is composed of PhD Candidates in related fields of study.

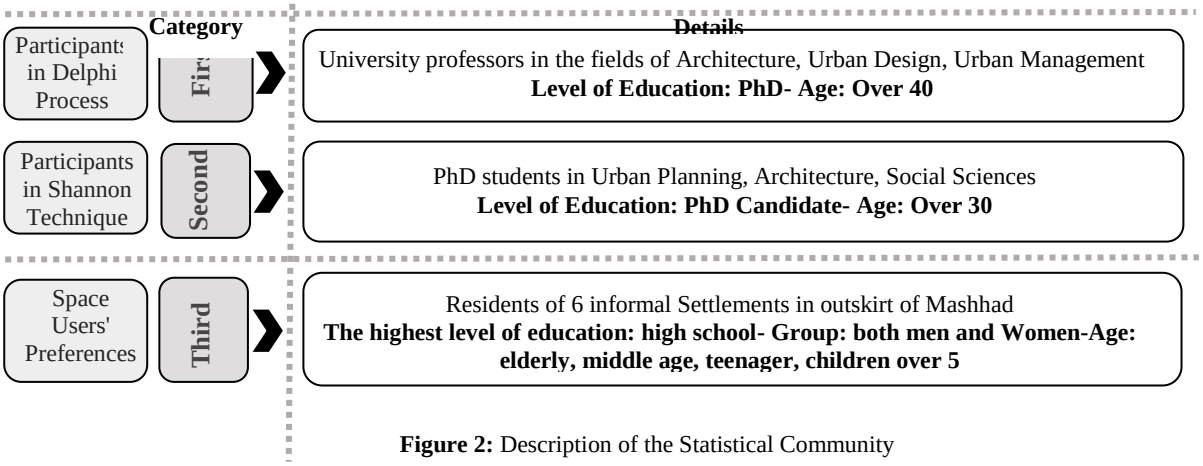

Figure 2: Description of the Statistical Community

As it is said before, the method used to investigate the experts' opinions was Fuzzy Delphi and Shannon Entropy Techniques including the expansion of a mathematical formula in the data analysis which is applied in the content analysis (Azar, 2001a: 26) and the result of the opinions is defined at this stage and then the prioritization of the quality standards relating to the informal settlements was determined.

Findings

To arrive at a shortlist of indicators affecting informal settings, a set of criteria was used from literature review and sent to the experts in the first group of the research to be completed in order to weight different parameters relating to informal settlements. For the next stage, this survey employed Fuzzy Delphi method in order to focus on the most significant quality components in informal settlements. Delphi panel, here, is consisted of 10 experts who studied and revised 33 common components achieved from literature. Based on the result, experts narrowed down the main dimensions and components to be employed in construction of the list of the quality components in informal settlements as it is clear in Table 2. Following the process of the collecting the results and carrying out the analysis on the data, the obtained results are sent to the experts and then will be reassessed by them according to the obtained results and this process will be continued until the initial consensus. This cycle was repeated twice in the research and finally the initial consensus was agreed by adding the components of the facility condition indexes and infrastructural indexes according to the experts' opinions. Then, the components of the assessment and the space users' priorities were appended to the results of the consensus and again were sent to the second group of experts according to the new variables to be assessed and ultimately after sending and reassessing the data, the final consensus was agreed on the effectiveness of the compiled qualities of informal settlements. As a result, green spaces and parks which were the indexes commented by the residents have been added to the list of the components and assessed. According to the obtained results of Fuzzy Delphi Analysis, as shown in Table 2, the components in which the none fuzzy average of the elites' opinions were less than 7 were deleted. Therefore, 13 out of 33 components were deleted from the final conceptual model of the research. After this stage, 21 codes in the form of closed questionnaires with Likert Five-point[1] Responses Scale were taken into consideration by the next 10 experts of the second group. The obtained data from this stage was scored as shown in Table 2, in which the point number 5 means *strongly agree* and the point number 1 means *strongly disagree* commented by each expert.

1. (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree.

Table 2: None Fuzzy Scores of Environmental Quality Components in Delphi Process and The Scores of the Experts in The Second Group to The Indices Obtained from The Delphi Method for Weighting the Indices in The Shannon Technique

components	None Fuzzy Scores in Delphi Method / Experts in the First Group	Experts' Scores in Second Group (1-5)									
	acceptable≥7	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	10
1.Environment Characteristics	**7.40**	4	5	5	4	5	4	5	3	4	3
2.Originality & Meaning	**6.34**										
3.diversity	**8.51**	3	3	3	4	3	4	3	3	4	3
4.Appearance of (built) environment	**7.32**	3	3	4	4	5	3	3	3	3	3
5.Control, monitor and Protecting	**9.31**	4	4	4	5	4	3	3	4	4	4
6.Security system	**9.41**	3	4	4	5	3	4	4	3	4	3
7.Emotional well being	**7.40**	3	3	3	3	3	4	4	4	3	3
8.Social well being	**9.50**	3	5	5	4	5	4	3	4	5	4
9.performance	**8.90**	5	5	5	4	5	4	4	5	4	3
10.contextual compatibility	**3.80**										
11.Space enclosure	**4.86**										
12.Quality of life	**8.37**	3	3	3	3	3	3	3	3	4	3
13.Efficiency & justice	**9.51**	5	5	5	4	5	5	4	4	5	5
14.Continuity & attachment	**6.86**										
15.Climate comfort	**1.26**										
16.Efficiency of primer services	**9.30**	3	4	4	3	3	3	3	4	3	3
17.City view	**5.70**										
18.Crime prevention	**7.50**	3	3	2	3	4	3	2	3	3	3
19.permeability	**7.86**	4	4	4	3	3	4	4	3	3	3
20.Risk of natural disaster	**9.42**	3	3	2	2	3	4	2	2	3	3
21.legibility	**8.60**	3	3	3	4	3	3	2	1	3	3
22.Flexibility	**8.51**	3	3	3	3	3	2	1	1	3	2
23.Mixed use	**6.41**										
24.accessibility	**9.31**	4	5	4	4	4	3	4	4	4	4
25.variety	**4.73**										
26.Scales & proportions	**5.44**										
27.Facilities & infrastructure	**9.07**	5	5	4	4	5	4	4	5	4	4
28.compactness	**1.26**										
29.phantasm	**8.57**	4	5	5	4	5	3	4	3	5	4
30.hierarchy	**1.18**										
31.privacy	**1.30**										
32.Cleanliness/ unpolluted	**7.57**	3	4	5	5	4	3	5	3	5	3
33.greenery	**7.00**	3	4	3	5	3	5	4	3	4	3

In order to discover the rate of agreement among the experts about each index, the easiest method was initially used i.e. subtotal of the points and their average after collecting the data at this stage. Also, these 21 components were classified into two criterion layers or dimensions: objective qualities of built environments' attributes and subjective qualities (Chan & Li, 2014: 827; Yu & Liu, 2018: 70; Liu & Zhang, 2018:118). In the next level, the indicators are grouped into seven categories following two main dimensions as it is seen in Table 3: the Function group is related to accessibility and permeability, flexibility, legibility, and diversity; the Appearance group refers to architectural and environmental values; the Management group considers the efficiency with which maintenance activities are undertaken and the quality and quantity of facilities and infrastructure; the Environment group is linked to the quality of the landscape and the environmental system; and the Security group relates to perceptions of personal safety and security; the Health and Well-being group represents the area's quality of life, citizens' priorities, needs, and levels of satisfaction through emotional and social wellbeing and at last, Identity group that defines performance, equal opportunities, people's perception in a site. All the above-mentioned components and categories have been shown in Table

3 plus the subtotal and the average of each index. At the next stage, the data was analyzed through the Shannon Entropy Technique. The information content of each index and its weight can be calculated through this method because of its more accuracy compared to data frequency (Azar, 2002: 16).

Table 3: Hierarchical Classification of Effective Factors and Findings from the Shannon Technique

A	B	C	D	Total Score	Average Score		Information Content	Component's Weight	Average Weight	
target	dimensions	categories	components	component	component	Category			Category	Dimension
Explanation of Factors Affecting Informal Human Settlements	*Built environment (objective qualities)/B1*	Function/C1	Accessibility/ Permeability/D1	40	4.0	**3.12**	0.997	**0.04793**	0.04737	**0.4744**
			Flexibility/D2	24	2.4		0.972	**0.04672**		
			Legibility/D3	28	2.8		0.982	**0.04720**		
			Diversity/D4	33	3.3		0.991	**0.04764**		
		Appearance/ C2	Environment characteristics/D5	42	4.2	**3.45**	0.996	**0.04788**	0.04747	
			Built Environment characteristics/D6	27	2.7		0.979	**0.04706**		
		Management /C3	Efficiency of primer services/D7	33	3.3	**3.85**	0.979	**0.04706**	0.04750	
			Facilities and infrastructure/D8	44	4.4		0.997	**0.04793**		
	Residential satisfaction (subjective qualities)/B2	Environment /C4	Greenery/D9	36	3.6	**3.82**	0.990	**0.04759**	0.04755	**0.4763**
			Unpolluted/D10	40	4.0		0.989	**0.04754**		
			Cleanliness/D11	40	4.0		0.989	**0.04754**		
		Safety and security/C5	Security systems/D12	39	3.9	**3.80**	0.996	**0.04780**	0.04772	
			Risk of natural disaster/D13	27	2.7		0.979	**0.04706**		
			Crime prevention/D14	47	4.7		0.998	**0.04797**		
			Control, monitor and care/D15	39	3.9		0.996	**0.04788**		
		Health and well-being/C6	Emotional wellbeing/D16	34	3.4	**3.57**	0.992	**0.04769**	0.04767	
			Quality of life/D17	31	3.1		0.990	**0.04759**		
			Social wellbeing/D18	42	4.2		0.993	**0.04773**		
		Identity/C7	Justice/D19	38	3.8	**4.1**	0.985	**0.04735**	0.04763	
			Performance/D20	43	4.3		0.995	**0.04783**		
			Phantasm/D21	42	4.2		0.993	**0.04773**		

Analysis and Discussion

Nowadays, it is important to evaluate the quality of urban life especially in informal settlements in order to define public intervention priorities, and to evaluate problems to ensure that the policies developed are compatible with the local context but it is needed to bring enough knowledge about the factors affecting these fabrics. Hence, informal communities are not only about letting communities extensively involved in the improvements of their communities through development only, it is also about recognizing the communities' ability, need and problem to grow and sustain itself via strengthening the relationship between people and urban spaces. This relationship can be seen as the

experiential construction of space originated in the everyday use of places, including social, cultural, and functional usages. This survey focused on identification of quality components that can be understood in terms of how they impact on people and on places through studying human needs and activities and their connection with urban space qualities.

In this study, the findings obtained from the frequency Table shows different ranking for the indexes compare to the Shannon Algorithm; therefore, the Shannon Algorithm has more accuracy to weight the indexes. The weight of the indexes has been considered according to the Shannon Algorithm Result Coding. Accordingly, it seems that quality components in "Function" and "Appearance" categories have minimum significance for informal settings from the perspective of experts which means that to improve the quality of these settlements, primary needs and activities not the preferences, should be considered throughout initial stages.

It is worth to note that all these qualities mentioned here in order, will have cultural implications in a planned process that will act in relation to the residents' needs and will definitely change the behavioral patterns gradually in urban spaces which are themselves a key factor in measuring the level of qualification in spaces. Also, according to this study's findings, the criterion layers of subjective qualities seem to be much more significant for informal fabrics which means in discussing the environmental qualities in such contexts with different degrees of vulnerability as well as different characteristics and conditions in compare to the main city spaces, the concept of quality is becoming important firstly at the lowest level in relation to the needs of residents. In addition, measuring residents' satisfaction in these communities is important not just as a measure to assess the success of housing policy, but also significant in contributing to residents' public health and happiness, which correspond to basic human needs. This is even more important for residents with special needs such as psychological disabilities. Residential satisfaction refers to the gap between the residents' psychological expectations and actual perception of the living environment. It is an important factor in measuring the residents' quality of life. Residents' satisfaction can stem from personal reaction towards the physical environment, but it can also be contributed by the sentiment among the residents that they could influence the outcome of urban transformation in their community with their participation in the process of change. In this way, it was also noted that psychological perception of the optimal environment among residents was also important, especially the residents' perception of what could have been done from design stage and what could be changed in the future.

Conclusion:

Assessments of the quality of urban life represent a multidisciplinary concept that encompasses environmental, social, and urban planning features, and a subjective estimation. Citizens and stakeholders have high expectations both in terms of quality and quantity, and city decision makers need to monitor the impacts of their city strategy over time while reflecting on how the city can become a better place to live. In this sense, it can be said that informal settlements are vital and urgent part of the means in which the council can participate in the improvement of living conditions, poverty alleviation and control of development. In the present study, we aimed to discover the effective qualitative indexes in improving the quality of lives relating to the citizens of informal settlements and also we explained how to use the Fuzzy Delphi Method to provide the indexes. For this purpose, two groups including 10 experts for each group in addition to space users of some informal districts were selected and after reviewing the literature of the subject, the elites' [selected from the both groups] opinions were used based on the purpose of the study. At each stage 10 questionnaires were completed and then submitted. At the next stage, 21 components were obtained from the Delphi Questionnaire and classified firstly into 2 main dimensions of objective and subjective qualities and the into 7 categories including Safety and Security, Health and Wellbeing, Identity, Environment, Management, Appearance and Function. During the process of closed questionnaire, the model and its components was re-examined by the elites of the second group. The data obtained from the questionnaires was analyzed using two methods consists of Fuzzy Delphi and the Shannon Analytical Technique and due to the fact that the Shannon Technique has more accuracy, this method was determined to weight the data. The findings obtained from the analysis through the Shannon Technique showed that between objective and subjective dimensions, the later one which relates to

residents' satisfaction seems to be considered greatly in the process of improving informal communities. Also, among categories, the ones entitled Identity, Management and environment respectively, could play a role in improving the quality of the informal settlements and the Safety and Security in addition to Health and Wellbeing categories has the biggest impact on the improvement of the quality of lives relating to the residents in these Fabrics. Accordingly, the Appearance and Function layers have the minimum amount of impact. Also, among the single indexes "crime prevention", "accessibility and permeability" and "facilities and infrastructures" are in the maximum of being effective and "flexibility" "efficiency of primer services", "risk of natural disasters" and "built environment characteristics" has minimum impact on the improvement of the quality of life in informal settlements from the viewpoint of the experts.

While the proposal for upgrading informal Settlements by qualifying and development of these areas is recommended in this research, it remains to be seen how the existence of quality and quantity factors in the informal settlements may reflect on the improvement of living standards and future upgrading projects via the affection of improving urban qualities on changing the needs of settlers and rising the level of residents' activities. Based on this research, relevant future research vectors include increasing the diversity of survey samples and applying the evaluation system to more informal communities. In addition to the residents of informal settlements and academic experts, other stakeholders, such as government housing departments and developers can also be involved in the survey so as to understand the views and needs of all parties fully. In conclusion, more research is needed on exploring the factors affecting the informal communities so as to have a more effective and comprehensive understanding of the relationships between the residential environment and the residents' subjective feelings of the environment in informal settlements.

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