

the elevation of citizens' life quality and the achievement of sustainable housing.

2. Research Background

Corin and Tamporan (2011) have paid of the analysis of different effective dimensions on the housing with the title of "evaluation of housing quality" and the affecting factors and are categorized in seven components. According to the results of this research and based on the examination of the indexes, the importance order of these seven components

in the housing quality is arranged by the following indexes: construction material and methods, stability, aesthetics, construction lands, infrastructures, design and the location of the construction. Sharipah (2011) have categorized the indexes for evaluating the housing quality into two main human and social demands in his research with the title of "Economical and high quality housing: Theoretical framework for design and planning of the high housing with a high quality" that is evident in his proposed diagram (1).

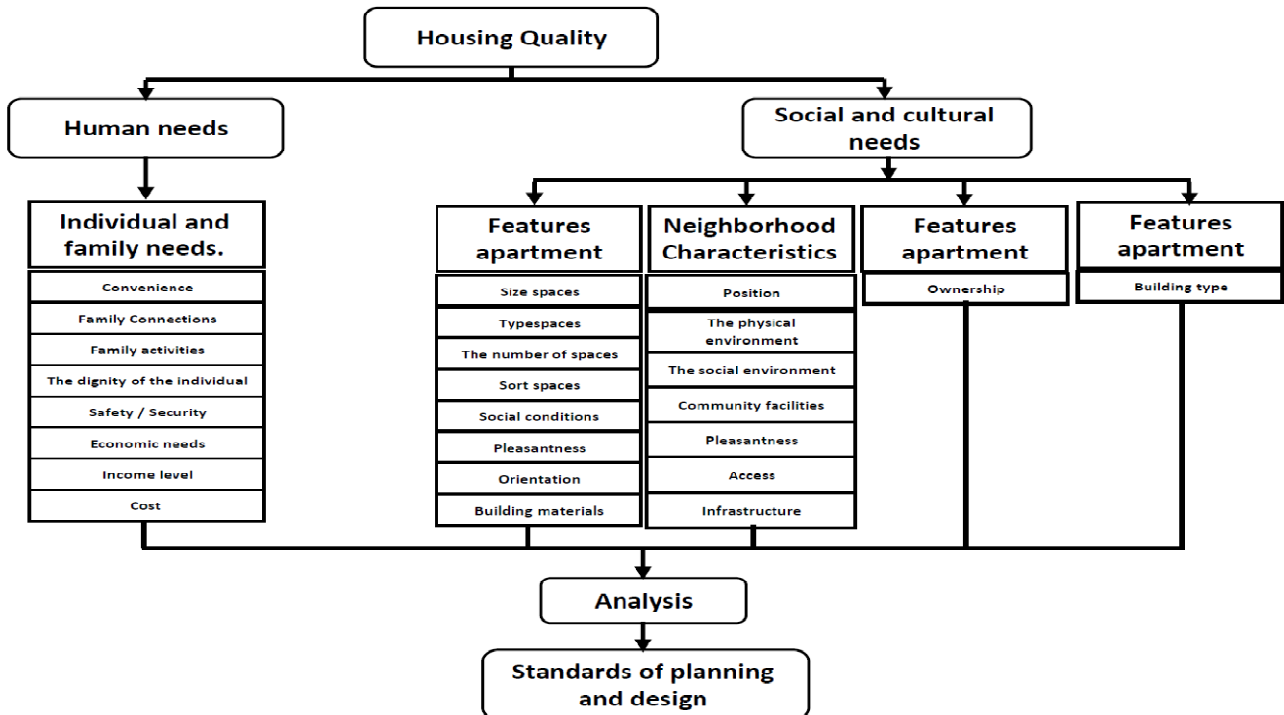


Fig.1. Criteria in evaluation of housing quality (Sharipah, 2011:9)

Kalin and Myles (2009) have paid to the specifications of the high quality housing and the impacts of it on the charm and health of the societies in their research with the title of "High quality housing. The high quality housing has a suitable access, high economical and natural quality which should be appropriate with the individual needs. In the mentioned research, the sustainable research is referred as a key tool in the creation of sustainable societies and it suggests the location of housing to be adjusted proportionate with the environmental conditions and the fact that the technical, hygienic conditions should be considered in the construction of housings.

Gifford and Lacombe (2006) have paid to the relationship between the housing quality and the behavioural problems of the children in their research with the title of "Housing quality and children's socioemotional health". This study marks a significant relationship

between the amounts of children's behavioural problems and the quality of housing, it states that there is a relationship between the general conditions of the inhabitants and the physical conditions of the residential building inhabitants.

Shamaee and Jahani (2012) have paid to the effects of the type of residency on the identity of the localities in a research titled "Analysis of the vertical development of the city on the local identity: case study of 7th municipality district in Tehran" to research and survey the impact of heightening on the local identities. Findings of the mentioned research shows that the identity of the neighbourhoods in the district of Tehran is subjected to changes by the sudden heightening. The average score of the social participation and collective mentality, sense of belonging and the recognition of the neighbourhood

borders and commitment in the system of apartment housing is reduced in comparison to the standard city life. Azizi and Malek Mohammad Nejad (2008) have paid to the dimensions and criteria of for the design and planning of residential buildings and have done a comparative research on some of these maxims of two samples of standard and skyscraper patterns in a research with the title of “Comparative research for two types of standard and skyscraper residential housing complexes”. Findings of the research shows that in the standard housing, more

3. Materials & Methods

The following research is from the comparative type with the use of a descriptive-analytic method and with employing popular library tools along with field observations. To collect data about the housing quality in each neighbourhood, the subjective approach was employed. Number of questionnaires were calculated by using the Cochran method, which was evaluated as 100 according to the sum of the bulk of both populations in which 50 questionnaires was allocated for each neighbourhood (In the Cochran formula, N was considered as equal to 50000, Z was 1.6, p and q we each equal 0.5 and d was equal to 0.1).

In this research, the very main indexes and the components of housing quality were extracted by revising the domestic

desirable residential environments are provided in comparison to the skyscrapers.

The lower density and the existence of open green spaces and their impacts on the Physical-spatial qualities have caused the priority in the overall score of the standard model to the skyscrapers. In the construction of residential building complexes, observation of urbanism maxims and creation of a suitable space for living and providing the services and facilities for their inhabitants can turn the new spaces into the desirable residential environments.

and foreign literature related to the topic and the Delphi method was employed to assign the weight of criteria and the sub-criteria. The two model were compared after receiving the opinion of experts and by using the (AHP) hierarchical analysis method. The hierarchical analysis process is a flexible, powerful and simple method for making decisions in a conditions that contradictory decision making criteria make it difficult to chose between the options. This method which was first suggested by Thomas. L. Saaty on the early 1980s, itwas considered as an efficient, suitable method of analysing the compatibilities in making judgements due to its simplicity, flexibility and the use of qualitative and quantitative criteria simultaneously (Zebardast, 2001: 13).

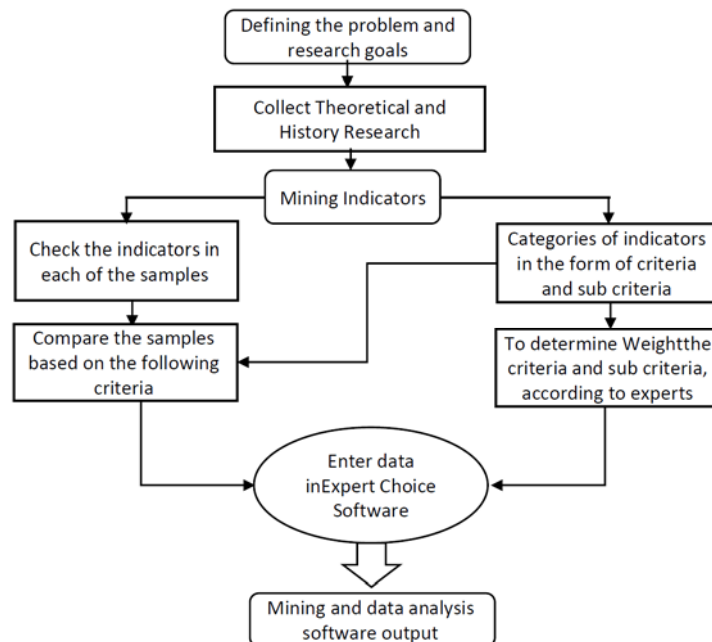


Fig. 2. Process Research

In the hierarchical analysis, the weighting of criteria and sub-criteria were first took place by the opinions of a number experts (15 experts). On the next step and in order to reach for the final score of each option, the twin

competition between two samples were done according to each of the sub-criteria. This comparison was done based on the results of accomplished questionnaires. According to this fact, the geometrical average of for the answer to

each question was calculated for each step and options were compared according to the two resulting scores for each sub-criteria in the Expert Choice software. Finally, by specification of the superior option, score of the options were also extracted for each criteria, the recommendations were proposed according to the analysis of this model's outputs. Process of this research are shown in the figure 2.

4. Theory/calculation

4.1. Concept of housing and its components

The concept of housing includes the whole residential environment in addition to its physical location which includes all of the demanding services and facilities which are mandatory for the living of families and the employment, education and personal hygienic pans. Generally, the need for housing has two aspects, quantitative and qualitative. The qualitative dimension includes the need for housing, recognition of phenomena and the matters which are related to the lack of shelter and the rates of access to them which is in fact the rates of answering to these demands without considering its quality. In the qualitative dimension, a number of topics and phenomena are proposed which are related to the lack of housing, the unfavourable housing or tightness of housings.

According to the definition of housing on different dimensions, we can define the suitable and efficient shelter as follow: "A favourable housing is a suitable residing place in which welfare, suitable access, security, stability and endurance of the structure, enough lightening, ventilation and the primal infrastructure including irrigation, hygiene and education, healthy living environment, suitable and accessible place in regard to the employment and primary facilities plus the grounds of growth and reinforcement of relations between the members of the family and those between the neighbours are provided for its inhabitants which should be more importantly proportional to the financial capacities of the family" (Lotfi et al., 2009: 93).

In the 2nd conference of human settlement (1996) which was held in Istanbul, the convenient housing was defined as this: "Suitable shelter does not only mean a roof on a person; the convenient shelter means a suitable welfare, space and the appropriate physical access and security, security in ownership, endurance and sustainability of the structure, lighting, ventilation and proper heating system, good primary infrastructures including the hygiene and waste of dump, good environmental quality and hygienic factors, suitable location in regard to the employment and facilities; which should all be supplied according to the affordability of the people" (Pour Mohammadi, 2006: 3-4).

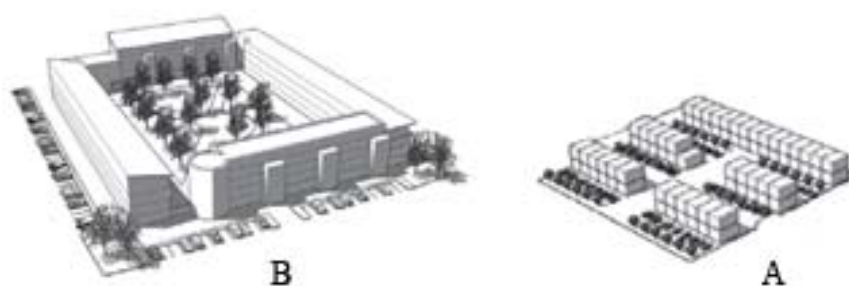
Table 1
Different aspects in planning the housing (Pour Mohammadi, 2006: 23)

Housing	Social Aspects	Economical Aspects	Physical Aspects
Housing unit (Individual and the family)	<ul style="list-style-type: none"> ● Size of the family ● Type of the family ● Moral group 	<ul style="list-style-type: none"> ● Income ● Tax ● Expenses of housing 	<ul style="list-style-type: none"> ● Are of the housing unit ● Number of room in the housing unit ● Conditions of the building ● Type of ownership
Neighbourhood (Society and the circumference environment)	<ul style="list-style-type: none"> ● Services ● Playing roles in decisions ● Social meetings ● Criminology ● Group breakup 	<ul style="list-style-type: none"> ● Financial resources to resolve the demands 	<ul style="list-style-type: none"> ● Services ● Density ● Green spaces and areas ● Security of transportation ● Access to the services ● Employment status ● Specification of housing unit establishment

Three main criteria in categorising the human-environmental factors that are effectful to the design of Physical[/shell] design of the residential complexes. First on the outward link of the residential bundles with the circumfering environment; the most important point in this criteria is that it develop Physical-social persistence and links for the complexes with the environments and to create a local ID. Second, is a criterion regarding the internal links and the relationships with the outside of the residential units; in this criteria, establishment of relationships and achieving a balance between the internal privacy of the complexes and the social interactions, the quality of establishment a sense of security, orientation and pedestrian access, motor vehicle access and considering proper stop-points are some of the essential topics on the urban design. Third, on the scale of residential units; in this scale, relations and proportions of the interior spaces of the housing and coordinating it with

the culture and the traditions of the residents are some other points on designing it. In addition to this, the climate and energy saving on all of these scales, from the ideas on orientation of buildings and designing the premises and yards to the scale of adjacency of residential units are some of the most important points (Eyni-Far, 2000:110).

Residents of the complexes with more than four stories are categorized in the rank of “apartment dwellers” while those who live in the buildings with less that four stories are categorized on the rank of “standard dwellers” (Shamae & Jahani, 2011: 76).



- A. Standard residential bundle
- B. Apartment residential bundle

Fig. 3. Typology of conventional housing and apartment

4.2. Sustainable Housing

As an essential and important demand of urban space, housing plays a key role in the sustainable urban development. We can defy the sustainable housing as the following: “that type of housing that can satisfy the present vital demands of the existing generation based on the functionality of natural resources of energy and is at the same time neighbourhoods which can create attractive and safe neighbourhoods by paying attention to ecological,cultural and economical issues is a sustainable housing. In another definition sustainable housing is defined as a type of housing which has the lowest amount of inconsistency and incompatibility with its circumferingnaturalenvironment and

with the world on a larger scale. Sufficient space, physical access, sufficient security, sustainability of the structure,persistence of the useful life, beneficial of natural and artificial light,heating and ventilation, residential and infrastructural services like water and electricity and etc, hygienic facilities and the management of waste and residually, suitable environmental life quality, social and neighbourly relationships, visual and physical relationship with the nature and green space which should be accessible for the residence with a reasonable price are all signs of the healthy and sustainable housing” (Buzi et al, 2010: 31).

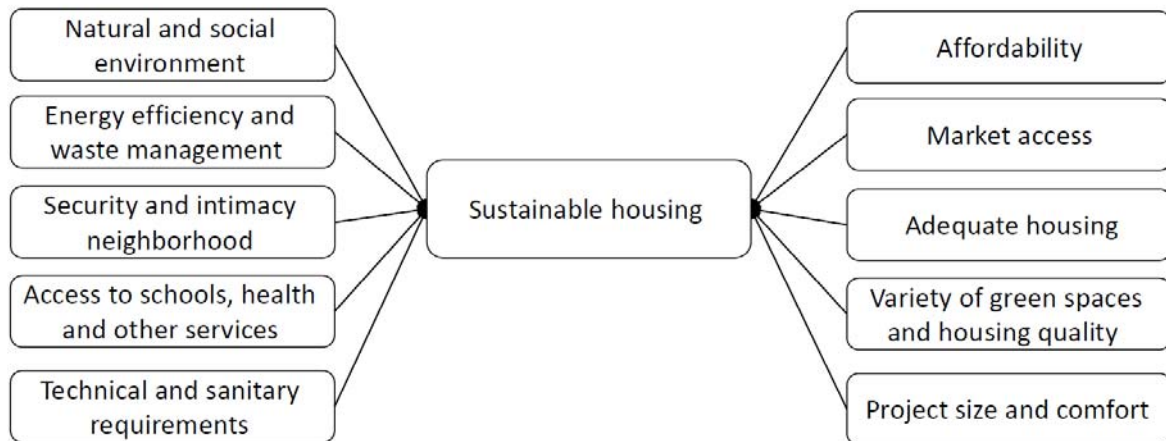


Fig. 4. criteria of the sustainable housing (Maliene and Malys, 2009)

4.3 Housing Quality

Housing quality is one of the main criteria in evaluating of life quality and it is tested along in the other criterion of street quality criteria, visual and noise quality for the evaluation of environmental quality ([Http://www.rgs.org](http://www.rgs.org)).

From the viewpoint of urbanism, buildings should be constructed on the best and most healthy urban areas. In a qualitative point of view, housing should fulfill the self-related demands and needs and should provide the ethical social and hygienical, welfare and peacefulness, feeling of security for the residents, beauty and access to the public local services, enjoying the clean weather, lack of unwanted sounds, living with privacy from a stranger eye, negotiation of healthy relationships with the other residents, adequate open spaces and green landscapes, having enough foundation space in proportion to the number of family members is considered as some other necessities (Bazi et al, 2011: 192).

The concept of living space quality in the housing researches which were done in Netherlands included the structure quality analysis, surveying the functional quality and to have an eye on the consumption of energy, and studying the diverse aspects of living spaces and housing quality. An analysis on the quality of housing is possible by receiving the quality analysis of housing from the mind of addressees citizens namingly the inhabitant of the residential unit about the quality of their access to the equipments of the residential complex, satisfactory housing ideas, feeling of security, etc., in addition to the specification of the housing. In regard to the consumption of gas, water and electricity, a triple-year statistical program can find the heating and ventilation habits of the resident families (Habibi & Ahari, 2001: 11). Turkoglu have analysed the amount of satisfaction from housing in

the rural areas. He have proposed six factors in his research that can provide levels of satisfaction from their housing (Turkoglu, 1997: 55-64).

- Physical size and condition of the housing
- Access to the center of the state, workspaces, hospitals, centers for shopping and services.
- Access to appreciation, educational centers
- Social and corporeal dimensions and environmental issues
- Weather, controlling the air inside of the house
- Satisfaction of the neighbours

Also in another definition of impacting factors on the housing quality which is proposed on the neighbourhood scale, we can mention these points: (www.torghabe.ir)

- Desirable form of the housing
- Security
- Safety, convenience and the scale of residents access to the facilities and Physical services of the neighbourhood (convenience, easement and hygiene)
- Access to the open spaces, green spaces
- Providing the necessary facilities and equipments of the housing
- Adjacency of the housing with incompatible land uses.

4.5 Extraction of Indexes

Analysing the indexes is one of the different approaches and tools for identifying the specification of the housing which can facilitate any type of planning and deciding regarding the housing. According what is present in the theoretical aspects of the research, the most important factors of housing quality can be shown in the Table 2. In this table, indexes of the housing quality are gathered in the form of indexes and subindexes.

Table 2
Documentation and final sum up of the housing quality variables

Dimensions	Variables	Fathalian & Partoe (2011)	Zabihi et al. (2011)	Sartipi -Pour (2005)	Lotfi et al. (2009)	Pour-Mohamadi (2006)	Arevalo & Chamorro (2003)	HC A ³	HU D ²	Maliene & Malys (2009)	NC HH ¹	Meng & Hall (2006)
Housing Expenses	Quality of the ownership and the price of the housing	*		*	*	*	*	*		*		*
	Current expenses of the housing unit	*		*	*	*			*			
Facilities and infrastructures of the housing unit.	Number of rooms in the housing unit		*	*	*	*	*	*	*	*	*	*
	Area of the unit	*	*	*	*	*	*	*	*	*	*	*
	Access to the pipe water electricity, gas and sewage.		*	*	*	*	*	*	*		*	*
	Facilities, stockhouses, elevator and car parkings.	*	*	*		*		*	*		*	*
	Living spaces (Kitchen, toilet, bathroom, etc.)	*	*	*	*	*	*	*	*	*	*	*
Housing Skeleton	Age of the building	*		*	*		*	*	*	*		
	Type of the building material and the structure endurance	*	*	*	*	*	*	*	*	*	*	*
	Building visage							*			*	
	Number of stories			*	*		*					
	Safety against accidents and disasters		*		*	*		*	*	*	*	*
Social Conditions	Observing the right of other people		*			*				*		
	Facilities for the handicapped and people with physical disadvantages					*	*	*	*		*	
	Safety and security of the building (Welfare of the women and the children)					*		*			*	
Local Services	Access points (pedestrian and motor vehicle pathways)		*			*	*	*	*	*	*	*
	Environmental (Contamination, Green spaces, etc.)		*			*	*	*	*	*	*	*
	Physical facility services		*			*		*	*			
	Safety and security in the neighbourhood		*			*	*		*	*	*	
	Social interactions and local belonging		*			*			*	*	*	
	Residential adjacencies		*				*	*			*	
Interior Design (Architecture)	Sunlight and absorption	*	*		*	*	*	*	*	*	*	*
	Landscape and view	*	*			*	*	*	*	*		
	Security and privacy		*			*						
	Energy efficiency	*		*			*	*	*	*	*	*

5. Introduction of Case Studies

According to the research goals, a number of aimed samples including Standard and Apartment housing were chosen. After research among the constructed buildings in Tehran finally “Narmak” and “Ekbatan Complex” were chosen. These two zones, are similar to each other in some aspects; They are both founded at the same era in time, they are both prefabricated buildings, characteristic specifications in the Physical, social and cultural aspects, a unified forming visage and long time residing times are some of the similar specifications of these two neighbourhoods, also according to the large expanse of both complex, a specific range was chosen and surveyed for this research. The first phase was chosen from Ekbatan

complex and Haft Hoz was chosen from Narmak complex. The main reason behind these choices was the more residency records and the equality of the residing citizens. Position of the zones in Tehran city and their plans are shown in the photo. 5.

As it is evident in the photo 5, in Haft Hoz neighbourhood, design is done according to the standard type of housing but in Ekbatan, another type is utilised that is for the apartment buildings. This point causes a diverse difference in the maxims of urban design and architecture and many of Physical, social specifications. Table 3 shows a brief comparison list of the both neighbourhoods.

As it is evident in the photo 5, in the Haft Hoz area, design was done based on the standard type and for the first phase of Ekbatan the apartment type was employed.

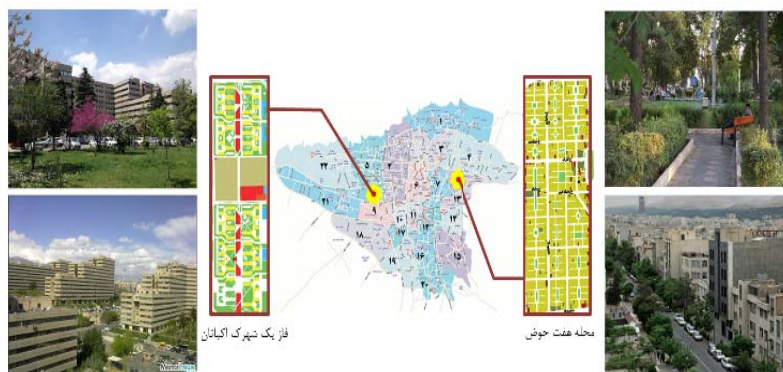


Fig.5. Location of the research areas on the city map of Tehran.

Table 3
General specifications of the studied samples

Factors	1st phase of Ekbatan complex	Haft Hoz neighbourhood
Location	District 5 - Area 6	District 8 - Area 4
Date of the design	1950s	1930s
Expanse	75 Hectares	109 Hectares
Population	16,000 persons	30,000 persons
Population density	213	275

6. Results

In this research, a number of matrices for the binary comparison of the indexes and sub-indexes and the recommendation of the experts were used to perform a 9 unit clockwise comparison. According to the extracted table from the indexes and sub-indexes of the housing quality (Table. 2), each of the expert analysts have answered to a 6 x 6 matrix for the comparison of main indexes and 6 more matrices for the comparison of sub-indexes. After collecting the data from the housing experts (15 of them), and because of the differences on the fluctuating score rates from each expert, a geometrical

average of the expert observations were calculated at first and then a final flat matrix was imported into Expert Choice software (ver.10) for making a comparison between indexes and sub-indexes. On the step for importing the data into the software, the incompatibility rate was calculated for each matrix. This number reflects the accuracy of the matrix and the precision in the binary comparisons which should be less than 0.1. In this research, it was observed that all of the imported matrices follow this rule. As one of the first outputs of the hierarchical analysis model, defying the weight of indexes

and sub-indexes in relation to each other which is show in the photo 6.

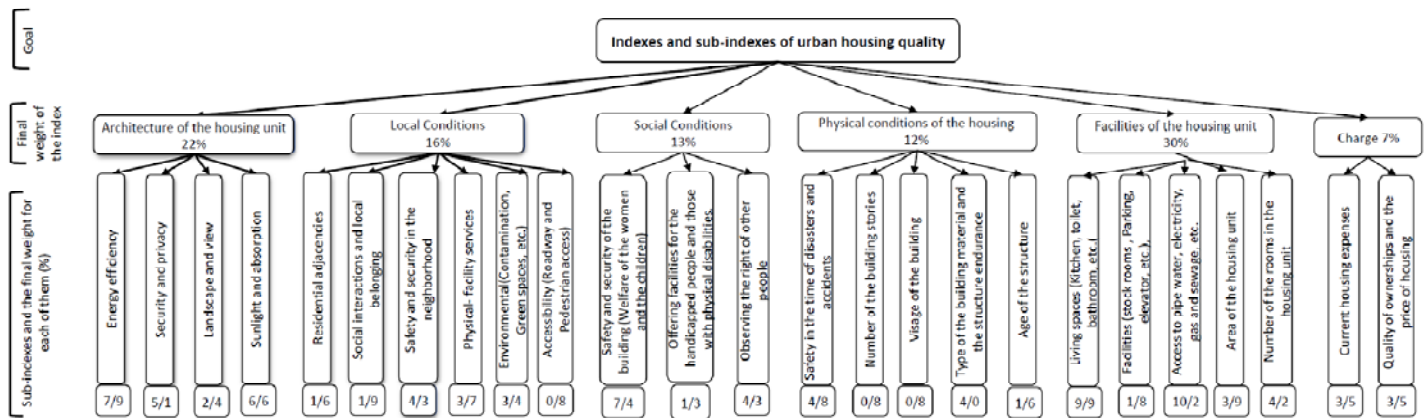
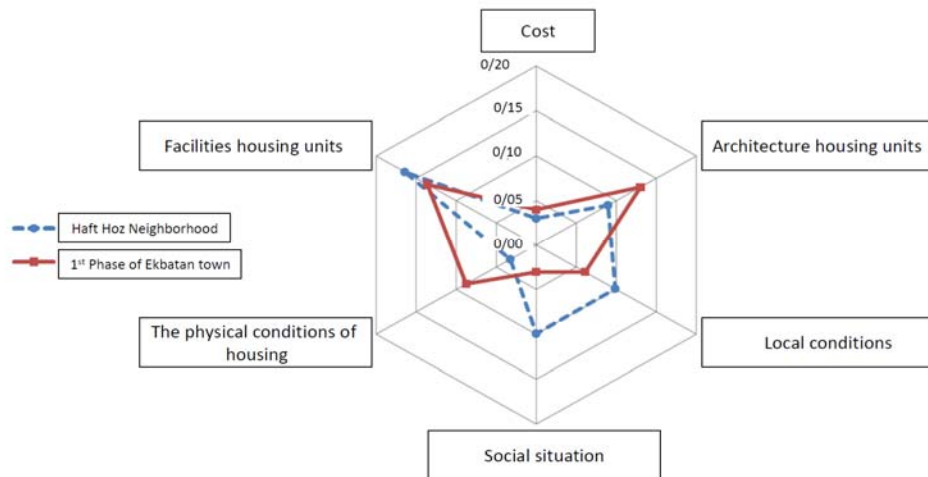


Fig. 6. The Ultimate Weight Chart criteria and sub-criteria

7. Discussion

Based on the binary comparison of the indexes, it is observed that the weight for the facilities of the housing unit defies 30% of the housing quality. Also, architecture index defies the a 22%, local conditions 16%, social conditions 13%, Physical conditions of the housing 12% and 7% is its rate for the expenses. The weight of the indexes are also achieved based on the hierarchical analysis which is shown in Figure 6. On the next step and in order to reach for the final score of each choice in proportion with the goals of the research, the binary

comparison between two samples based on each of sub-indexes in the environment of Expert Choice software. This comparison is performed based on the results of the filled questionnaires. According to this basis, the geometrical average of answer to each question is calculated on each step and choices are being compared with each other in the computer by comparing the two resulting scores for each sub-index. By doing binary comparisons for a number of 25 index, we can get a final output from the software. This photo shows the final output of the software.



Haft Hoz	514	[Redacted]
Ekbatan	.486	[Redacted]

Fig. 7. Diagram for the weight of the final weight for each choice (output of the Expert Choice software)
 Synthesis with respect to the comparison on the housing quality
 Overall Inconsistency = .03

As it is evident in the photo 7, the two cities has slight differences in the viewpoint of housing quality. Results of the study shows that the score of Haft Hoz Neighbourhood is 0.514 opposed to the score for Ekbatan that is 0.486. Although the figure 7 shows some indicators of housing quality in the two areas, also the identification of weak and strong points of each neighbourhood has an important role

on the process of hierarchical analysis based on the indexes, hierarchical analysis process has the power to extract it. Table 4, shows the score of each neighbourhood for each index and also the final score of each neighbourhood in relation to each index (which is calculated by the multiplication of the index weight on the score of each neighbourhood on the same index).

Table 4
Score points for each criterion

Index(es)	Index Weight	Score of the neighbourhoods for each index		Score of the neighbourhoods for both index	
		Haft Hoz	Ekbatan 1st Phase	Haft Hoz	Ekbatan 1st Phase
Charge	0.07	0.429	0.571	0.030	0.040
Housing unit facilities	0.30	0.547	0.453	0.164	0.136
Physical conditions of the housing	0.12	0.270	0.730	0.032	0.088
Social conditions	0.13	0.765	0.235	0.099	0.031
Local conditions	0.16	0.617	0.383	0.099	0.061
Architecture of the housing unit	0.22	0.408	0.592	0.090	0.130
Result	1	3.036	2.964	0.514	0.486

As it is evident in the Table 4, although the two areas were analysed on a single layer but a number of manifest differences are shown in the indexes of housing quality. The Haft Hoz neighbourhood has a prominence in the indexes of local conditions, social conditions and the facilities of the housing unit to the first phase of Ekbatan

complex. In opposite, the indexes of Physical conditions of the housing, architecture of the housing unit and the charges of housing have reached a higher score in the first phase of Ekbatan complex. In order to have a better image of the final score of the neighbourhoods on each index, their star-graph is presented in the Figure 8.

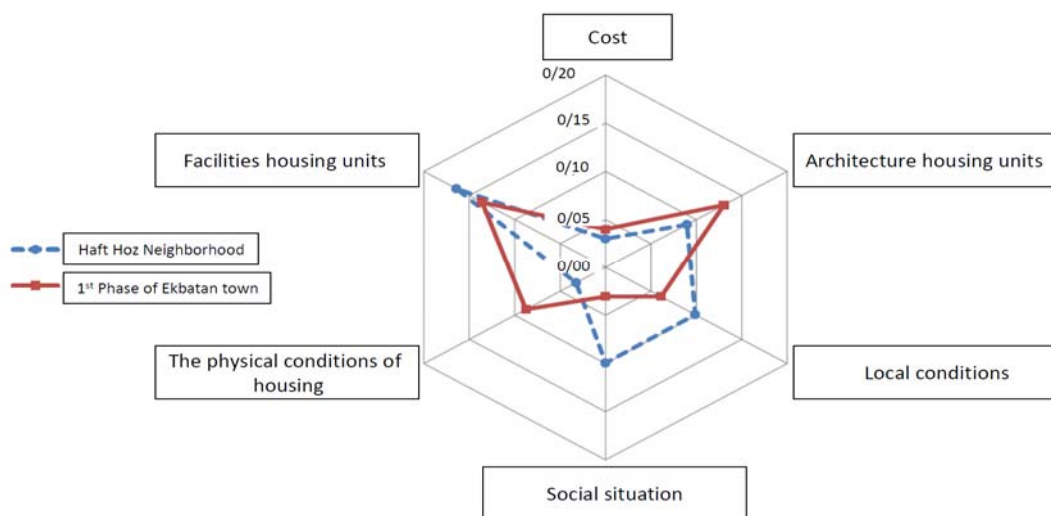


Fig.8. The star graph of the final score of neighbourhoods on each index.

According to the figure 8, it is observed that the most difference of housing quality between the two case studies is on the “social conditions” index in which Ekbatan complex have reached for a smaller score. The “Physical conditions of the housing” index has the second standing after it which Haft Hoz have reached for a smaller score. From the other four indexes, two indexes of “local conditions” and “facilities of the housing unit” have reached a higher score in Haft Hoz and the other two indexes of “Architecture of the housing unit” and “Charges” have reached a higher standing in first phase of Ekbatan complex.

8. Conclusions

In the following research, with a comparative study of the housing quality in two different types of standard and apartment building styles, the main indexes of housing quality was subjected to research based on the viewpoint of the residents. It is important that this research have been performed on two of the prefabricated housing complexes since the construction of buildings in such neighbourhoods were done in a goal-oriented method aligned with the maxims of urban design and architecture and the results of such analogy would shed light on the weak and strong point of such plannings in the field of housing quality. Findings of this research shows that there is a minute difference between the housing quality in the two neighbourhoods of Haft Hoz and the first phase of Ekbatan complex and how they both have some shortcomings in providing a desirable housing space. This research shows that the housing quality score in Haft Hoz is 0.514 and the first phase of Ekbatan complex is 0.486, that shows the minor advantage of housing quality in Haft Hoz. Also the formal data reflect the fact that Haft Hoz area reaches a higher score in the indexes of social conditions, local conditions and facilities of the housing unit than to the first phase of Ekbatan complex, in opposition the Physical housing condition indexes, architecture of the housing unit and charges have reached a higher score for the first phase of Ekbatan complex.

Although this study was done on two specific samples but we can take advantage of some of its general results as the basic maxims for designing neighbourhoods with the satisfactory housing quality. A number of these maxims are included in the following lines:

- To elevate the housing quality of the citizens of a neighbourhood, the specifications of the housing
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Appendices

1. NCHH is the abbreviation of National Center for Healthy Housing which is retrieved on the online platform with this address (<http://www.healthyhomestraining.org/Codes/HQ S.htm>) and have mentioned to some of the housing quality standards.

should be studied and researched on three levels. These three levels include the housing unit, residential complex and the neighbourhood which should be considered alongside with each other.

- The cultural and traditional ideas of the citizens has a high level of importance while designing the facilities and equipments of the housing and it can reduce the incompatibilities to the lowest level.
 - In the standard and apartment building complexes, designers must pay attention to the Physical factors in addition to the recognition, cultural and social factors on the satisfaction of the residents from the housing.
 - The conditions of climate and domestic specifications should be considered during the design of a housing to suggest a proper pattern which can help to the sustainability of the housing.
 - Introduction with the Persian-Islamic traditional housing and taking advantage of those patterns in the design process, aligned with correspondence with the culture of the residents, will lead to their satisfaction and elevation of the housing quality.
 - Using the enduring building material in constructions aligned with the modern science of constructing buildings will reduce the expenses of housing section on the long run in addition to the elevation of Physical housing conditions and removes the need for new constructions.
 - Paying attention to the qualitative aspects of the residential complexes especially those related to the aspects of cultural, climate and aesthetics can contribute to the rates of citizens satisfaction from the housing.
 - Presenting definition or a specific norm for evaluating the qualitative aspects of the housing and the living environment can be a pre-action in order to reach for a compiled planning in the field of housing planning and urban design to reduce the issues in this field.
 - Correct localization of the residential complexes, supplying the demands of the residents in the neighbourhood and the safety and security by a correct design of the spaces can help to increase the sense of belonging in the citizens in addition to the creation of a dynamic and active environment.
2. HUD is the abbreviation of Housing and Urban Development which is retrieved on the online platform with the title of “Housing Choice Voucher Program Guidebook”
 3. HCA is the abbreviation of the “Homes and Communities Agency” which is online on the Housing Quality Indicators (HQI) website and revolves around the indexes of housing quality.

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