



Flexibility Solutions in Response to Housing Design Issues

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ABSTRACT

Undesired quality and the existing issues in the field of housing are of the main problems in Iran. Removing such problems is one of the necessities in the development plan of architecture and urban development. Providing flexibility by the possibility of creating compatibility or by changing the frame and space for various uses shall lead to the qualitative improvement of the residence space and the satisfaction of many of the needs. By such an approach, it is possible to present solutions for optimizing the space and a suitable response to some of the issues in the field of housing; accordingly, the research was conducted with the purpose of evaluating the effect of each flexibility strategy on solving the housing problems.

The current study is an applied study from the purpose viewpoint, and is a combination of documentary and survey methods, from the method viewpoint. To determine the relation between the strategies and the issues, the qualitative method of interview is used and to evaluate the effect of strategies on the issues of the housing field, a questionnaire is used based on the Likert scale. According to the analyses and the findings obtained from the interview and the survey, among the nine existing issues in the field of housing design, seven issues with different rates are solvable using the flexibility strategies. On the one hand, the results indicate that considering the obtained rates, the flexibility strategies are able to solve the issues of “monotony and variety of the residential patterns given the variety of the exploiters”, “paying less attention to the needs of the exploiter” and “paying no attention to the cultural and identity conditions”, respectively, more than other issues. On the other hand, the strategies of “service core”, “movable separating surfaces” and “movable and flexible furniture” are most effective in solving the housing problems

Keywords: *Housing, Issues and Problems, Strategies, Flexibility*

1. INTRODUCTION

In the framework of supplying the required space for the human comfort, housing is not only a material existence the realization of which requires engineering knowledge, but also a spatial

quality which is responsible for satisfying the mental needs of the human [1]. Housing cannot be considered merely as a physical structure; rather, it is a multi-functional structure which pays attention to different aspects. The formation of the housing is dependent on cultural, climatic, economic, livelihood factors and conditions and the building technique of the consuming society.

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Actually, in addition to supplying a shelter as an initial and key need of the human, housing bears various other responsibilities, too, and it is one of the most important factors affecting the life style and the cultural pattern of the residence [2]. A major part of investments and state development also occur in the field of housing. Rafiei (2003) presents some statistics regarding the amount of such investments in this area and states that in post-revolution era, the housing area allocated 20 to 40 percent of total investments to itself which included 4 to 8 percent of the gross productions [3]. From 1980 to 1983, more than 30 percent of the national macro investment costs were related to the housing area. In 1988, about 33 percent of the income of the poor class was allocated to the housing costs. In 1999, out of the civil credits of the government with regards to construction, housing and urban development, around 19 percent was allocated to the housing area [4]. Such statistics and similar ones, all indicate the importance of housing and its role in the macroeconomics of the country. Accordingly, maybe it is possible to claim that the housing area has become the inseparable part of the state general, planning and management system and falls under the general objectives of development [5].

Housing is a critical issue in developing countries. Lack of adequate resources, management weakness, lack of national comprehensive planning of housing and other dysfunctions in the economic infrastructures of such countries, on the one hand, and the quick increase of population, particularly, urban population, on the other hand, have made the problem of such countries complicated and multi-dimensional[6]. The other point is the difference in the type of the housing problem in different parts of Iran. In some regions, the problem is the chronic shortage of housing which is mainly rooted in the population movement and immigration from small residences to the larger ones. In some other regions, the problem is not the housing shortage; rather, the it is the low quality of housing, and the great distance between the housing and the minimum desired criteria of living space, such as strength and safety, health and conform conditions [1]. The increasingly development of housing problems in the country and the necessity of removing them make it inevitably necessary to pay attention to the problems and present efficient strategies to

solve the problems and issues. However, based on studies, significant attention has not been paid to such strategies, particularly in the area of flexibility, and the shortage of studies conducted in this area is clear. Flexibility has many uses as an approach to respond to the different functions of the space and the various activities of its users. By this approach, it is possible to create solutions for optimizing the space and present a suitable response to the needs of the users in every moment of life proportionate to the life style, in different levels of building design, from architecture to furniture [7]. Thus, as Gharvi Al-Khansari (2011) states, although flexibility in architecture might be created in response to the climatic and structural changes, the aspect of such a concept which is given more importance to is the capability of reacting and problem solving in the area of housing[8]; therefor, considering the necessity of solving the problems and issues existing in the area of housing design, and paying attention to the flexibility strategies in order to solve them, the current study aims at evaluating the effect of each flexibility strategy on the housing problems, which has become possible by collecting data through library studies and the opinions of the specialized team through a survey.

Literature Review

The term Flexibility entered the field of architecture around the beginning of 1950, raised by Gropius in 1940[9], and also it was discussed about as part of the modern movement by such architects as Le Corbusier, Mies van der Rohe, and then Habraken and Hertberger. Such an idea was as a result of transformations in technology, which made it possible for the fixed-building structures to separate from their elements. On the one hand, by the spread of different methods and strategies such as folding furniture, movable partition, etc., the functional overlapping of spaces in the internal composition of the building became possible [10]. On the other hand, the word is raised in a book entitled "Word-Building" [9], in which flexibility is deemed as one of the eighteen keywords in the modern architecture. Finally, in two articles entitled "Flexible Housing: Opportunities and Limits" and "The Flexible Housing", the authors conducted the latest studies on the area of flexible housing, including criticizing the

status of housing in social, economic and environmental fields. Moreover, they pointed to nine strategies which were considered as the flexibility principles in housing [11].

Some studies are conducted in Iran about flexibility and housing, which led to presenting some strategies. For example, in an article entitled “A Pattern for Analyzing the Flexibility in the Iranian Traditional Housing”, a two-dimensional matrix was proposed, one dimension of which was types and factors of flexibility and the other dimension was the three common scales of the traditional houses including micro-scale, medium-scale and macro-scale, and such an analysis might be useful in editing the principles and regulations of the design of new residential units and complexes [12]. Furthermore, in an article entitled “The Role of Furniture in the Flexibility of the Internal Space of Housing”, the behavioral features of furniture were analyzed and categorized to optimally use the space and be accountable to the needs of the users [7]. In another research entitled “Investigating Harms and Limits of Flexibility in the Iranian Contemporary Housing” written by Akram Hosseini et al., by a comprehensive consideration of the word and concept of flexibility, the pathology and reasons of lack of flexibility in the area of Iranian contemporary housing were investigated, and the authors finally suggested planning as a solution for removing the key obstacles of the tendency to the flexibility in the area of housing [13].

Reviewing the literature regarding the patterns and strategies indicates that in the studies conducted by most of the researchers, the most valid strategies of flexibility are related the

findings of Till and Schneider, which are the criteria of investigation in the current study.

Research Method

The current study is an applied study from the purpose viewpoint, and is a combinational study (documentary and survey methods) from the method viewpoint, in which quantitative and statistical methods are used for analyses. Proportionate to the title and purpose of the study, the target population in the current study includes 11 managers and executive officials informed of housing issues and the university professors informed of the field of housing and flexibility, living in Tehran and Mashhad, eight of which filled out the questionnaire, meaning that more than 72 percent of the target population participated in the interview.

The relation of each strategy with the indexes of housing issues from the perspective of experts was evaluated in two stages. In the first stage, they were asked to merely consider the relation or lack of relation of flexibility strategies (as the independent variable) with the housing issues (as the dependent variable). After considering the findings, out of 9 issues, 7 issues were only determined as being related to the area of housing (Table 1). In the second stage, using the Liker scale (point 1 indicating the ineffectiveness to point 5 indicating to be most effective), the relation of each strategy with the weighing issue by the experts was investigated. Since among the previous literature, in the latest studies by Rezvani [15], the components and indexes of housing were presented, the theoretical framework of the current study was selected based on the results of the mentioned study (Table 2) and also based on the flexibility strategies by Schneider and till (Table 3).

Table 1. Introducing the Research Variables

Number of responsive variables from the perspective of experts	Source	NO. of variables	Variable title	Variable
9	[14]	9	Flexibility Strategies	Independent
7	[15]	9	Housing Design Issues	Dependent



Figure 1. The Relation between Housing Design Issues and the Flexibility Strategies

Table 2. Issues and Problems of Housing Field with an Emphasis on the Design Area

Weight (shanon)	Housing Design Issues	NO.
1.03138	Lack of attention to building sustainability approaches and the use of clean energy	Issue 1
1.03136	Paying less attention to the needs of the exploiter	Issue 2
1.03132	Paying no attention to the cultural and identity conditions	Issue 3
1.03131	Paying less attention to the climatic & environmental conditions in building design	Issue 4
1.03129	Monotony & Variety of the residential patterns given the variety of the exploiters	Issue 5
1.03136	Not observing many of the technical principles, regulations & standards	Issue 6
1.03133	Formalism & Decoration	Issue 7
1.03128	not paying the necessary attention to safety issues in design	Issue 8
1.03135	not paying enough attention to the values and the quality of the architectural design	Issue 9

(BaradaranTavakoli et al, 2020)

Table 3. Flexibility Strategies in the Housing Architecture

Flexibility Strategies	NO.
Functionally Neutral Rooms	Strategy 1
Circulation Space Usage	Strategy 2
Service Core	Strategy 3
Same Room	Strategy 4
Movable Separating Surfaces	Strategy 5
Switch Room	Strategy 6
Movable & Flexible Furniture	Strategy 7
Vertical & Horizontal Additions	Strategy 8
Joining & Dividing Units	Strategy 9

(Schneider et al, 2007)

The main instrument of data collection in this study was the questionnaire. To ensure the content validity of the questionnaire, the opinions of the specialized expert individuals, informed of the field of housing and flexibility were used, employing the snowball method, and the final questionnaire was confirmed by the target population. To assess the reliability of the questionnaire, Cronbach’s alpha test was used. Considering that the value of the obtained Cronbach’s alpha (equal to 0.812) was greater than 0.7, the questionnaire is reliable enough.

Findings

The main question of the study is: What strategies of flexibility, to what extent, are

accountable to what problems in the area of housing? Based on the library and documentary-based studies and surveys conducted on the specialized team of experts, among nine issues in the area of housing design, the strategies respond to merely seven issues; therefore, in the following table, the findings related to such issues are presented (Table 4). It is worthy of note that in order for scrutinizing the findings, considering the research by Rezvani[15], in which the weights of the issues in the area of housing were evaluated by the Shannon Entropy method, the same results are used for scoring, in the current study.

Table 4. Results Obtained from the Questionnaire

Average	Stgy 9	Stgy 8	Stgy 7	Stgy 6	Stgy 5	Stgy 4	Stgy 3	Stgy 2	Stgy 1	
1.78	1.03	1.23	1.03	1.03	4.12	1.03	4.43	1.13	1.03	Issue 1
3.34	3.91	1.13	4.33	3.09	4.53	3.30	4.12	1.03	4.64	Issue 2
2.05	2.16	2.06	3.50	1.23	1.13	1.23	3.09	3.09	1.03	Issue 3
1.69	1.13	1.03	1.23	1.23	1.03	1.03	4.12	1.03	3.40	Issue 4
3.42	4.22	1.13	4.95	1.03	4.53	4.53	4.22	4.02	2.16	Issue 5
1.31	1.03	1.03	1.13	1.03	1.03	1.03	3.50	1.03	1.03	Issue 6

1.37	1.03	4.12	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	Issue 7
1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	Issue 8
1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	Issue 9
	1.84	1.53	2.14	1.30	2.16	1.69	2.95	1.60	1.82		Average

Considering the weight of each issue in the amount of the efficacy of flexibility strategies, the strategies prioritized in solving the issues of the housing are: “service core”, weighing 2.95; “movable separating surfaces”, weighing 2.16; and “movable and flexible furniture” weighing 2.14, respectively. Moreover the issue of “monotony and lack of variety of the residential patterns” weighing 3.42, “paying less attention to the needs of the exploiter”, weighing 3.34, and “paying no attention to the cultural and identity conditions”, weighing 2.05, have the highest solving possibility through the flexibility strategies.

It is worthy of note that such a prioritization is used to show how much the housing issued are solved using the flexibility strategies and one cannot ignore the importance of each of the indexes of the housing issues. Accordingly,

using the term “low priority” in the area of housing design issues solved by flexibility does not indicate that the issue is not important; the reality is that in the conducted survey some of the issues are in the lower rows of the table, considering the flexibility strategies and based on the weights obtained. Accordingly, the indexes of “paying less attention to the climatic and environmental conditions in building design”, “formalism and decoration” and “not observing many of the technical principles, regulations and standards” gained the lowest ranks (Table 5). Furthermore, two issues of “not paying the necessary attention to safety issues in design” and “not paying enough attention to the values and the quality of the architectural design” were omitted from the list due to the lack of being accountable to the housing issues, from the perspective of the experts.

Table 5. Ranking of the Housing Design Issues Relevant to the Flexibility Strategies

Weight	Housing Design Issues	Priority
3.42	Monotony & Variety of the residential patterns given the variety of the exploiters	1
3.34	Paying less attention to the needs of the exploiter	2
2.05	Paying no attention to the cultural and identity conditions	3
1.78	Lack of attention to building sustainability approaches and the use of clean energy	4
1.69	Paying less attention to the climatic & environmental conditions in building design	5
1.37	Formalism & Decoration	6
1.31	Not observing many of the technical principles, regulations & standards	7

Table 6. Ranking of the Flexibility Strategies Considering the Amount of Their Effectiveness in Solving the Issues of Housing Design

Weight	Flexibility Strategies	No.
2.95	Service Core	Strategy 3
2.16	Movable Separating Surfaces	Strategy 5
2.14	Movable & Flexible Furniture	Strategy 7
1.84	Joining & Dividing Units	Strategy 9
1.82	Functionally Neutral Rooms	Strategy 1
1.69	Same Room	Strategy 4
1.60	Circulation Space Usage	Strategy 2
1.53	Vertical & Horizontal Additions	Strategy 8
1.30	Switch Room	Strategy 6

Finally, the model of the effectiveness amount of the architectural flexibility strategies in solving the housing design issues is shown in the following figure. These indexes indicate the

priority and the amount of the effectiveness of the strategies on the housing design issues (Figure 2).

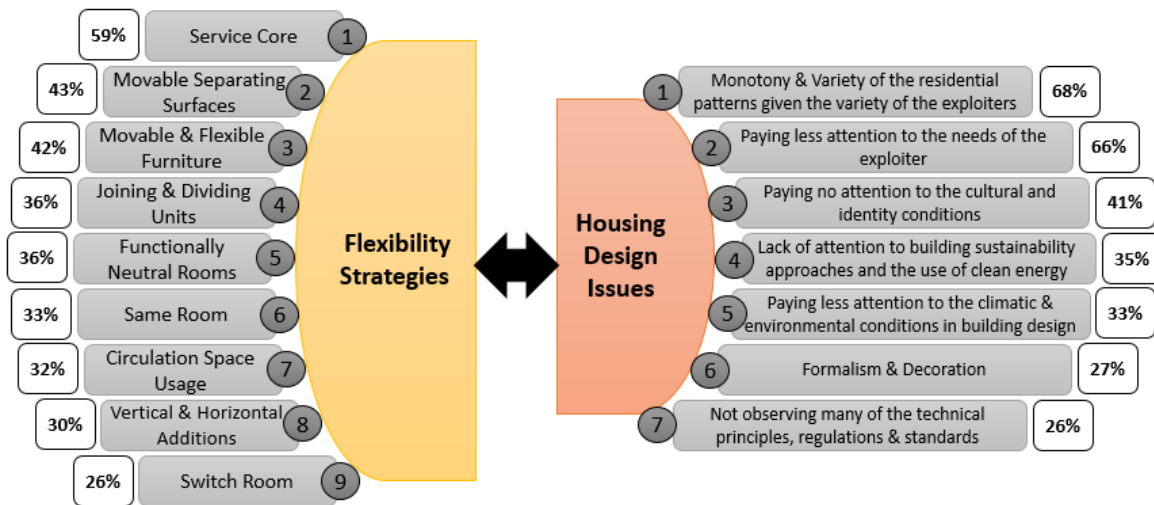


Figure 2. Ranking and the Amount of the Effectiveness of Architectural Flexibility Strategies on the Issues of Housing Design

Discussion

Experts have presented various solutions to solve the issues and problems in the area of housing; however, no codified research about using the architectural flexibility strategies in response to the housing problems has been conducted so far; therefore, evaluating the amount of the effectiveness of flexibility strategies on the housing issues is the main purpose of the study. This purpose and the results of this study which are dependent on the opinions of the domestic experts indicate a local pattern used in the architectural planning, considering the life style and the local culture. The results are in accordance with the findings of James Wentling (2015). Based on the study of Wentling [16], today the demands of the exploiters obviously differ from the past times. In the past, constructors would sell the houses based on each sq. meter of the property, but today they emphasize the existing facilities. The design and emphasis on the qualitative and sensual values have significantly dominated the construction demands of the past. The exploiters demand a sort of design for the houses which reflects and facilitates their special life style. This emphasis on the life style based design reveal the importance and necessity of housing design for living, more than ever. Therefore, the flexibility strategies concentrate mostly on the hosing design issues.

The results of the current study showed that most of the flexibility strategies for solving the housing issues are effective in different levels and are in accordance with the priorities of the research of Rezvani [15], in such a way that based on the current study, flexibility has found a high priority to solve the housing problems. In the current study, such issues as “monotony and variety of the residential patterns given the variety of the exploiters”, “paying less attention to the needs of the exploiter” and “paying no attention to the cultural and identity conditions” are considered to be solvable, between 41 to 68 percent.

Moreover, the results of the current study are in accordance with the results of the research of Fateh et al. (2018). As they state, “Based on the opinions of most of the experts, the issue of flexibility leads to the variety, sense of living and attachment in the residents, because in a long run, there is a possibility of the growth and development in the units at different levels at the same time with the growth and development of the family and their facilities and needs” [17]. In the current study also, the issues of “monotony and variety of the residential patterns given the variety of the exploiters” and “paying less attention to the needs of the exploiter” are ranked first and second, respectively, based on the experts’ perspective.

Conclusion

The current study was conducted with the goal of identifying the relation between the flexibility strategies and the housing issues, and determining the amount of the effectiveness of them on solving the issues. In the method employed, data were collected through library studies and gathering the opinions of the specialized team through a survey. The study has concentrated on the housing design issues, supposing that the flexibility strategies are mostly effective in this area of building. The results indicate that among nine indexes existing in the housing design issues, the

architectural flexibility strategies are able to solve many of the issues in this field, in such a way that, on the one hand, “monotony and variety of the residential patterns given the variety of the exploiters” and “paying less attention to the needs of the exploiter” are most possible to be solved by the flexibility strategies, respectively. On the other hand, other strategies namely, “service core”, “movable separating surfaces” and “movable and flexible furniture” might have the biggest role in solving the housing issues. Lastly, to solve the problems of housing design, the architectural flexibility strategies are suggested in Table 7.

Table 7. The Proposed Strategies in the Area of Flexibility to Help Solve the Housing Design Issues

Flexibility Strategies to help solve housing issues	Housing issues
Circulation Space Usage, Service Core, Same Room, Movable & Flexible Furniture, Movable Separating Surfaces, Joining & Dividing Units	Monotony & Variety of the residential patterns given the variety of the exploiters
Service Core, Functionally Neutral Rooms, Same Room, Movable & Flexible Furniture, Switch Room, Movable Separating Surfaces, Joining & Dividing Units	Paying less attention to the needs of the exploiter
Circulation Space Usage, Service Core, Movable Separating Surfaces	Paying no attention to the cultural and identity conditions
Service Core, Movable & Flexible Furniture	Lack of attention to building sustainability approaches and the use of clean energy
Service Core, Functionally Neutral Rooms	Paying less attention to the climatic & environmental conditions in building design
Vertical & Horizontal Additions	Formalism & Decoration
Service Core	Not observing many of the technical principles, regulations & standards

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