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Study of Ecological Design of Residential Complexes Using SPSS to Elevate Resident Satisfaction

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Abstract

This article reports the general residential satisfaction, affecting ecological factors, and their importance in area in Tehran. The collected field data was analyzed using SPSS. Cronbach's alpha variable was used to determine the reliability of the questionnaire and the Friedman test was used to assess priorities that influence residential satisfaction. The results show that the quality of residential environments and general satisfaction of their residents may be enhanced by identifying these criteria and making appropriate plans for their improvement.

Abstrak

Kajian tentang Rancangan Ekologi Kompleks-Kompleks Pemukiman dengan Menggunakan SPSS untuk Meningkatkan Kepuasan Pemukim. Artikel ini melaporkan kepuasan pemukiman secara umum, faktor-faktor ekologi yang mempengaruhi, dan kepentingan wilayahnya di Teheran. Data lapangan yang dikumpulkan dianalisis dengan menggunakan SPSS. Variabel alfa Cronbach digunakan untuk menentukan keandalan kuisoner dan uji Friedman digunakan untuk menilai prioritas-prioritas yang mempengaruhi kepuasan pemukiman. Hasil-hasilnya menunjukkan bahwa kualitas lingkungan tempat tinggal dan kepuasan penghuninya secara umum dapat ditingkatkan dengan mengenali kriteria-kriterian ini dan membuat rencana yang sesuai untuk pengembangannya.

Keywords: suitable land, SPSS, residential complex

1. Introduction

Increasing global urban growth following the Industrial Revolution created many problems, including a housing shortage. Housing has always been one of the first challenges humans face and we have attempted to find a suitable, reasonable, and well-thought-out response for it. The housing sector is a development sector in every community. In addition to the economic and social significance of the housing sector, housing-related job creation and the relationships between housing and other sectors have made it the focus of public attention and an appropriate tool for the realization of economic policies. An ecological approach to architecture is completely different from other architectural approaches; an architect has to consider the demolition phase and the return of construction as the natural cycle of the design process. The environment introduces new factors, and hence limitations to architecture. As a result, experimentation is affected, resulting in different forms and construction materials that are the features of contemporary architecture [1]-[3].

One of the missions of designers and architects is to create a suitable relationship between people and their physical environment. To this end, space creators must have a correct understanding of human behavior in different environments to enhance the bond of people to a place [4]. Housing or living spaces should be efficient in two aspects: (1) the materials contribute to create an environment with suitable accessibility and facilities, with desirable temperature, pressure, humidity, light, etc., (2) the spiritual aspect concerns the satisfaction of spiritual needs, such as the creation of spaces that match the lifestyle, culture, social mores, and traditions of the residents. The perfect combination of these two conditions can lead to a sense of housing desirability and provide various levels of housing satisfaction [5]-[6]. Measuring levels of residential satisfaction is a complicated process that depends on many factors [7],

and the satisfaction a person perceives differs under various individual, social, economic, cultural, and physical conditions. Demographic and individual factors, values, expectations, comparison with other dwellings, and hope for the future are among the personal characteristics that influence an individual's satisfaction. Therefore, residential satisfaction depends directly on satisfaction with residential units, the neighborhood, or neighborhood units, and indirectly on individual, cultural, and social characteristics of the residents [8].

Ecological design is a multifaceted field embracing green architecture, sustainable agriculture, ecological engineering, ecological restoration, and regenerative development that can sustain the pattern of ecological interdependencies and nurture the conditions for all living systems to thrive [9]-[13]. This article identifies the general level of residential satisfaction and affecting ecological factors to determine their relative importance in relation to each other in the study area of Tehran. With this understanding, suitable plans can be made for their improvement, by possibly upgrading the quality of housing environments and enhancing the residents' satisfaction.

Research site. The study site is located in northern Tehran and covers an area of 14,586 m^2. The main access route is Khan-e-Sefid (Figure 1).

The capital of Iran, Tehran, has a population of 7,507,036 and, with an area of 730 km^2; it is the largest city. Tehran Province has a population of 13,273,009 and an area of 18,814 km^2. Tehran is located between mountains and plains, and three main factors impact its climate: the Alborz mountain range, humid westerly wind, and the expanse of the Province. In fact, the Alborz mountain range moderates Tehran's climate. Northern Tehran has a moderate and mountainous climate and its low areas have a semi-arid climate. As a result, Tehran's special geographic location has various climates.

Figure 1. Site Location

2. Methods

In this study, face and content validity were used to evaluate the validity of the questionnaire. After designing and preparing the questionnaire, experts, supervisors, and consultants were asked to review and present their opinions. The necessary omissions and additions were then made, and the face and content validity of the questionnaire were confirmed.

Cronbach's alpha was used to measure the reliability of the questionnaire. Cronbach's alpha, a scale-based coefficient, is used to evaluate one-dimensionality of attitudes, beliefs, etc. In fact, the aim is to measure the degree of similarity between responses. Generally, Cronbach's alpha is calculated using one of the following relations.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} S_i^p}{\sigma^p}\right) \quad (1)$$

or

$$\alpha = \frac{k\bar{C}}{\bar{V} + (k-1)\bar{C}} \quad (2)$$

Here, k is the number of items, S_i^p is the variance of the i^{th} item, σ^p is the total variance, $\bar{C}$ is the mean covariance between items, and $\bar{V}$ is the mean variance of the items.

We can conclude from the definition of Cronbach's alpha that:

1) The stronger the positive correlation between the items is, the larger the increase in the value of Cronbach's alpha will be, and vice versa.
2) Cronbach's alpha decreases with increases in the mean variance of the items.
3) Cronbach's alpha is positively or negatively affected with increases in the number of items (depending on the type of correlation between the items).
4) Cronbach's alpha increases with reductions in the mean variance of items caused by increases in sample size.

The closer Cronbach's alpha is to 1, the stronger the internal correlation between the items and therefore the more homogeneous the items will be. Cronbach's alpha values of 45%, 75%, and 95% indicate a low, moderate/acceptable, and high reliability coefficient, respectively [14]. Obviously, if the value is low, it must be checked to identify the item that can be removed toacc improve the coefficient [ibid].

In this study, Cronbach's alpha was used to evaluate reliability of the questionnaire. Cronbach's alpha for all 22 items of the questionnaire was 0.783, which indicated acceptable reliability of the questionnaire.

Data analysis is an important part of every research to confirm or reject research hypotheses. At present, data analysis is one of the most basic and important parts of all research projects. Raw data is analyzed using statistical techniques and, after being processed, is offered to the users as information.

Descriptive statistics related to demographic variables of the research including age, education level, marital status, and employment status was studied first to analyze the collected data. This was followed by studying the analytical statistics that were used for correlation analysis to determine the levels of residential satisfaction and for analysis of the means.

Since people do not always tell their real age, four age groups were selected for the respondents. Results were presented as a pie chart and table. The majority of the respondents were from 20 to 40 years old (Figure 2). The education level of the respondents are shown in Figure 3. The gender of the respondents was also analyzed: more than 50% of them were male (Figure 4). The economic status of the respondents were classified into three income ranges; more than 60% of respondents had a monthly income of $200–600 (Figure 5).

The means and standard deviations were used to measure residential satisfaction levels. It is worth noting that satisfaction was assessed in several sections. The mean scores of the five-point Likert scale questionnaire (from +2 for "complete satisfaction" to -2 for "complete dissatisfaction") showed that the residents were satisfied only with the building complex services and dissatisfied with the other items.

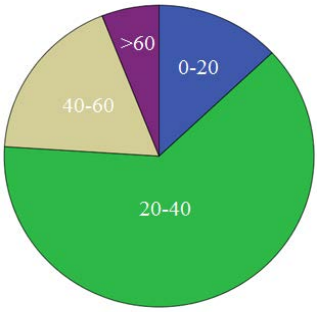

Figure 2. Age of Residents

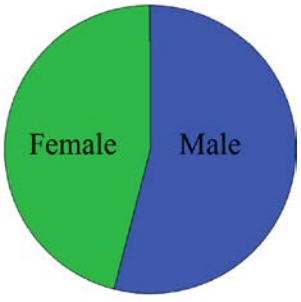

Figure 3. Gender of Residents

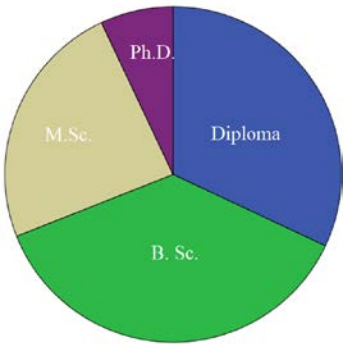

Figure 4. Education Level

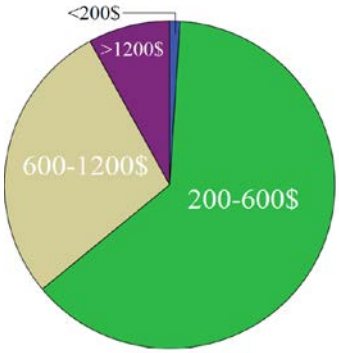

Figure 5. Monthly Income

Table 1. Classification Based on a Weighted Liker Scale

2	Complete satisfaction
1	Satisfaction
0	Neutral
-1	Dissatisfaction
-2	Complete dissatisfaction

Kolmogorov-Smirnov test. The statistical distribution of the variable under investigation should be ensured prior to selecting the test for hypotheses testing. The statistical distribution of variables was investigated using goodness of fit tests, including the Kolmogorov-Smirnov and chi-square tests. the Kolmogorov-Smirnov test is usually used to examine data normality. In this study, data normality was investigated using the Kolmogorov-Smirnov test. The null and alternative hypotheses of the study were, "data distribution is normal" and "data distribution is not normal," respectively. H0: Data distribution is normal H1: Data distribution is not normal

Finally, if the significance level is less than 0.05, the null hypothesis is rejected. If the significance level is ≥ 0.05, the null hypothesis is confirmed and data is normally distributed.

Friedman Test. The Friedman test was used considering the Kolmogorov-Smirnov test results, the significance level of < 0.05, and because the variable was not normally distributed. The following results were obtained:

Test Statistics

N	100
Chi-Square	219.108
df	18
Asymp. Sig.	0.000

Table 2. Descriptive Statistics

Items	Number	Minimum	Maximum	Mean	Standard deviation	Variance
There are adequate parking lots for residents.	100	-2	2	0.15	1.234	1.523
Hygiene is at a desirable level.	100	-2	2	0.03	1.283	1.646
Noise pollution by the cars disturbs the residents.	100	-2	2	0.55	1.403	1.967
There is a suitable playground for children.	100	-2	2	-0.48	1.283	1.646
There is suitable space for social interactions.	100	-2	2	-0.45	1.242	1.54314
The designed outdoor areas can be used by disabled people.	100	-2	2	-0.83	1.207	1.456
Recreational and sports facilities are satisfactory.	100	-2	2	-0.45	1.149	1.32121
Complex management is satisfactory.	100	-2	2	-019	1.203	1.448
Infrastructures (electricity, water, gas, fire stations, etc.) are satisfactory.	100	-2	2	-0.38	1.384	1.915
Room sizes and ceiling heights are satisfactory.	100	-2	2	0.19	1.277	1.630
Natural air conditioning and lighting are satisfactory.	100	-2	2	-0.16	1.324	1.752
Designed green space is satisfactory.	100	-2	2	-0.15	1.359	1.846
Residential unit price is reasonable.	100	-2	2	-0.97	1.058	1.120
Are satisfied that many of their needs and expectations (market, outdoor area, grocery supplies, etc.) are satisfactorily fulfilled inside the complex.	100	-2	2	0.88	1.305	1.703
Total	100					

Table 3. Kolmogorov-Smirnov Test

		Age of residents	Gender of residents	Education level	Monthly income
N		100	100	100	100
Normal Parameters *a, b*	Mean	2.17	1.46	2.06	1.42
	Std. Deviation	0.726	0.501	0.919	0.684
Most Extreme Differences	Absolute	0.353	0.361	0.216	0.370
	Positive	0.353	0.361	0.216	0.370
	Negative	-0.277	-0.319	-0.157	-0.260
Test Statistic		0.353	0.361	0.216	0.370
Asymp. Sig. (2-tailed)		0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]

Table 3. Kolmogorov-Smirnov Test (*Continue*)

		Indicators place residents in the same place	The residential complex is attractive for you	Are you willing to leave the residential complex?	Participation in the improvement of the residential complex is at the upper level	The distance to the public transport is convenient	The facade of the buildings is in harmony with each other	The brightness of the residential complexes is suitable
N		100	100	100	100	100	100	100
Normal Parameters a, b	Mean	0.83	-0.19	0.49	0.05	0.39	-0.34	0.01
	Std. Deviation	1.016	1.061	1.105	1.029	1.171	1.224	1.251
Most Extreme Differences	Absolute	0.296	0.227	0.198	0.189	0.239	0.255	0.236
	Positive	0.189	0.227	0.151	0.189	0.132	0.265	0.230
	Negative	-0.296	-0.149	-0.198	-0.181	-0.239	-0.193	-0.236
Test Statistic		0.296	0.227	0.198	0.189	0.239	0.255	0.236
Asymp. Sig. (2-tailed)		0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]

Table 3. Kolmogorov-Smirnov Test (*Continue*)

		The complex view is provided in the surroundings.	There are adequate parking lots for residents.	Hygiene is at a desirable level.	Noise pollution by the cars disturbs the residents.	There is a suitable playground for children.	There is suitable space for social interactions.	The designed outdoor areas can be used by disabled people.
N		100	100	100	100	100	100	100
Normal Parameters a, b	Mean	-0.26	0.15	0.03	0.55	-0.48	-0.45	-0.83
	Std. Deviation	1.252	1.234	1.283	1.403	1.283	1.242	1.207
Most Extreme Differences	Absolute	0.233	0.195	0.165	0.206	0.217	0.231	0.234
	Positive	0.223	0.194	0.159	0.151	0.217	0.231	0.234
	Negative	-0.213	-0.195	-0.165	-0.206	-0.186	-0.178	-0.166
Test Statistic		0.223	0.195	0.165	0.206	0.217	0.231	0.234
Asymp. Sig. (2-tailed)		0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]

Table 3. Kolmogorov-Smirnov Test (*Continue*)

		Recreational and sports facilities are satisfactory.	Complex management is satisfactory.	Infrastructures (electricity, water, gas, fire stations, etc.) are satisfactory.	Room sizes and ceiling heights are satisfactory.	Natural air conditioning and lighting are satisfactory.	Designed green space is satisfactory.	Residential unit price is reasonable.	Are satisfied that many of their needs and expectations are satisfactorily fulfilled inside the complex.
N		100	100	100	100	100	100	100	100
Normal Parameters a, b	Mean	-0.45	-0.19	-0.38	0.19	-0.16	-0.15	-0.97	0.88
	Std. Deviation	1.149	1.203	1.384	1.277	1.324	1.359	1.058	1.305
Most Extreme Differences	Absolute	0.184	0.190	0.189	0.257	0.210	0.201	0.245	0.265
	Positive	0.184	0.190	0.189	0.144	0.197	0.194	0.245	0.195
	Negative	-0.156	-0.179	-0.181	-0.257	-0.210	-0.201	-0.165	-0.265
Test Statistic		0.184	0.190	0.189	0.257	0.210	0.201	0.245	0.265
Asymp. Sig. (2-tailed)		0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]	0.000 [c]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

Table 4. Friedman Test

Mean Rank	Ranks
10.99	Participation in improving the residential complex is at a high level.
12.08	The complex is close to public transportation.
8.99	The building facades are in harmony with each other.
10.49	There is suitable lighting for passages in the residential complex.
9.67	The complex has a view of the surrounding landscape.
11.23	There are adequate parking lots for the residents.
10.74	Cleanliness and hygiene are at a desirable level.
12.49	Noise pollution caused by cars disturbs the residents.
8.39	There is a suitable playground for children.
8.45	There is an appropriate area for social interactions.
6.96	The designed open areas can be used by disabled people.
8.50	The recreational and sports facilities are satisfactory.
9.81	Complex management is satisfactory.
9.11	Infrastructures facilities (electricity, water, gas, fire stations, etc.) are satisfactory.
11.51	Room sizes and ceiling heights are satisfactory.
10.15	Natural air conditioning and lighting are satisfactory.
9.94	The designed green space is satisfactory.
6.62	The residential unit price is reasonable.
13.92	Are satisfied that many of their needs and expectations (market, outdoor area, needed groceries, etc.) are satisfactorily met within the complex.

3. Results and Discussion

Achieving the objectives of an ecological design faces some limitations. Therefore, the threshold level of satisfaction with ecological design should be determined. We must prioritize the desired items to create harmony between nature and design context, and plan.

First, the building orientation depends on factors such as natural land conditions, the need for private spaces, noise control and reduction, sunlight, and wind. The key responsibility of the architect is to make the most use of sunlight by considering the thermal, hygienic, and psychological conditions required by the building. In addition, the building should be designed in a way that allows logical responses to issues such as airflow and natural air conditioning.

Additionally, the nature of residential complexes allows for the creation of public spaces that act as local places for social interactions. If the public spaces fulfill the individual and social needs of residents of all ages, a large part of life activities can be transferred from indoors to public spaces to partially compensate for small residential units. Creation of such spaces as a market, open areas for social interactions, and spaces for preparing food required by residents (an identified priority of the residents) can be effective in realizing this goal. Therefore, to meet this need of the residents of this residential complex, the market was located at the entrance area, and the open and garden areas were located on the terraces in the design. Transportation demand directly depends on human activities and their locations in time and space. Therefore, the most effective method to influence this demand is to reduce the distance between these activities. If people can find jobs, stores, services, and recreational facilities near their living places, the need for personal trips decreases.

Another strategy in ecological design is the use of green spaces. Green space can have positive effects including oxygen generation, carbon dioxide absorption, air pollution reductions, relative humidity increases, weather modification, and noise pollution reductions, which may greatly enhance residential satisfaction. Consequently, designing various green spaces inside the complex and planting many trees on the complex facades (green walls) has satisfied this need. A hydroponic irrigation system was designed to irrigate and fertilize the trees on the building facades. Due to water scarcity and water crises caused by droughts that have continued for many years in Iran, the use of alternative agricultural crops with low water requirements and modern irrigation practices are necessary. Hydroponics is becoming a widely used technique in modern farming because it substantially increases water productivity.

This system consists of square-shaped modular panels that provide a vertical growing environment for plants and their supports. These modular panels, made of polystyrene, are connected at a distance from the building façade by a lightweight structural system. To make the wall system lighter, hydroponic culture systems are used, and the cultivation bed only holds the plants that are provided nutrients through the irrigation system. Additionally, attempts were made to place these panels in areas of the complex's façade that receive the most sunlight and rainwater for the highest efficiency.

Green walls also provide a habitat for different species of plants, attract living creatures and birds, and are thus ecologically important because they maintain biodiversity. Moreover, the walls store heating and cooling energy by creating thermal insulation in winter and summer, and thus reduce energy consumption in buildings. From a social perspective, green walls contribute to social and mental health, and enhance residential satisfaction by combining nature and buildings, beautifying the living environment of the residents.

Therefore, according to the results of the above-mentioned test, fulfilling the residential needs (market, open area, grocery supplies, etc.) inside the residential complex is a

top priority and can enhance residential satisfaction. The next priority is to reduce noise pollution caused by cars because it disturbs the residents. The third priority of the residents is the distance from the complex to public transportation that should also be considered in ecological design.

4. Conclusion

The general residential satisfaction, affecting ecological factors, and their importance in area in Tehran was reported in this research. The collected field data analyzed using SPSS. Cronbach's alpha variable used to determine the reliability of the questionnaire and the Friedman test used to assess priorities that influence residential satisfaction. The results showed that the quality of residential environments and general satisfaction of their residents may be enhanced by identifying these criteria and making appropriate plans for their improvement.

References

[1] M.D.O. Brandstetter, Built. Hum. Environ. Rev. 4 (2011) 56.
[2] M. Erlhoff, T. Marshall (Eds.), Design dictionary: perspectives on design terminology. Walter de Gruyter, Jerman, 2007.
[3] A.R. Kearney, Environ. Behav, 38 (2006) 112.
[4] L.K. Waxman, Florida State University, Tallahassee, FL, 2004, unpublished.
[5] H. Zabihi, H. Farah, R. Kamal, Hoviatshahr. 5 (2011) 103.
[6] H. Zabihi, F. Habib, K. Rahbarimanesh, Sci. Res. 67 (2012) 36.
[7] R. Gifford, Archit. Cultural J. 2-3 (1999) 21.
[8] G.C. Galster, G.W. Hesser, Environ. Behav. 13 (1981) 735.
[9] J.I. Nassauer, Landsc. Urban Plan. 106 (2012) 221.
[10] F. Steiner. Landsc. Urban Plan. 125 (2014) 304.
[11] M.F. Prescott, Y. Ninsalam, Sustain. Cities Soc. 20 (2016) 222.
[12] J. Carlier, J. Moran, Sci. Total Environ. 651 (2019) 3241.
[13] Y. Chen, Y. Wei, L. Peng, Ocean Coast. Manage. 165 (2018) 244.
[14] L.J. Cronbach, Psychometrika. 16 (1951) 297.