



Research Article

Investigating the Impact of Human Interactions with Environmental Green Spaces on Individual Satisfaction to Enhance the Quality of Life in Residential Complexes in Shahrood, Iran

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Abstract

Aims: Quality of life is a key challenge in contemporary architecture and urban planning, particularly in relation to social sustainability. This study investigates how architectural-environmental features - including green balcony design, visual transparency and view to nature, and communal green spaces - affect residential satisfaction and quality of life in housing complexes in Shahrood, Iran.

Methodology: A survey-based method was employed, and the statistical population was determined using the detailed plan of Shahrood municipality. By applying non-random purposive sampling, 316 questionnaires were distributed among middle-income households. Data were analyzed using SPSS 24 through descriptive statistics, one-sample t-tests, and multiple regression analysis.

Findings: Results from the t-test indicated that responses to items associated with all hypotheses were significantly positive, highlighting residents' general satisfaction with green balconies, visual access to greenery, and communal social spaces. The multiple regression model further demonstrated that 61% of the variance in residents' quality of life was explained by the three predictors. Among them, visual transparency and access to surrounding greenery had the strongest effect ($\beta = 0.42$), followed by green balcony design ($\beta = 0.28$) and communal green spaces ($\beta = 0.26$).

Conclusion: The study shows that green balconies, visual transparency, and communal green spaces are perceived as important contributors to residential satisfaction and quality of life, with regression results confirming that these factors explain a substantial share of the variance. However, as the focus was mainly on physical environmental perceptions, the findings should be interpreted cautiously, and broader future studies are recommended.

Keywords: Social Areas, Residential Environmental Green Spaces, Quality of Life, Human-Environment Interaction, Residential Satisfaction

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1. Introduction and literature

The 11th Sustainable Development Goal (SDG 11) focuses on developing safety, durability, and sustainable human

settlements and cities [1]. Interactive living refers to how humans engage with their surroundings, which includes private space (house), medium space (neighborhood), and public space, which is the city [2]. Humans have always

had a natural need for communal life and social interaction, encouraging them to live and dwell alongside their peers. According to current data, about half of the world's population lives in cities, and this figure is likely to rise in the following decades, with urban areas expected to house 68% of the global population by 2050 [3]. About 90% of the expected urban population growth will occur in Asia and Africa, where the size and number of cities will double [4]. The issue arises from the struggle to meet people's needs amidst the availability of urban facilities. As the population increased, so did the concentration of industries, capital, and urban services, turning large cities into modern metropolises and posing significant challenges for postmodern civilization. Urban planning and development are now among the most pressing issues of the twenty-first century [5]. Modern cities face significant housing challenges due to unequal economic and social growth. This leads to neighborhoods that vary significantly in quality, contributing to urban inequality. Disparities in urban housing are a key factor in this issue [6]. Due to the rapid growth of urban populations and the increasing demand for housing, there has been a greater reliance on developing multi-story structures to meet housing needs [7].

A residential building consists of separate dwellings where individuals may live or stay regularly. Each dwelling features its own cooking and bathroom facilities and may also be referred to as an apartment or condominium [8]. Residential complexes consist of various building types, such as single-family and multi-family apartments, which can be low-rise, mid-rise, or high-rise. Their designs are shaped by climate, urban planning, and complex internal functional and technological construction processes, aiming to create open spaces that enhance residential areas [9]. These complexes also prioritize privacy, establishing a distinct separation from the surrounding urban environment.

Apartments and communal living have been increasingly common in Iran in recent decades, particularly in larger cities, due to urban expansion and rising land prices. They would be designed to provide suitable housing at reasonable costs in a healthy, safe, pleasant, and sustainable environment and to establish an integrated settlement that promotes economic, social, and cultural growth [10]. The move to apartment living underscores the challenges of modern urban development. The initial residential complexes were designed for low-density living in green settings but have evolved into high-density buildings, criticized for insufficient natural light and visual transparency, which can disconnect residents from their environment and affect the nervous and endocrine systems [11]. Many people in urban multi-household complexes feel their lifestyle harms their privacy and solitude, leading

to increased isolation and loneliness, which is linked to higher mental health risks [12, 13]. This may be influenced by the physical characteristics of the environment and the demands of urban living (problems related to urban density) [14, 15].

For example, a lack of green space, traffic noise, and pollution can harm mental health. Additionally, car-centric areas are linked to low physical activity and increased mental health risks [12]. The relationships we establish with others are vital for our survival as a species. We have evolved to rely on regular, ongoing interactions for our mental and physical well-being [16]. Finding a balance between solitude and socializing is key to improving quality of life. Experts advocate for residential spaces that encourage activities and foster community connections. These environments should cater to the unique needs of individuals or social institutions, addressing aspects such as security, self-esteem, self-actualization, cognitive satisfaction, and aesthetics [17]. The importance of developing residential areas today stems from the fact that most individuals spend approximately 60% of their lives at home [18]. The abovementioned factors have diminished the quality of life in contemporary residential buildings. The World Health Organization defines quality of life as a condition of complete physical, mental, and social well-being [19]. Quality of life encompasses factors affecting living conditions and well-being, fostering an environment for happiness.

It evaluates satisfaction across socioeconomic classes and measures life contentment for individuals and communities, reflecting their joy or dissatisfaction [20]. The quality of the physical environment is crucial to quality of life, as improving it directly affects resident satisfaction [21]. The environment's design influences human interactions, and today's architecture and urban planning should focus on enhancing both objective and subjective aspects of quality of life to create a liveable urban [22–24].

Many contemporary residential complexes in Shahrood, especially Mehr Housing and National Housing, face major design flaws. Issues include neglect of green spaces, low-quality facades, conflicting pedestrian and vehicle paths, and poor semi-open spaces. Additionally, there is a lack of visual transparency and natural light, which adversely affects living conditions.

This research explores how green communal spaces and the visual transparency of home surroundings affect residents' satisfaction.

The aim is to propose strategies that improve living quality by addressing factors that influence satisfaction in residential complexes. These strategies align with basic needs and spatial quality, ultimately showing how architecture can enhance societal well-being.

1.1. Research questions

The research intends to answer three key questions:

- How much does using semi-open green space in residential units impact the quality of life and satisfaction?
- How do creative green space, visual visibility, and the surrounding environmental aspects of a residential unit affect resident satisfaction?
- How does building innovative and usable communal space improve the quality of life in residential communities?

1.2. Exploring the conceptual aspects related to the quality of life

Scholars and specialists in psychology, sociology, economics, architecture, and urban planning have extensively studied and redefined the multidimensional and diverse concept of quality of life in recent decades [6, 25, 26]. From a psychological view, quality of life relies on individuals' satisfaction with diverse living conditions, and satisfaction with the living environment is crucial in achieving a high quality of life. Furthermore, housing quality can significantly impact the residents' overall quality of life [27]. Recognizing that a suitable living environment is crucial in enhancing the quality of life is essential [5]. This definition involves more than the residential unit and includes services, education, health care, recreation, welfare facilities, and employment planning [6].

Several definitions of "quality of life environment" focus on human interactions and surroundings. Das (2008) identifies three key factors influencing quality of life: social, physical, and economic aspects. He notes that an individual's sense of well-being or hardship in their environment is the main criterion for assessing their quality of life [28]. This concept was introduced in the early 20th century under the title "standard of living" and was the subject of critique and examination by experts under the same title until the mid-1970s [29]. These theories failed to address the socio-cultural needs of societies post-World War II. As a result, researchers began incorporating living standards, income, and social concepts, broadening the definition of quality of life to include health, well-being, and environmental conditions.

1.3. The concept of quality of life today

Today, quality of life includes various factors such as social welfare, mental well-being, relationships, income, housing, and health. These factors' objective and subjective aspects play a significant role in shaping personal and

social experiences [30]. Ultimately, an individual's quality of life is shaped by objective realities and perceptions of these elements, including their environment and self-awareness (Figure 1).

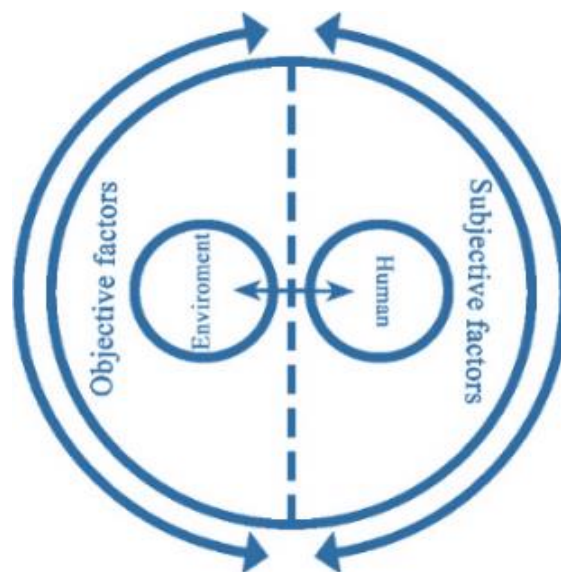


Figure 1. Quality of life is determined by the relationship between humans and the environment based on subjective and objective factors



Figure 2. Some indicators affecting quality of life

The rise of social indicators in evaluating quality of life has led to scrutiny of the link between economic growth and social welfare. In contrast, subjective well-being encompasses how individuals feel about their lives, including emotions like joy and sadness in response to events, as well as satisfaction in key areas such as work, relationships, health, and purpose [31].

Phillips (2006) highlights that quality of life has both objective and subjective aspects. The objective aspect focuses on fulfilling basic needs and social expectations, while the subjective aspect aims to enhance mental well-being through pleasure, contentment, goals, and personal growth [32]. Among the various definitions of quality of life, the one provided by The World Health Organization (WHO, 1994) stands out. This definition describes quality of life as “individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, personal beliefs, and their relationship to salient features of their environment” [33, 34]. Figure 2 shows some of the crucial indicators influencing quality of life.

1.4. Individuals' interactions with the surrounding environment

Urbanization has expanded significantly in recent years, leading to various cultural, social, economic, psychological, and sociological challenges [35]. Unbalanced urban development has resulted in problems stemming from how environments influence behavior and social interactions. Rapid urban growth has produced neighborhoods around both old and new cities, yet many lack livable qualities. The uneven expansion and vertical growth of cities without adequate infrastructure exacerbate these issues, while high population density in suburban areas heightens the challenges (Figure 3).

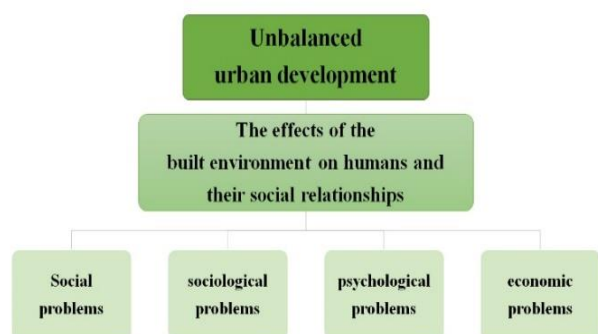


Figure 3. Unbalanced urban development and its adverse effects on human societies

One of the most significant negative consequences of population growth and density in residential complexes of modern cities is the reduction of social interactions among individuals [36]. Several factors contribute to this issue:

- Inattention to the quality of spatial design.
- Streets and urban transportation networks need adequate capacity to connect the downtown areas to neighboring areas and neighborhoods.
- More access to urban services and infrastructure is required.
- The absence of regular public transit services.
- Lack of adequate pedestrian paths (sidewalks) and insufficient street separation to them.
- Failure to observe per capita open, semi-open, and green spaces inside complexes and neighborhoods and provide various service functions.
- Poor levels of safety and security.
- The rise of environmental pollution.
- Poor urban lighting design.
- Conditions that promote criminal growth.
- Inadequate accessibility for people with impairments.

These elements are part of the environmental and physical issues confronting recent architectural and urban planning environments (Figure 4). The individual's relationship with their residential environment involves several key concepts, including privacy, personal space, boundaries, territory, neighborhood units, density, and congestion. Each of these factors can impact a person's satisfaction with their surroundings. Ultimately, how an individual perceives their environment hinges on its quality. However, as noted earlier, this perception can differ from person to person, often influenced by sociocultural, economic, or psychological factors unique to each individual [37].

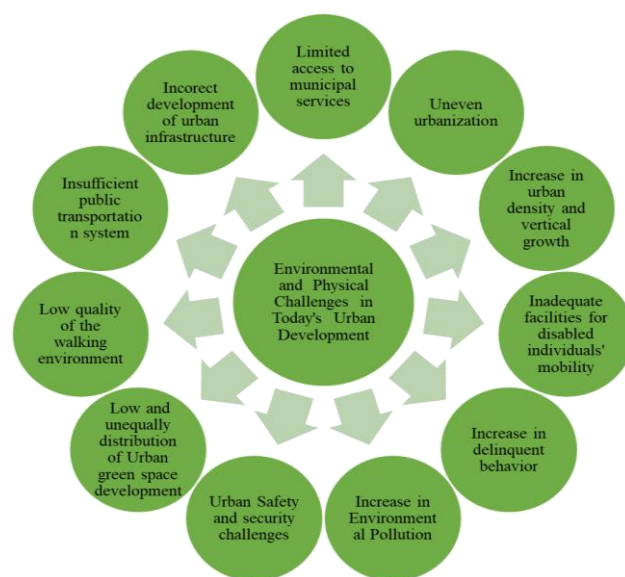


Figure 4. Some environmental and physical issues arise in contemporary urban development

The relationship between humans and their environment is crucial, as memories and narratives formed over time in a living environment create a sense of social belonging. This connection forms a significant part of a person's character and social identity, influencing their identification and introduction to others. This can be referred to as self-identity with space, and in this regard, social processes in creating a sense of place attachment are more important than physical quality [38]. From a psychological and emotional standpoint, place remains an essential subject and objective for human interactions, particularly emotional ones. Places, whether houses, neighborhoods, or public places, are more than just physical settings and the activities inside them; they also incorporate people's meanings and feelings toward one another and the environment [39]. Continuing this discussion, we will examine the characteristics of individuals' satisfaction with their living environment.

1.5. Residential satisfaction approach (happiness with the living environment)

As previously mentioned, the quality of a living environment depends on two main factors: objective physical aspects and subjective satisfaction. In architecture, the value of each design lies in its ability to provide comfort, tranquility, and satisfaction while meeting their needs [40]. Residential satisfaction research primarily leads to the idea of causality, that is, elements impacting occupant attitudes toward other occupants and the environment [41]. Many researchers suggest that an individual's environmental satisfaction reflects their overall happiness or contentment regarding specific life aspects [42]. However, assessing individual satisfaction with living environments is challenging due to the vastness and diversity of influential factors. Researchers choose indicators based on context, considering cultural, environmental, and value conditions through field studies and information gathering. Residential satisfaction is frequently utilized as an essential indicator to evaluate the performance of housing programs toward different persons and to find which objective residential features are relevant to distinct inhabitants [43]. In this context, Das (2008), drawing from his extensive research, has identified three key components that significantly influence individuals' satisfaction with their lives: environmental factors, social characteristics, and economic factors [28]. A crucial point to consider is the role of housing and the quality of the residential environment in shaping individuals' satisfaction with their standard of living [44]. This aspect is often one of the most important criteria for evaluating their living spaces. Thus, satisfaction is closely linked to the various dimensions of the surrounding environment. Its primary

goal is to reflect the overall quality of life and the individual's relationship with their environment. This relationship is characterized by a positive experience and a sense of contentment derived from the living conditions in a specific location. According to Glaster, the theory of residential satisfaction stems from a gap between the desires and needs of residents and the current reality within their living environment [45, 46]. In addition to the effects of the living environment on individuals' satisfaction levels, the urban environment can also be significantly influential on a larger scale. In this regard, Lezing and Maranz state that a quality urban environment instills a sense of well-being and satisfaction in residents through physical, social, or symbolic characteristics [47]. Such an environment ensures a quality of life and primarily supports economic, social, and cultural activities. The following section briefly outlines some complex factors influencing residents' satisfaction levels.

1.6. Factors influencing resident satisfaction

Humans' satisfaction with their living conditions and standard of living is the most critical criterion for determining their quality of life. Sheldon and Land (1972) defined this subjective criterion as occupants' feelings, perceptions, and experiences with their living environment [27]. As previously said, quality of life is influenced by various factors, including environmental, social, and so on. Satisfaction with the residential environment is typically characterized as the perceived gap between the response to inhabitants' wants and desires and the reality of their current residential fabric [25].

The feeling of Satisfaction with one's living environment is shaped not only by the physical attributes of the home and place but also by interactions with neighbors and the neighborhood's social and physical characteristics. Additionally, an individual's subjective perspective is significant, and satisfaction level regarding living conditions can differ based on their outlook. For example, in Iranian-Islamic culture, contentment is a trait repeatedly emphasized to individuals, and it is stated that each person should possess it regardless of the level of comfort they experience in their lives. In contrast to this viewpoint, some individuals constantly strive to achieve their ideals and aspirations. They take steps to change the quantitative and qualitative conditions of their lives based on specific goals and ideals.

The goal is to improve the quality of the living environment based on the individual's satisfaction with the state of the factors affecting it. It is important to note that when measuring factors influencing satisfaction, the concept of residence and living environment extends beyond just housing and personal spaces.

An individual's residence is part of an interconnected system that includes the housing unit, neighborhood, district, and city, with each level playing a significant role based on the individual's interactions with them (Figure 5). Consequently, various criteria, including personal characteristics and personality traits, as well as environmental, physical, social, cultural, economic, and psychological factors, will influence individuals' satisfaction. These elements collectively foster a sense of belonging, often derived from positive feelings about satisfaction with a place, which are reflected in individuals' memories (Figure 6). Table 1 outlines key indicators of the factors influencing residential satisfaction. Various factors affect an individual's satisfaction with their living environment. This research evaluates three key physical indicators in Shahrood: green open spaces, which promote social interactions; semi-open spaces (green balcony); and visual transparency, which enhances environmental quality. We will further discuss these crucial factors.



Figure 5. The hierarchy of people's interaction with their living environment relates to their life satisfaction

1.7. Influencing open and semi-open green spaces on the quality of the residential environment

Residential complexes and communities are considered an inseparable part of modern cities, often located in the peripheral areas of urban fabric for various reasons. The connection and physical continuity between the city and emerging urban complexes is vital. In this regard, Einifar (2000) considers a suitable combination of components and relationships, including form, building materials, color, texture, necessary openings in the building, and ultimately the creation of open environments and peripheral green spaces, to be essential [49]. Congestion is the primary issue in high-density complexes, contributing to various social and psychological problems in housing. Thus, harmonious green spaces and open areas around residential units are crucial. Key design concepts include human scale, natural light, noise control, visibility of green areas, privacy, quiet, and safety.



Figure 6. Criteria influencing life satisfaction levels

Table 1. Some of the key indicators affecting residential satisfaction [48]

Residential Satisfaction	Individual Components	Gender, Age, Level of education, Marital status, Employment, Average monthly income, Household size, and Type of ownership
	Environmental Component	Lighting and ventilation, Color schemes, urban landscape, Quality of materials, Diversity and flexibility, Ecological factors, Amenities and facilities, Accessibility and transportation, Spatial hierarchy, Space enclosure and proportions, Clarity and legibility, Disabled accessibility, and Density
	Physical Components	Residential unit dimensions, Space dimensions, Availability of open areas, Separation of public and private spaces, Presence of intermediary and connecting areas, Number of rooms, Privacy and isolation within living units, Quality of the lobby, Utilization of building rooftops for community and recreational purposes, Density of apartment units within the complex, Number of facilities, and The existence of a multipurpose hall.
	Psychological Components	Sense of security, Privacy, Personalized environments, The ability to monitor open spaces, Lack of surveillance, and Duration of stay.
	Economic components	Home purchase costs, and Housing loan options
	Social and cultural components	Neighborhood relations, Participation in social activities, Safety and security, Ethnicity, Customs and traditions, and Beliefs and values

Access to natural resources like green spaces, forests, and rivers is vital for quality of life [25]. The main issues of residential complexes in Iran include the neglect of proportions between open and semi-open spaces and surrounding buildings, human scale, spatial enclosure, aesthetic quality, and the limited presence of green spaces [50]. From another perspective, the open spaces and green areas surrounding such complexes are the main link between the city and the residential environment. On the one hand, they are part of the residents' private living spaces and have an inseparable relationship with them. On the other hand, they have an unbreakable bond with the surrounding urban environments in terms of physical, formal, accessibility, and other aspects. Regarding the importance of these places in people's lives, most inhabitants choose public spaces closer to their homes. The value of open and public areas in a residential complex is determined by their spatial intimacy and proximity to their private living environment, not their significance or magnitude [50]. Semi-open spaces have been significant in Iranian architecture, mainly features like iwans and columned porticos, which serve climatic functions, create spatial hierarchies, and facilitate movement between

indoors and outdoors. Additionally, porticos and covered terraces have been crucial for daily activities in residential architecture. However, these spaces have lost their former importance and functionality in contemporary times. This decline can be attributed to economic factors, limited living space in modern homes, and privacy issues due to increased density in residential complexes.

Although the passage of time necessitates changes in requirements and conceptions, some human needs, particularly those connected to psychological and personality qualities, have solid foundations and may alter in form over time. Among these is the continual human desire for connection with nature and open and semi-open areas (courtyard, terrace, and porch).

It is crucial to reevaluate how open and semi-open spaces impact social interactions and the quality of life in residential architecture. This underscores the need for further research in this area. This study investigates how nearby green spaces in housing complexes promote social interactions and assesses the connection between their visibility and resident satisfaction. Based on the findings, the aim is to identify practical solutions to enhance the quality of life.

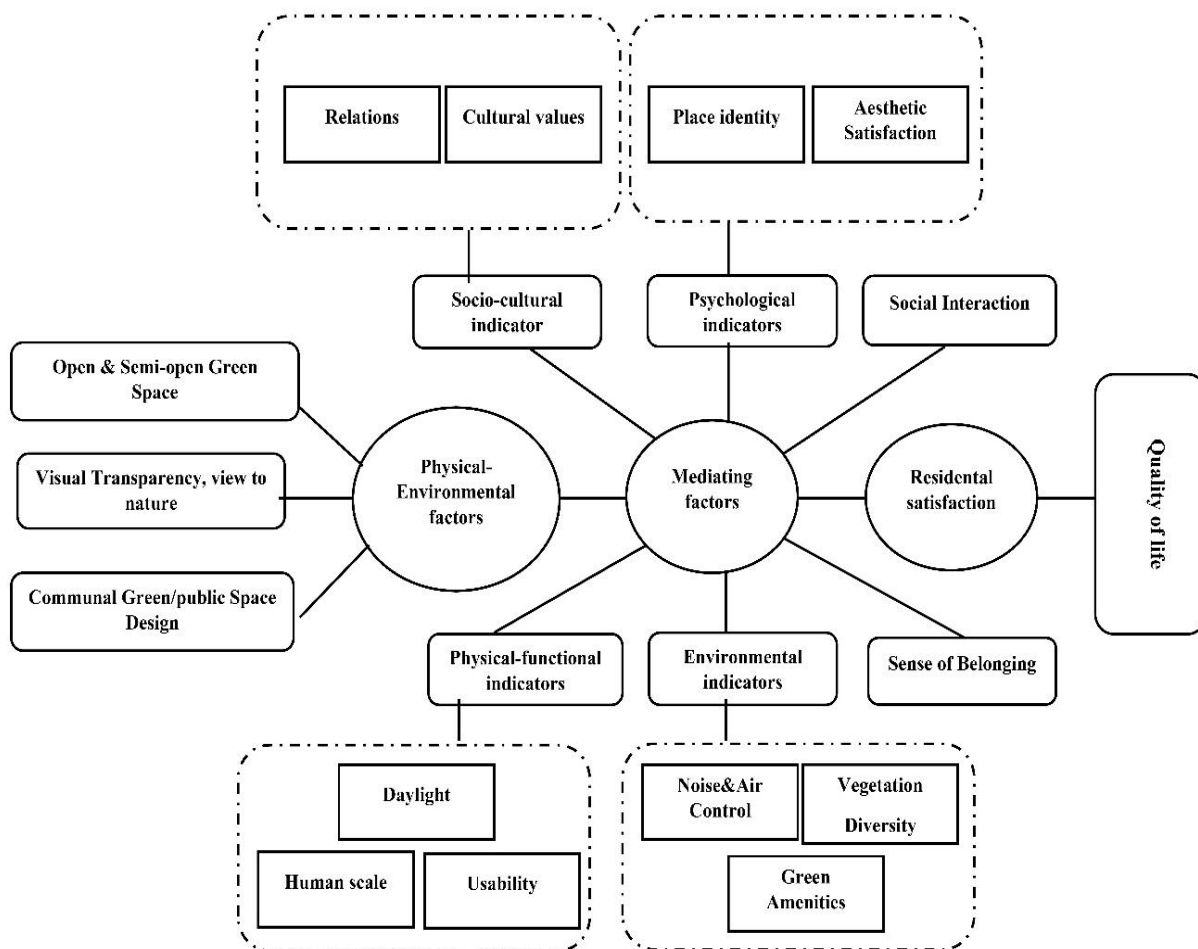


Figure 7. The study's conceptual framework

This attachment to nature not only holds aesthetic value but also plays a vital role in enhancing individuals' mental health, social well-being, and overall quality of life. Shahrood city, with its unique biodiversity and climatic diversity, provides an ideal context to examine the impact of green spaces and visual transparency on residents' satisfaction. Many international studies have not adequately addressed these specific cultural and ecological dimensions. Therefore, this research, by focusing on the particular cultural and environmental characteristics of Iran and Shahrood, contributes to the development and localization of residential satisfaction models and fills an existing gap in the global literature. This offers a unique theoretical contribution to the field of human-environment interaction within the Iranian cultural context and strengthens the study's novelty. [Figure 7](#) depicts the conceptual model developed for this study.

2. Methodology

This article emphasizes the significance of green spaces in surrounding areas and semi-open areas within residential complexes. These features are crucial in enhancing residential satisfaction and improving residents' overall quality of life. Limitations in residential satisfaction studies are one of the factors considered when developing the research approach [40]. For this purpose, comprehensive studies were initially conducted on texts and similar research to extract the relevant principles, factors, and indicators. The primary tool for data collection is a questionnaire, which underwent a face validity assessment before its distribution. After exploring various analytical methods, we have used multiple regression, which effectively examines relationships among multiple variables. Finally, we will analyze the research data using SPSS software. Two methods -the simple weighted average and the one-sample t-test- have been used to measure and analyze the data in this research.

2.1. The research target population and Statistical population

The method used to select the statistical population for this research involved consulting the Water and Wastewater Department about the total number of company subscribers, including commercial units, apartments, villas, and more. It was determined that there are approximately 85,000 subscribers in total. According to relevant experts, around 40 percent of this figure comprises apartment blocks, equating to about 34,000 units. Further investigations indicated that the middle-income segments of this population make up 55 percent of the 34,000 units,

resulting in approximately 18,700 units. Notably, only 9 percent of these middle-income segments live in residential complexes, and based on the detailed plan of Shahrood City, we analyzed 18 residential complexes. Considering the number of blocks, floors, and families -with an average of four members per family- we found that these complexes house approximately 5,916 residents. Experts indicate that only 30 percent of these residents belong to the middle-income group within the complexes. Since the residents generally do not reside in their units simultaneously or were absent during the interviews, we employed selective or stratified sampling. Finally, we interviewed the managers of the relevant residential complexes to identify the middle-class residents. Based on this, the sample size was determined to be 316 people according to Cochran's formula, which is non-random and purposive.

Given the specific characteristics of the study population, including the geographical dispersion of residents in residential complexes, the non-simultaneous presence of family members, and limited access to individuals, purposive sampling was chosen as an appropriate and efficient method. This approach allows for the deliberate selection of samples based on specific criteria, such as belonging to the middle-income group and residing in selected residential complexes. The use of purposive sampling enabled the study to extract relevant and high-quality data from the target population, whereas simple random sampling was not feasible due to operational constraints and limitations in time and resources. However, it should be noted that the non-random nature of this method may impose limitations on the generalizability of the results to the entire population, which is discussed in detail in the limitations and conclusion sections.

2.2. The contents of the questionnaire

The questionnaire is a Likert scale comprising 15 closed-ended questions designed to test the research hypothesis ([Table 2](#)). The results were then analyzed as 4740 statistical data points using SPSS software. Additionally, the internal consistency of the questionnaire was calculated using Cronbach's alpha, resulting in a very high value of 0.985. While this indicates excellent reliability, such a high alpha may also imply redundancy among some items, suggesting that several questions might be measuring very similar or overlapping aspects of the construct. This potential item redundancy should be taken into consideration when interpreting the findings. It is recommended that future research review and refine the questionnaire to reduce overlap and enhance the diversity of items, thereby improving measurement precision.

Table 2. Research questions

Hypothesis 1: Designing a green balcony	1	Do you like having a green balcony in your home?
	2	I prefer green coverage on the facades of our building block.
	3	Having a green balcony helps reduce my stress and anxiety.
	4	If I had a green balcony at home, I would use it daily.
	5	I find it pleasant to see a green balcony at home.
Hypothesis 2: A clear view of the surrounding greenery	6	Would you like to observe the green space outdoors from the inside?
	7	The view of the green courtyard from inside the home improves my quality of life.
	8	If there is a large opening overlooking the outside space, I use it daily.
	9	Observing the natural landscape and the transitions between day and night, I feel lively.
	10	I feel good watching the view of our yard from inside the house.
Hypothesis 3: Establishing communal spaces to facilitate social interactions	11	Does having green spaces in residential-public areas such as community gardens, parks, and plazas enhance your feelings about being there?
	12	Spending my leisure time in the green courtyard of the community where I live refreshes and energizes me.
	13	I feel pleasant about the cozy atmosphere with the neighbors in the green yard.
	14	The sound of flowing water in a green environment reminds me of a good feeling.
	15	I feel good about conversing with others in a calm and green environment.

3. Results and discussions

At the beginning of the analysis, we focused on counting the number of individuals who gave specific answers to each question after collecting and entering the data. This process enables us to examine how the sample is distributed across different categories for each variable. The outcome of this counting is referred to as the frequency distribution. Frequency distribution commonly includes frequency and percentage frequency, and it is generally used for nominal or ordinal variables. It is only applied for relative interval variables when, for example, we measure people's income numerically. Still, if we recode people's income and categorize it into three classes, we can use frequency distribution for the income variable. The second important indicator in the frequency table is the valid percentage. This percentage is calculated by proportionally dividing the nonresponse percentage by the sum of the other percentages. Specifically, if we divide the nonresponse percentage by the total of the other percentages, we obtain a fraction that represents the ratio. Then, each percentage should be added to (the product of the ratio and that percentage). To find the cumulative frequency percentage, divide the cumulative frequency by the total sum of the data counts and then multiply the result by 100 to express it as a percentage. We can create a relatively complete frequency distribution table by following these steps. Based on descriptive findings from 316 questionnaires, the frequency table shows that 48

percent of the respondents were women and 52 percent were men. Thus, most respondents were men. The frequency table of the age variable indicates that most respondents were between the ages of 28 and 37, and this table also shows the percentage of respondents aged 18 to 57.

The marital status frequency table indicates that 96.8% of respondents were married, and 3.2% were single. Regarding education level distribution, the table results reveal that the most significant proportion was associated with a bachelor's degree, and the rest percentages are shown in the table. Out of 316 questionnaires regarding the income component, the highest rate was related to an income of less than 75 million rials per month, which accounted for 36.7% of the respondents. Additionally, an income between 75 and 150 million rials accounted for 35.4 percent, and an income between 150 and 250 million rials accounted for 19.3 percent of the respondents (Table 3).

In this section, the descriptive results of the indicators examined in this study are presented in Table 4. The table shows that all scores are above 3, indicating a tendency among residents of residential complexes to favor green terraces, visual clarity, and social interactions. Overall, the highest scores were given to three indicators: visual clarity regarding the surrounding green space, which received an average score of 4.56; the creation of green terraces, with an average of 4.47; and social interactions, with an average of 4.45 (Table 4).

Table 3. Descriptive characteristics of the research statistical population

Gender	Female	Male	Marital status	Single	Married
	48.7%	51.3%		3.2%	96.8%
Age	18 & 27	28 & 37	38 & 47	48 & 57	Over 58 years old
	8.9%	41.8%	21.2%	15.8%	12.3%
Education	Illiterate	Middle School	High School Diploma	Bachelor's degree	Postgraduate degree
	2.8%	4.1%	28.5%	37.3%	27.3%
Income (Million rials)	Less than 75	75 to 150	150 to 250	Non-response	
	36.7%	35.4%	19.3%	8.6%	

Table 4. Descriptive statistics for the statements related to the research hypotheses

Index	Statements	Number	Statistics		Overall average
			Standard deviation	Average	
Designing a green balcony	Facade greening	316	0.768	4.40	4.47
	Effects of a green balcony on stress reduction	316	0.658	4.46	
	Utilizing the green balcony space during the day	316	0.636	4.39	
	The enjoyment of observing the green balcony.	316	0.488	4.61	
A clear view of the surrounding greenery	A clear view of the lush surrounding landscapes.	316	0.605	4.57	4.56
	Leveraging large windows for visual transparency.	316	0.649	4.53	
	The connection between daily observations of natural landscapes and a sense of vitality.	316	0.603	4.59	
	The pleasant sensation of enjoying the green inner courtyard view regularly.	316	0.607	4.56	
Establishing communal spaces to facilitate social interactions	The feeling of vitality and cheerfulness derived from spending time in the green areas of the complexes' open spaces.	316	0.640	4.58	4.45
	The joy of connecting with neighbors in the green spaces of residential complexes.	316	0.731	4.23	
	The soothing sound of water flowing	316	0.555	4.64	
	A sense of enjoyment from conversations and interactions in the communal areas of the complexes.	316	0.730	4.33	

3.1. Inferential statistics

In this section, inferential data analysis has been conducted to examine the research hypotheses using SPSS version 24 software. Table 5 shows the frequency distribution of responses to direct questions regarding the research hypotheses. Further, a one-sample t-test was performed at a 95% confidence level to investigate the study hypotheses, and the findings are shown in Table 6. Regarding the relationship between green balconies and quality of life, the results from Table 6 show a t-statistic of 43.061 and a significance level of 0.00, indicating that the first hypothesis is accepted. In terms of the impact of visual transparency on quality of life, the results in Table 6 reveal that the t-statistic value was 45.961 at a significance level of 0.00, indicating that this study's second hypothesis is likewise accepted. Finally, the third hypothesis of this

research, which suggests a significant relationship between communal green spaces and the improvement of quality of life in residential complexes, is supported by the results presented in Table 6. The t-statistical value of 41.486 has a significance level of 0.00.

3.2. Multiple regression analysis

To further examine the relative contribution of each architectural-environmental factor to residents' quality of life, a multiple regression analysis was conducted (Table 7). This analysis complements the descriptive t-test results presented earlier, which assessed general satisfaction levels. In this model, green balcony design, visual transparency/view to nature, and communal green spaces were entered as independent variables, while residential satisfaction/quality of life served as the dependent variable.

Table 5. Frequency distribution of responses to direct questions regarding the research hypotheses

Question number	Hypothesizes Subject	Yes		No	
		Frequency	percentage	Frequency	percentage
1	There seems to be a significant relationship between green balconies and improved quality of life.	309	97.8%	7	2.2%
2	It seems that creating visual transparency in residential spaces (while maintaining privacy and thermal comfort) can enhance the connection between indoor and outdoor spaces, improving the quality of life.	306	96.8%	10	3.2%
3	It seems that creating an innovative communal green space (open space) in the residential complex significantly affects the quality of life.	309	97.8%	7	2.2%

Table 6. The one-sample t-test Results for the research indicators

Index	Mean difference	t-value	Significance level (p-value)	confidence interval 95%		Status
				Lower limit	Upper Limit	
Designing a green balcony	1.465	43.061	0.00	1.398	1.532	Required
A clear view of the surrounding greenery	1.559	45.961	0.00	1.493	1.626	Required
Establishing green communal spaces to facilitate social interactions	1.444	41.486	0.00	1.375	1.375	Required

Table 7. Multiple regression results for architectural-environmental indicators predicting quality of life

Independent Variable	B (Unstandardized Coefficient)	β (Standardized Coefficient)	t-value	Sig. (p)
Green Balcony	0.31	0.28	6.72	0.000
Visual Transparency / View to Nature	0.46	0.42	9.81	0.000
Communal Green Spaces	0.29	0.26	6.15	0.000

The model indicates that about 61% of the variance in residents' quality of life is explained by the three predictors. Among them, visual transparency and access to surrounding greenery had the strongest impact ($\beta = 0.42$), confirming the critical role of visual connection to nature. Green balcony design ($\beta = 0.28$) and communal green spaces ($\beta = 0.26$) also contributed significantly, underscoring their importance in fostering satisfaction and well-being. These findings are consistent with previous studies emphasizing the positive influence of natural visibility and green social areas on residential quality of life.

The results of this study are strongly supported by previous research on the mediating role of psychological, social, environmental, physical, and place-attachment factors in shaping residential satisfaction and quality of life. For instance, Wang et al. (2019) demonstrated that the relationship between urban greenery and mental well-being is significantly mediated by stress reduction, physical activity, social cohesion, and environmental quality [51]. This is consistent with the current study, where the psychological benefits of green balconies and visual transparency reduce stress and enhance peace of mind. Similarly, Francis et al. (2012) emphasized that communal green spaces foster neighbor interactions and social integration, supporting the social dimension of our findings [52].

From an environmental and physical perspective, research in China has shown that landscape openness, biodiversity, and visual accessibility directly increase residents' satisfaction [53]. These findings echo the importance of visual transparency and open/semi-open green spaces in our study. Moreover, evidence from Iran- such as the study in Rasht by Jafari Mehrabadi et al. (2023)- confirms that social- welfare and physical characteristics of residential environments are decisive predictors of satisfaction, aligning with our results on communal green space and physical-spatial quality [54].

Finally, the role of place attachment is particularly significant in the Iranian cultural context, where gardens and nature have historically shaped identity and everyday life. Recent meta-analytical evidence shows that gardening and direct contact with vegetation substantially improve well-being, mental health, and quality of life [55]. In Shahrood - situated at the foothills of the Alborz mountains and surrounded by diverse ecosystems -this cultural affinity toward nature is even stronger. The traditional concept of the Persian garden, as a symbol of harmony between humans and the environment, amplifies residents' sensitivity to greenery and reinforces the mediating role of place attachment. As research indicates that environmental degradation directly correlates with a decline in urban quality of life, integrating ecological indicators becomes a

necessity for residential stability [56]. Thus, visual and physical access to natural elements in residential complexes not only enhances satisfaction but also connects contemporary housing design with deep-rooted cultural values and the unique natural landscape of Shahrood.

4. Conclusion

The impact of architectural environmental factors on quality of life was one of the main assumptions of this research. The literature, theoretical foundations, and collected documents have confirmed a direct relationship between these two components in a logical order. Theorists in the two aspects of quality and dwelling, such as Heidegger and Norberg-Schulz, agree that dwelling cannot be understood without establishing a meaningful connection between humans and an assumed environment. This connection is further reinforced by green management models, which emphasize that high quality of life in residential spaces is achieved through a convergence between the residents' desires and the concrete environmental reality [57].

Each individual's perception of their living space, which reflects the quality of the place, consists of various components. This research addresses the necessity of environmental architectural elements and examines the correlation and relationship between its variables. Given the results of past research, it was expected that other components in ensuring the quality of life in residential complexes would be more intense and stronger; however, the descriptive statistics of the data showed that the strength of architectural environmental factors is not less than other aspects.

The study's findings revealed that the frequency of positive responses to the questions related to each hypothesis was relatively high on the Likert scale. This suggests that features such as a green balcony, good visual visibility, and social spaces are perceived by participants as important factors that may contribute to satisfaction and quality of life. However, since the study focused primarily on perceptions related to physical environmental factors, the findings should be interpreted with caution and not generalized to all objective or subjective aspects of life. Further research incorporating a broader range of factors and more diverse methodologies is recommended to better understand the relative importance of physical environmental elements in overall quality of life.

Therefore, it is entirely logical that residential units in complexes where green balconies and terraces are designed creatively, optimally, and functionally to create a space for daily activities or even as part of the living area are more appealing to people. On the other hand, our audience in this research believes that if visual transparency is enhanced

through visible walls such as windows and wide openings, they will be more satisfied with their living space, which can determine their quality of life. Additionally, one of the most critical assumptions evaluated in this research, which was strongly felt due to the weakening of human relationships, was the consideration of a suitable place for creating social interactions within the neighborhood zones of these buildings. The study tested this, and the results indicated that increasing social interactions in an appropriate functional space significantly impacts the residents' quality of life.

Since the impact of architectural-environmental factors on quality of life, one of the most critical dimensions of residential satisfaction has been identified, improving decision-making processes in designing residential complexes to enhance these factors is necessary. To enhance the quality of life in residential areas, it is essential to recognize and address various influencing factors. Designers, builders, and stakeholders should work to achieve an optimal balance between the occupancy levels of buildings and the density of residential spaces in relation to open areas. This includes thoughtfully designing outdoor green spaces, incorporating fountains, and creating communal and public areas that foster a sense of belonging and increase social interactions within the neighborhood of residential complexes.

Additionally, revitalizing semi-open spaces and terraces of residential units is crucial. These areas should serve purposes beyond mere storage or dirty kitchen (back kitchen) use, focusing instead on enhancing the quality of life while ensuring suitable views and landscapes are maintained, all while respecting residents' privacy. Further, appropriate openings can significantly improve visibility and daylight quality without compromising individual privacy. Moreover, effectively controlling sunlight exposure throughout summer and winter is vital for enhancing overall residential life quality. By considering these aspects, we can create more livable and well-being environments. Ultimately, complexes aligning with residents' needs will have extraordinary durability and sustainability. Needs such as a sense of vitality, belonging, and connection with nature, which are considered essential for the design of residential complexes, lead to the enhancement of the complexes and, ultimately, to the quality of the urban environment.

Building on the multiple regression results presented earlier, it is important to recognize that while architectural-environmental factors such as green balconies, visual transparency, and communal green spaces significantly contribute to residential satisfaction and quality of life, these elements represent only part of a more complex interplay of influences. Quality of life is shaped by a wide range of environmental, social, psychological, and cultural

factors that extend beyond the physical design of residential complexes. Therefore, the findings should be interpreted as highlighting key architectural contributors rather than definitive determinants of well-being. Future research integrating subjective perceptions, social dynamics, and broader contextual variables alongside architectural features will provide a more comprehensive understanding of how diverse factors collectively influence residents' overall quality of life.

4.1. Study limitations

This study has several limitations that should be considered when interpreting its findings. First, the use of a purposive, non-random sampling technique -restricted to middle-income households residing in housing estates in the city of Shahrood- substantially limits the generalizability of the results. The sample size of 316, while adequate for this exploratory research, does not represent the broader urban population in Iran or other socioeconomic groups. Consequently, the external validity of our findings is constrained, and the results should not be generalized to other urban areas in Iran or beyond. Future research would benefit from employing probability sampling methods, such as stratified random sampling across diverse demographic groups and geographic regions, to enhance both representativeness and generalizability.

Authors Contribution

The author solely contributed to the conception, design, data collection, analysis, and writing of the manuscript. The author has read and approved the final version of the manuscript.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interests

The author declares that there are no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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