Towards Sustainable Residential Developments: Al-Ghadir Village and Al-Amirat in Najaf in Iraq

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Abstract

The idea of sustainability has emerged as a solution to many problems faced by cities and has become a mandatory practice in various fields and sectors, especially in the housing sector, given its significant economic and social importance. Therefore, it is essential to understand the concept of sustainability and how to achieve it in the planning of residential complexes. This research examines the problem of the varying levels of environmental sustainability in residential complexes, which has negatively affected the provision of suitable living conditions in many communities. It hypothesizes that indicators play a role in creating residential projects that are suitable from all social, economic, and environmental aspects.

The aim of this study is to assess the level of urban sustainability in two residential complexes by measuring residents' satisfaction through self-determined indicators. The study relied on a descriptive approach and statistical methods, utilizing the Mann-Whitney U test to identify significant differences between the two complexes.

The study found that most indicators showed significant differences. Among the notable findings were that most urban criteria related to the residential environments in the study area complied with national standards, except for the criteria related to the adequacy of educational, healthcare, and commercial services concerning the population size. Residents were dissatisfied with social indicators related to privacy, the scarcity of green and open spaces, play areas for children, and the lack of public transportation within the residential complex.

Keywords: Sustainability, Sustainable housing complexes, Sustainable development, Iraq.

1. Introduction

The issue of housing is of great importance in all societies as it is closely tied to meeting essential and crucial needs, especially in the face of rapid urbanization and increasing complexity of urban life. Housing sector plays a pivotal role in the sustainability of the urban environment, as residential areas constitute the largest portion of urban land use and are integral to the relationship between the environment and society.

Indicators of urban sustainability in residential complexes are measurable parameters used to evaluate and monitor the performance of these communities in achieving sustainable goals. These indicators provide valuable insights into the effectiveness of urban planning, resource management and quality of life in residential developments. By evaluating these

indicators, urban planners and stakeholders can identify areas for improvement and implement strategies to enhance the sustainability of residential complexes. Integrating sustainability into urban development not only contributes to the well-being of residents but also helps create more resilient and environmentally friendly cities for the future.

The aim of this paper is to assess the level of urban sustainability in residential complexes with a specific focus on Al-Ghadir and Al-Amirat residential complexes in Najaf, Iraq by measuring residents' satisfaction through self-determined indicators. The study intends to analyze the extent to which these residential complexes meet the criteria of sustainability, encompassing social, economic, and environmental aspects. By using residents' satisfaction as a measure, the study intends to identify strengths and weaknesses in the planning and design of these complexes and shed light on areas that need improvement to enhance the overall quality of living conditions for the residents.

Its objectives are as follows.

1. Defining a set of criteria and indicators for assessing sustainability in housing projects, enabling their use as tools in decision-making processes for future development.
2. Providing an overview of the current state of residential complexes from a sustainability perspective to enhance their strengths and identify the weaknesses, aiming to avoid them in future residential developments.

2.Theoretical Basis and General Concepts

2.1 Concept of Sustainability

The concept of sustainability has emerged during the last two decades coinciding with the rise of modern developmental trends, especially after the United Nations Conference on Environment and Development (Earth Summit) held in Rio de Janeiro in 1992. The concept of sustainability was adopted through the agenda 21, which focused on urban sustainability in its seventh chapter. Sustainability is based on a human perspective that aims to achieve a balance between the present needs and the ability to meet future needs (Ibrahim, 2012; Jagatramka, Kumar & Pipralia, 2020).

Sustainability is the fair and efficient distribution of resources among generations while preserving the limited environmental system. It represents a dynamic balance in the interaction between people and the environmental capacity without causing harm to the ecosystem (Mensah, 2019). The concept of sustainability is based on three interconnected and interrelated dimensions: economic, social, and environmental, as illustrated in the Figure 1.

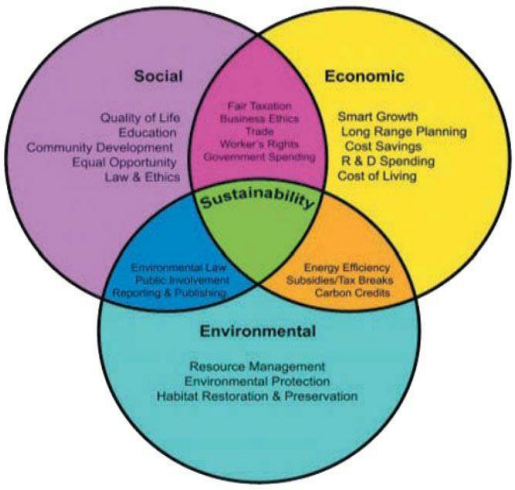

Fig. 1: Relationships between the environmental, economic and social aspects of sustainability
Source: Mensah, 2019

These interconnected relationships form a solid foundation through which decisions and actions can be taken effectively when considered collectively. The hypothetical scenario mentioned in the above figure illustrates the links between the three dimensions of sustainability, emphasizing the need for their integration to achieve sustainable development. It highlights how these economic, social, and environmental pillars are interrelated and mutually reinforcing, ultimately promoting sustainable development (Wanamaker,2020).

Indeed, it can be said that sustainability, as a general concept, focuses on enhancing opportunities and well-being for future generations. Embracing the concept of sustainability as a general framework for achieving development lays the foundation for what is known as sustainable development.

2.2 Sustainable Development

The concept of sustainable development was crystallized in the report of the World Commission on Environment and Development (WCED), also known as the Brundtland Commission. The definition provided by the commission in its 1987 report "Our Common Future" is the most widely recognized and globally circulated document. Sustainable development is defined as development that meets the basic needs of the present generation without compromising the ability of future generations to meet their own needs (WCED, 1987). In other words, it is the process of developing the built environment to meet the needs of people while avoiding socially and environmentally unacceptable impacts.

The definition presented by the Brundtland Commission is more comprehensive and covers the multiple aspects and principles of sustainable development. Its core idea revolves around the notion of needs and the future dimension. The principle of sustainable development aims to achieve a balance in meeting needs and effectively utilize natural resources in the present without jeopardizing the interests and ability of future generations to meet their needs while ensuring the continuity and effectiveness of activities and outcomes.

2.2.1 Dimensions of Sustainable Development

The dimensions of sustainable development are traditionally divided, from the perspective of the triple bottom line of sustainability, into the environmental, economic, and social dimensions (Shama & Motlak, 2019). The research will address the dimensions of sustainable development through a set of terms and impacts related to the housing system. They are:

Economic dimension

The economic dimension of sustainable housing arises from the following (Golubchikov & Badyina, 2012).

- Improving the effective supply and demand of housing by achieving stability in housing markets.
- Affordability of the supplied housing costs.
- Providing serviced land for housing projects.
- Ensuring housing for different social strata.

Social dimension

The social dimension holds significant importance for achieving quality in the built environment, as it has become a fundamental pillar in sustainable urban development. Social sustainability in housing revolves around providing the right to adequate housing and ensuring safe, affordable, and diverse housing options (diverse tenure, income, and types). Additionally, it involves empowering residents, promoting public participation and providing easy access to social infrastructure and public spaces (Motlak, 2022). Despite the fact that traditional housing policies focus on meeting basic social needs, it is essential to ensure that housing also addresses other needs related to facilities, mobility, and the final needs of human and social capital development, such as a sense of belonging, cohesion, and well-being within local and broader communities (Abdulkareem & Basee, 2023).

Environmental dimension

The environmental dimension of sustainable housing is based on the resilience of the ecosystem and focuses on maintaining ecological balance and utilizing clean energy sources (Shemirani & Hodjati, 2013). According to Golubchikov & Badyina (2012), the environmental goals of sustainable housing can be summarized as follows.

- Developing land use and managing design by adopting climate-responsive design mechanisms in land use planning, movement, block and open space design, and public places to provide thermal comfort for users.
- Achieving maximum efficiency in natural resource utilization, focusing on renewable resources, and managing non-renewable resources in a way that reduces negative impacts on the environment.
- Reducing environmentally polluting emissions by minimizing the environmental footprints of housing in terms of energy, greenhouse gas emissions, resource use, and waste.
- Enhancing resilience and adaptability in terms of design quality and greening.

2.2.2 Sustainable Development Goals

Sustainable Development Goals (SDGs) are a set of carefully planned and strategic objectives aimed at achieving sustainable growth and development. The United Nations General Assembly adopted the SDGs in its 2030 Agenda for Sustainable Development, presented in its report in 2015 (Al Musawi, & Al Baghdadi,2023). Goal 11 of the Sustainable Development Goals focuses on making cities and human settlements inclusive, safe, resilient, and sustainable. It is considered the first international goal that prioritizes sustainable urban development as a fundamental requirement for achieving sustainable development.

The aim is to ensure the sustainable development of cities and achieve environmental, economic, and social sustainability in urban communities. It also emphasizes the provision of adequate and affordable housing, basic services, and sustainable transportation.

SDG 11 aims to create cities that are livable, environmentally friendly, economically prosperous, socially inclusive, and able to withstand challenges. It places significant importance on promoting sustainable urbanization as an essential pillar of sustainable development.

3. The Concept of Residential Complexes

The concept of residential complexes is defined by the United Nations Human Settlements Program (Habitat) as integrated residential areas with comprehensive services and facilities. They represent a new approach to urban development in residential areas and often include diverse housing units that cater to different economic and social levels. Additionally, these complexes encompass road networks and pedestrian pathways, as well as public service facilities and some commercial activities. They are equipped with all necessary infrastructure networks, and their development and implementation are carried out in an integrated manner.

A residential complex has two aspects: the first involves the idea of physical environments, referring to the possibility of constructing a neighborhood, while the second involves bringing together social classes with shared purposes (Lewis, 2005). In summary, residential complexes are planned areas that offer a mix of housing options suitable for various socio-economic backgrounds. They are designed to be self-sufficient with well-connected roads, walkways, public services, commercial establishments, and all essential utilities. The development of these integrated residential complexes involves considering both the physical environment and social aspects to create cohesive and inclusive communities.

4- Sustainability Trends in City Planning and Residential Neighborhoods

Several modern planning trends have emerged in the latter half of the twentieth century, aiming to create integrated residential environments capable of coping with new challenges. These trends have arisen due to increased awareness of sustainability concepts and the promotion of sustainable communities with integrated urban fabrics that enhance environmental, social, and economic aspects. Some of these trends include compact city, new

urbanism, smart growth, and urban villages. According to Shama & Motlak (2019), these trends share several principles, which can be summarized as follows

1. Increasing housing density: Reducing distances, improving infrastructure efficiency, and addressing housing needs by providing high-density housing.
2. Providing mixed-use development: Integrating activities, services, and workplaces with residential units.
3. Establishing sustainable transportation: Relying on pedestrian and bicycle movement within residential areas and reducing emissions.
4. Offering diverse housing options: Offering a variety of housing patterns and options with diverse property ownership to cater to different levels of society and promote cultural and social diversity.
5. Creating greenery and open spaces: Increasing open spaces and green areas to enhance enjoyment, mitigate pollution, create a pleasant environment, encourage pedestrian movement, and foster social interaction.

These planning trends all aim to create sustainable, integrated, and livable communities by prioritizing efficient land use, environmental preservation, social cohesion and economic viability. They seek to build cities and neighborhoods that adapt to changing needs and contribute to a more sustainable and resilient future.

5. Review of Literature

Many studies deal with the issue of sustainability indicators in housing projects with different methods and perspectives, and propose a variety of approaches to achieve environmental and social sustainability in residential communities. Here is an overview of how these studies address the issue of sustainability indicators.

Al-Zubaidi (2006) examines the concept of sustainability, particularly environmental sustainability, and its impact on housing to develop a model for sustainable housing. She starts from the planning, design, and implementation stages, extending to post-occupancy evaluation, reuse, and recycling. The aim is to formulate design indicators for sustainable housing and housing agglomerations in Iraq and Arab countries. The study focuses on utilizing renewable energy sources, especially solar energy, to generate electricity through the use of photovoltaic cells in the design process. It concludes that sustainable housing is a comprehensive concept that encompasses various aspects, including environmental sustainability.

Hanna (2012) focuses on sustainable environmental control in vertical housing and specifically highlights hot dry regions facing high energy consumption challenges. She explores environmental control through three levels: natural adaptation, technological solutions, and urban alternatives. She aims to integrate these three levels to achieve environmentally sustainable housing compatible with the surroundings. Similarly, Al-Darzi (2013) is also interested in the most significant urban challenges in housing environments, categorizing them into three types related to human needs, the housing environment, and the urban level. She emphasizes the challenge of providing security and safety in housing environments, which represent fundamental human needs that ensure peace and stability. She identifies key elements contributing to enhancing security and safety, such as urban and environmental design, urban planning, and spatial organization.

On the contrary, Karaji et al. (2019) focus on a collective housing project in the Islamic Republic of Iran to meet the increasing demand for housing. They examine the social impact of this housing model on the housing environment and develop a method to assess social sustainability indicators in collective housing projects. They identify 33 indicators from internationally recognized rating systems (BREEM, LEED, ENVISION, Green Globes) based on expert opinions.

Ibrahim (2020) evaluates the level of satisfaction among residents in a public housing project in the United Arab Emirates. The evaluation is based on urban design indicators and urban, architectural, and social characteristics of housing units. He emphasizes measuring sustainability on both environmental and social levels using the national classification system,

ESTDAMA. At the same time, Sabih (2019) examines the extent to which the elements of sustainability can be achieved through the application of high-density housing models linking them to the environmental, social and economic dimensions. She also seeks to provide an information base on high-density vertical housing projects.

Márquez, et al. (2019) conduct a comparative analysis of housing indicators used in single-family housing rating systems. The objective is to introduce new housing indicators that promote the concept of sustainability in MIC cities. They identify 37 indicators for multi-criteria assessments and 2 for mandatory-criteria assessments, offering fresh perspectives on various topics. Moreover, the methodology used to derive these indicators could prove valuable tools for other researchers seeking to identify new sustainable indicators.

This review makes it clear that most of these studies focus on one aspect of sustainability while neglecting the others. However, this research differs in its specific focus on assessing the level of urban sustainability in two residential complexes based on residents' satisfaction with self-determined indicators. While the earlier studies covered various aspects of sustainability in housing projects, this study focuses on urban sustainability and the direct impact on residents' satisfaction. It also aims to identify significant differences between the two residential complexes, which allows for a more detailed analysis of how different planning approaches can influence sustainability and residents' living conditions.

6.0 Research Methodology

The research adopted a descriptive-analytical methodology. It administered a questionnaire to assess residents' satisfaction levels regarding sustainability indicators in the two residential complexes. The two residential complexes were Al-Ghadir village and Al-Amirat in Najaf, Iraq. They were selected on the basis of being among the first residential complexes established in the city. They have been completed and all of their residential units have been occupied. The researcher collected basic data, such as maps, and reports of the study areas from the Department of Research and Studies in the Directorate of Urban Planning in Najaf. However, to ensure up-to-date information, the data was supplemented and updated through on-site visits, observations, and surveys.

The Likert three-point scale was used, and the weighted arithmetic mean was calculated for the research sample. A random sample of (60) respondents was selected for each complex, and the Mann-Whitney U test was used to obtain quantifiable results and determine if there were significant differences between the two complexes.

Findings

Normality Test

The Shapiro-Wilk (S-W) and Kolmogorov-Smirnov (K-S) tests were applied to the data of both groups separately to determine whether the data collected through the questionnaires follows a normal distribution or not.

Table 1: Results of the normality test for the two residential complexes
Source: Based on IBM SPSS V.26 output.

Variables	N	K-S	Sig.	S-W	Sig.
Al-Ghadir	60	0.115	0.046	0.961	0.051
Al-Amirat	60	0.081	0.200	0.984	0.633

Table 1 indicates that the assumption of normality is not met in the data collected from Al-Ghadir Village residential complex, with a statistically significant value less than or equal to 0.05. However, for Al-Amirat residential complex, the assumption of normality is met in the data, with a statistically significant value greater than 0.05.

Cronbach's Alpha Test

This test assesses the accuracy and consistency of the measurement tool used in the research, as well as the consistency of responses to the posed questions. The results of the

reliability test were analyzed using Cronbach's alpha reliability scale with the help of statistical software SPSS. The test results are shown in the Table 2.

Table 2: Results of Cronbach's alpha test for the two residential complexes
Source: Based on IBM SPSS V.26 output.

Reliability Statistics	Cronbach's Alpha	N of Items
Data Set 1	.826	25
Data Set 2	.751	25

The tables above indicate that the reliability coefficient is high, and it is greater than the minimum value of 0.70. This suggests that the questions of the form were good and proven.

7.0 Study Area

The two residential complexes Al-Ghadir village and Al-Amirat were located in the city of Najaf as shown in the Fig.

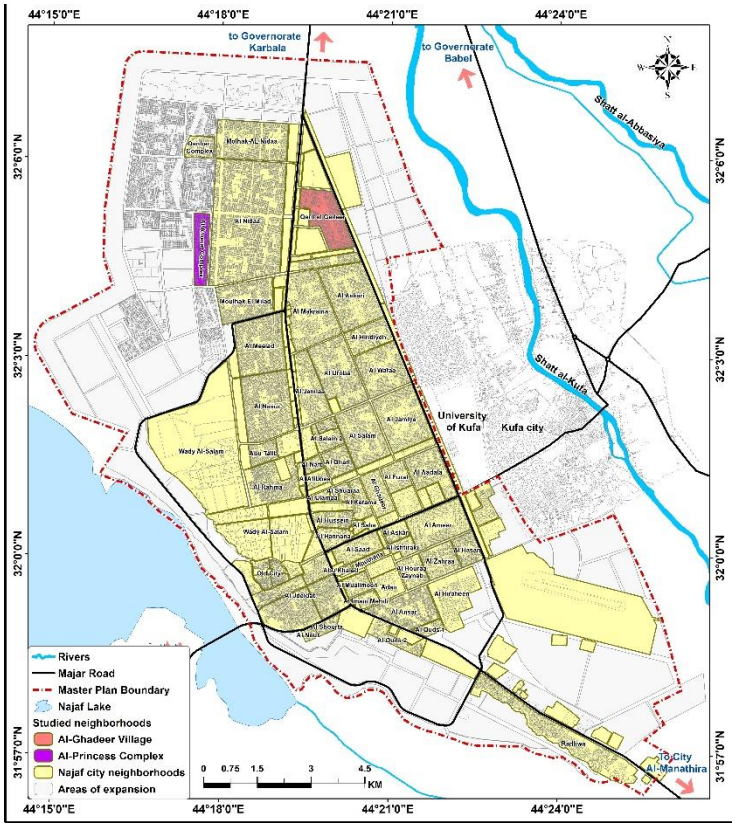

Fig. 2: The two study areas
Source: Author

8.0 Indicators of Sustainable Residential Complexes

Sustainable housing is a multifaceted concept that takes into account the urban, social, environmental, and economic dimensions of housing, which collectively impact the lives and well-being of residents. Indicators of sustainable residential complexes can be classified according to the dimensions of sustainability: urban, social, environmental, and economic.

8.1 Urban indicators

8.1.1 Community services

These services constitute an essential part of human life and include the elements of community services efficiency of the service and its adequacy for the size of the population as

well as the distance of access to it from residential units, and includes educational, health, and commercial aspects.

a. Educational Services

Table 3 shows the assessment of the quality and adequacy of educational services such as kindergarten, primary and secondary.

Table 3: Comparison of indicators of satisfaction with educational services

Indicators	Mean Rank		Mann-Whitney test	
	Al-Ghadir	Al-Amirat	Z Value	Statistical Significance
1. Efficiency and adequacy of Kindergartens	37.50	83.50	8.367	0.000
2. Quality and adequacy of Primary Schools	55.37	65.63	1.717	0.086
3. Quality and adequacy of Secondary Schools	39.32	81.68	7.232	0.000
4. Ease of access to Kindergartens	48.00	73.00	5.560	0.000
5. Ease of access to Primary Schools	69.68	51.33	3.088	0.002
6. Ease of access to Secondary Schools	59.54	61.46	0.348	0.728

Table 3 shows statistically significant differences between the two residential complexes in indicators related to the efficiency of kindergartens and secondary schools, favoring the Al-Amirat residential complex. Additionally, there is a statistically significant difference in the ease of access to kindergartens, favoring Al-Amirat. However, there is no significant difference in the ease of access to secondary schools and the quality of primary schools.

b. Health Services: Table 4 shows the assessment of the quality and accessibility of health services.

Table 4: Comparison of health service satisfaction indicators for the two research samples

Indicators	Mann-Whitney test			Statistical Significance
	Mean Rank		Z Value	
1. Quality and adequacy of Health Services	46.49	74.51	4.754	0.000
2. Ease of access to Health Services	47.29	73.71	4.500	0.000

Table 4 indicates statistically significant differences between the two residential complexes in indicators related to the quality and adequacy of health services and the ease of access to them, favoring Al-Amirat residential complex.

c. Commercial Services: Table 5 shows the assessment of the quality, adequacy and accessibility of commercial services.

Table 5: Comparison of indicators of satisfaction with commercial services

Indicators	Mean Rank		Mann-Whitney test	
	Al-Ghadir	Al-Amirat	Z Value	Statistical Significance
1. Quality and adequacy of Commercial Services	50.45	70.55	3.387	0.001
2. Ease of access to Commercial Services	69.70	51.30	3.282	0.001

It shows that there are statistically significant differences between the two complexes in the indicators related to the quality and adequacy of commercial services and ease of access to them in favor of the Princess Complex.

8.1.2 Infrastructure Services

Table 6 shows the assessment of the quality of infrastructure services, including water, electricity and sewage networks.

Table 6: Comparison of Indicators of Satisfaction with Infrastructure Networks

Indicators	Mean Rank		Mann-Whitney test	
	Al-Ghadir	Al-Amirat	Z Value	Statistical Significance
Quality of Infrastructure Networks	55.08	65.92	1.824	0.068

The p-value for this indicator is 0.068, which is greater than the common significance level of 0.05, indicating that there is no statistically significant difference between the two complexes in terms of the quality of infrastructure networks.

8.1.3 Transport services

Table 7 shows the assessment of the quality of transport services, which includes the efficiency of roads within the two complexes and public transport services within the vicinity of the two complexes.

Table 7: Comparison of indicators of satisfaction with transport services

Indicators	Mean Rank		Mann-Whitney test	
	Al-Ghadir	Al-Amirat	Z Value	Statistical Significance
1. Efficiency of Roads within the Complexes	59.58	61.43	0.311	0.756
2. Availability of Public Transportation within the Complexes	62.17	58.83	0.601	0.548

The p-values for both indicators are greater than the common significance level of 0.05, indicating that there are no statistically significant differences between the two complexes in terms of the efficiency of roads within the complexes and the availability of public transportation within the complexes.

8.2 Social indicators

Table 8 shows the results of the significant comparison of social indicators in the two compilations.

Table 8: Comparison of satisfaction indicators with social indicators

Indicators	Mean Rank		Mann-Whitney test	
	Al-Ghadir	Al-Amirat	Z Value	Statistical Significance
1. Level of social interaction among the residents	60.03	60.97	0.202	0.840
2. Availability of security and safety	47.30	73.70	4.539	0.000
3. Level of privacy	42.20	78.80	6.293	0.000
4. Level of social compatibility among the residents	56.25	64.75	1.514	0.130

The results show that there are statistically significant differences between the two complexes in terms of the availability of security and safety, the level of privacy, and the level of social compatibility among the residents, favoring Al-Amirat residential complex. However, there is no statistically significant difference in the level of social interaction among the residents between the two complexes.

8.3 Environmental indicators

Table 9 shows the results of the significant comparison of environmental indicators in the two complexes.

Table 9: Comparison of indicators of satisfaction with environmental indicators

Indicators	Mean Rank		Mann-Whitney test	
	Al-Ghadir	Al-Amirat	Z Value	Statistical Significance
1. Efficiency of waste collection and environmental conservation	42.73	78.28	5.979	0.000
2. Use of renewable energy sources	60.50	60.50	0.000	1.000
3. Level of pollution	67.47	53.53	2.457	0.014

The Table 9 shows that there are no significant differences in the indicator of the use of renewable energy sources. There were significant differences in the efficiency of waste service index in favor of Al-Amirat Complex, while the results showed a significant difference in the high level of pollution in the Al Ghadeer complex.

8.4 Economic indicators

Economic indicators are related to affordability of housing, as the availability of affordable housing is a fundamental indicator of sustainable housing quality. It is directly linked to the household income level, as it indicates the capacity of different social groups to bear housing expenses without compromising on other essential life necessities. Table 10 shows the results of the comparison of the housing affordability index in the two complexes

Table 10: Comparison of the indicators of satisfaction with the housing affordability index

Indicators	Mean Rank		Mann-Whitney test	
	Al-Ghadir	Al-Amirat	Z Value	Statistical Significance
Affordability	61.15	59.85	0.219	0.827

The p-value for this indicator is 0.827, which is greater than the significance level of 0.05, indicating that there is no statistically significant difference between the two complexes in terms of the ability to afford housing costs.

9. Conclusions

1. Sustainable residential complexes that incorporate diverse housing units and prioritize sustainable criteria and indicators can significantly enhance the quality of life of the residents. Thes provide essential services and ensure easy access to services and workplaces, while promoting sustainable transportation through pedestrian movement, are crucial aspects of fostering a sustainable living environment.
2. **Educational Services**: The study identified statistically significant differences in educational service indicators, particularly in the efficiency and adequacy of kindergartens and secondary schools, favoring Al-Amirat residential complex. This suggests that Al-Ghadir Village should focus on improving the efficiency and quality of their educational facilities to enhance the educational experience of its residents.
3. **Accessibility Indicators**: The study also revealed significant differences in accessibility indicators for access to kindergartens and healthcare services, with Al-Ghadir Village showing an advantage in these areas. However, Al-Amirat residential complex had an advantage in proximity to primary schools and commercial centers. This highlights the importance of ensuring well-distributed and easily accessible services within residential complexes.
4. **Social Indicators**: Al-Amirat residential complex demonstrated statistically significant differences in social indicators such as security, safety, and privacy. Enhancing these aspects in Al-Ghadir Village could lead to an improved sense of safety and community among its residents.
5. **Environmental Indicators**: Environmental indicators showed significant differences between the two complexes, with Al-Amirat having a more efficient waste collection service but facing higher pollution levels. Both complexes should prioritize

sustainable waste management and pollution control strategies to ensure a healthier environment for residents.

6. **Areas of Resident Dissatisfaction**: The study identified specific areas of resident dissatisfaction, including recreational and green areas, certain educational and commercial services, waste collection efficiency, security, safety, and privacy. Addressing these concerns can contribute to overall resident satisfaction and well-being.
7. **Public Transportation**: The absence of public transportation and reliance on private transport can lead to environmental pollution and noise within the residential environment. Implementing sustainable transportation solutions and promoting alternative modes of transport can help mitigate these issues.

In conclusion, the study highlights the significance of incorporating sustainable criteria and indicators in the development and management of residential complexes. Addressing the identified areas of improvement and adopting sustainable practices will contribute to creating healthier, more livable, and environmentally friendly living environments for residents in both Al-Ghadir Village and Al-Amirat residential complex. the research effectively addresses the issue of varying environmental sustainability levels in residential complexes and its impact on community living conditions. The findings provide valuable insights into the shortcomings and strengths of the examined residential complexes. the research could benefit from a more comprehensive exploration of the underlying reasons for the differences observed and from a deeper investigation into residents' perceptions to gain a holistic understanding. Additionally, expanding the scope of the study to include a wider range of residential complexes could enhance the generalizability of the findings.

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