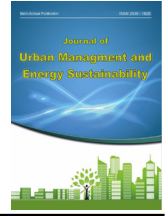


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CASE STUDY RESEARCH

An analysis of dimensions and indices of urban livability with emphasis on the environmental sustainability approach (Case study: District 22 of Tehran)

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ABSTRACT

Today, cities have faced many economic, social, and environmental challenges, while the population rate increase with a high urbanization ratio has harmed cities. The continuation of urbanization growth with social, economic, and environmental problems creates a crisis and threat to the stability of cities. Therefore, the necessity and importance of discussing livability and sustainable development in cities are apparent. This research aims to analyze the dimensions and indicators of livability with emphasis on the environmental sustainability approach in the district 22 of Tehran. The research method is descriptive-analytical with the applicable-developmental objective. A statistical sample is from citizens and experts, and the study is in an urban area. The questionnaire on a 5-point Likert scale. To determine the reliability of the questionnaire, we used Cronbach's alpha coefficient reliability method, which obtained a score of 0.717, which confirms the reliability and validity of the questionnaire. The data are analyzed using statistical tests such as t-test (T.test) is used to determine their significance. The results of the research show that among the environmental dimensions, infrastructure, and urban, social, cultural, and economic dimensions, the environmental dimension has the best condition with 69.77%, and the socio-cultural dimension has the worst situation with 45.01% among the dimensions of urban livability in the district 22 of Tehran. It is also clear from this table that urban livability is 57.42% in the district 22 of Tehran, which is considered close to the average level. Therefore, primary importance should be considered to social, cultural, economic, and environmental indicators to create livability and reach urban sustainability in the district 22 of Tehran.

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1. Introduction

Three centuries ago, the industrial revolution in Europe profoundly impacted human life. In the long term, the result of the industrial revolution turned into a double-sided coin, the evident and optimistic side of which includes changes in raw material procurement, changes in agriculture, the creation of a national market and income-generating economic developments, new patterns of consumption, demographic changes, and most importantly, the increasing growth of cities and towns—living and facing many challenges in the economic, social, and environmental fields. Therefore, by carefully evaluating them, it is possible to identify many existing problems and take action to solve them. (Hatami et al, 2019) The theory of urban livability is one of the debates that emerged from sustainable urban development, which focuses on all residents' social, economic, physical, and mental health. We might say most studies on urban livability believe that a livable place should be safe, attractive, social cohesion and connectivity, educational facilities, diverse, affordable housing, open public spaces, shopping centers, appropriate health services, appropriate sustainability, and cultural, recreational, transportation facilities should be optimal constructions. Ecological cities and sustainable development are closely related, and it is a concept that deals with all the relationships between the subjective and objective dimensions of human settlements. (Saitluanga, 2013) While with the rapid expansion of cities and the increase in by urbanization in Iran, many of the lands in cities went under construction, and as a result, destroying gardens and agricultural lands, not only the environmental balance between the service levels of cities was disturbed, but also with the increase in population. The need for infrastructure services and infrastructural facilities and proper and sufficient elasticity of the urban transportation network will not meet the needs of today's residents. (Hakmat Nia, 1400). Tehran is the 21st city in the world, the second metropolis in Asia, and the first city in Iran. It is considered economic, industrial, service, educational, research, administrative, and political. (Tehran Province Management and Planning Organization, 2016). District 22 of

Tehran is located at the western end of the Tehran metropolis. It has unique characteristics in terms of climate and nature. It has unique characteristics, with a background in agriculture and animal husbandry. Therefore, with the increasing urban development in the capital, which is saturated in the more central areas, entering the more peripheral and less developed areas more or less like district 22 of Tehran, which can manage the development of urban spaces in a sustainable and balanced way with planning, can bring a bright future with the favorable environment and also preserve the potential urban spaces for the next generation ([Detailed Plan of district22 of Tehran, 2015](#)). The current research aims to provide a foundation for research in bio-friendly cities. Also, it seeks to formulate the concept and indicators of a bio-friendly city through deep descriptive and analytical analysis. The critical question of the research is the realization of these dimensions and indices of urban livability in the district 22 of Tehran.

2. Materials and Methods

2.1. Research Background

The survey shows that, despite the importance of the studied topic in urban livability, few studies have been done on the studied topic so far. Nevertheless, the results of several studies are mentioned below.

The studies and research carried out on urban livability are based on indicators and have had a quantitative aspect, and standard (repetitive) criteria have been investigated. The current research is new and innovative in analyzing the dimensions and indicators considered. In addition, this research deals with providing optimal solutions based on the analysis of indicators in a specialized way and their effects. Finally, solutions based on the indicators in the studied area will be provided.

2.2. Theoretical framework of research

Oxford culture defines *Livability* as having the value of life, equivalent to English. In the culture of urbanism, Robert Cowan defines the word *Livability* as suitable for life and providing quality of life (Cowan & Hall, 2005). It describes well Abraham Mazlo first formed the

Table 1: Some domestic and foreign studies on urban livability

Researcher	Title	Key factors
Orouji et al. (2022)	An integrated approach to urban livability development	The issue of connection and traffic density and the per capita needs of public infrastructure for the metropolis and the influential factors in the city of Rawalpindi are "individual well-being," "urban economy," and "urban environment."
Viok (2020)	The relationship between urban heat and livability	There is research on the relationship between growing urban areas and livability, such as Doha, and the relationship between the built environment and livability. The increase in temperature requires further changes in planning and development systems to answer new questions related to livability.
Amith (2020)	Discovering livability in the era of smart cities, a case study of Bhopal	The primary purpose of the research is to evaluate the living conditions in the cities of Bhopal based on the following three aspects: 1. Smart Transportation 2. The impact of intelligent living on the city 3. Good governance, including electronic management and participation of the city and reviewing the initiatives of the intelligent city of Bhopal
	Assessing the impact of climate change on urban viability in China	This study of the livability status of 288 cities in China found that heat waves and significant rainfall events affect the livability of cities in southern China.
John et al (2018)	Evaluation of factors determining satisfaction with urban livability in China	In this article, using a large-scale survey in 40 Chinese cities, the respondents are moderately satisfied with urban livability in China. The respondents are relatively satisfied with the facilities of the natural environment and the cultural and social environment, while they are a little dissatisfied with the urban security, environmental health and transportation.
Badland et al (2014)	Urban livability: lessons from Australia to explore social health indicators	11 general health and social welfare areas were identified, including crime and security, education and employment, income, health, social services, housing, recreation and culture, local food and other goods, natural environment, national atmosphere, social cohesion, and local democracy.
Shahriari and Moshksar (2022)	Assessment of livability in urban neighborhoods (case study: Qasr al-Dasht neighborhood Shiraz)	Livability in the Qasr al-Dasht neighborhood is above the average level. According to the Pearson correlation coefficient, there is a direct and statistically significant relationship between the dependent variables under study, i.e., economic, social, physical, and environmental components of the Minister of Construction and Services.
Khezrloo, Abedini (2022)	A comparative study of livability in the new and old context of cities, a case example: Oroumieh city	The level of livability in the old context based on the indicators of access to main roads, average land price, population density, access to sports and recreational use, access to therapeutic use, access to educational and cultural use, access to commercial use, the number of literate people and the number of employees is in a better situation than the new context.
Hataminejad et al (2021)	Measuring the dimensions of neighborhood sustainability and sustainable development (case example: Sarab city neighborhoods)	The achievement of livability is improving the quality of urban spaces in modern cities, along with their humanization and the state of diversity and development in residential areas, as one of the most fundamental pillars of sustainable urban development.
Sediqinejad et al (2019)	Assessing the livability of the metropolis' central parts from the residents' point of view (case study: Tehran metropolis)	The accessibility and environmental dimensions have been in an acceptable condition. Also, from the residents' point of view, the economic, physical, and socio-cultural dimensions have the weakest livability condition.
Ziari et al (2019)	Analysis of the dimensions and components of the of small cities livability to sustainable development, a case study, evaluation title: Bandar Deilam	Small cities are desirable in terms of the economic index of livability. However, the social dimension could be more favorable due to the poor quality of the index, and the environmental dimension is also in bad condition due to natural limitations and is not suitable for living.
Hataminejad et al (2019)	Measuring urban livability dimensions indicators in Noor Abad Delfan city	The extent of its dimensions is associated with weakness, and as we move from the environmental dimension to the social and economic dimension, the intensity of livability decreases.

Table 2: Dimensions and indices of urban livability

-Dimensions and indices of urban livability dimension	index	Statement
Social and cultural	Security and city crime	Night security, security of women and children's traffic during the day and night, neighborhood crimes and quarrels, security of parked vehicles, regular police patrols
	Identity and belonging to place	A sense of attachment and attachment, knowing and communicating with neighbors, the most suitable place to live, willingness to leave the neighborhood if the financial conditions improve, hoping to improve the living conditions and development of the neighborhood, holding passionate religious celebrations and mourning
	Participation	Trusting the decisions of the city council and the municipality, participating in the decisions of the city council, participating financially in city projects and having a good teamwork spirit, respecting and respecting people's condition, being a member of neighborhood groups and associations, accepting responsibility.
Infrastructure and urban services	Health and hygiene	The availability of therapists and hospitals, the quality of clinic and hospital services, the presence of an addiction treatment and counseling center on site, the availability of a pharmacy, the presence of specialized medical centers, the presence and quality of medical expertise, satisfaction with urgency and function of 115
	Urban Facilities and infrastructure	The quality of providing services such as water, electricity, gas and telephone lines, Internet facilities and services, the variety of goods and services, and the existence of chain and large stores. Prosperous arcades and local markets, the possibility of obtaining daily necessities on the spot, the existence of sufficient number of banks
	Public transport and passage quality	The quality and performance of public transportation, the appropriateness of public transportation working hours, the appropriateness of the distribution of public transportation stations, the appropriateness of public transportation prices, easy access to the highway and other areas of the city, and the quality of sidewalks, safe and full sidewalks
	Educational centers and leisure facilities	School education facilities, the quality of classes for spending leisure time, the quality of school buildings, how to access educational centers, the quality of children's playgrounds and parks, the quality of neighborhood cinemas, the presence of sufficient and well-equipped libraries, the presence of interesting museums, the quality of restaurants and coffee shops. The quality of spaces and recreational facilities and spending quality leisure time
	Economic	housing
Employment and food-energy consumption		The appropriateness of the income of the head of the household, the existence of numerous job opportunities, the profitable and prosperous investment in the neighborhood, and the possibility of buying or renting housing at a reasonable price in the neighborhood.
Environmental	Green and public space	The vibrancy of public spaces and parks, the lighting of public spaces and green spaces, exciting and attractive public spaces, and the safety and cleanliness of public and green spaces.
	Pollution	The cleanliness of the neighborhood, the amount of noise pollution, the amount of air pollution, the quality of garbage collection, the desirability of surface water collection, the presence of verminous animals and insects, and pollution caused by workshop and warehouse activities.
	Drinking water	Quantity and quality of drinking water

theory of Livability in response to social needs. With increasing concerns about the economic relationship of the world's cities, it was first introduced by Henry Lefardi in 1987 to urban development and urban planning issues. The future development of Livability has attracted global attention since the 1980s. (Wei et al., 2018) Kennedy and Buys believe Livability is defined by terms such as community welfare and represents the characteristics (Kennedy & Buys, 2010) that make a place where people always want to live.

Livability refers to conditions required for the excellent living of people in a particular area, which will provide comfort, well-being, and satisfaction to its residents for a long time. The concept of a livable city in its true sense requires two essential elements that are in harmony with each other. The first element is the population, which has basic needs such as Services, goods, shelter, energy, water, food, sanitation, public safety, management, education, entertainment, social and economic participation (West, 2008), creativity, and many other needs.

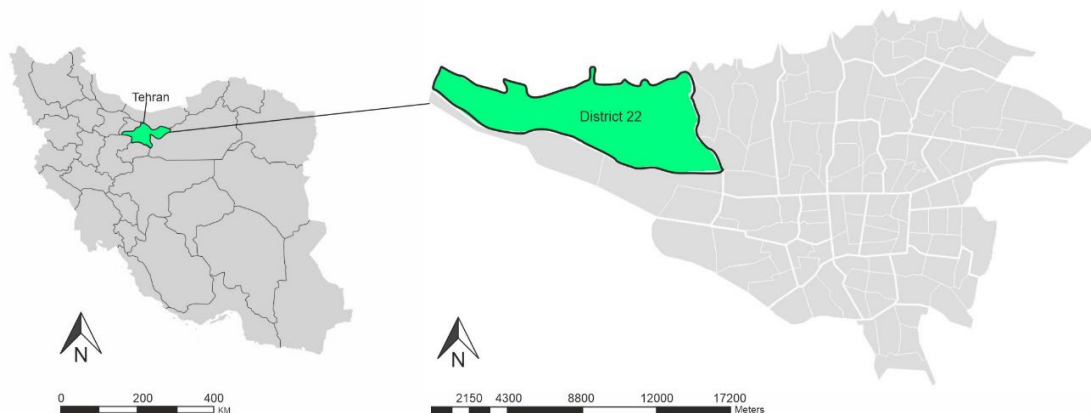
Another element of Livability includes the city's environment, defined by its physical and biological characteristics. The environmental element of the city's ecosystem and the green spaces and waters around the city are important. (Ziyari, 2017) Livability is defined as the product of social, economic, health, and environmental conditions that affect humans (Elsawy and Atef, 2019) and social welfare. In modern urban planning, Livability refers to a city as a

living, healthy, and natural being that accepts commands, learns, feels values, and interprets. Its parts are fully connected, it has breathing organs, and it is alive (Hekmat Nia, 1400).

The term sustainable city was used by the National Department of Arts to achieve their desired planning ideas, followed by other research centers and organizations such as the US Environmental Protection Agency (Ghanbari et al., 1400). In Europe, studies related to sustainable cities go back to 1975, when the magazine the perspective published a collection of short articles by experts per year (IMCL) in the field of creating livable cities. International meetings was established in 1985, held every six months in Europe and the United States of America, and Venice was the first elected city for this meeting (Larice 2005).

Livability is a complex and multi-dimensional concept. This has caused it to be challenging to assess the level of Livability of an area, in other words, the involvement of various social, economic, physical, and environmental dimensions and indicators. On the one hand, different perceptions of people on the concept of Livability have caused complexity and difficulty in understanding this issue. The existence of such obstacles and problems and the livability level of a place can be identified and evaluated by different criteria (Irandoost, 2014).

District 22 of Tehran municipality, located in the northwest of Tehran, with an area of about 6 thousand hectares of the urban area and 18000



Map 1: Map of the political boundaries of the district 22 of Tehran Municipality (source: District Municipality of Tehran 1401)

hectares of the city boundary, constitutes one-seventh of the area of Tehran city. This area is located between eastern longitudes 51° 10' to 20° 40' and northern latitudes 35° 16' 32' to 35° 19' 57' in the northwestern part of Tehran and the lower reaches of the Kan stream and Vardij river basins. This region is limited to Alborz foothills from the north, Ken from the east, Tehran-Karaj freeway from the south, and Garmdareh city from the west.

2.3. Methodology

The main objective of this research is an analysis of urban livability in the district 22 of Tehran. Therefore, the research method is based on practical development, which means that the criteria and indicators compiled for the analysis of livability in the study area can be used for other regions and areas of other cities as well. The method and nature are descriptive-analytical of a case that was selected as a study sample district 22 of Tehran. Library study and field survey methods were used to collect the necessary data. To determine the sample size among the residents of the district 22 of Tehran according to the population of the district and using the

Cochran method, 384 questionnaires were prepared and completed by the citizens. Also, 20 urban affairs specialists and relevant officials at the regional level have been selected to answer targeted questions. In the method of analyzing the indicators extracted in the study area based on a public questionnaire, a sample is analyzed by the T statistical test. Then the hierarchical analysis method and expert opinions are used to describe the criteria and indicators to determine their importance.

3. Findings and Discussion

In this section, the analysis of urban livability in the district 22 of Tehran is carried out. For this purpose, in the process of this research, the indicators of the analysis of urban livability in the study area through a popular questionnaire and based on the opinion of the citizens were qualitatively measured with the T-test. Then the research criteria and indicators were scored in the Expert Choice software using the method AHP has been developed in order to explain the measures of urban livability planning in the district 22 of Tehran through a questionnaire.

Table 3: Analysis of environmental indicators with T-test in the district 22 of Tehran

Environmental indicators	medium	Standard deviation	T stat	Significance level	inf	sup
air pollution	3.73			0	0.63	0.83
Noise	2.53	0.84	10.26 -	0	-0.55	-0.27
Drinking water quality	3.35	1.14	5.72	0	0.23	0.47
The quality of garbage collection	3.51	0.93	10.24	0	0.41	0.61
Wastewater collection quality	3.27	1.07	6.55	0	0.26	0.48
Quantity and quality of green space	3.88	0.85	19.44	0	0.75	0.97

Table 4: Evaluation of urban infrastructure and services indicators with T-test in the district 22 of Tehran

Urban infrastructure and services index	medium	Standard deviation	T stat	Significance level	inf	sup
Access and quality of public transportation	2.08	0.97	-17.55	0	-1.01	-0.81
Quality of sidewalks	4.11	1.01	21.6	0	0.61	0.82
Access to urban facilities	5	1.15	25.2	0	0.81	0.99
Access to medical centers	1.91	0.79	-25.72	0	-1.18	-1.01
Access to educational centers	2.91	0.79	-4.56	0	-1.16	-1.00
User diversity	1.96	0.94	-20.46	0	1.13-	-0.93

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In the analysis of the livability indicators of the region, a sample T-test has been used. Given that the option of the Likert scale template includes “Completely Disagree: 1”, “ Disagree: 2”, “Medium: 3”, “Agree: 4”, and “completely agree: 5”. The value of the test item is considered to be 3. Therefore, if the average of the answers for each or all of the indicators is more than 3, it means that from the point of view of the tested community, the index is at a better level, otherwise, it is equal to or less than 3, it indicates that it is average or weak.

As can be seen in Table 3, the index of quantity and quality of green space with a weighted average of 3.88 and a significance level of 0.000, and a positive lower and upper limit (positive confidence interval) compared to the other mentioned indicators, the best status of the above index is at an acceptable level and above the average level. In this table, pollution, with a weighted average of 2.53 and a negative

confidence interval, is the worst among other environmental indicators.

As can be seen in Table 4, the index of access to urban facilities with a weighted average of 5 and a significance level of 0.000 and a positive upper and lower limit (positive confidence interval) has a better status among the indicators of urban infrastructure and services. Therefore, the index is at a good and acceptable level. The index of access to medical centers with weighted average of 1.91 is at a low and unacceptable level, which is the worst situation among other indicators. As can be seen in Table 5, the index of belonging to the place has a weighted average of 3.76 and a significance level of 0.000 and a positive lower and upper limit (positive confidence interval) compared to the other mentioned indicators. public services, the level of citizens’ participation, and the level of crimes with weighted averages of 2.14, 2.76, and 2.47, respectively, are below the average level and are unacceptable.

As can be seen in Table 6, the index of food and energy consumption with a weighted

Table 5: Evaluation of social and cultural indicators with T-test in the district 22 of Tehran

Social and cultural index	medium	Standard deviation	T stat	Significance level	inf	sup
Security of public spaces	2.14	1.08	-14.75	0	-0.97	-0.74
Citizen participation rate	2.76	0.97	-4.61	0	-0.34	-0.13
Crime rate	2.47	0.94	-10.34	0	-0.62	-0.42
Belonging to the place	3.76	0.86	16.17	0	0.67	0.85

Table 6: Evaluation of economic indicators with the T-test in the district 22 of Tehran.

Economic indicators	medium	Standard deviation	T stat	Significance level	inf	sup
The quantity and quality of housing	3.17	0.99	3.36	0	-0.07	-0.74
Food and energy consumption	3.61	0.92	12.43	0	0.51	-0.13
The amount of employment and income	2.01	0.97	18.93	0	-0.62	-0.42

Table 7: Relative weights and scores of dimensions and indices and their weighted averages of AHP

Dimensions	Urban services and infrastructure	environmental	Social and cultural	Economic	Total
Score	65.13	69.77	45.01	49.77	57.42

Table 8: Evaluation of urban livability by scoring its dimensions in the district 22 of Tehran

	Importance	index	Importance	Weighted average
environmental	0.110	air pollution	0.115	3.73
		Noise	0.145	2.53
		Drinking water quality	0.287	3.35
		The quality of garbage collection	0.230	3.51
		Wastewater collection quality	0.185	3.27
		Quantity and quality of green space	0.328	3.88
Urban services and infrastructure	0.296	Access and quality of public transportation	0.305	2.08
		Quality of sidewalks	0.123	4.11
		Access to city facilities	0.206	5
		Access to medical centers	0.130	1.91
		Access to educational centers	0.159	2.91
		User diversity	0.398	1.96
Social-cultural	0.230	The amount of belonging to the place	0.220	2.14
		Citizen participation rate	0.231	2.76
		Crime rate	0.255	2.47
		Security of public environments	0.350	3.76
Economic	0.214	Food and energy consumption	0.264	3.17
		The quantity and quality of housing	0.258	3.61
		The amount of employment and income	0.371	2.01

average of 3.61 and a significance level of 0.000 and a positive lower and upper limit (positive confidence interval) has a better situation than other indicators. Therefore, this index is at an acceptable level and above average. The indicators of employment and income, with a weighted average of 2.01 are at a low level. It is unacceptable that it has the worst situation among other indicators.

3.1. Determining the importance coefficient of the dimensions of the indicators

In this part, first, we have extracted the binary comparison of the indicators for each criterion

from the questionnaire completed by the experts. Then their weight is calculated with the Expert choice software and provided in table 7. According to the objective of assessing urban livability, the compatibility amount is 0.05, which indicates very suitable compatibility in binary comparisons. Also the weighted average extracted from the T. test is also given in the table.

According to Table 7, the dimension of urban infrastructure with an importance coefficient of 0.269 is the most influential factor in livability centered on environmental sustainability, and social, cultural, economic and environmental dimensions are in the next ranks of urban

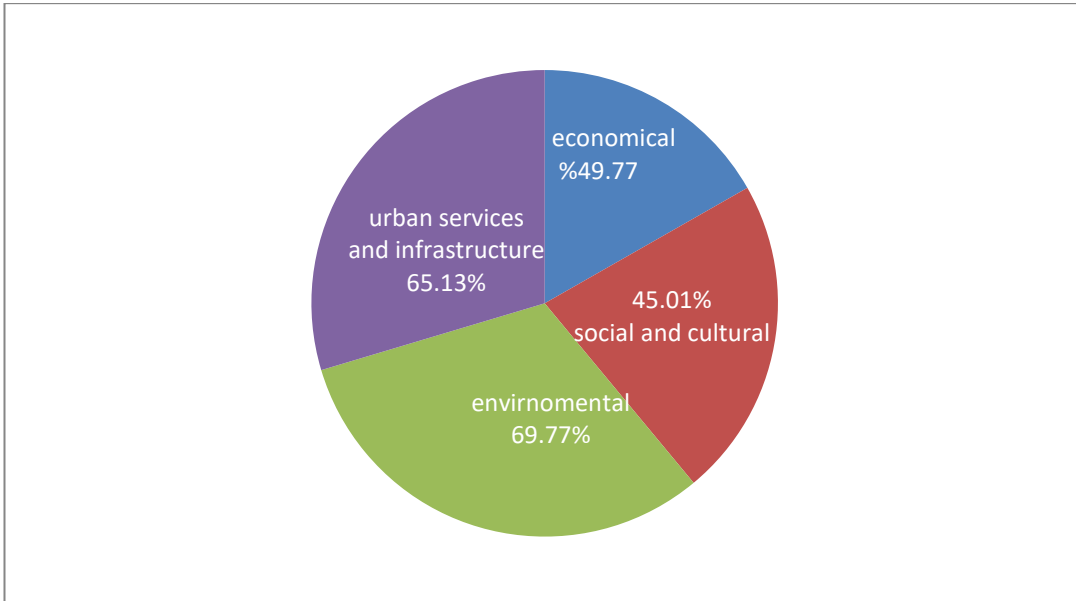


Diagram1: influence degree of each of the dimensions in the realization of urban livability in the district 22 of Tehran

livability in the district 22 of Tehran.

According to Table 8, the environmental dimension is the best with 69.77%, and the social and cultural dimension is the worst with 45.01%, among the dimensions of urban livability in the district 22 of Tehran, and it is clear from this table that the level of urban livability in the 22nd district of Tehran is 57.42%, which is close to the average level.

Since, based on the perspective of sustainable development, livability is evaluated through 4 economic, social, cultural, and environmental dimensions of the Minister of Construction and Urban Services. Therefore, to check livability, it is first necessary to prepare components that can be considered economic, social, cultural, environmental, and the Minister of Construction and Urban Services. In this work, by summing up the components of the researched items, we form a particular index, the ability of the livability level in each of the dimensions of the measured contract. For this purpose, the T. test was used. As was said before, due to the number 3 being placed in the critical value of the numerical value, the value of numerical value of 3 or higher numbers is considered favorable for livability. The results

of Tables 3, 4, 5, and 6, which were used from the sample T-test, show that the average obtained for each of the components in the social and cultural dimensions (security of public environments, crime rate, citizen participation rate) is below level 3, as well as the infrastructure and urban services dimensions (access to medical centers, public transportation, and educational centers) (at least 3) is self-assigned, so the components are weak in the viability of the district 22 of Tehran.

Similarly, according to the results of Table 6, in the binary comparison of indicators by experts, the dimensions of infrastructure and urban services are the essential factors in the urban livability of the 22nd district of Tehran, and social and cultural, economic and environmental are in the following ranks of the livability of the district 22 of Tehran. As in the results of the analysis of each of the social and cultural dimensions, economic infrastructure, and urban and environmental services In table 8, it was found that the livability of the environment is more than other indicators, and socially and culturally, the least livability is in the district 22 of Tehran. Secondly, the overall urban livability in the district 22 of Tehran is close to the average level.

4. Result and Conclusion

Today, urban livability is a wide range of necessities for people living in a community, such as diverse housing options, economic development, built environment with mixed-use, access to a wide range of services and facilities, access to green space, human-centered transportation, helps the quality of life of the community, reaching It facilitates sustainable development. In this regard, the present study has been conducted to analyze the dimensions and indicators of urban livability in the district 22 of Tehran. The study results show that among the environmental, infrastructure and urban services, social, cultural and economic dimensions, the environmental dimension is the best with 69.77% and the socio-cultural dimension with 45.01%. The worst situation among the dimensions of urban livability is in the district 22 of Tehran. It is clear from this table that the urban livability rate in the district 22 of Tehran is 57.42%, which is close to the average level. Finally, suggestions and solutions can be presented according to the priority of improving the social and cultural, economic, infrastructure, and urban and environmental services as follows for the implementation of urban livability.

- Increasing and controlling sufficient surveillance in the streets and paying attention to the lighting of the passageways and alleys in the area to feel more secure.
- Increasing social interaction and social connection between the residents of the region
- Using policies that provide opportunities for participation and citizens in the programs and strengthening the potential of young people and experts to participate in the preparation of regional programs.
- Encouraging investors in the private and public sectors for job creation and proper organization of shopping centers
- Organization and transfer of incongruent jobs in the region
- Distribution of medical and health services at the regional level
- Increasing the required levels of public transportation and strengthening it
- Development of transport axis around metro

and bus stations to reduce noise pollution in the region

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