Original Research Article

Application of Numerical Taxonomy and Cluster Analysis in Ranking the Development Level of Tehran Districts Based on Cultural Tourism*

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Abstract | Today, the concept of cultural tourism has drawn upon the factor of culture to facilitate development. The most important prerequisite to stress culture and culture-based industries necessitates a solid background. Tehran, as the capital of Iranian civilization, has this advantage which can help the cultural tourism industry to contribute to urban development. However, the concept of cultural tourism is neglected in urban development plans. Therefore, the questions that arise include: a) what are the indicators of cultural tourism for the development of Tehran? b) How is the development in the 22 districts of Tehran ranked based on cultural tourism? This research is descriptive-analytical nature using a mixed approach to explain the framework of cultural tourism's effectiveness on the development of Iranian cities. To this end, ranking the development status of the 22 districts of Tehran was carried out based on a road map to benefit from the hidden cultural treasures of Tehran by attaching cultural tourism to urban development plans. This study employed documentary, and field study methods as data collection methods while content analysis, swing weighting, taxonomy-numerical, and cluster analysis were used as analytical methods. The results show that the 12th district of Tehran, with the most recorded places, and historical sites, Oud Lajan Bazaar, and Tehran Bazaar, have been given a higher priority compared to the rest districts of Tehran. Districts 6 and 1 of Tehran have had a better rank compared to other districts because of hotels and exhibitions of painting, photography, and sculpture and they have been ranked second and third respectively.

Keywords | Cultural tourism, Taxonomy-numerical, Cluster analysis, Development, Tehran.

Introduction | The development and transformation which have been based solely on the economy of cities for several decades are now becoming culture-based meaning that culture as a productive factor contributes to profitability and income (Liang & Wang, 2020; Loi, Tran, Tran, Nguyen & Hoang, 2019; Ochoa & Ramirez, 2018; He, 2018). This will occur by giving importance to culture and culture-based industries in cities, using them as capital for the development of urban society and as the core of the identity of the department. Cultural tourism has been fruitful in the growth and development of many cities from a cultural perspective. This is despite the fact that the most important prerequisite for stressing culture and the use of the industries resulting from it, including cultural tourism, for urban development, is the existence of a solid and appropriate background. Iran, as one of the few surviving civilizations from the past ages, has many historical, cultural, and artistic achievements that can be used as a potential for the growth

and development of cities. The city of Tehran, the capital of Iran's ancient civilization, is not an exception to this rule and can make urban development by taking advantage of cultural tourism. It is worth mentioning that the districts of Tehran city do not have similar and equal conditions in terms of cultural indicators, and neglecting this issue can lead to the replacement of the cultural tourism industry in the development of Tehran city with another unsuitable factor and urban development will not be possible. This study attempts to answer two questions: what components and indicators of cultural tourism contribute to the development of Tehran? And then, based on the statistics, how is the development of the 22 districts of Tehran ranked based on the framework of cultural tourism? Therefore, the purpose of the research is to develop the framework of the cultural tourism industry in the city of Tehran and finally to evaluate it in the 22 districts of the city of Tehran to determine the extent of development of the districts so that based on the results, a cultural tourism map can be drawn in the city of Tehran.

Research Background

An article entitled "Cultural Tourism: A Review of Recent Research and Trends" by Richards (2018) examined the definitions of cultural tourism and presented it as the main element of international tourism accounting for more than 39% of development. In an article entitled "Investigating the Market Structure of Cultural Tourism Using Cloud Data" Xu (2020), acknowledged that cultural tourism originates from communication channels. In this way, the construction of the new Silk Road, based on the name of the old Silk Road, can play a decisive role in attracting cultural tourists and developing Shenyang by changing the construction situation around the mentioned road. In an article titled "The Contribution of the Venetian Monuments of Rhodes to the Cultural Tourism and Local Development of the Island," Manola (2022) investigated the contribution of Italian historical monuments to the development of the island of Rhodes. He explained how the development of tourism was associated with the customs contributing to culture local sustainability and rich cultural, historical, and natural resources. Stosia et al. (2022), in a research paper titled "Sustainable Cultural Tourism Development Perspective", listed cultural tourism based on architectural monuments, festivals, and cultural and educational institutions and suggested ways to improve the situation, encourage investment in cultural tourism and sustainability enhancement. Zhang (2022) argues that cultural tourism results from the development of the evolving creative economy, in an article entitled "Analysis of the Overall Development Method of Cultural Tourism in the Environment of the Creative Economy". Examining the evolution of creative and cultural tourism, he proves

that development based on cultural tourism with a score of 4.⁴ out of 9.⁴ is superior to other developments. In another essay entitled "Heritage Resources as a Stimulus for the Development of Cultural Tourism in Ethiopia: a review study", Tadesse (2023) stated that cultural tourism is a function of tangible and intangible cultural assets, including natural heritage, world heritage, ethnic diversity, etc. By emphasizing them, development can be made based on sustainable cultural tourism. Based on this, it can be said that many studies have been conducted on cultural tourism; some of these studies have presented examples of cultural tourism; others have evaluated the effects of cultural tourism on the development of cities, and have compared the development in some cities. The originality of this research is to develop a cultural tourism map of Tehran using two methods of numerical taxonomy and cluster analysis in ranking the development of Tehran's districts, which has not been studied in any research so far.

Theoretical Framework
• Concepts associated with the tourism industry and cultural tourism

The expansion of tourism has led to a significant increase in the scale and importance of cultural production and consumption. It has also made culture to be the subject of travel for an increasing number of people around the world, and destinations have been introduced through their cultural assets to stand out and attract the attention of tourists. This combination of culture and tourism, recently known as cultural tourism, has become a global social practice (Richards, 2021, 1). The concept of cultural tourism has evolved and has been discussed from different angles (Chen & Huang, 2018). The reason for this is the complexity of the concept of culture, whose meaning is evolutionary and associated with rapid growth (Richards, 2021; Richards, 2018; Niemczyk, 2013; Zadel & Bogdan, 2013), which explains why there is no single definition (Vong, 2016). From Pratt's point of view, cultural tourism is expressed through the protection, maintenance, and renovation of cultural heritage (Pratt, 2002, 33). Hausmann refers to cultural tourism as the visit of people motivated by the cultural values (aesthetic, historical, etc.) of a specific destination (Hausmann, 2007). The United Nations World Tourism Organization considers cultural tourism a form of tourism activity in which the tourist has the motivation to learn, discover, experience, and consume cultural attractions, which are distinctive material, spiritual, and emotional features of society, including art and architecture, historical and cultural heritage, and cuisine. Literature, music, and living cultures are born with lifestyles, value systems, beliefs, and traditions (World Tourism Organization, 2023). Kasemsarn refers to cultural tourism as the movement of people with basically cultural

motives, such as performing art tours, festivals, and other cultural events, and visiting historical places and monuments (Kasemsarn, Harrison & Nickpour, 2023, 1411). Based on what has been discussed, cultural tourism means the behavioral process of perception, understanding the specific content of human culture through tourism, and it refers to appreciating foreign traditional culture, tracking cultural celebrities, or participating in local cultural activities. In fact, cultural tourism refers to an activity that people do to meet their basic cultural needs, including performing arts, festivals, cultural heritage, getting to know folk customs, local food, etc. In other words, cultural tourism in a broad sense generally refers to all activities of people to meet diverse needs, improve cultural achievements, and increase their knowledge, experience, and wealth (Wang, Chen & Zhao, 2023,165; Kasemsarn, Harrison & Nickpour, 2023; Richards, 2021).

• **Factors affecting cultural tourism**

In general, many factors play a role in the cultural tourism industry, and the interaction and communication between them make cultural tourism possible. Among these factors, shown in Fig. 1, we can mention communication, branding, cultural and natural heritage, and visual arts (Xu, 2020; Unesco, 2021; Manola, 2022). Concerning the indicators of the primary model (Fig. 1), Zhou believes that cultural tourism, firstly, is a function of the annual volume of tourists that enter the cities, and secondly, it depends on indicators such as the number and quality of commercial centers, serving as platforms for creating economic relations and the number and quality of hotels used to accommodate tourists (Zhou, Yang & Kim, 2020, 4). In addition, from UNESCO's point of view, the quality of annual celebrations and festivals through which cultural activities and connections are promoted can be included in this category (OECD, 2021, 22;

Unesco, 2021, 9). Regarding the branding component. Veris considers urban advertisement a vital element of cultural tourism and acknowledges that if cultural marketing is done appropriately through urban billboards, access to the Internet, and the introduction of cultural attractions (both food and clothing, etc.), it can contribute to the development of cities based on cultural tourism (Vries, 2020, 28). In this regard, we can refer to the areas where fashion, supply, and display of local clothing are promoted. Concerning the cultural and natural heritage component, UNESCO acknowledges that the number and quality of museums, the number of historical and registered places, and historical sites as cultural heritage and attractions such as mountains, the sea, etc. as natural heritage can be influential (UNESCO, 2021, 9). Finally, the fourth dimension of the primary model of cultural tourism is based on the visual arts, including exhibitions, photography centers, sculptures, and markets for the supply of cultural products that can lead to the development of cities (OECD, 2021, 22; Maddah, 2021, 8; Unesco, 2021, 9).

• **Concepts associated with urban development**

The concept of urban development was initially focused on economic growth based on income and gross per capita, but factors such as attention to basic needs made the concept of development and consequently, urban development evolve. In the next decade, with the reform of the market and human-centered development, people's well-being was emphasized in the development of the city. Then, the approach of empowerment, environmental protection, poverty eradication, etc. was proposed. In the case of urban development, the emphasis on the economic dimension was replaced by the emphasis on all dimensions, including political, economic, social, technical, environmental, legal, and physical, as they were agreed upon by prominent foreign theorists and domestic experts (Hojjati, Zabihi & Zarabadi, 2022, 50).

• **Identifying the components and indicators of cultural tourism affecting the development of cities**

As the major concern of this study was ranking the development levels of the districts of Tehran in the framework of cultural tourism, we need to select the components and indicators of cultural tourism which can be assessed. For this reason, after extracting those components and indicators from the theoretical foundations (Fig. 1), we have them evaluated by experts through questionnaires. The components and indicators pertinent to the context of Iran were selected. Based on the consensus of experts in Iran and Tehran, they could lend themselves to measurement. while confirming the dimensions, components, and indicators of cultural industries and urban development, other dimensions and components that could affect the development of cities were also identified, including the location of the communication route, such as the existence

Fig. 1. Factors affecting the cultural tourism-primary model. Source: Authors.

of a railway station, airport, subway, etc. in the district, as well as the index of the number of urban startups. Based on what has been discussed, the components and indicators of the cultural tourism industry that can affect urban development in Iranian cities are described in Table 1.

Methodology

The research is descriptive-analytical using a mixed approach to rank the development status of the 22 districts of Tehran based on cultural tourism indicators. It also attempts to draw a cultural tourism map of Tehran. In this regard, the indicators of cultural tourism were calculated using documentary and content analysis methods. Then, using the experts' opinions, the calculated indicators were checked in terms of content validity. The experts in this research were 40 participants with specialized doctorates in urban planning and cultural management. In the next step, using the fluctuating weighting method, each of the cultural tourism indicators effective on urban development was given a score (0 = no impact, 10 = the most impact). Those important indices which were reported by the experts but were not in the documentary sources were included in the conceptual framework of cultural tourism. Then, using the residents' questionnaire, 385 samples based on Morgan's table and Cochran's formula were selected. the GIS map of Tehran, the development and construction plan of Tehran, and the detailed plans of 22 districts, the status of indicators in the 22 districts of Tehran, were evaluated. Finally, the data was entered into SPSS software and prioritized and clustered by the method of numerical taxonomy and cluster analysis of the districts of Tehran city in terms of development. It should be mentioned that, firstly, for the reliability of the data in the residents' questionnaire, Cronbach's alpha was used, and since Cronbach's alpha was above 0.7 in the cultural tourism industry, it can be said that the questionnaire has the necessary reliability or consistency. In the next step, all the indicators that were examined qualitatively were also converted quantitatively on a rating method to make it possible to use the numerical and cluster taxonomy methods. Then, to check the status of each index, the quantitative and qualitative points of the mentioned index were multiplied together to create a single status for each index. The reason for using two multi-criteria analysis methods is that in the cluster analysis method, homogeneous clusters are introduced. However, the priority of the clusters is not determined in this method. Therefore, the cluster analysis method in combination with the numerical taxonomy method determines the priority of the clusters in addition to the clustering of the 22 districts of Tehran.

Research Findings and Discussion
• Weighting the indicators
Determining the weight of cultural tourism indicators is described in Table 2. To determine the weight of the

Table 1. The components and indicators of the cultural tourism industry affecting the development of Iran cities. Source: Authors.

Aspect	Component	Indicator	Source
Cultural tourism industry	Communication	Being on the communication path	Interview with experts
		The number and quality of hotels	(Zhou,Yang & Kim, 2020, 4)
		The number and quality of business centers	(Zhou,Yang & Kim, 2020, 4)
		Percentage of annual tourism	(Zhou,Yang & Kim, 2020, 6)
	Branding	The number and quality of annual celebrations and festivals	(OECD, 2021, 22; Unesco, 2021, 9)
		Advertising	(Vries, 2020, 28)
		The number of startups	Interview with experts
		Food and edibles	(Maddah, 2021, 8)
		Fashion	(Maddah, 2021, 8)
	Cultural and natural heritage	The number and quality of museums	(Unesco, 2021, 9)
		Number of historical and registered heritage sites	(Maddah, 2021, 8; Unesco, 2021, 9)
		Historical sites	(Unesco, 2021, 9; Lei, 2021, 11)
		Natural heritage	(Unesco, 2021, 9; Lei, 2021, 11)
	Visual arts	The number and quality of painting exhibitions	(OECD, 2021, 23)
		The number and quality of photography centers	(Maddah, 2021, 8; Unesco, 2021, 9)
		The number and quality of sculpture centers	(Maddah, 2021, 8)
		The number and quality of the annual handicraft market	(OECD, 2021, 22; Maddah, 2021, 8; Unesco, 2021, 9)

Table 2. The weight of cultural tourism indicators affecting the development of cities in Iran. Source: Authors.

Weight		Indicator		Weight	Component	
0.0584	C1	Subway	Located in the communication path			
	C2	Railway-Airport and ...				
0.0679	C3	The number and quality of hotels		0.2542	Communication	
0.0633	C4	The number and quality of business centers				
0.0646	-	Percentage of annual tourism				
0.0688	C5	The number and quality of annual celebrations and festivals				
0.0735	C6	Advertisement				
0.0334	C7	The number of startups		0.2580	Branding	Cultural tourism industry
0.0250	C8	Food and edibles				
0.0573	C9	Fashion				
0.0671	C10	The number and quality of museums				
0.0697	C11	Number of historical and registered heritage sites		0.2777	Cultural tourism industry	
0.0701	C12	Historical sites				
0.0708	C13	Natural Heritage				
0.0540	C14	The number and quality of painting exhibitions				
0.0480	C15	The number and quality of photography centers		0.2102	Virtual arts	
0.0473	C16	The number and quality of sculpture centers				
0.0609	C17	The number and quality of the annual handicraft market				
1	-	-		1	-	Total

components, the sum of the weights of the indicators in each component was added to form the weight of the corresponding component. The advertising index has the highest score in the total of cultural tourism indicators.

• **Evaluation of cultural tourism indicators in Tehran districts**

In this section, the indicators were selected to contextualize the concept of cultural tourism, they could examine the status of the indicators from the perspective of urban planning. It should be mentioned that the descriptive status of all 17 indicators was verified by field methods, including observation and matching with the GIS of Tehran city in 2022. Since the annual tourism index did not create a distinction in the district from the point of view of cultural tourism, with the approval of experts, a score of 1 was considered for all districts of Tehran, and the mentioned index was removed from the calculations. It should be noted that after checking the quantitative status, its qualitative status was obtained for each index using the residents' questionnaire and multiplied by the quantitative score using the previously mentioned rating method to calculate the consolidated score (Table 3). Based on the previous discussion, the distribution map of cultural tourism indicators in Tehran was determined as described in Fig. 2.

• **Using a numerical taxonomy method to rank the development of the districts in Tehran city**

Numerical taxonomy is one of the most widely used methods

which compares the extent to which districts are based on the desired services. This method divides the studied units into homogeneous subsets based on the desired indicators to determine the ideal points for each class (Kalantari, 2016, 69). Accordingly, to rank the 22 districts of Tehran using cultural tourism indicators, the numerical taxonomy method was used to identify and prioritize homogeneous districts.

- **Forming the initial decision matrix**

To analyze the numerical taxonomy, at the beginning of the task, the status of all 17 cultural tourism indicators affecting urban development in a balanced way in 22 districts of Tehran, was entered into SPSS software, and the initial decision matrix was formed. In the mentioned matrix, the first column shows the 22 districts of Tehran, and the other columns show the status of cultural tourism indicators.

- **Calculating the distance of each district from other districts and determining homogeneous districts**

To calculate the distance of each district from other districts, the scale difference was first addressed with the Z-Score method, so that cultural tourism indicators could be normalized. Then the proximity matrix (Table 4) was formed. This matrix specifies the distance of each district of Tehran city to another one based on each of the cultural tourism indicators. Then, the upper limit and the lower limit were calculated in the proximity matrix, the shortest distance between the districts was calculated, and the districts whose shortest distance from others were not in the upper limit or

Table 3. Distribution of cultural tourism indicators in 22 districts of Tehran. Source: Authors.

| C17	C16	C15	C14	C13	C12	C11	C10	C9	C8	C7	C6	C5	C4	C3	C2	C1	Districts
5.88	46.7	36.4	306.24	5	34	18	88.6	3	0	2	22	9.68	52.36	36.4	0	6	1
3.09	16.44	17	77.4	6	11	2	8.16	1	8.7	3	20	9.46	80.1	21.4	0	11	2
8.66	55.38	21.24	249.76	5	0	6	25.68	2	13.23	4	23	17.8	61.35	49.68	0	6	3
0	9.24	8.62	58.5	6	7	4	16.44	0	2.98	1	17	0	25.84	12.12	0	9	4
0	0	0	2.19	3	0	1	0	0	0	3	21	0	47.32	0	0	7	5
15.52	129.34	79.99	489.72	2	63	17	17.48	2	0	2	12	7.28	54.6	186.81	0	12	6
2.83	9.48	11.43	89.93	1	15	10	20.45	1	3.24	3	10	4.76	53.34	12.96	0	13	7
0	0	8.4	6.5	3	0	1	3.14	0	0	0	5	0	59.04	4.1	0	7	8
0	0	3.16	3.43	2	8	1	3.02	0	0	0	7	0	11.88	0	1	3	9
0	0	0	2.19	2	1	5	5.72	0	0	0	3	0	8.56	0	0	6	10
0	5.94	21.5	27.68	3	8	28	12.5	2	0	1	3	3.83	152.32	17.85	0	15	11
23.05	0	3.52	13.24	1	66	157	55.8	3	8.2	0	1	0	158.07	21.71	0	16	12
0	0	2.57	0	1	5	18	4.22	0	0	0	11	0	7.32	0	0	4	13
0	0	0	0	2	9	3	0	0	0	0	6	0	12.21	0	0	6	14
0	0	2.86	0	5	4	2	3.27	0	0	0	10	0	9.3	4.66	0	2	15
0	0	0	2.25	1	7	3	0	0	0	0	3	0	10.86	0	1	4	16
0	0	0	0	4	3	0	0	0	0	0	4	0	20.9	0	0	2	17
0	0	0	0	1	4	0	0	0	0	0	23	0	9.4	1.64	0	1	18
0	0	0	0	6	3	1	0	0	0	0	7	0	11.28	0	0	6	19
0	0	0	0	4	16	0	3.22	0	0	0	8	0	5.37	1.58	0	3	20
0	0	0	0	5	0	0	3.69	0	0	0	27	0	8.24	0	0	0	21
0	0	0	0	6	0	0	0	0	0	0	31	0	13.8	7.71	0	4	22
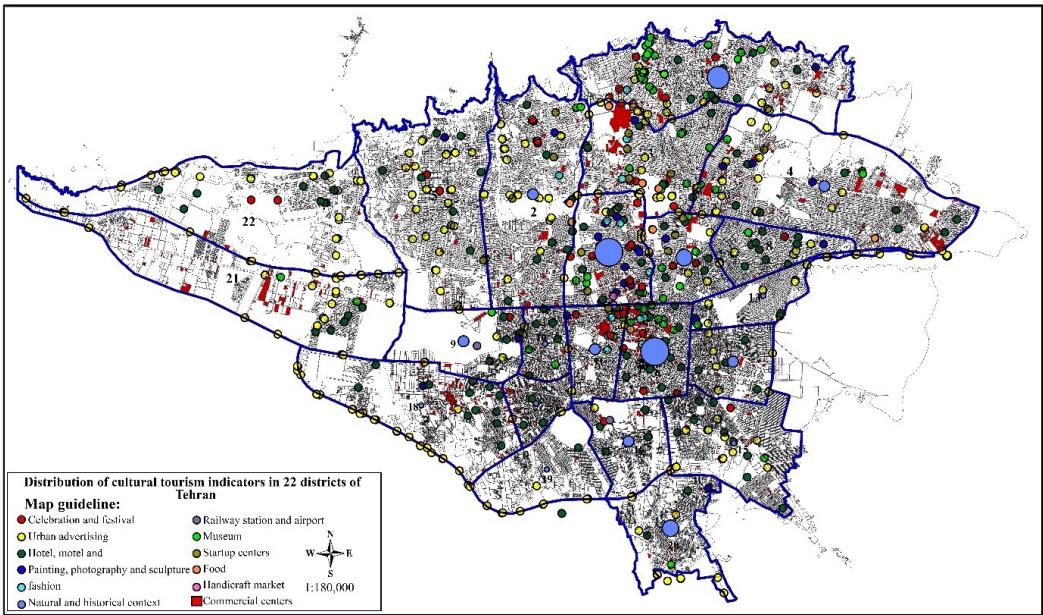
Fig. 2. Distribution of cultural tourism indicators in 22 districts of Tehran. Source: Authors.

the lower limit were removed. According to Table 6, the 12th district of Tehran city was not in the upper and lower limits, and it was removed from the relevant table and calculations. Since in this research, only the district 1 was removed, there was no need for re-examination, and the 12th district was placed separately in one homogeneous group.

- **Calculating the composite distance of each district of Tehran from the ideal district**

To check the composite distance of each district from the ideal district, first, the ideal matrix was formed, and then the composite distance of each district of Tehran city from the ideal district was calculated. The terms of an ideal matrix are the ideal value or the largest number in the Hurston-standardized matrix (any index). The lower the value of the compound distance of each district from the ideal district, the more developed it is, and the higher this value is, the less developed the desired district is in the relevant indicators. Accordingly, all the normalized levels were reduced from the ideal value and reached the power of 2. Finally, concerning cultural tourism, the CIO and the level of development were

Table 4. The proximity matrix and the distance of each district from another. Source: Authors.

Districts	Euclidean distance																						Shortest
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
1	0.0	33.6	32.9	37.8	48.9	52.2	33.0	51.1	52.8	55.0	41.2	74.8	53.5	54.5	50.3	69.8	54.6	55.4	64.5	50.2	51.3	51.5	32.9
2	33.6	0.0	14.0	12.4	17.1	79.1	12.7	23.9	29.9	30.2	21.3	76.7	31.3	28.7	26.0	45.2	28.5	32.9	35.7	27.1	28.0	24.5	12.4
3	32.9	14.0	0.0	41.4	46.8	70.9	32.5	57.8	61.0	62.5	51.3	96.2	61.6	61.8	57.6	76.8	60.7	61.3	70.5	59.7	57.3	56.2	14.0
4	37.8	12.4	41.4	0.0	7.5	90.5	13.6	7.2	9.7	9.7	21.2	82.7	11.1	9.0	5.6	24.8	8.2	13.3	15.9	6.6	8.1	6.3	5.6
5	48.9	17.1	46.8	7.5	0.0	102.2	10.1	8.7	9.6	10.4	22.4	91.9	9.2	9.2	9.9	23.2	10.7	8.9	22.4	10.0	10.0	10.0	7.5
6	52.2	79.1	70.9	90.5	102.2	0.0	72.7	98.4	102.3	104.5	81.5	108.4	102.7	101.6	106.1	116.0	108.0	108.7	119/6	102.6	115.0	112.9	70.9
7	33.0	12.7	32.5	13.6	10.1	72.7	0.0	13.4	16.2	14.6	12.5	61.0	15.2	14.1	21.6	27.5	20.2	20.9	32.7	18.7	28.2	28.2	10.1
8	51.1	23.9	57.8	7.2	8.7	98.4	13.4	0.0	2.6	2.0	14.4	79.8	3.9	2.0	4.1	14/8	2.6	8.5	15.6	3.7	11.2	12.7	2.0
9	52.8	29.9	61.0	9.7	9.6	102.3	16.2	2.6	0.0	0.9	25.0	86.9	0.8	0.5	2.7	12.1	1.4	3.8	16.6	1.4	8.2	12.0	0.5
10	55.0	30.2	62.5	9.7	10.4	104.5	14.6	2.0	0.9	0.0	22.4	84.3	1.5	0.4	4.0	12.2	2.1	6.6	16.3	2.6	11.5	14.6	0.4
11	41.2	21.3	51.3	21.2	22.4	81.5	12.5	14.4	25.0	22.4	0.0	53.5	25.4	22.1	27.8	36.6	25.4	34.2	36.3	26.7	38.0	36.0	12.5
12	74.8	76.7	96.2	82.7	91.9	108.4	61.0	79.8	86.9	84.3	53.5	0.0	83.1	83.1	94.3	97.2	91.6	97.8	104.3	88.1	107.0	106/6	53.5
13	53.5	31.3	61.6	11.1	9.2	102.7	15.2	3.9	0.8	1.5	25.4	83.1	0.0	1.1	4.9	12.6	3.8	2.6	19.3	3.3	8.9	12.5	0.8
14	54.5	28.7	61.8	9.0	9.2	101.6	14.1	2.0	0.5	0.4	22.1	83.1	1.1	0.0	3.7	12.2	2.1	5.2	16.1	1.8	10.1	12.8	0.4
15	50.3	26.0	57.6	5.6	9.9	106.1	21.6	4.1	2.7	4.0	27.8	94.3	4.9	3.7	0.0	16.9	0.9	6.7	12.8	0.8	3/9	6.1	0.8
16	69.8	45.2	76.8	24.8	23.2	116.0	27.5	14.8	12.1	12.2	36.6	97.2	12.6	12.2	16.9	0.0	14.4	17.0	7.4	14.7	24.2	28.5	7.4
17	54.6	28.5	60.7	8.2	10.7	108.0	20.2	2.6	1.4	2.1	25.4	91.6	3.8	2.1	0.9	14.4	0.0	7.1	13.6	0.9	7.2	10.5	0.9
18	55.4	32.9	61.3	13.3	8.9	108.7	20.9	8.5	3.8	6.6	34.2	97.8	2.6	5.2	6.7	17.0	7.1	0.0	23.0	6.0	4.8	8.3	2.6
19	64.5	35.7	70.5	15.9	22.4	119.6	32.7	15.6	16.6	16.3	36.3	104.3	19.3	16.1	12.8	7.4	13.6	23.0	0.0	13.7	18.7	19.0	7.4
20	50.2	27.1	59.7	6.6	10.0	102.6	18.7	3.7	1.4	2.6	26.7	88.1	3.3	1.8	0.8	14.7	0.9	6.0	13.7	0.0	6.0	8.6	0.8
21	51.3	28.0	57.3	8.1	10.0	115.0	28.2	11.2	8.2	11.5	38.0	107.0	8.9	10.1	3.9	24.2	7.2	4.8	18.7	6.0	0.0	1.4	1.4
22	51.5	24.5	56.2	6.3	10.0	112.9	28.2	12.7	12.0	14.6	36.0	106.6	12.5	12.8	6.1	28.5	10.5	8.3	19.0	8.6	1.4	0.0	1.4
d												11.191											
sd												18.313											
D+					$D+= \bar{d} + 2sd$														47.851				
D-					$D−= \bar{d} − 2sd$														-25.435				

calculated to determine the ranking of district ions from the point of view of cultural tourism indicators. Table 5 shows the compound distance of each district from the ideal district. In the Cio column, the ideal value in each index is subtracted from the values in the standard matrix and reaches the power of 2. In the next step, the sum of the squares of the mentioned indicators in each of the dimensions of cultural tourism is calculated, and finally, the square root is taken from it. It should be noted that in the calculations related to cultural tourism, district 12, which was excluded due to heterogeneity, was not included in the calculations. To calculate Dl, each of the calculated Cio is divided by the mean plus 2 times the standard deviation of Cio.

- **Calculating the level of development and ranking of the 22 districts of Tehran**

In Table 6, districts with a lower value of development level were ranked higher in terms of development. It should be noted that the 12th district of Tehran was removed due to heterogeneity, by referring to the state of the district in terms of the status of the mentioned indicators, the removed district was determined. In the cultural tourism industry, district 12, which was identified as a heterogeneous district compared with other districts and a separate homogeneous district, will be ranked higher than other districts according to the points it has obtained based on cultural tourism indicators. Based

on what was mentioned, in the cultural tourism industry, district 12 is the priority, followed by the following districts: 6, 1, 3, and 2. meanwhile, the 17th district of Tehran is at the lowest level of development.

• **Clustering Tehran districts based on cultural tourism**

Cluster analysis seeks to rank the districts in Tehran city based on cultural tourism indicators, and the purpose of this analysis is to form discrete clusters of districts with common characteristics. In this way, by finding similarities, it places similar districts in a cluster, and on the other hand, by finding differences among the districts, it differentiates the clusters from each other (Mousavi & Hakmat Nia, 2006, 236). Therefore, after determining the degree of homogeneity and also ranking the 22 districts of Tehran in terms of development based on cultural tourism, it is necessary to cluster the 22 districts of Tehran to draw a map of cultural tourism. In this regard, to cluster and separate districts, the hierarchical cluster analysis method was used. In this section, it is determined in which cluster each of the 22 districts of Tehran is located based on points in the cultural tourism industry or, in other words, which of the 22 districts of Tehran are similar in terms of cultural tourism. This makes them be placed in one cluster. The districts were clustered into 9 levels which can be described as Good (level 1, level 2,

Table 5. Composite distance of each district from the ideal one. Source: Authors.

						Cultural tourism indicators													**Cio**	**Dl**
	c1	c2	c3	c4	c5	c6	c7	c8	c9	C10	C11	c12	c13	c14	c15	c16	c17		
1	5.01	11.55	14.04	5.84	2.99	1.01	2.30	13.26	0.00	0.00	17.57	2.95	0.28	2.12	5.62	7.52	8.36	10.02	0.532
2	1.25	11.55	16.98	3.17	3.15	1.51	0.57	1.55	3.64	14.16	21.85	8.70	0.00	10.68	11.73	14.03	11.29	11.65	0.619
3	5.01	11.55	11.67	4.89	0.00	0.80	0.00	0.00	0.91	8.66	20.74	12.53	0.28	3.62	10.20	6.02	5.87	10.14	0.538
4	2.45	11.55	18.94	9.13	14.35	2.45	5.17	7.96	8.19	11.39	21.29	10.02	0.00	11.68	15.06	15.87	15.06	13.44	0.714
5	4.05	11.55	21.66	6.41	14.35	1.25	0.57	13.26	8.19	17.18	22.13	12.53	2.52	14.93	18.91	18.41	15.06	14.25	0.756
6	0.80	11.55	0.00	5.59	5.01	4.51	2.30	13.26	0.91	11.07	17.83	0.03	4.47	0.00	0.00	0.00	1.61	8.89	0.472
7	0.45	11.55	18.76	5.73	7.70	5.51	0.57	7.56	3.64	10.16	19.65	7.48	6.99	10.04	13.89	15.81	11.59	12.53	0.666
8	4.05	11.55	20.72	5.12	14.35	8.44	9.18	13.26	8.19	15.98	22.13	12.53	2.52	14.67	15.15	18.41	15.06	14.54	0.772
9	8.46	11.55	21.66	11.16	14.35	7.19	9.18	13.26	8.19	16.03	22.13	9.68	4.47	14.86	17.45	18.41	15.06	14.94	0.793
10	5.01	11.55	21.66	11.67	14.35	9.79	9.18	13.26	8.19	15.03	21.01	12.16	4.47	14.93	18.91	18.41	15.06	14.99	0.796
11	0.05	11.55	17.72	0.02	8/84	9.79	5.17	13.26	0.91	12.67	15.14	9.68	2.52	13.41	10.11	16.76	15.06	12.75	0.677
12	0.00	11.55	16.91	0.00	14.35	11.24	9.18	1.92	0.00	2.35	0.00	0.00	6.99	14.27	17.29	18.41	0.00	11.16	0.00
13	7.21	11.55	21.66	11.87	14.35	5.00	9.18	13.26	8.19	15.58	17.57	10.71	6.99	15.07	17.72	18.41	15.06	14.81	0.787
14	5.01	11.55	21.66	11.11	14.35	7.81	9.18	13.26	8.19	17.18	21.57	9.35	4.47	15.07	18.91	18.41	15.06	14.90	0.791
15	9.81	11.55	20.59	11.56	14.35	5.51	9.18	13.26	8.19	15.93	21.85	11.06	0.28	15.07	17/59	18.41	15.06	14.81	0.786
16	7.21	0.00	21.66	11.32	14.35	9.79	9.18	13.26	8.19	17.18	21.57	10.02	6.99	14.93	18.91	18.41	15.06	14.77	0.784
17	9.81	11.55	21.66	9.83	14.35	9.10	9.18	13.26	8.19	17.18	22.42	11.42	1.12	15.07	18.91	18.41	15.06	15.05	0.799
18	11.26	11.55	21.28	11.54	14.35	0.80	9.18	13.26	8.19	17.18	22.42	11.06	6.99	15.07	18.91	18.41	15.06	15.05	0.799
19	5.01	0.00	21.66	11.25	14.35	7.19	9.18	13.26	8.19	17.18	22.13	11.42	0.00	15.07	18.91	18.41	15.06	14/43	0.766
20	8.46	11.55	21.29	12.18	14.35	6.61	9.18	13.26	8.19	15.95	22.42	7.19	1.12	15.07	18.91	18.41	15.06	14.81	0.786
21	12.82	11.55	21.66	11.72	14.35	0.20	9.18	13.26	8.19	15.78	22.42	12.53	0.28	15.07	18.91	18.41	15.06	14.88	0.79
22	7.21	11.55	19.91	10.87	14.35	0.00	9.18	13.26	8.19	17.18	22.42	12.53	0.00	15.07	18.91	18.41	15.06	14.63	0.777
										میانگینCio								13.01	
										Sdio								1.91	
Co										Cio+2Sdio= 18/832									

Table 6. Calculation of the level of development and ranking of the 22 districts of Tehran. Source: Authors.

DL	Districts of Tehran	Rank
-	12	1
0.472	6	2
0.532	1	3
0.538	3	4
0.619	2	5
0.666	7	6
0.677	11	7
0.714	4	8
0.756	5	9
0.766	19	10
0.772	8	11
0.777	22	12
0.784	16	13
0.786	20	14
0.786	15	15
0.787	13	16
0.790	21	17
0.791	14	18
0.793	9	19
0.796	10	20
0.799	18	21
0.799	17	22

level 3), Average (level 1, level 2, level 3), Poor (level 1, level 2, and level 3).

- **Development of a decision matrix and a proximity matrix**

In this section, similar to the numerical taxonomy method (Table 4), the decision matrix and the proximity matrix are formed at the beginning. In this matrix, the distance of each district of Tehran city from another district is calculated based on cultural tourism indicators using the Euclidean distance method. It should be noted that in this method, similar to the numerical taxonomy method, the indicators in each of the dimensions of cultural tourism should be addressed using the Z-Score method.

- **Forming the density matrix**

In this section, the two districts that have the least distance or intra-group variance by using the nearest neighbor method are placed in the same group. Then other districts are added to the cluster based on the smallest distance and form the third cluster. Finally, this process has continued until all 22 districts of Tehran are placed in one category or cluster. The results of the clustering stage and integration coefficient for the 22 districts of Tehran are summarized in Table 7. In this table, according to the similarity of the number of clusters, the clustering steps are done in 21 steps. In the first stage, districts 10 and 14 of Tehran were merged and formed the first cluster. In the second stage, district 9 of Tehran was added to the first cluster, and then in the fourth stage, district 13 of Tehran was added to it. These steps took place until all 22 districts of Tehran were finally placed in one cluster.

- **Clustering of 22 districts of Tehran**

A total of 22 districts of Tehran were placed in 9 clusters based on the indicators in the cultural tourism industry (see Table 8), namely: Good (level 1), Good (level 2),

Table 7. Cluster density composition - cultural tourism industry. Source: Authors.

Clustering Stages	Merging clusters		Integration coefficient	First Clustering		Recurrence
	First Cluster	Second Cluster		First Cluster	Second Cluster	
1	10	14	0.616	0	0	2
2	9	10	0.721	0	1	3
3	9	13	0.913	2	0	7
4	15	20	0.914	0	0	5
5	15	17	0.931	4	0	7
6	21	22	1.168	0	0	10
7	9	15	1.171	3	5	8
8	8	9	1.401	0	7	9
9	8	18	1.615	8	0	10
10	8	21	1.974	9	6	11
11	4	8	2.363	0	10	13
12	16	19	2.728	0	0	15
13	4	5	2.733	11	0	14
14	4	7	3.181	13	0	15
15	4	16	3.484	14	12	16
16	2	4	3.521	0	15	17
17	2	11	3.530	16	0	18
18	2	3	3.744	17	0	19
19	1	2	5.737	0	18	20
20	1	6	7.222	19	0	21
21	1	12	7.312	20	0	0

Good (level 3), Average (level 1), Average (level 2), Average (level 3), Poo (level 1), Poor (level 2), Poor (level 3). It should be noted that the order of clustering below does not determine the priority and ranking of development but only reflects the similarity of the districts clustered. Figure 3 also shows the hierarchical composition of the districts of Tehran.

• **Prioritizing the clusters based on cultural tourism framework**

In this section, to interpret the results, it is necessary to combine the results of the clustering with the results of the numerical taxonomy method so that the priority of the clusters can be determined accurately. As shown in Table 9 and Table 6 regarding the ranking of districts using the numerical taxonomy method, it can be concluded that the 12th district of Tehran city (Cluster No 8) is in the highest level of development based on cultural tourism indicators. It has been classified as Good (level 1). District 6 of Tehran (Cluster No. 6) is in second place, classified as Good (level 2), and the district 1 of Tehran (Cluster No. 1) is in third place, classified as Good (level 3). It should be noted that the sum of the above 3 clusters has determined the level of superiority, and partial clustering has been done in line with the

cultural tourism map of Tehran. Concerning the level of development of the districts classified as average, the fourth rank includes the 3rd district of Tehran (cluster no. 3) with level 1, the fifth rank includes the 2nd district of Tehran (cluster no. 2) with level 2, and finally, the 6th
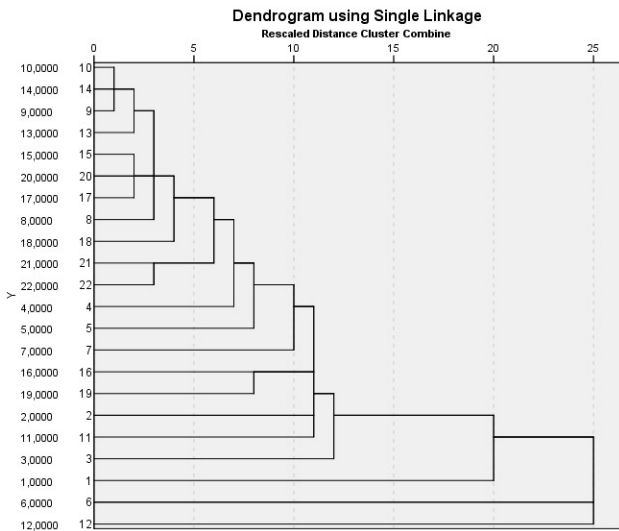

Fig. 3. Schematic diagram of 22 districts in Tehran city - cultural tourism industry. Source: Authors.

rank includes the 7th district of Tehran (cluster no. 6) with level 3. Finally, in the clustering of the development of the districts of Tehran classified as poor, the seventh rank includes the 11th district of Tehran (cluster number 7) with level 1, the eighth rank includes the 16th and 19th districts of Tehran (cluster number 9) with level 2, and the 9th rank includes districts 4, 5, 8, 9, 10, 13, 14, 15, 17, 18, 20, 21, and 22 of Tehran (cluster number 4) with level 3. To better understand Table 8, Figure 4 is drawn. In this figure, the state of development of the 22 districts of Tehran city from the point of view of cultural tourism has been determined. The green color spectrum indicates the development in the superior category, the yellow color spectrum indicates the development in the average category, and the red color spectrum indicates the development in the poor category.

Conclusion

The results indicate that the 12th, 6th, and 1st districts of Tehran are among the best districts. The descriptive state of the urban development of the districts of Tehran in the framework of cultural tourism show that based on the indicators in the cultural tourism industry, including the number of registered historical places of cultural heritage, historical sites, museums, Oud Lajan Handicraft Bazaar, Tehran Bazaar, the 12th district of Tehran is one of the most important business areas in terms of branding. It also indicates this district is superior to other districts of Tehran concerning many indicators Districts 6 and 1 of Tehran fall in second and third place respectively, due to the composite indices of hotels, and platforms for holding exhibitions of paintings, photography, sculpture, etc. Districts 2, 3, and 7 of Tehran fall on the average level while on the weak level, there are districts 11, 16, 19, 4, and the rest. The analytical results derived from the numerical taxonomy method and the cluster analysis

method are completely based on the descriptive table of the urban development status of the districts of Tehran framed by cultural tourism. From another point of view, in the technical and executive systems of urban planning, urban and district development plans are one of the most important tools that are used to develop cities and districts and improve the quality of lives of residents by creating collective platforms, creating job opportunities, branding, and developing transportation axes. This will not be achieved unless all aspects and components of urban development, including political, social, cultural, etc., are developed. In fact, it is impossible to think about the concept of city development while overlooking the cultural concepts which is the fourth pillar of sustainability, and everything that bears culture as a contributing factor to development. Despite this importance, the concept of culture and, consequently, cultural tourism as a driving force for the development of cities in all dimensions of urban development has been neglected in such plans. Therefore, the cultural tourism map based on the analyses carried out in the 22 districts of Tehran can be added as a road map, and cultural attachment to the development and urban plan of Tehran can be used as a driving force in the direction of development by benefiting from the cultural treasure hidden in Tehran. The use of this treasure and its information and findings will lead to the development, growth, and improvement of the city since it relies on internal capacities, which are the appropriate culture of the society. The concern is that if this internal and capable capacity is not used, there will be other alternatives which, firstly, are not compatible with our urban society, and secondly, in the long run, it can cause a deviation from the proper path of our urban development. Such alternatives need to be replaced.

Table 8. Cluster members - cultural tourism industry. Source: Authors.

Cluster members																					
Clustered Districts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	6	17	18	19	20	21	22
	1	2	3	4	4	5	6	4	4	4	7	8	4	4	4	9	4	4	9	4	4	4

Table 9. Clustering of 22 districts of Tehran based on indicators of the cultural tourism industry. Source: Authors.

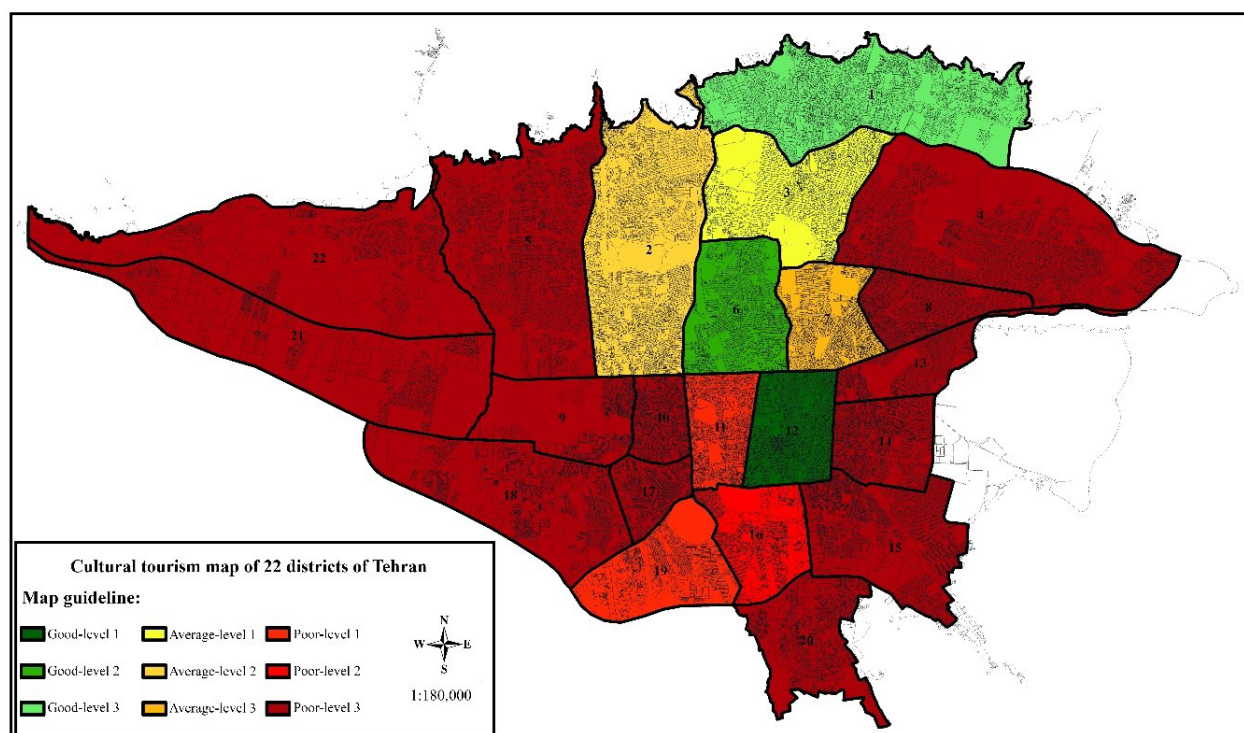| The superiority of the 22 districts of Tehran								
Level	Good			Average			Poor		
	Level 1	Level 2	Level 3	Level 1	Level 2	Level 3	Level 1	Level 2	Level 3
Districts	12	6	1	3	2	7	11	19,16	4,5,8,9,10,13,14,15,17,18,20,21,22

Fig. 4. Cultural tourism map of 22 districts of Tehran. Source: Authors.

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