Decision Science Letters 7 (2018) 417–426

Contents lists available at GrowingScience

Decision Science Letters

homepage: www.GrowingScience.com/dsl

Ranking the cities with potential of tourism investment in Fars province using numerical taxonomy

Ardeshir Bagheri[a,b*], Masoomeh Moharrer[c], Moslem Bagheri[c] and Maryam Nekooee Zadeh[c]

[a]*Masters Student, Department of Industrial Management, University of Shiraz, Iran*
[b]*Expert in the Monitoring and Evaluation at the Provincial Governorate of Fars, Iran*
[c]*Assistant Professor, Department of Tourism Management, University of Shiraz, Shiraz, Iran*

C H R O N I C L E

Article history:
Received September 1, 2017
Received in revised format:
January 8, 2017
Accepted January 15, 2018
Available online
January 15, 2018

Keywords:
Tourism
City
Fars Province
Numerical taxonomy

A B S T R A C T

Tourism industry is one of the most important parts of economic development. It can create job either directly or through stimulating other economic sectors. Therefore, it is important for policy makers to determine the best places with good potentials for tourism development. Fars province has been the center of civilization and the origin of the Iranian literature and mysticism celebrities and could be a potential investment of tourism. However, this province does not have the infrastructure required to accommodate tourists, especially during holiday seasons. This study ranks different cities located in the Fras province having the necessary potential for investment in the tourism sector by using the numerical taxonomy in terms of 12 indicators. The research population includes 29 cities in this province based on the devision of 2016. The necessary data are collected from Directorate General of Cultural Heritage, Handicrafts, and Tourism in Fars province. It is found that the cities of Shiraz, Marvdasht, Firouzabad, Sepidan, and Kazerun were the best cities for tourism investment, respectively.

1. Introduction

Iran has special importance for foreign tourists due to its soil breadth, geographical location, communication routes, and tourist attractions. Its charming nature, climate diversity, and its rich culture and civilization have made this ancient country full of diverse attractions (Zangiabadi et al. 2012: 53). Thus, there is a need to use all facilities and capabilities for creating a comprehensive and sustainable development and replacement of new sources of income with oil resources. In this regard, development of the tourism industry, which economists consider it as the third most dynamic and growing economic phenomenon after the oil and auto industry is regarded as the essential need for economic development (Madhushi & Naserpour, 2003: 27). The necessity of paying serious attention for tourism issue, as a new phenomenon in the 21st century machine life, is being felt increasingly in the world and its importance is increasing. Its importance at the current age depends more on its economic cycle, which has high potential in the area of local and international economic dynamics (Zangiabadi et al., 2012,

* Corresponding author. Tel.: +989171003045
E-mail address: ardeshir.bagheri2@gmail.com (A. Bagheri)

doi: 10.5267/j.dsl.2018.1.005

52). In addition, tourism includes major part of the global economy and it is one of the largest industries in the world. It is predicted that the number of international tourists to reach 1.6 billion people and its turnover to increase to more than 2 trillion dollars by 2020 in the world (Zangiabadi et al., 2012). Tourism also affects economic growth indirectly, since it shows the dynamic effect in the whole economy in the form of spillovers or other externalities (Tayebi et al., 2007). Accordingly, when tourism booms due to its high interaction with other economic activities, other economic activities provided for that good and service will also boom along with it. It means that tourism can act as a driving force for economic growth, which will expand other activities. Moreover, economic growth is effective in tourism development. Economic development leads to tourism development through development of tourism facilities and infrastructure, including development of transportation and roads, expanding the electronic money, development of information and communication technology, expanding the residencies, restaurants and hotels, the development of public health and development of recreational facilities and welfare affairs (Tayebi et al., 2007). Tourism, as a service industry, plays an important role in the development of many countries and has been expanding significantly in recent years. This expansion subsequently yields several benefits for related businesses, such as hotels and resorts, travel agencies, restaurants, and souvenir shops (Chaisumpunsakul & Pholphirul, 2017). Travelling and tourism industry is considered as the greatest and the most diverse industry in the world. Most countries consider this dynamic industry as the main source of revenue, employment and growth of their private sector and infrastructural development (Makui & Nikkhah, 2011: 29).

Based on what was stated, it can be realized that the development of the tourism industry would leave positive impacts on other aspects and dimensions of the host country. The following figure summarizes the most important impacts of the tourism industry development on the host country using the information collected:

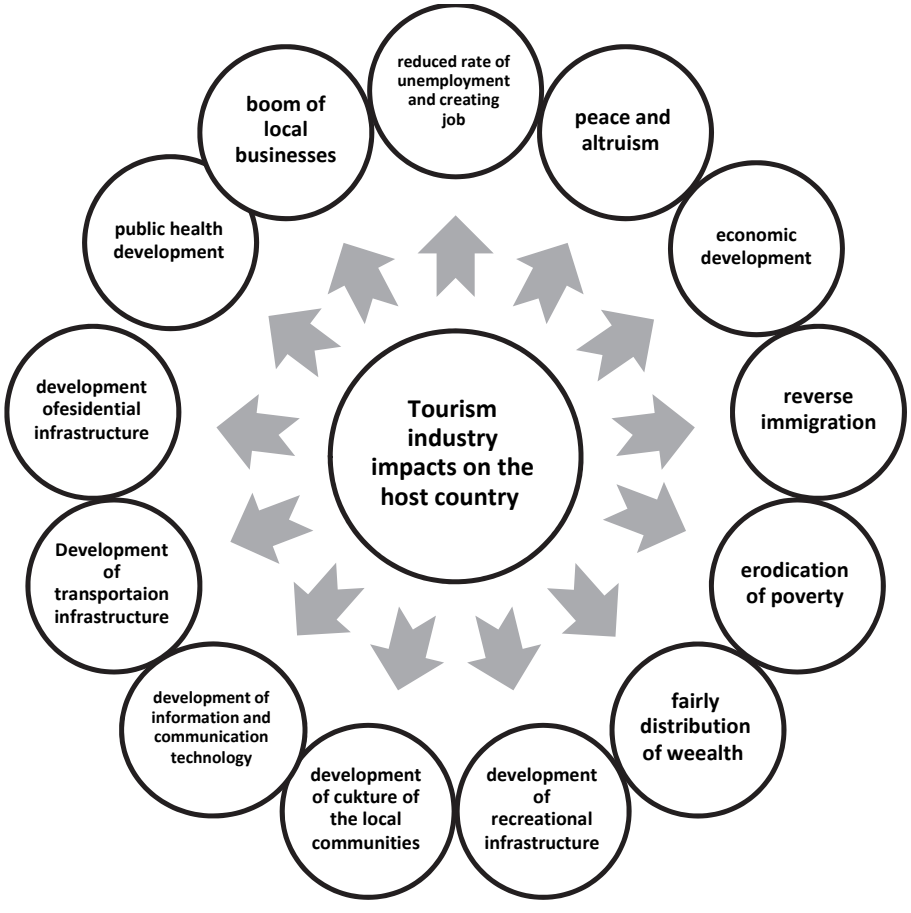

Fig. 1. Tourism industry impacts on the host country

Tourism infrastructure development in different regions of the world does not follow symmetrically equal pattern (Bagheri et al., 2018). Optimal exploitation of infrastructure and finding the inequalities in tourist areas are essential for tourism development. By recognizing the infrastructure and ranking them at the level of areas, tourists can be managed well. Therefore, coordination between the number of tourists and the capacity of tourism spaces, especially infrastructure, is necessary. Determining the superior centers and ranking them in tourism development for providing better service, social and economic justice at the level of areas are essential. One of the methods used to rank the tourism areas is investigating the urban facilities and services such as hotels and accommodations, access and transportation networks, social communication facilities, cultural and art attractions, and providing tourist services in all areas (Shamaee & Mousavand 2011, 25). Potential for supporting tourism is defined as factors that enhance historical sites to be important and appropriate for tourism management. Some historical sites may have high tourism attractiveness, but there are limitations to basic facilities like toilets and car parking. Some of them may have a limitation from external factors such as environmental conditions surrounding the tourist attractions. Communities around tourist attractions are one of the environmental conditions that can affect the area. The cleanness, tidiness, safety, and ancient buildings of these communities are considered (Sonchaem et al; 2017: 2-3)

Hence, investigating the development indicators and infrastructures of this industry in different regions of Iran seems to be an essential. Fars province with potentials such as climate diversity and abundant natural and historical attractions is one of the rich provinces in the tourism area. In the light of having great historical and cultural-historical (four recorded World Heritage sites), ecotourism, rural and nomadic (more than 12% of Iran's nomadic people are living in this province), religious (more than 1400 holy tombs), and health resources and capacities since old days, this province tries to develop this industry using its unique potentials and capacities to provide superior tourism services to attract foreign tourism and currency and accordingly achieve the high goals of the resistive economy and development outlook document of province, horizon 2025.

The position of this province as the center of international communications in the geopolitical region of the south of Iran, social and economic communication channel of Iran with Persian Gulf countries, the position of Shiraz as the center of the aerial communication and the most important socio-economic center at south of Iran, and international reputation of this city along with Pasargadae and Persepolis as the first tourism destinations in light of having 1404 holy tombs, including the holy shrines of Ahmadi and Mohammadi, Hazrat Seyed Alaeddin Hussein, and Imam Ali ibn Hamzah have made this city known as the third shrine of Ahl al-Bayt (family of the Islamic prophet Muhammad). It requires considering this God-given gift as undeniable necessity.

Despite these potentials, infrastructures of tourism have been distributed in unbalanced form in cities of this province, and each city has different facilities and infrastructures, and even different climates. Thus, evaluating the cities and ranking them for investment seems to be essential and this can lead to the development of this province. On the other hand, establishment of an international tourism city, town, or village has always been considered in this province. Thus, paying attention to different needs and interests of tourists makes it necessary to pay special attention to this issue. In addition, one of the topics, having many critics in cultural communities, is the topic of promoting the abnormalities and harms caused through cultural interactions with international tourisms. This topic can bring special consequences for the host community. However, what can cause the lowest harm and damage to the host community is establishment of the tourism villages and organizing the tourists, and location is one of its important requirements, since tourisms have different needs and demands.

Thus, given the importance of tourism due to its role in the development of the province, exploitation level of its cities has been studied based on the indicators of tourism development, so that useful steps can be taken for future use of provincial planners and managers in determining the priority of investment in the cities of this province. Accordingly, this research was conducted to investigate cities having high potential for investment in the tourism area.

2. Literature review

Makui and Nikkhah (2011) presented a fuzzy decision making methodology to find the best scenario planning of an Iranian tourist industry. They considered two primary criteria for designing a methodology which were the number residential and the season of the year. The proposed model of this paper has considered analytical hierarchy process (AHP) (Saaty, 2004) method to prioritize different criteria and using fuzzy numbers analyzed the proposed approach for an empirical study of Iranian case study. Momeni and Ghahari (2013) investigated the development status of Fars province cities using numerical taxonomy. Their research findings revealed that the number of developed cities was reduced and the number of deprived cities was increased during the statistical period. Ardakani (2014) presented an empirical investigation to determine important factors influencing development of tourism industry in city of Yazd, Iran. The proposed study determined 40 different factors and, using three methods of TOPSIS (Hwang & Yoon, 1981), SAW and Taxonomy (Sneath, & Sokal, 1973), the factors have been ranked, accordingly. Feizabadi and Maleki (2015) also examined and compared the development level in rural regions of Iran's provinces using numerical taxonomy technique and factor analysis method. Bagheri et al. (2018) examined the hard assets of the tourism infrastructure in different provinces of Iran. Their results showed that the development of tourism infrastructure in different regions of Iran was asymmetric and imbalanced.

3. The study area

3.1 Geographic location of Fars province and country divisions:

With an area of 123946 km^2, Fars province covers about 7.5% of the total area of Iran. It is located at geographical position of 27˚ 3’ to 31˚ 40’ north latitude and 50˚ 36’ to 55˚ 35’ east longitude. This province is considered as one of the most important tourist attractions in light of having many natural, historical, geological, geomorphological, cultural-rural, and nomadic attractions at the level 1 of region.

Fig. 2. The map of Iran and province of Fars

This province has shared border with provinces of Kohgiluyeh and Boyerahmad and Isfahan, and parts of Yazd province in north, Kerman Yazd provinces in east, Hormozgan province in south, and Bushehr province in south. In addition, based on the latest divisions, Fars province has 29 cities.

4. Methodology

Taxonomies or concept hierarchies are crucial for any knowledge-based system, i.e. a system equipped with declarative knowledge about the domain, which is capable of reasoning on the basis of knowledge. Concept hierarchies are in fact important because they allow to structure information into categories, thus fostering its search and reuse (Cimiano et al., 2005). The method of this research is descriptive-analytical and quantitative. It was conducted using numerical taxonomy spatial measurement models. The research population included whole area of Fars province, including 29 cities based on the division of 2016. The data were collected from Directorate General of Cultural Heritage, Arts and Crafts and Tourism of Fars province. As the Gerash city did not have required information, this city was not examined and 28 other cities were analyzed. Using the view of experts, 12 indicators were determined to evaluate the cities with potential of establishing international tourism city. Indicators used in this research included 1. Tourism spots with potential of investment, 2. Number of tourism sample areas, 3. Number of historical, cultural, and religious attractions, 4. Having rural and nomadic attractions, 5. Number of natural attractions, 6. Number of national works recorded, 7-number of the international sites recorded, 8-Being located in important communications roads of the province, 9- having rail lines, 10-having airports, 11-having lakes, rivers, dams, 12-Having appropriate climatic conditions (Table 1). To conduct the research calculations, 12 tourism indicators were analyzed first by using numerical taxonomy model.

Table 1
Research indicators

Indicator	Abbreviation
Tourism spots with potential of investment	C1
Number of tourism sample areas	C2
Number of historical, cultural, and religious attractions	C3
Having rural and nomadic attractions	C4
Number of natural attractions	C5
Number of national works recorded	C6
Number of the international works recorded	C7
Being located in important communications roads of the province	C8
Having rail lines	C9
Having airports	C10
Having lakes, rivers, dams	C11
Having appropriate climatic conditions	C12

5. Numerical taxonomy analysis for ranking the cities with potential of investment

Several methods have been used to determine the development level of the regions and one of the most important of them is numerical taxonomy. The numerical taxonomy divides a set into more or less homogeneous subsets and uses as a scale for recognizing the level of economic and social development in planning (Bidabad, 1983: 27). This method was proposed for the first time by Adenson in 1763. However, it was developed and expanded by a number of Polish mathematicians in the early 1950s. This methodology was proposed as a tool to rank the development level of different nations in UNESCO in 1968. This method is one of the most complex ranking techniques, determining the development level by combining multiple indicators. The goal of regional planning might be equalizing the development levels of the regions and the optimal spatial balance of development levels of development and establishing the social justice through it (Qadiri & Habibi, 2004: 155). The numerical taxonomy analysis technique is implemented in several steps as follows (Rohlf, 2013; Sneath & Sokal, 1973):

1- Forming the initial matrix Table 2. Forming the standard matrix 3. Calculating the distances between the parts 4. Calculating the distance between each part and other parts 5. Drawing an optimum diagram 6. Determining the homogeneous parts 7. Calculating the compound distance of each region of the

optimal region 8. Calculating the development level of the parts, and 9- Ordering of the parts based on the development level.

2- The initial information matrix table should be formed based on the indicators used, so that the name of studied regions is placed in one column and the values of the used indicators are placed in the opposite columns.

$$\begin{bmatrix} X_{11} & \cdots & X_{1n} \\ \vdots & \ddots & \vdots \\ X_{m1} & \cdots & X_{mn} \end{bmatrix} \quad (1)$$

Here *X, n* and *m* represent the name of the different regions, places and indicators, respectively. In this step, the data matrix was formed as described in the Table 4 in Appendix using the data collected from the Directorate General of Cultural Heritage, Handicrafts, and Tourism of Fars province.

3-After preparing the data matrix, as different indicators might have different scales; it is needed that the used indicators to be abandoned from the scale so that the lack of homogeneity of the indicators to be resolved. For this purpose, a standardization method can be used, which by transforming the indicators to the standardized indicator, the mean of all indicators would be zero and their SD would be 1. We form the matched standard matrix as follows:

$$\begin{bmatrix} Z_{11} & \cdots & Z_{1n} \\ \vdots & \ddots & \vdots \\ Z_{m1} & \cdots & Z_{mn} \end{bmatrix} \quad (2)$$

To calculate the standard matrix, the following equation can be used:

$$Z_{ij} = \frac{X_{ij} - \bar{X}_J}{S_i}, \quad (3)$$

where $\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_{ij}$ and $S_i = \sqrt{\frac{\sum\left(X_{ij} - \overline{X}\right)^2}{n}}$ *i=1,...,n.*

4-Calculating distances between parts: After calculating the standard matrix, difference or distance of each part relative to the other parts of each of the indicators can be obtained.

In this step, given the standardized numbers in the standard matrix *Z*, we obtain the compound distances between different *n* activities for *m* indicators as follows: if we obtain the distance between the activities in paired, the compound distance matrix would be obtained. As matrix of distances is a symmetric matrix, it can be concluded that this matrix is symmetric and its diameter is equal to zero. Moreover, the matrix is square with dimensions of n by n. Members of this matrix show the compound distance of each activity from another activity, and in each row of this matrix, the lowest value represents the shortest distance between that activity and other activities or the greatest proximity.

Step 4: Determining the shortest distances

Each element of the matrix *C* represents the distance between two activities in the considered indicator. In this matrix, we determine the shortest distance in each row and write it in the separate column (for example, column *d*). Then, we calculate the mean and standard deviation of the shortest distances of each row, that is, column d. Then, we calculate the upper limit distances (d^+) and the lower limit distances (d^-) according to the following equation to determine the homogeneous activities.

$d(^+) = d + 2Sd$ $\qquad$ $d(^-) = d - 2Sd$

In this step, the activities, whose minimum distances are between upper limit and lower limit distances, would be homogenous and they are placed in same group. However, if minimum distances of two activities are more than upper limit and less than lower limit distance, these activities should be deleted, due to non-homogeneity. Determining the homogeneous groups was formed as described in the Table 5 in Appendix.

Stage 5: Ranking of homogeneous activities in terms of criteria studied

If all activities are not placed in a homogeneous group in this step, then we would form the data matrix for homogeneous activities:

Table 4 shows that, except for the city of Larestan, the rest of cities are in a homogeneous group. Thus, the row of data related to the Larestan city is deleted and the matrix of new data is formed. Then, their mean and standard deviation are calculated.

In the next step, we standardize the matrix of the new homogeneous data, and in the matrix of standardized indicators, the ideal is considered for each of the indicators, and after finding the ideal values for each of the activities, we calculate the "ideal" for each activity. Selecting the ideal value depends on the type of indicators investigated, so that if the selected indicators are positive, we consider the largest number of each column as the ideal. However, if the indicator is negative, the larger number indicates non-ideal. Thus, the smallest value is selected as the ideal value. As in this problem, larger values are better, so the maximum of each column is selected as the ideal point. Standard matrix of homogeneous group was formed as described in the Table 6 in Appendix.

Step 6: Calculating the level of having homogeneous activities

In this step, a combined indicator called "level of having" is introduced, which has a limited range and it is between zero and one. As the value of fi is closer to zero, the "level of having" would be lower. According to this "level of having", activities can be ranked and prioritized based on the indicators investigated.

Table 2
Determining the "level of having" in each city in Fars province

cities	Abadeh	Arsenjan	Estahban	Eghlid	Bawanat	Pasargad	Jahrom	Kharah	Khorrambid
CIO	11.7	11.50	10.6	9.97	9.5	10.02	10.48	11.18	10.83
Fi	0.853	0.843	0.809	0.761	0.725	0.765	0.8	0.853	0.827
city	Khonj	Darab	Rostam	Zarrin Dasht	Sepidan	Sarvestan	shiraz	Farashband	Fasa
CIO	10.69	10.11	11.2	12.31	8.94	10.38	4.43	0.803	9.91
Fi	0.816	0.772	0.875	0.94	0.682	0.793	0.338	10.51	0.756
city	Firoozabad	Qir and Kazrin	Kezeroun	Kovar	Lamerd	Marvdasht	Mamasani	Mehr	Neyriz
CIO	8.65	11.60	9.05	10.86	11.41	8.29	9.82	10.99	10.05
Fi	0.661	0.885	0.691	0.829	0.871	0.633	0.75	0.839	0.768

Mean = 10.15 Standard deviation = 1.47 CO = 13.10

6. Findings

This research tried to investigate the potential of Fars province cities in terms of investment in tourism infrastructure using numerical taxonomy. It was found that the cities of Shiraz, Marvdasht, Firouzabad, Sepidan, and Kazeroun, respectively, were the best cities in terms of the potentials for tourism investment. Table 3 presents the results of the research and ranking of the cities of province in this regard. Based on the indicators used in this research, cities were prioritized. Findings of research and status and facilities of the cities with higher rank suggest the accuracy of the research. However, the issue which should be considered is that Fras province is diverse in terms of climate and if the conditions for investment in cities with high rank are not provided, investment can be performed in other places. However, the results of this research can provide great help for macro-investment policies.

Table 3
Ranking the cities

Rank	City	CIO	Fi	Rank	City	CIO	Fi
1	Shiraz	4.433	0.338	15	Farshaband	10.511	0.803
2	Marvdasht	8.291	0.633	16	Estahban	10.600	0.809
3	Firuzabad	8.654	0.661	17	Khenj	10.691	0.816
4	Sepidan	8.938	0.682	18	Khorrambid	10.830	0.827
5	Kazerun	9.049	0.691	19	Kovar	10.862	0.829
6	Bawanat	9.496	0.725	20	Mehr	10.992	0.839
7	Mamasani	9.824	0.750	21	Arsanjan	11.046	0.843
8	Fasa	9.905	0.756	22	Abadeh	11.167	0.853
9	Eglid	9.966	0.761	23	Kharame	11.178	0.853
10	Pasargas	10.015	0.765	24	Rostam	11.196	0.855
11	Neyriz	10.054	0.768	25	Lamerd	11.413	0.871
12	Darab	10.111	0.772	26	Qir and Kazrin	11.596	0.885
13	Sarvestan	10.381	0.793	27	Zarrin dasht	12.313	0.940
14	Jahrom	10.484	0.800				

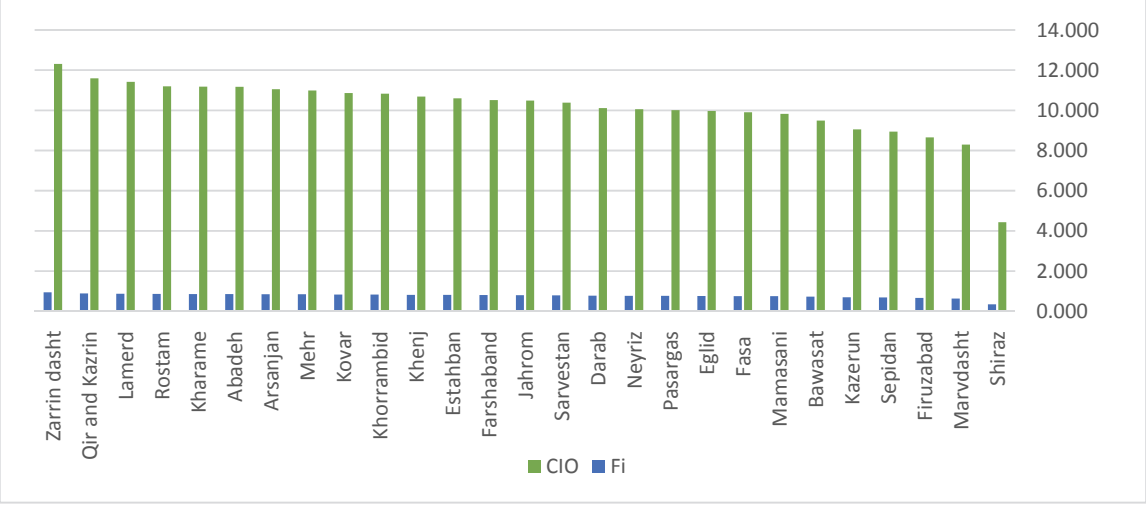

Fig. 3. The ranking of the cities with potential of tourism investment in the Fars province

7. Suggestions

However, the point that should be considered in this method is that numerical taxonomy divides the indicators into homogeneous and non-homogeneous groups, deletes the non-homogeneous groups, and does not prioritize them, which is considered as the shortcoming of taxonomy method. For example, Larestan city was among the non-homogeneous groups in this research and it was not included in the investigations, while this city has an appropriate environment in terms of having tourism infrastructure, such as the airport and tourist attractions. However, it is poor in terms of some other indicators, which a separate study needs to be conducted for this city and feasibility to be performed.

References

Ardakani, M. (2014). Ranking different factors influencing on development of tourism industry. *Management Science Letters*, *4*(5), 917-920.

Bagheri, M., Shojaei, P., & Khorami, M. (2018). A comparative survey of the condition of tourism infrastructure in Iranian provinces using VIKOR and TOPSIS. *Decision Science Letters*, *7*(1), 87-102.

Bidabad, B (1983). Numerical taxonomy analysis and using it in the classification of cities and development Indicators for regional planning. *Planning and Budget Organization Publications* [in Persian].

Chaisumpunsakul, W., & Pholphirul, P. (2017). Does international trade promote international tourism demand? Evidence from Thailand's trading partners. *Kasetsart Journal of Social Sciences*.

Cimiano, P., Hotho, A., & Staab, S. (2005). Learning concept hierarchies from text corpora using formal concept analysis. *Journal of Artificial Intelligence Research*, *24*(1), 305-339.

Feizabadi, Y., & Maleki, F. (2015). Investigating and comparing the development level of rural areas in Iranian Provinces. *Journal of Development of Rural Economics and Agriculture Studies*, 1(1), 72-82, [in Persian].

Hwang, C.L., & Yoon, K. (1981). *Multiple Attribute Decision Making: Methods and Applications*. New York: Springer-Verlag.

Madhushi, M., & Naserpour, N. (2003). Assessing the barriers of tourism development industry in Lorestan Province. *Journal of Commercial Research*, 25-58, [in Persian].

Makui, A., & Nikkhah, Z. (2011). Designing fuzzy expert system for creating and ranking of tourism scenarios using fuzzy AHP method. *Management Science Letters*, *1*(1), 29-40.

Momeni, M., & Ghahari, Gh., (2013). An analysis of development status of Fars Province. *Regional Planning Journal*, *3*(9), 53-66, [in Persian].

Qadiri, M., & Habibi, K. (2004). Assessing and analyzing the development levels of cities and towns in Golestan province. *Journal of Social Sciences*, *11*, 147-170, [in Persian].

Rohlf, F. J. (2013). *Taxonomy, Numerical*. Brenner's Encyclopedia of Genetics (Second Edition), 26–29.

Saaty, T. L. (2004). Decision making—the analytic hierarchy and network processes (AHP/ANP). *Journal of Systems Science and Systems Engineering*, *13*(1), 1-35.

Shamaee, A., & Mousivand, A.J. (2011). Ranking the Isfahan Province Cities in terms of tourism infrastructure using TOPSIS and AHP Model. *Urban Regional Studies and Research*, 3(10), [in Persian].

Sneath, P. H., & Sokal, R. R. (1973). *Numerical taxonomy*. The principles and practice of numerical classification.

Sonchaem, W., Phuditthanawong, W., Hutacharoen, R., & Hinjiranan, P. (2017). Influential factors on tourism potential of Buddhist temples: Case study of Buddhist temples in cultural conservation zone of Bangkok Metropolitan Administration (Rattanakosin and Thonburi). *Kasetsart Journal of Social Sciences*.

Tayebi, S.K., Babaki, R., & Jabbari, A. (2007). Investigating the relationship between tourism development and economic growth in Iran (1959-2004). *Research Journal of Humanities and Social Sciences, special for economics*, 7(26), Isfahan, [in Persian].

Zangiabadi, A. Z., Vand, L. P. E., Pour, E. H., & Moslehi, M. (2012). Spatial analysis of tourism development indicators using TOPSIS (a case study of towns of Isfahan Province). *geography and urban development Journal*, *1*., [in Persian].

Appendix

Table 4
Data matrix

City	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Abadeh	4	2	5	1	17	42	0	1	1	0	1	0
Arsenjan	3	1	6	1	13	111	0	1	1	0	1	1
Estahban	4	3	10	1	13	110	0	1	0	0	3	1
Eglid	8	6	5	1	15	45	0	1	1	0	4	1
Bawanat	10	3	56	1	35	47	0	1	0	0	2	1
Pasargad	6	2	5	1	6	112	2	1	1	0	3	1
Jahrom	5	3	4	1	16	71	0	1	1	1	2	0
Kharame	8	0	7	1	10	30	0	1	1	0	3	0
Korrambidbid	4	2	10	1	8	92	0	1	1	0	2	1
Khenj	3	1	60	1	20	15	0	1	1	0	2	0
Darab	5	1	40	1	30	93	0	1	0	1	2	0
Rostam	3	2	7	1	10	60	0	1	0	0	2	1
Zarrin Dasht	3	2	10	1	12	26	0	0	0	0	5	0
Sepidan	12	6	10	1	32	95	0	1	0	0	11	1
Sarvestan	6	4	4	1	23	20	0	1	1	0	5	0
Shiraz	20	11	130	1	57	616	1	1	1	1	1	1
Farashband	10	1	20	1	9	98	0	1	0	0	5	0
Fasa	4	4	10	1	21	68	0	1	0	1	12	0
Firouzabad	15	3	43	1	90	107	0	1	0	0	2	1
Qir and Karzin	5	1	10	0	8	52	0	1	1	0	5	0
Kazerun	10	4	55	1	20	188	0	1	0	0	5	0
Kovar	15	0	17	1	20	42	0	1	0	0	1	0
Larestan	47	4	647	1	71	182	0	1	1	1	9	0
Lamerd	4	2	10	1	18	62	0	1	0	1	2	0
Marvdasht	8	7	13	1	7	299	2	1	1	0	5	1
Mamasani	5	4	27	1	15	82	0	1	0	0	9	1
Mehr	7	1	8	1	0	71	0	1	1	0	5	0
Neyriz	10	2	13	1	26	50	0	1	0	0	9	0
mean	**8.71**	**2.93**	**44.39**	**0.93**	**22.21**	**103.07**	**0.18**	**0.96**	**0.5**	**0.21**	**4.21**	**0.43**
SD	**8.62**	**2.37**	**121.15**	**0.26**	**20.06**	**116.7**	**0.55**	**0.19**	**0.51**	**0.42**	**3.13**	**0.50**

Table 5
Determining the homogeneous groups

City	Clr:	City	Clr:	City	Clr:	City	Clr:
Abadeh	0.76	Kharame	0.99	Sarvestan	1.59	Kavar	1.64
Arsanjan	0.62	Khorrambid	0.62	Shiraz	5.48	Larestan	7.66
Estahban	0.71	Khonj	0.76	Farashband	1.61	Lamerd	3.31
Eghlid	1.94	Darab	2.28	Fasa	2.82	Marvdasht	2.73
Bawanat	1.49	Rostam	0.71	Firuzabad	2.85	Mamasani	1.59
Pasargad	2.73	Zarrin Dasht	5.41	Qir and	3.31	Mohr	0.99
Jahrom	2.28	Sepidan	1.59	Kazerun	1.61	Neyriz	1.64

UCL upper limit 5.52 Lcl lower limit -1.11 Mean 2.20 Standard deviation 1.66

Table 6
Standard matrix of homogeneous group

City	C1 Yes.no	C2 number	C3 Yes.no	C4 Yes.no	C5 Yes.no	C6 number	C7 number	C8 number	C9 Yes.no	C10 number	C11 number	C12 number
Abadeh	-0.76	-0.37	-0.62	0.28	-0.19	-0.49	-0.33	0.19	1.02	-0.47	-1.00	-0.88
Arsanjan	-0.99	-0.78	-0.58	0.28	-0.41	0.09	-0.33	0.19	1.02	-0.47	-1.00	1.10
Estahban	-0.76	0.05	-0.44	0.28	-0.41	0.08	-0.33	0.19	-0.95	-0.47	-0.34	1.10
Eglid	0.16	1.29	-0.58	0.28	-0.30	-0.47	-0.33	0.19	1.02	-0.47	-0.01	1.10
Bawanat	0.63	0.05	1.23	0.28	0.81	-0.45	-0.33	0.19	-0.95	-0.47	-0.67	1.10
Pasargad	-0.30	-0.37	-0.62	0.28	-0.80	0.10	3.26	0.19	1.02	-0.47	-0.34	1.10
Jahrom	-0.53	0.05	-0.66	0.28	-0.25	-0.25	-0.33	0.19	1.02	2.06	-0.67	-0.88
Kharame	0.16	-1.20	-0.55	0.28	-0.58	-0.59	-0.33	0.19	1.02	-0.47	-0.34	-0.88
Khorrambid	-0.76	-0.37	-0.44	0.28	-0.69	-0.07	-0.33	0.19	1.02	-0.47	-0.67	1.10
Khonj	-0.99	-0.78	1.38	0.28	-0.02	-0.72	-0.33	0.19	1.02	-0.47	-0.67	-0.88
Darab	-0.53	-0.78	0.65	0.28	0.53	-0.06	-0.33	0.19	-0.95	2.06	-0.67	-0.88
Rostam	-0.99	-0.37	-0.55	0.28	-0.58	-0.34	-0.33	0.19	-0.95	-0.47	-0.67	1.10
Zarrin Dasht	-0.99	-0.37	-0.44	0.28	-0.47	-0.63	-0.33	-5.00	-0.95	-0.47	0.32	-0.88
Sepidan	1.09	1.29	-0.44	0.28	0.65	-0.04	-0.33	0.19	-0.95	-0.47	2.29	1.10
Sarvestan	-0.30	0.46	-0.66	0.28	0.14	-0.68	-0.33	0.19	1.02	-0.47	0.32	-0.88
Shiraz	2.94	3.37	3.92	0.28	2.04	4.37	1.46	0.19	1.02	2.06	-1.00	1.10
Farashband	0.63	-0.78	-0.08	0.28	-0.63	-0.02	-0.33	0.19	-0.95	-0.47	0.32	-0.88
Fasa	-0.76	0.46	-0.44	0.28	0.03	-0.27	-0.33	0.19	-0.95	2.06	2.62	-0.88
Firuzabad	1.78	0.05	0.76	0.28	3.87	0.06	-0.33	0.19	-0.95	-0.47	-0.67	1.10
Qir and Karezin	-0.53	-0.78	-0.44	-3.47	-0.69	-0.41	-0.33	0.19	1.02	-0.47	0.32	-0.88
Kazerun	0.63	0.46	1.20	0.28	-0.02	0.74	-0.33	0.19	-0.95	-0.47	0.32	-0.88
Kovar	1.78	-1.20	-0.18	0.28	-0.02	-0.49	-0.33	0.19	-0.95	-0.47	-1.00	-0.88
Lamerd	-0.76	-0.37	-0.44	-3.47	-0.13	-0.32	-0.33	0.19	-0.95	2.06	-0.67	-0.88
Marvdasht	0.16	1.71	-0.33	0.28	-0.75	1.69	3.26	0.19	1.02	-0.47	0.32	1.10
Mamasani	-0.53	0.46	0.18	0.28	-0.30	-0.15	-0.33	0.19	-0.95	-0.47	1.63	1.10
Mehr	-0.07	-0.78	-0.51	0.28	-1.14	-0.25	-0.33	0.19	1.02	-0.47	0.32	-0.88
Neyriz	0.63	-0.37	-0.33	0.28	0.31	-0.43	-0.33	0.19	-0.95	-0.47	1.63	-0.88
Max	2.94	3.37	3.92	0.28	3.87	4.37	3.26	0.19	1.02	2.06	2.62	1.10