Decision Science Letters 7 (2018) 87–102

Contents lists available at GrowingScience

Decision Science Letters

homepage: www.GrowingScience.com/dsl

A comparative survey of the condition of tourism infrastructure in Iranian provinces using VIKOR and TOPSIS

Moslem Bagheri[a*], Payam Shojaei[b] and Maryam Tayebi Khorami[c]

[a]*Assistant Professor, Department of Tourism Management, Shiraz University, Shiraz, Iran*
[b]*Assistant Professor, Department of Management, Shiraz University, Shiraz, Iran*
[c]*Masters Student, Department of Management, Shiraz University, Shiraz, Iran*

C H R O N I C L E

Article history:
Received Febryary 16, 2017
Received in revised format:
February 22, 2017
Accepted April 2, 2017
Available online
April 5 2017

Keywords:
Soft infrastructure
Hard infrastructure
Tourism infrastructure
VIKOR
TOPSIS

A B S T R A C T

Tourism infrastructure development in different regions of the world does not follow a symmetrically equal pattern. Because of the importance of infrastructure in the tourism development, the present research is an attempt to examine the hard elements of tourism infrastructure in different provinces of Iran, using the indicators proposed by Pearce and Wu (2015) [Pearce, P. L. & Wu, M. Y. (2015). Soft infrastructure at tourism sites: identifying key issues for Asian tourism from case studies. *Tourism Recreation Research, 40* (1), 120-132.]. To accomplish this, the data registered in the statistical yearbook of the Statistical Center of Iran were investigated. The method of research was analytical survey. To analyze and rank the data collected from the yearbook, VIKOR and TOPSIS methods were employed. The results of the analysis show that Tehran Province was under the best conditions of the Iranian tourism infrastructure, whereas Ilam Province was under the worst condition. The results about the condition of hard tourism infrastructure in the provinces of Iran, next to their tourism potentials, can provide necessary data for the future planning of the industry.

1. Introduction

Nowadays tourism and its benefits have become a focal issue in most countries, including the developing ones (Hall & Lew, 2009), while the role of tourism in the economic and social welfare of host communities has been receiving considerable attention (Walker & Walker, 2011). According to the observations of the World Tourism and Travel Council (WTTC), tourism is developing into the largest industry in the world, while the estimates of WTTC suggest that the financial contribution of tourism in 2016 has been more than 7.2 trillion dollars and it has subsumed nearly 9.8% of the global GDP. This industry has also created more than 284 million jobs worldwide, accounting for 9.4% of global employment (i.e. 1 in 11 jobs on the planet). The tourism industry seems to be one of the major

* Corresponding author. Tel: +987136134421
E-mail address: bagherimoslem@shirazu.ac.ir (M. Bagheri)

doi: 10.5267/j.dsl.2017.4.001

drivers of development in developing countries, such as Iran, contributing as a vehicle that sustains economic growth (Tribe, 2004; Garcia & Rivero, 2015). According to the data presented by WTTC, Iran ranks 137th in total contribution to GDP (out of 184 countries), 152nd in total contribution to employment, and 141st in capital investment. WTTC has also forecasted that Iran will move up its rank to 39th in total contribution to GDP, 11th in total contribution to employment, 45th in contribution to capital investment, and 175th in contribution to exports within the period 2015-2025. The reality, however, suggests that the condition of tourism in Iran has not yet gone up to its potentials and there is still room for significant improvement in this field.

According to the macro-plan of the tourism industry in Iran's Future Outlook (called *Iran Outlook 1404*), the country will have to attract 20 million tourists by the end of its 7th Development Plan in 2025 (Rahimpoor, 2008). However, the figures in the Iranian tourism industry do not suggest such anticipations; for example, only 13% of the anticipations have come true (Kargar, 2007), and unfortunately Iran's share of the world tourism income represents the insignificant figure of approximately 1% (Amiri Aghdaie & Momeni, 2011). A large number of studies and surveys have been conducted on the obstacles to Iran's tourism development. One of the serious challenges facing today's Iranian tourism industry is the lack of an integrated planning that sufficiently addresses tourism infrastructure and its role in supplying touristic products (Maleki & Mavadat, 2014).

The demands of twenty-first century tourists are specialized and diverse (Boers & Cottrell, 2007), as a result of which tourists are not simply satisfied with old touristic experiences. To meet such demands, it is important to develop new touristic products and destinations, providing tourists with more inspiring sources of experience (Dujmovic & Vitasovic, 2014). The infrastructural basis of a country determines its potential attractiveness as a tourism destination (Seetanah, et al., 2011; Tribe, 2004; Hall & Page, 2006). This same factor directly influences the practicality and quality of a touristic product, but despite its importance, different touristic regions, including Iran, have not managed to construct adequate tourism infrastructures.

Apart from political and cultural barriers impeding tourism development in Iran, the inappropriate condition of tourism infrastructure is one of the fundamental problems facing the industry, postponing its development and accounting for its low share of the world tourism income (Maleki & Mavadat, 2014). Even in different Iranian provinces, especially those with noticeable potentials in tourism, the development of tourism infrastructure has been considerably poor and widely different from that in metropolises such as Tehran.

As a contribution, this study investigates the condition of tourism infrastructure in different Iranian provinces, comparing them to find how proportional the hard infrastructures are in comparison to their tourism potentials. To accomplish this aim, the indicators proposed by Pearce and Wu (2015) and the data registered in the statistical yearbook of the Statistical Centre of Iran are investigated and analysed. The results can provide part of the data necessary for the future planning and budgeting of the industry in the provinces of Iran.

2. Literature Review

Tourism is considered to be one of the fastest-growing industries over the past two decades, especially in countries with emerging and developing economies. While the growth of the industry is evident, it is crucial to maintain and enhance it with a sustained strategy for further expansion (Thapa, 2012). One of the widely approved strategies to achieve this goal is to conceptualize tourism as an integrated system. As Vanhove (2010) points out, "a tourism system can be defined as a framework that shows the interaction between: tourism supply at the destination, the bridging elements between supply and demand, and tourism demand". Based on such a view, development depends on the way through which resources are allocated to the elements of supply over time and space (Boer & Cottrell, 2007). Tourism

supply involves the provision of goods and services to facilitate business, pleasure, and leisure activities away from one's home environment. This process, however, can be technically complicated, because identifying appropriate goods, services and achieving desired quality for international travellers can involve numerous factors to consider (Zhang & Murphy, 2009). The supply side of the tourism system has a fundamental function in the other elements of the system, and policymakers are expected to pay enough attention to its hard and soft infrastructures (Goeldner & Ritchie, 2009; Garcia & Rivero, 2015; Panasuik, 2007).

Scholars and policymakers unanimously agree that the development of infrastructure serves as the main factor that generally sustains tourism arrivals and economic growth (Suleiman & Albiman, 2014; Yu, 2016). For instance, tourism infrastructure creates touristic brands, influencing the level of regional development (Panasuik, 2007).

2.1.Tourism Infrastructure

An extensive and efficient infrastructure is a vital factor that ensures the effective functioning of a country's economy (Bookman & Bookman, 2007). Poor infrastructure could interrupt a nation's economic growth and international competitiveness (Hope, 2010; Tribe, 2004). In fact, a well-developed infrastructure helps to minimize the negative effects of distance between regions, linking the national market at low costs to markets in other regions (Nallathiga, 2015).

The tourism infrastructure is a sub-type of infrastructure that includes facilities and services implemented in a particular locality to meet the needs of local residents (Goeldner & Ritchie, 2009), and to serve tourism-specific purposes. Tourism infrastructure has the potential to increase competition and boost tourism by making available travelling conveniences to tourists (Suleiman & Albiman, 2014). Besides attracting tourists, tourism infrastructure is part of tourism product that can direct tourists and shape their spatial-temporal orientation (Panasuik, 2007; Williams, 2009). Furthermore, tourism infrastructure can also have knock-on effects on other parts of the tourism system (Hall & Pagge, 2006).

In the same vein, Smith (1974) emphasizes the function of service infrastructure in creating product experience and in shaping the overall image of a destination for tourists (Seetanah, et al., 2011; Tribe, 2004). Investment in tourism-related infrastructures is important in building tourist arrivals, which quantitatively constitute a proportion of the infrastructures and qualitatively ensure that tourists are sufficiently satisfied and motivated. The important factors that readily require the effective action of policymakers and executives include cost supply, consideration of consumers' increasing demands, suitability of the location, and the efficient management of operators (Jamil & Puad, 2010).

Tourism infrastructure itself can be subjected to various methods of classification. For example, Ghosal (2013), like many other scholars (e.g. Pearce & Wu, 2015; Hall & Page, 2006), divides tourism infrastructure into hard and soft types, which are in some studies called *social and economic sub-sectors* (Hope, 2010). The social infrastructure sub-sector is responsible for specific social services, such as the provision of education, information, urban planning, health services, and other social welfare services in a society. The economic infrastructural sub-sector, on the other hand, includes a set of hard-core economic activities which are related to the production of energy and power, transportation services, water and communication services, and so on (Enimola, 2010).

In order to systematize the tourism sector within the soft infrastructure, an amalgamation of diverse factors is shaped, including hospitality, interpretation and person-to-person encounters that tourists experience (Pearce & Wu, 2015). Thapa (2012) has also added professional human resources to the sub-set of soft infrastructure, emphasizing the human factor as the most important element of infrastructure in developing countries. The factors associated with soft infrastructure and their interplay

with hard infrastructure are taken into account in the model proposed by Pearce and Wu (2015) (see Fig. 1).

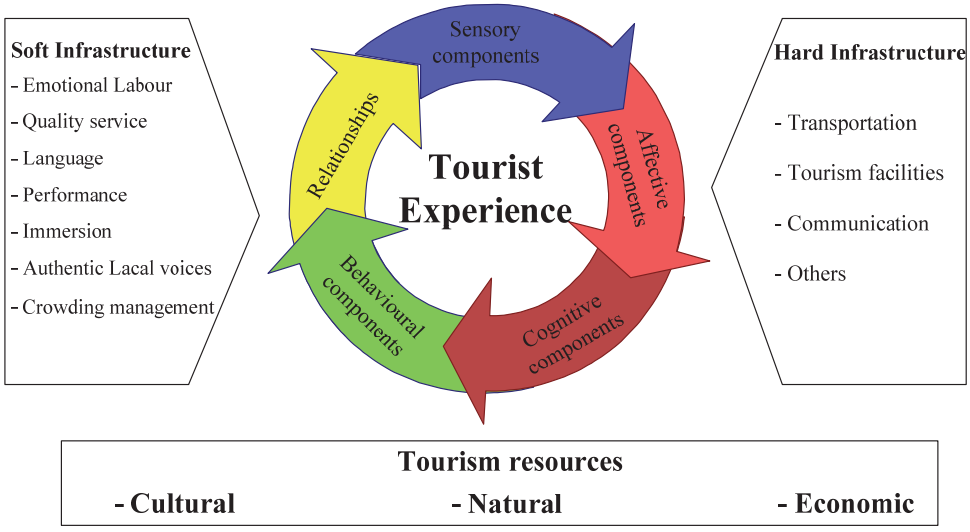

Fig. 1. The overall interplay of soft and hard infrastructure forces affecting tourists' experiences (Pearce & Wu, 2015)

Traditionally, there is a distinction between transport infrastructure at the destination and the public utilities. The major elements of the former include roads, railways, transportation services for sightseeing tours, airports, cruise terminals, harbours, local transport networks, and taxis and parking facilities. Public utilities, in contrast, include such elements as electricity, water supply, health care, communication networks, sewage system, waste disposal, water treatment, and so on (Vandhove, 2010; Williams, 2009).

There are different approaches that deal with the stages of development of tourism infrastructure. Tourism infrastructure planning, for instance, is a well-known approach that ensures that tourism development is managed, promoted and monitored (Sharpley, 2008). There is also another approach that integrates different tourism-related infrastructures, dealing with integrated planning of attraction, service and transportation facilities (Boer & Cottrell, 2007; Williams, 2009). Despite the evident variety and complexity of views on tourism planning, two points are important to consider. First, tourism planning is a political process, as governments normally set the agenda for tourism development. Secondly, contemporary approaches, which are used in advanced countries, may not work well in developing countries (Sharpley, 2008). Besides contributing to the tourism industry, improvements in infrastructure will at the same time serve the local population and enhance the standards of living. In order to create a favourable atmosphere for investment in tourism infrastructure, Jamieson (2001) has enumerated eight key measures as follows:

- Creating a clear picture of the role of tourism in solving social, economic and environmental problems;
- Establishing tourism investment information centres;
- Encouraging cooperation and integrated tourism development planning;
- Fostering a positive investment climate;
- Building special tourism investment zones;
- Supporting human resource development;
- Creating opportunities for strategic product development;
- Adopting innovative means of delivering quality infrastructure development (Tribe, 2004).

Apart from the role of local governments.organizations in the constitution of tourism infrastructure, there are various regional and global organizations that help developing countries by investing in their infrastructural projects. The World Bank is one of the global organizations with considerable experiences in infrastructure investment (Bookman & Bookman, 2007).

2.2.Tourism Industry and Tourism Infrastructure in Iran

With over 5000 years of civilization, Iran (politically known as Islamic republic of Iran) is a country in the Middle East, a region with an average annual growth rate of 10% since 2000, and has been recently one of the world's fastest-growing economies (Sharpley, 2008). The country ranks 10th in hosting historical monuments and attractions (Morakabati, 2011), and is the 10th country in the world with maximum ecotourism attractions (Armaghan, 2007). These rankings suggest that Iran involves high potentials in the field of tourism.

According to the macro-plan of the tourism industry in Iran's Future Outlook (Iran Outlook 1404), the country will have to attract 20 million tourists by the end of its 7th development program in 2025 (Rahimpoor, 2008). However, realistically considered, figures in the Iranian tourism industry do not seem to be capable of realizing the anticipations, because so far only 13% of the anticipations have come true (Kargar, 2007). Iran's share of the world tourism income is about 1%, which is a relatively insignificant rate (Amiri Aghdaei & Momeni, 2011).

A large number of studies and surveys have been conducted on the obstacles to Iran's tourism development. As Sharpley (2008) states, "for many countries in the region, international leisure tourism has been either culturally undesirable or economically unnecessary, particularly in the oil-rich Gulf states, whilst political instability continues to serve as a barrier to tourism development". In addition to political and cultural barriers to tourism development in Iran, some of studies (e.g. Ahadnejad Raveshti & Salehi Mishani, 2012; Soleimani Moghadam & Islami, 2011; Samadian, Hoseini & Rauf Ava, 2009) have observed that the inappropriate condition of tourism infrastructure in the country is one of the fundamental problems that has delayed the progress of the Iranian tourism industry.

Although in some parts of Iran, such as the capital Tehran, tourism infrastructure and facilities are available, many other regions of the country suffer from poor and inadequate infrastructures. This asymmetry signals the imbalanced development across Iranian provinces in terms of the tourism industry (Maleki & Mavadat, 2014; Shamai & Mousavand, 2011). Since tourism infrastructure plays has a major function in the development of the industry and has the potential to leverage economic progress, the present study evaluates the condition of hard tourism infrastructure in the provinces of Iran, providing necessary data for future planning in the field.

3. Methodology

The present study relied on an analytical survey method to explore and discuss the reasons leading to the conditions under study. The purpose was to investigate indicators of hard infrastructure in the context of the tourist industry in Iran, based on Pearce and Wu's (2015) model. In the following sub-sections, different aspects of the method are further explained. To collect the data for analysis in this study, the Iranian statistical yearbook was used, as a source containing up-to-date information about different areas. Based on the information in the yearbook, the conditions of tourism infrastructure in different provinces of Iran were investigated.

3.1. Data Analysis

In order to analyse the data collected from the statistical yearbook, Pearce and Wu's (2015) model of infrastructure was employed. More specifically, the 4 indicators assumed in the model were used in the

analysis to describe the condition of the hard dimension of the Iranian infrastructure. Considering these original indicators, 20 indicators were extracted from the statistical yearbook published by the Statistics Centre of Iran. These indicators and their quantity in the different provinces of Iran are displayed in Appendix 1. To analyse the data, first the indicators were weighed through Shannon entropy and then the provinces were ranked through VIKOR and TOPSIS methods. All of these methods as used in the present study are explored in detail in the following section.

3.2. Shannon entropy

Entropy is a very important concept in social sciences, physics, and information theory. When the data of a decision matrix are completely specified, this method can be used to evaluate the weights. In information theory, entropy is a measure of uncertainty and is defined with the specified probability distribution P_i. If m is the number of alternatives and n is the number of indicators, the weights of the indicators are obtained through the following steps:

First step: The probability distribution is calculated through the Eq.1

$$P_{ij} = \frac{a_{ij}}{\sum_{i=1}^{m} a_{ij}} \tag{1}$$

Second step: The value of entropy is calculate in which$k = \frac{1}{\ln m}$.

$$E_j = -k \sum_{i=1}^{m} P_{ij} \ln P_{ij} \tag{2}$$

Third step: The value of the uncertainty is obtained from the Eq.3

$$d_j = 1 - E_j \tag{3}$$

Fourth step: The index weights are calculated via the Eq.4

$$w_j = \frac{d_j}{\sum_{i=1}^{n} d_j} \tag{4}$$

In the present research, the method of Shannon entropy was employed to calculate the weights of the indicators (see Table 1).

Table 1
The weights of the indicators

Active hospitals	0.0337	Number of marked automotive vehicles and motorcycle	0.066688054
Stable beds	0.0497	Number of residencies in the country	0.076309
Number of infirmaries, clinics and polyclinics according to the type of dependence	0.046519733	The length of the average pressure of distribution network (Km)	0.018922
Number of emergency centres in the hospitals	0.024432826	Length of the weak pressure of distribution network (Km)	0.025561
Number of movie theatres	0.1106	Number of gas branch	0.04216
number of seats in movie theatres	0.0993702	Cities covered by the installations of water and sewage	0.016998
Number of sport places	0.02681	Cities with sewage branches	0.035191
The square of sports places	0.026	Number of sewage refineries	0.02838257
Number of high speed internet lines	0.06235	The square of green space	0.03984
Transportation corporations	0.02633	Number of airports	0.027335

3.3. VIKOR method

VIKOR, standing for *Vlsekriterijumska Optimizacija I Kompromisno Resenje*, was first developed in 1998 by Opricovic (Chu et al., 2007). This method is used to optimize multi-criteria complex systems (Opricovic, 1998, 2002). It also focuses on ranking and selecting set alternatives, and on determining a consistent solution for a problem with conflicting criteria. The compromise solution is a feasible solution closest to the ideal solution. *Compromise*, more specifically, means an agreement established by mutual consensus made between the alternatives (Opricovic, 2004, 2007). Assuming that each alternative is evaluated by a criterion function the compromise ranking could be performed by comparing the measure of closeness to the ideal alternative. The value of *Lp, j* indicates the distance of each alternative from the best ideal solution (Rao, 2007). The extended VIKOR method uses the following form of L_P metric:

$$L_{p,j} = \left\{ \sum_{i=1}^{n} \left[W_i \left(f_i^* - f_{ij} \right) / \left(f_i^* - f_i^- \right) \right]^p \right\}^{1/p} \qquad 1 \leq p \leq \infty \quad \text{j=1, 2, 3… J}$$

The solution obtained by *minj Sj* is a maximum group utility (‘‘majority’’ rule), and the solution obtained by *minj Rj* is a minimum individual regret of the ‘‘opponent’’. The compromise ranking algorithm of VIKOR involves the following steps:

a) Determine the best f_j^* and the worst f_j^- values of all criterion functions j=1, 2, 3… n

$$f_j^* = \max_i f_{ij} \qquad f_j^- = \min_i f_{ij}$$

b) Compute the values of S_i and R_i by the relations:

$$S_i = \sum_{i=1}^{n} \frac{w(f_i^* - f_{ij})}{(f_i^- - f_{ij})}$$

$$R_i = \max_i \frac{w(f_i^* - f_{ij})}{(f_i^- - f_{ij})}$$

Where Wi is the weight of criteria, expressing their relative importance.

c) Compute the values ofQ_i:

$$Q_i = \frac{v(S_i - S^*)}{S^- - S^*} + \frac{(1-v)(R_i - R^*)}{R^- - R^*} \tag{5}$$

where

$$S^* = \min_j S_j \quad , \quad S^- = \max_j S_j$$

$$R^* = \min_j R_j \quad , \quad R^- = \max_j R_j$$

And v is introduced as weight of the strategy of ‘‘the majority of criteria’’ (or ‘‘the maximum group utility’’), here v = 0.5.

d) Rank the alternatives sorting by values of S, R and Q in decreasing order, Propose as a compromise solution the alternative A(1), which is the best ranked by the measure Q(minimum), if the following two conditions are satisfied:

a. Acceptable advantage. Q ((A^2)) _ Q ((A^1)) ≥DQ, where DQ =1.j-1 and A (2) is the alternative with second position in the ranking list by Q

b. Acceptable stability in decision-making. The alternative A (1) must also be the best ranked by S or.and R This compromise solution is stable within a decision-making process, which could be the

strategy of maximum group utility (when v >0.5 is needed), or "by consensus" (v>0.5), or with veto (v <0.5).

If one of the conditions is not satisfied, then a set of compromise Solutions can be proposed including:

a. Alternative A(1) and A(2) if only condition b is not satisfied, or
b. Alternatives A (1), A (2)... A (M) if the condition is not satisfied. A (M) is determined by the relation Q (A^M-A^1) < DQ for maximum M (the positions of these alternatives are "in closeness").

3.4. Techniques for order preference by similarity to an ideal solution (TOPSIS)

TOPSIS is a multiple-criteria decision-making method which was initially proposed by Hwang and Yoon (1981). In this method, *M* alternatives by *N* index are evaluated. The technique is based on the idea that the optimal solution should have the shortest distance from the positive ideal solution and is the farthest one from the negative ideal solution. A solution is determined as a positive ideal solution if it maximizes the benefit criteria or minimizes the cost criteria. On the other hand, the solution which maximizes the cost criteria or minimizes the benefit criteria is called the *negative ideal solution*. (Oztaysi, 2014) In other words, in ranking alternatives in TOPSIS method, alternatives with the greatest similarity to the ideal solution gain the highest rank. The target interval between the two criteria is shown, as an example in Figure (1). A+ and A- are respectively the solution of the positive and negative ideals. Alternative A1 has the shorter interval to the ideal solution and is more distant from the negative ideal solution.

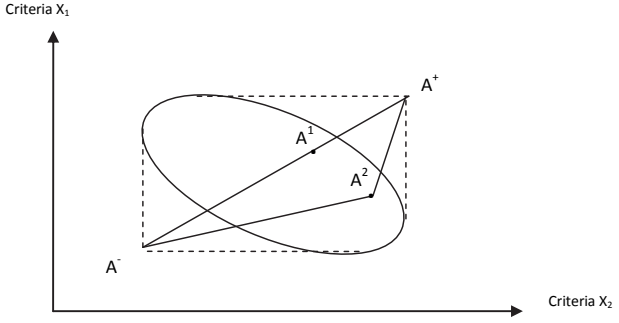

Fig. 2. The target interval is the ideal solution between two criteria: positive and negative

In this method, in addition to the distance of an alternative the ideal point of A_i, its distance from the negative ideal point is considered as well. It is assumed that the desirability of each indicator is increasing or reducing steadily. Problem solving with this method requires the following six steps:

The first step: The quantification and normalization of decision matrix (N):

To normalize the decision matrix for each element, the following equation is used:

$$n_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}} \tag{6}$$

Step two: Obtaining the weighted normalized matrix (V):

In order to obtain the weighted normalized matrix, the normalized matrix (N) is multiplied by $W_{n\times n}$, which is a square matrix and its diametrical elements are the weights of the indicators and the rest of the elements are 0.

$$V = N \times W_{n\times n} \tag{7}$$

Step three: Obtaining a positive ideal V_j^+ and a negative ideal V_j^- for each indicator.

Step four: determining the distance between each alternative and its positive and negative ideals.

$$d_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+\right)^2} \tag{8}$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2} \tag{9}$$

Step five: determining the relative proximity of each alternative to the ideal solution.

$$CL_i^* = \frac{d_i^-}{d_i^- + d_i^+} \qquad CL_i^* = \frac{d_i^-}{d_i^- + d_i^+} \tag{10}$$

Step six: ranking the alternatives:

The alternative with the greater CL is the best alternative to choose.

4. Results

In this section, the outputs of VIKOR and TOPSIS methods are reviewed and analysed, and different Iranian provinces are ranked according to these outputs.

4.1. VIKOR Results

S, R and Q measures of the Iranian provinces are illustrated in Table 2.

Table 2
S, R and Q measures of the provinces

No	Province	S	R	Q
1	East Azerbaijan	0.775923	0.118889	0.831056
2	West Azerbaijan	0.857104	0.123426	0.915463
3	Ardabil	0.908901	0.124334	0.954354
4	Isfahan	0.619912	0.114351	0.700333
5	Alborz	0.938478	0.119796	0.938499
6	ILam	0.971611	0.125241	1
7	Bushehr	0.916108	0.120704	0.931486
8	Tehran	0.163778	0.058825	0
9	Chaharmahal Bakhtiari	0.932674	0.124334	0.969068
10	South Khorasan	0.949991	0.122519	0.966122
11	Razavi Khorasan	0.585539	0.109813	0.644897
12	North Khorasan	0.962249	0.125241	0.994206
13	Khuzestan	0.748104	0.116166	0.793341
14	Zanjan	0.949511	0.125241	0.986321
15	Semnan	0.913731	0.124334	0.957344
16	Sistan and Baluchistan	0.883317	0.125241	0.945352
17	Fars	0.700102	0.117074	0.770462
18	Qazvin	0.929646	0.124334	0.967194
19	Qom	0.943561	0.123426	0.968974
20	Kurdistan	0.916637	0.123426	0.95231
21	Kerman	0.805286	0.117074	0.835565
22	Kermanshah	0.873499	0.124334	0.932442
23	Kohgiluyeh and Boyer-Ahmad	0.961659	0.124334	0.987008
24	Golestan	0.902198	0.117981	0.90238
25	Gilan	0.80424	0.116166	0.828085
26	Lorestan	0.914895	0.120704	0.930735
27	Mazandaran	0.783546	0.118889	0.835774
28	Markazi	0.89244	0.123426	0.937334
29	Hormozgan	0.877424	0.124334	0.934872
30	Hamadan	0.886164	0.119796	0.90612
31	Yazd	0.913147	0.124334	0.956982

According to the results of S, R and Q for each of the provinces, Table 3 displays the rank of each province.

Table 3
Ranking of the provinces

Province	S	Province	R	Province	Q
ILam	0.971611	ILam	0.125241	ILam	1
North Khorasan	0.962249	North Khorasan	0.125241	North Khorasan	0.994206
Kohgiluyeh and Boyer-Ahmad	0.961659	Zanjan	0.125241	Kohgiluyeh and Boyer-Ahmad	0.987008
South Khorasan	0.949991	Sistan and Baluchistan	0.125241	Zanjan	0.986321
Zanjan	0.949511	Ardabil	0.124334	Chaharmahal Bakhtiari	0.969068
Qom	0.943561	Chaharmahal Bakhtiari	0.124334	Qom	0.968974
Alborz	0.938478	Semnan	0.124334	Qazvin	0.967194
Chaharmahal Bakhtiari	0.932674	Qazvin	0.124334	South Khorasan	0.966122
Qazvin	0.929646	Kermanshah	0.124334	Yazd	0.956982
Kurdistan	0.916637	Kohgiluyeh and Boyer-Ahmad	0.124334	Semnan	0.957344
Bushehr	0.916108	Hormozgan	0.124334	Ardabil	0.954354
Lorestan	0.914895	Yazd	0.124334	Kurdistan	0.95231
Semnan	0.913731	West Azerbaijan	0.123426	Sistan and Baluchistan	0.945352
Yazd	0.913147	Qom	0.123426	Alborz	0.938499
Ardabil	0.908901	Kurdistan	0.123426	Markazi	0.937334
Golestan	0.902198	Markazi	0.123426	Hormozgan	0.934872
Markazi	0.89244	South Khorasan	0.122519	Kermanshah	0.932442
Hamadan	0.886164	Bushehr	0.120704	Bushehr	0.931486
Sistan and Baluchistan	0.883317	Lorestan	0.120704	Lorestan	0.930735
Hormozgan	0.877424	Hamadan	0.119796	West Azerbaijan	0.915463
Kermanshah	0.873499	Alborz	0.119796	Hamadan	0.90612
West Azerbaijan	0.857104	Mazandaran	0.118889	Golestan	0.90238
Kerman	0.805286	East Azerbaijan	0.118889	Mazandaran	0.835774
Gilan	0.80424	Golestan	0.117981	Kerman	0.835565
Mazandaran	0.783546	Kerman	0.117074	East Azerbaijan	0.831056
East Azerbaijan	0.775923	Fars	0.117074	Gilan	0.828085
Khuzestan	0.748104	Gilan	0.116166	Khuzestan	0.793341
Fars	0.700102	Khuzestan	0.116166	Fars	0.770462
Isfahan	0.619912	Isfahan	0.114351	Isfahan	0.700333
Razavi Khorasan	0.585539	Razavi Khorasan	0.109813	Razavi Khorasan	0.644897
Tehran	0.163778	Tehran	0.058825	Tehran	0

As Table 3 shows, the provinces of Tehran, Razavi Khorasan, and Isfahan were respectively ranked 1st to 3rd as provinces with conditions better than those of other provinces in terms of infrastructure.

4.2. TOPSIS Results

The results obtained from TOPSIS analysis (see Table 4) confirmed the results observed in the VIKOR test. In fact, the provinces of Tehran, Razavi Khorasan, and Isfahan demonstrated better rates in their tourism infrastructure.

Table 4
Results of TOPSIS

No	Province	d-	d+	CL
1	East Azerbaijan	0.03195	0.18921	0.144464
2	West Azerbaijan	0.020228	0.199201	0.092185
3	Ardabil	0.017927	0.203248	0.081052
4	Isfahan	0.057245	0.175435	0.246025
5	Alborz	0.013625	0.203364	0.06279
6	ILam	0.005167	0.212005	0.023792
7	Bushehr	0.014063	0.205026	0.064187
8	Tehran	0.199143	0.054408	0.785417
9	Chaharmahal Bakhtiari	0.010258	0.208561	0.046881
10	South Khorasan	0.008249	0.209003	0.03797
11	Razavi Khorasan	0.088999	0.161261	0.355627
12	North Khorasan	0.005843	0.211233	0.026918
13	Khuzestan	0.035931	0.185578	0.162209
14	Zanjan	0.007197	0.210222	0.033104
15	Semnan	0.016387	0.208475	0.072875
16	Sistan and Baluchistan	0.017137	0.208207	0.076049
17	Fars	0.044771	0.179419	0.1997
18	Qazvin	0.011276	0.208661	0.051269
19	Qom	0.011603	0.206243	0.053263
20	Kurdistan	0.013712	0.206231	0.062345
21	Kerman	0.027133	0.198501	0.120251
22	Kermanshah	0.020345	0.204656	0.090421
23	Kohgiluyeh and Boyer-Ahmad	0.006013	0.211026	0.027706
24	Golestan	0.015037	0.200788	0.069671
25	Gilan	0.033518	0.188871	0.150717
26	Lorestan	0.012877	0.204033	0.059366
27	Mazandaran	0.032728	0.189072	0.147558
28	Markazi	0.015399	0.205868	0.069594
29	Hormozgān	0.022471	0.206928	0.097957
30	Hamadan	0.019758	0.200814	0.089577
31	Yazd	0.013225	0.204383	0.060775

5. Discussion and Conclusion

Nowadays, tourism is considered to be a key industry that contributes to the economic and social welfare of developing countries (Walker & Walker, 2011). This industry is developing into the largest industry in the world, although its development is not homogenous in different countries, including Iran. In contrast to its diverse potentials in the tourism industry, Iran has a limited and slow-moving tourism industry, despite its high potentials (Amiri Aghdaei & Momeni, 2011). Many studies have tried to figure out the reasons behind this shortcoming. The inappropriate condition of the Iranian tourism infrastructure is one of the fundamental reasons (Soleimani Moghadam & Islami, 2011).

Tourism infrastructure, as one of the main elements of the supply side of the tourism system (Vanhove, 2010), sets the ground for tourism development (Panasuik, 2007). As a result of the importance of tourism infrastructure, a number of approaches have been proposed to define and categorize this notion, while most of them unanimously divide the tourism infrastructure into hard and soft types. In the

present research, the hard assets of the tourism infrastructure were examined in the different provinces of Iran, using Pearce and Wu's (2015) model. Considering the elements of this model, 20 indicators were extracted based on the statistical yearbook of the Statistical Centre of Iran. The weights of these indicators were then measured through Shannon entropy, while VIKOR and TOPSIS were also applied to rank the provinces.

The results from VIKOR and TOPSIS were found to be relatively different. The results showed that the level of hard infrastructure in different regions of Iran was not homogenous, and among the provinces, Tehran, Razavi Khorasan, Isfahan and Fars were placed 1st to 4th, respectively, as the regions with more appropriate conditions than the others in terms of the tourism hard infrastructure. The results also demonstrated Ilam, North Khorasan, and Kohgiluyeh and Boyer-Ahmad had the least developed conditions in terms of the tourism hard infrastructure.

Given the results, it can be concluded that the development of tourism infrastructure in different regions of Iran was asymmetric and imbalanced. This observation confirmed the findings of other relevant studies (e.g. Bayati Khatibi et al., 2015; Karami et al., 2013; Shamai & Masoudvand, 2011). Furthermore, the results indicated that the provinces with lower ranks, such as Kohgiluyeh and Boyer-Ahmad, were among the provinces which were relatively underdeveloped from industrial and economic perspectives. However, they seemed to have a considerable potential in the field of tourism. This finding also confirmed the observations of previous studies as conducted by Bayati Khatibi et al., (2015), Ebrahimzade et al. (2014) and Shamai and Masoudvand (2011).

In contrast, the provinces with major urban zones (metropolises), such as the capital, showed the best rankings, although Tehran city, compared to the other metropolises in advanced countries, showed a relatively less favourable condition (Famil Norouzi et al., 2015). It is also important to mention that the provinces with better infrastructural conditions hosted a higher number of domestic and foreign visitors and tourists.

It can be concluded, in line with the findings of the studies already mentioned (i.e. Ahadnejad Raveshti & Salehi Mishani, 2012; Soleimani Moghadam & Islami, 2011; Samadian, Hoseini & Rauf Ava, 2009), the tourism infrastructure is a key factor in tourist attraction as well as tourism development. It should be also noted that in a developing country such as Iran, the expansion of the tourism infrastructure in all of the regions will help to improve the entire course of development of the tourism industry, which ultimately results in the overall development of the country.

6. Suggestions

Based on the results observed in this study, two groups of suggestions are proposed in this section. The first group includes a set of practical ideas that can guide policy-makers in their plans of tourism industry development in Iran. The next set of suggestions address possible academic topics for research.

6.1. Practical Suggestions

- An attempt should be made by the state to establish infrastructural bases for all of the provinces, especially those that seem to have been underdeveloped in the area, such as Ilam, North Khorasan, and Kohgiluyeh and Boyer-Ahmad.

- An attempt should be made by the Statistical Centre of Iran to define new indicators in its model of hard infrastructure, including the indicators that can reveal the condition of the food and beverage system. The model should also be updated in a specific time period based on expert opinions.

- The Statistical Centre of Iran should also design a system to examine the condition of soft infrastructure in the different regions of the country.

6.2. Suggestions for Research

- The relation between tourism infrastructure and tourism development in the different provinces of Iran must be exactly investigated through quantitative methods.

- The indicators for evaluating tourism hard infrastructure must be reviewed and updated in the regular time periods, paying sufficient attention to local considerations

The concept of soft infrastructure in the context of tourism must be explained and its indicators must be extracted, by paying sufficient attention to local considerations.

- The condition of soft infrastructure in different provinces of Iran must be examined and compared.

- Practical solutions must be proposed and ranked to improve the condition of tourism infrastructure in Iran.

References

Ahadnejad Raveshti, M. & Salehi Mishani, H. (2012). Evaluating the spatial distribution of the tourism infrastructures and determination of the role of economic- political processes and physical growth of cities in it (case study of Zanjan). *Tourism Studies, 1* (1), 91-105.

Amiri Aghdaie, S. F. & Momeni, R. (2011). Investigating effective factors on development of tourism industry in Iran. *Asian Social Science, 7* (12), 98-109.

Armaghan, S. (2007). *Tourism and its role in geography*. Islamshahr: Azad university of Islamshahr.

Bayati Khatibi, M., Zeinali, B. & Shojaivand, B. (2015). Survey and analysis of the urban tourism infrastructures' distribution (case study of the east Azerbayjan province). *Geographical space, 15* (49), 213-236.

Boers, B. & Cottrell, S. (2007). Sustainable tourism infrastructure planning: a GIS-supported approach. *Tourism Geographies, 9* (1), 1-21.

Bookman, M. Z. & Bookman, K. R. (2007). *Medical tourism in developing countries.* New York, NY: Palgrave Macmillan.

Chu, M.-T., Shyu, J., Tzeng, G.-H. & Khosla, R. (2007). Comparison among three analytical methods for knowledge communities: group decision analysis. *Expert Systems with Applications*, 33 (4), 1011-1024.

Dujmovic, M. & Vitasovic, A. (2014). Tourism product and destination positioning. *Mediterranean Journal of Social Sciences. 5* (19), 570-579.

Ebrahimzade, I., Hafez Rezazade, M. & Daraei, M. (2014). Optimized planning and locating of the urban tourism facilities and infrastructures by the application of GIS: case study of Semnan. *Geography and Development,* 35, 33-48.

Enimola, S. S. (2010). Infrastructure and economic growth: the Nigeria experience, 1980-2006. *Journal of Infrastructure Development, 2* (2), 121-133.

Famil Norouzi, H., Sharifi, Sh. & Sheidayi, A. (2015). Evaluation of urban tourism through emphasizing the development of tourism infrastructures and urban competitiveness (case study of Tehran). *Urban Management,* 39, 369-392.

Garcia, P. J. C. & Rivero, M. S. (2015). Tourism and economic development: analysis of geographic features and infrastructure provision. *Current Issues in Tourism, 18* (7), 609-632.

Ghoshal, S. (2013). Soft or hard: infrastructure matters in rural economic empowerment. *Journal of Infrastructure Development, 5* (2), 137-149.

Goeldner, C. R. & Ritchie, J. R. (2009). *Tourism: principles, practices, philosophies*. (11th Edition), New Jersey, NJ: John Wiley & Sons.

Hall, C. M. & Lew, A. A. (2009). *Understanding and managing tourism impacts; an integrated approach.* New York, NY: Routledge.

Hall, C. M. & Page, S. J. (2006). *The geography of tourism and recreation.* (3rd Edition), New York, NY: Routledge.

Hope, K. R. (2010). Infrastructure constraints and development in Kenya: an analytical review. *Journal of Infrastructure Development, 2* (2), 91-104.
Jamil, J. & Puad, M. S. (2010). Challenges in managing infrastructure for urban tourism: a comparative study of three Asian cities. *WIT Transactions on Ecology and the Environment, 142*, 243-253.
Karami, F., Zeinali, B., Shojaeevand, B. & Omrani, Kh. (2013). Survey and analysis of the unequal distribution of the tourism infrastructures (case study of the province of Golestan). *Tourism Studies, 2* (3), 139-159.
Kargar, B. (2007). *Urbanization development and tourism industry in Iran (from concept to solution).* Tehran: Geographical organization of the army.
Maleki, S. & Mavadat, E. (2014). An analysis of the distribution and prioritizing tourism infrastructure of Yazd province using planning techniques. *Journal of Practical Researches in the Geographical Sciences, 14* (34), 47-68.
Mohseni, R. A. (2009). Sustainable tourism in Iran; challenges and solutions. *Journal of Geographical Space, 28,* 149-171.
Morakabati, Y. (2011). Deterrents to tourism development in Iran. *International Journal of Tourism Research, 13,* 103-123.
Nallatiga, R. (2015). Assessing infrastructure level and growth performance of Indian states. *Journal of Infrastructure development, 7* (1), 76-100.
Opricovic, S. (1998). *Multicriteria Optimization of Civil Engineering Systems*, Faculty of Civil Engineering, Belgrade.
Opricovic, S. & Tzeng, G.-H. (2007). Extended VIKOR method in comparison with outranking methods. *European Journal of Operational Research*, *178*, 514-529.
Opricovic, S. & Tzeng, G. H. (2004). Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS. *European Journal of Operational Research, 156*, 445-455.
Opricovic, S. & Tzeng, G.-H. (2002). Multicriteria planning of post-earthquake sustainable reconstruction. *Computer-Aided Civil and Infrastructure Engineering*, 17(3), 211-220.
Panasuik, A. (2007). Tourism infrastructure as a determinant of regional development. *Ekonomika ir Vadyba: Aktualijos ir Perspektyvos, 1* (8), 212-215.
Pearce, P. L. & Wu, M. Y. (2015). Soft infrastructure at tourism sites: identifying key issues for Asian tourism from case studies. *Tourism Recreation Research, 40* (1), 120-132.
Rahimpoor, A. (2008). Study and survey of the status of Iran's tourism industry in the international market of tourism business. *Human Geography, 1* (1).
Rao R. V. (2007). *Decision making in the manufacturing environment using graph theory and fuzzy multiple attribute decision making methods*. London, UK: Springer-Verlag.
Samadian, A., Hoseini, S. H. & Rauf Ava, M. N. (2009). Role of training in the development of the infrastructures in the tourism industry of Iran. *Human Geography, 1* (4), 105-118.
Seetanah, B., Juwaheer, T. D., Lamport, M. J., Rojid, S., Sannassee, R. V. & Subadar, A. U. (2011). Does infrastructure matter in Tourism Development*?*. *University of Mauritius Research Journal*, 17(1), 89-108.
Sekaran, U. & Bougie, R. (2013). *Research methods for business: a skill-building approach.* (6th Edition), New Jersey, NJ: Wiley.
Shamai, A. & Mousavand, J. (2011). Classification of cities of Isfahan province in view point of tourism infrastructure by using TOPSIS and AHP models. *Urban- Regional Studies and Research Journal, 3* (10), 23-40.
Sharpley, R. (2008). Planning for tourism: the case of Dubai. *Tourism and Hospitality Planning and Development, 5* (1), 13-30.
Soleimani Moghadam, M. & Islami, Q. (2011). The role of accommodation infrastructures in the tourism activities of Rasht. *Geographical Perspective, 6* (17), 105-115.
Suleiman, N. N. & Albiman, M. M. (2014). Dynamic relationship between tourism, trade, infrastructure and economic growth: empirical evidence from Malaysia. *Journal of African Studies and Development, 6* (3), 49-55.
Strietska, I. O. & Tessaring, M. (2005). *Trends and skill needs in tourism*. Cedefop, 115.

Thapa, B. (2012). Soft-infrastructure in tourism development in developing countries. *Annals of Tourism Research, 39* (3), 1705-1710.

Tribe, J. (2004). *The economics of recreation, leisure and tourism.* (3rd Edition), Oxford, UK: Elsevier.

Vanhove, N. (2010). *The economics of tourism destinations*. London, UK: Taylor & Francis.

Walker, J. & Walker, J. (2011.) Tourism concepts and practices; Prentice Hall.

Williams, S. (2009). *Tourism geography: a new synthesis.* New York, NY: Routledge.

WTTC. (2015). *Economic impact of World.* Retrieved from: https:..www.wttc.org.-.media.files.reports.economic%20impact%20research.regional%202015.world2015.pdf

WTTC. (2015). *Economic impact of Iran.* Retrieved from: https:..www.wttc.org.-.media.files.reports.economic%20impact%20research.countries%202015.iran2015.pdf

Yu, M. (2016). Research on the impact of infrastructure construction on tourism industry: evidence from the "Wuhan-Guangzhou high speed rail". *Open Journal of Social Sciences, 4*, 126-131.

Zhang, Y. & Murphy, P. (2009). Supply-chain considerations in marketing underdeveloped regional destinations: A case study of Chinese tourism to the Goldfields region of Victoria. *Tourism Management, 30*, 278-287.

Appendix 1

Model indicators and the condition of provinces

Row	Provinces	Active hospital	Stable bed	Number of infirmaries, clinics and poly clinics according to the type of dependence	Number of emergency centres in the hospitals	Number of cinema halls	Capacity of cinema halls (number of seats)	Number of sports places	The square of sports places	Number of high speed internet lines	Transportation corporations	Number of marked automotive vehicles and motorcycle	Number of residencies in the country	The length of the average pressure of distribution's network (Km)	The length of the weak pressure of distribution's network (Km)	Number of gas branch	Cities covered by the installations of water and sewage	Cities with the branch of sewage	Number of sewage refineries	The square of green space	Number of airports
1	East Azerbaijan	46	7910	208	96	8	4390	1013	2903914	361075	91	53064	108	16703	14288	578646	58	12	9	296	2
2	West Azerbaijan	30	5189	121	67	3	2180	656	1775454	238471	40	51394	94	14485	11443	328716	38	11	7	101	2
3	Ardabil	15	2530	47	37	2	1141	509	1546634	99843	27	14619	216	7060	5923	189109	23	8	3	212	1
4	Isfahan	63	9461	402	129	13	4954	1309	3373117	606742	77	151846	158	24197	24765	995154	105	31	24	626	1
5	Alborz	16	2416	147	46	7	2595	183	501750	193430	12	10815	28	4836	7211	0	19	7	1	99	0
6	Ilam	9	998	26	34	1	300	172	474085	37169	4	11065	19	4367	2493	72675	19	4	4	30	1
7	Bushehr	14	1461	41	43	6	1541	265	957671	110351	157	37530	27	7100	5774	115647	33	3	3	69	2
8	Tehran	162	32700	655	207	139	43139	3314	7105475	2127186	126	539472	338	22274	39786	1467426	41	8	13	738	2
9	Chahar mahalo bakhtiari	9	1451	36	39	2	1200	295	582055	61283	29	15963	21	6296	4555	164673	34	8	5	237	1
10	South Khorasan	9	829	32	51	4	1150	472	838824	59619	11	12414	21	12197	4848	82002	21	1	1	54	2
11	Razavi Khorasan	56	12108	232	167	18	6268	1028	4491399	553347	103	153459	1027	31583	21955	787277	74	7	7	823	2
12	North Khorasan	11	1083	40	37	1	453	304	794077	50258	44	13901	19	5763	4159	123691	18	2	2	27	1
13	Khuzestan	49	7642	150	131	11	5306	1273	3971759	416141	105	109960	64	21027	17164	577324	62	17	7	147	3
14	Zanjan	13	2547	41	38	1	231	306	797608	71286	35	19537	26	7857	5437	142608	19	2	2	128	1
15	Semnan	11	2034	70	41	2	670	410	931946	89302	19	12448	16	6850	4202	127233	19	6	3	546	2
16	Sistano Baluchistan	18	989	58	95	1	200	639	1453661	86117	74	38327	41	22680	11369	6977	37	4	2	271	4
17	Fars	63	12126	25	157	10	6448	1597	4756048	445221	71	149422	200	33398	23101	622960	81	7	3	500	3
18	Ghazvin	14	2153	59	34	2	400	431	1078056	96217	43	19674	20	6763	4885	169065	26	14	4	158	0
19	Qom	10	2112	64	36	3	750	475	734934	135397	8	31794	81	3287	3569	160637	6	1	2	308	0
20	Kurdistan	17	2252	38	39	3	1329	259	766372	112034	53	15903	53	9905	5226	224680	24	18	4	46	1
21	Kerman	29	4541	104	119	10	292	933	2031270	171477	81	67901	65	29377	19814	297465	69	2	2	406	5
22	Kermanshah	23	3257	84	44	2	916	638	2042735	136853	37	35725	47	11221	6487	207500	27	27	7	217	1
23	Kokilouyeo bouyerahmad	9	775	52	32	2	563	266	1237580	29860	39	7883	15	4688	3318	93667	15	3	2	76	1
24	Golestan	25	2821	68	49	9	2289	504	1236436	128837	65	34230	49	7078	6988	254775	22	4	4	86	2
25	Gilan	31	4845	85	57	11	5386	890	2003131	190878	104	33692	218	8648	18528	455154	48	33	4	96	1
26	Lorestan	22	2692	45	56	6	2136	406	1008314	86240	100	25861	31	8866	6968	204475	24	7	4	25	1
27	Mazandaran	42	5499	153	10	8	3928	1777	3925713	418575	141	53775	178	14234	20381	621610	52	7	6	113	3
28	Markazi	19	2193	40	44	3	1120	711	1464260	118374	107	25910	18	11201	7982	255841	30	8	10	215	1
29	Hormozgan	20	2204	0	0	2	434	787	2422877	110193	245	54245	49	14434	8950	5580	36	5	4	27	5
30	Hamedan	21	3198	247	45	7	2356	666	1544884	97829	29	30989	30	9937	7545	297217	29	11	5	80	1
31	Yazd	19	2885	93	42	2	1600	454	1191266	134437	91	47312	66	9688	7378	188446	16	2	2	159	1