COMPARISON OF TOURISM POTENTIALS USING PREFERENCE SELECTION INDEX METHOD

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Abstract: *In a competitive economy, comparisons with competitors can be very useful. A Preference Selection Index (PSI) method is relatively new, efficient and easy to use multiple-criteria decision-making (MCDM) method. Therefore, the applicability of this method for comparison with competitors is discussed in this article. The comparison is made on the example of tourist destinations located in the Central and Southern / Mediterranean Europe.*
Keywords: *tourism, destination, competitiveness, MCDM, PSI method.*

INTRODUCTION

Multiple-criteria decision-making (MCDM), as a process of selecting one from a set of available alternatives, or ranking them, has so far been applied for solving a number of real decision-making problems in different areas.

As a result of the significant popularity of the multiple criteria analysis in the previous period, numerous MCDM methods have been proosed. As a prominent, the following methods can be mentioned MCDM methods: SAW (MacCrimon, 1968), AHP (Saaty, 1978), TOPSIS (Hwang & Yoon, 1981), VIKOR (Opricovic, 1998), ARAS (Zavadskas & Turskis, 2010), MULTIMOORA (Brauers & Zavadskas, 2010), and so on.

Despite the considerable number of previously proposed MCDM methods, there are also new MCDM methods. As one of the more recent, and certainly often used, a preference selection index (PSI) method can be mentioned. This method was proposed by Maniya and Bhatt in 2010.

Although PSI is a relatively new MCDM method, it has been used for solving many decision-making problems, such as: material selection (Maniya and Bhatt 2010), flexible manufacturing system selection (Maniya and Bhatt 2011), human resource management (Vahdani *et al*.

2014), cutting-fluids selection (Attri *et al*. 2014), sustainable mining contractor selection (Borujeni and Gitinavard 2017), and determination of laser cutting process conditions (Madic *et al*. 2017)

The specificity of the PSI method reflects through the fact that it does not require determination of the criteria weights before its use, because determining the importance of criteria is its integral part. In addition, the computational procedure is quite simple, which makes it very acceptable for use by persons who are not specialists in multiple criteria decision-making.

On the other hand, many countries with less developed tourism offer have noticed the benefits that tourism can bring and are making efforts to improve their tourism offer. In addition to traditional tourist offers, such as classic summer and winter tourism, they often base their offers on a number of new or less represented tourist attractions. In a competitive economy, it is very important to make comparisons with other competitors and take action so that the impact of the entry of new competitors or new offers is timely observed and appropriate measures taken.

Since 2009, the World Economic Forum has been publishing a Travel and Tourism Competitiveness Report every year. These reports contain data that can be used to assess competitiveness.

Therefore, this article is organized as follows: in Section 1 the computational procedure of the PSI method is presented in detail, and in Section 2 the use of the PSI method for determining for determining the level of competitiveness is shown. Finally in section 3 conclusions are given.

THE COMPUTATIONAL PROCEDURE OF THE PSI METHOD

Based on Maniya and Bhatt (2010) and Chauhan *et al*. (2016), the computational procedure of the PSI method contains the following steeps.

***Step* 1**. Determine the objective and identify the relevant criteria for the evaluation of the alternatives.

***Step* 2**. Evaluate the alternatives and construct initial decision-making matrix *D*, as follows:

$$D = [x_{ij}]_{mxn}\,, \tag{1}$$

where: x_{ij} denotes ratings of the alternative i in relation to criterion j, m is the number of alternatives and n is the number of criteria.

***Step* 3**. Construct the normalized decision matrix in which the elements of the matrix are calculated as follows:

$$r_{ij} = \frac{x_{ij}}{\max\limits_{i} x_{ij}} \text{ for beneficial (maximization) criteria,} \tag{2}$$

$$r_{ij} = \frac{\min\limits_{i} x_{ij}}{x_{ij}} \text{ for non-beneficial (minimization) criteria.} \tag{3}$$

***Step* 4**. Calculate preference variation value in relation to each criterion as follows:

$$\chi_j = \sum_{i=1}^{m} (r_{ij} - \bar{r}_j)^2 \tag{4}$$

where $\bar{r}_j$ denotes the mean value of normalized ratings of criterion j and it is determined as follows:

$$\bar{r}_j = \frac{1}{m} \sum_{i=1}^{m} r_{ij} \,. \tag{5}$$

***Step* 5**. Calculate deviation in the preference variation value as follows:

$$\Omega_j = 1 - \chi_j \tag{6}$$

Chauhan *et al*. (2016) proposed the following equation for determining deviation in the preference variation value:

$$\Omega_j = 1 - \frac{\chi_j}{m-1} \tag{7}$$

***Step* 6**. Determine the criteria weights using the following equation:

$$w_j = \frac{\Omega_j}{\sum_{j=1}^{n} \Omega_j} \tag{8}$$

***Step* 7**. Calculate the preference selection index of alternatives as follows:

$$S_i = \sum_{j=1}^{n} r_{ij} w_j \tag{9}$$

***Step* 8**. Based on the preference selection index values of the alternatives, determine the complete ranking order of alternatives. The alternative which has the largest preference selection index represents the best ranked alternative

A NUMERICAL ILLUSTRATION

Based on Calderwood & Soshkin (2019) Fedajev *et al*. (2019) conducted a comparative analysis of the tourism potential in the Republic of Serbia and Central and Eastern Europe as well as South East Europe. In this article the following 9 indicators, adopted from The Travel & Tourism Competitiveness Report 2019, were used: Number of hotel rooms (C_1), Quality of tourism infrastructure (C_2), Number of World Heritage natural sites (C_3), Total protected areas (C_4), Natural tourism digital demand (C_5), Attractiveness of natural assets (C_6), Number of World Heritage cultural sites (C_7), Oral and intangible cultural heritage (C_8), and Cultural and entertainment tourism digital demand (C_9).

According to above mentioned indicators, the ranking of the following alternatives is performed: Albania (A_1), Bosnia and Herzegovina (A_2), Bulgaria (A_3), Croatia (A_4), Czech Republic (A_5), Hungary (A_6), Montenegro (A_7), North Macedonia (A_8), Poland (A_9), Romania (A_{10}), Serbia (A_{11}), Slovak Republic (A_{12}), and Slovenia (A_{13}).

The initial decision making matrix is shown in **Table 1**.

Table 1. Initial data

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
A_1	0.60	4.50	1.00	13.50	15.00	5.60	2.00	1.00	2.00
A_2	0.50	3.70	0.00	1.40	2.00	4.60	3.00	3.00	8.00
A_3	1.70	4.60	3.00	28.30	19.00	5.00	7.00	7.00	5.00
A_4	1.90	4.90	2.00	23.60	85.00	6.00	8.00	17.00	21.00
A_5	1.30	5.00	0.00	22.20	12.00	4.30	12.00	6.00	5.00
A_6	0.80	4.80	1.00	22.60	4.00	4.50	7.00	6.00	7.00
A_7	2.70	5.10	1.00	4.20	15.00	5.90	3.00	0.00	2.00
A_8	0.40	3.20	1.00	9.70	1.00	4.20	1.00	5.00	1.00
A_9	0.40	4.60	1.00	38.10	13.00	4.40	14.00	1.00	18.00
A_{10}	0.80	3.70	2.00	24.30	8.00	5.10	6.00	7.00	7.00
A_{11}	0.40	4.30	0.00	6.60	1.00	4.50	5.00	3.00	1.00
A_{12}	0.70	4.40	2.00	37.60	4.00	5.10	5.00	6.00	2.00
A_{13}	1.10	4.70	2.00	55.10	19.00	5.90	2.00	4.00	5.00

Source: Travel & Tourism Competitiveness Report 2019

In the above mentioned article of Fedajev *et al*. (2019) the EDAS mentod is used for final ranking of alternatives while the significance of the criteria was determined using the Entropy method. In contrast, the PSI method is applied in this article, as shown in detail below.

The normalized decision matrix, constructed using Eq. (2), is shown in **Table 2.**

Table 2. The normalized decision-making matrix

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
A_1	0.22	0.88	0.33	0.25	0.18	0.93	0.14	0.06	0.10
A_2	0.19	0.73	0.00	0.03	0.02	0.77	0.21	0.18	0.38
A_3	0.63	0.90	1.00	0.51	0.22	0.83	0.50	0.41	0.24
A_4	0.70	0.96	0.67	0.43	1.00	1.00	0.57	1.00	1.00
A_5	0.48	0.98	0.00	0.40	0.14	0.72	0.86	0.35	0.24
A_6	0.30	0.94	0.33	0.41	0.05	0.75	0.50	0.35	0.33
A_7	1.00	1.00	0.33	0.08	0.18	0.98	0.21	0.00	0.10
A_8	0.15	0.63	0.33	0.18	0.01	0.70	0.07	0.29	0.05
A_9	0.15	0.90	0.33	0.69	0.15	0.73	1.00	0.06	0.86
A_{10}	0.30	0.73	0.67	0.44	0.09	0.85	0.43	0.41	0.33
A_{11}	0.15	0.84	0.00	0.12	0.01	0.75	0.36	0.18	0.05
A_{12}	0.26	0.86	0.67	0.68	0.05	0.85	0.36	0.35	0.10
A_{13}	0.41	0.92	0.67	1.00	0.22	0.98	0.14	0.24	0.24

Source: Author’s calculation

The mean value of normalized ratings, calculated using Eq. (5), and the preference variation values, calculated using Eq. (4), are shown in **Table 3**. The deviations in the preference variation, calculated using Eq. (7), and finally criteria weights, calculated using Eq. (8), are also shown in **Table 3**.

Table 3. The weights of criteria

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	Σ
$\bar{r}_j$	0.38	0.87	0.41	0.40	0.18	0.83	0.41	0.30	0.31	
χ_j	0.00	0.00	0.00	0.00	0.00	0.00	0.82	0.15	1.14	
Ω_j	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.99	0.90	8.82
w_j	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	1.00

Source: Author's calculation

Finally, the preference selection index of alternatives, calculated using Eq. (9), is shown in **Table 4**. In **Table 4** is also shown ranking order of considered alternatives.

Based on the data shown in **Table 4**, it can be concluded that according to the selected criteria, Croatia is the best positioned and Bulgaria is behind it in the second position. Romania is well placed in the fifth position, while Serbia is infamously ranked twelfth out of thirteen considered countries.

Table 4. The preference selection index and ranking order of alternatives

Alternative	*Country*	S_i	*Rank*
A_1	Albania	0.35	10
A_2	Bosnia and Herzegovina	0.28	11
A_3	Bulgaria	0.59	2
A_4	Croatia	0.81	1
A_5	Czech Republic	0.46	7
A_6	Hungary	0.44	8
A_7	Montenegro	0.44	9
A_8	North Macedonia	0.27	13
A_9	Poland	0.54	4
A_{10}	Romania	0.47	5
A_{11}	Serbia	0.27	12
A_{12}	Slovak Republic	0.47	6
A_{13}	Slovenia	0.54	3

Source: Author's calculation

The compariosn of results obtained using the PSI method and approach based on the combined use EDAS and Entropy methods are shown in **Table 5**.

Table 5. The compariosn of results obtaind using PSI and EDAS methods

		PSI	EDAS	
Alternative	*Country*	*Rank*	*Rank*	Δ
A_1	Albania	10	10	0
A_2	Bosnia and Herzegovina	11	12	-1
A_3	Bulgaria	2	2	0
A_4	Croatia	1	1	0
A_5	Czech Republic	7	6	1
A_6	Hungary	8	7	1
A_7	Montenegro	9	9	0
A_8	North Macedonia	13	11	2
A_9	Poland	4	4	0
A_{10}	Romania	5	5	0
A_{11}	Serbia	12	13	-1
A_{12}	Slovak Republic	6	8	-2
A_{13}	Slovenia	3	3	0

Source: Author's calculation

The results presented in **Table 5** confirm that the ranking results obtained using the PSI method and the combined application of EDAS and Entropy methods only slightly differ.

A much better insight into the competencies of the evaluated countries can be observed after recalculation of the values of the preference selection index using the following equation:

$$S_i' = \frac{S_i}{\sum_{i=1}^{m} S_i} \tag{10}$$

The relalculated values of the preference selection index are shown in **Table 6**.

Table 6. The recalculated preference selection indexes

Alternative	*Country*	S_i	*Rank*
A_1	Albania	0.43	10
A_2	Bosnia and Herzegovina	0.34	11
A_3	Bulgaria	0.72	2
A_4	Croatia	1.00	1
A_5	Czech Republic	0.57	7
A_6	Hungary	0.54	8
A_7	Montenegro	0.54	9
A_8	North Macedonia	0.33	13
A_9	Poland	0.66	4
A_{10}	Romania	0.58	5
A_{11}	Serbia	0.34	12
A_{12}	Slovak Republic	0.58	6
A_{13}	Slovenia	0.67	3

Source: Author's calculation

The recalculated values of preference selection indexes of four selected countries are shown in **Table 7** and in Figure 1.

Table 7. The recalculated preference selection indexes of four countries

Alternative	*Country*	S_i	*Rank*
A_3	Bulgaria	0.72	2
A_4	Croatia	1.00	1
A_{10}	Romania	0.58	5
A_{11}	Serbia	0.34	12

Source: Author's calculation

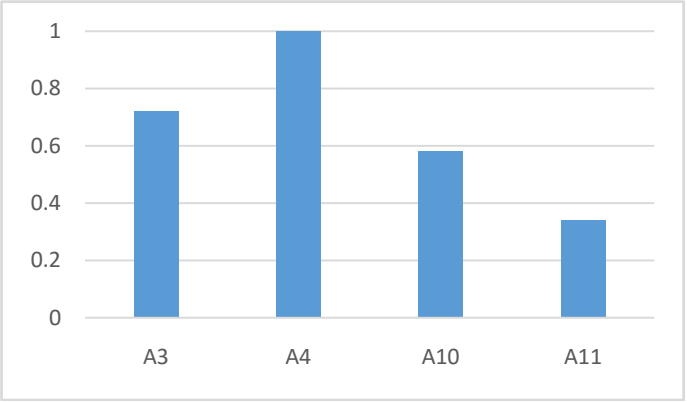

Figure 1. The competitiveness of selected countries

CONCLUSION

Based on the previously conducted calculation, it can be concluded that PSI is efficient and easy to use the method. An advantage of this method may be that it integrates the procedure for determining the weight of criteria in its procedure. In addition, the accuracy of the results obtained using the PSI method was verified by comparison with the results obtained using the Entropy and EDAS methods.

On the other hand, the results obtained indicate that Serbia has to make a lot of effort to become a tourist attractive destination. Romania is well placed in a good fifth position. However, it should pay attention that its preference selection index is only slightly higher than the preference selection index of Slovakia, the Czech Republic, and Hungaria. Therefore, Romania should continue to improve its tourism indicators.

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