MULTIPLE CRITERIA APPROACH IN THE RANKING OF THE SUSTAINABLE INDICATORS FOR CULTURAL HERITAGE SITES

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Abstract: *Cultural heritage sites become very attractive tourism destinations that visit a great number of tourists every year. This popularity has twofold effect – positive and negative. The negative side of this popularity is expressed through the probability of the devastation of a certain location. In order of the estimation of the sustainability of the cultural heritage sites a set of the indicators is introduced. In this paper the methodological framework for the evaluation and ranking of the cultural heritage sites sustainable indicators is proposed. Considered framework is based on the PIvot Pairwise RElative Criteria Importance Assessment i.e. PIPRECIA method. The main goal of this paper is to emphasize the importance of introducing the Multiple-Criteria Decision-Making methods in the process of the sustainability assessment of a certain cultural heritage site because in that way the tourism workers could easily and with assurance detect what are the most sensitive issues of some cultural destination that should be improved.*
Keywords: *PIPRECIA method, cultural heritage site, sustainability indicators, ranking.*

1. INTRODUCTION

At present, sustainability became an approach that is incorporated in different fields as well as in tourism. Term "sustainable tourism" indicates such a tourism activity which is in line with environmental, social and economic benefits (Lozano-Oyola et al., 2012). In order of achieving the sustainability, usually a certain set of indicators is created that enables destination managers to estimate the present conditions of certain destination, to identify problems and to clearly distinct what aspects should be improved in order of strengthening the sustainability. For that reason, the authors proposed a different set of indicators that could be used in the

process of the sustainability assessment (Miller, 2001; Miller and Twining-Ward, 2005; Blackstock et al., 2008; Tanguay et al., 2013).

Visiting the different historical and cultural sites became a very popular activity among tourists, nowadays. Increased popularity of cultural heritage sites brings a lot of issues that belong to the area of sustainable development. Sustainability of the cultural heritage site is not only connected with the preservation and protection of a location, but is, also, related to the tourism impact, social and economic benefits, environmental protection and promotion (Jamieson, 2000). Obtaining the sustainable cultural heritage site is a very demanding task that is enriched with obstacles of different kinds. In order of easier examination of the sustainability of the cultural heritage site, Ngamsomsuke et al. (2011) developed a set of sustainable indicators. With the aim of easier evaluation of the particular site by using mentioned indicators the application of the MCDM methods is suggested.

MCDM methods revealed very useful for solving a various real-world business problems. Until now, many different methods have been proposed and some of them are: TOPSIS (Hwang and Yoon, 1981), PROMETHEE (Brans and Vincke, 1985) and ELECTRE (Roy, 1991). Also, a new MCDM methods are recently developed, and some of them are: ARAS (Zavadskas and Turskis, 2010), WASPAS (Zavadskas et al., 2012) and WS PLP (Stanujkic and Zavadskas). Because of involving of uncertainty and vagueness of environment the appropriate extensions by involving fuzzy, grey and rough sets are performed. In this paper the application of the PIPRECIA method is proposed.

PIPRECIA method is newly introduced method by Stanujkic et al. (2017) which is very convenient for the criteria importance determination. The authors used it for evaluation of the conditions for implementing information technology in a warehouse system (Stević et al., 2018). Ivanov et al. (2018) applied the mentioned method in the case of evaluation of the websites of IT companies. Also, it is used for the estimation of the quality of the websites in the hotel industry (Stanujkic et al., 2018). Additionally, PIPRECIA method is used for the ranking of strategies pointed to the tourism development of the City of Zajecar (Popovic, 2018). Because this method is very applicable and easy to use, it is proposed as a convenient tool for assessment and ranking of the sustainable indicators of the cultural heritage sites. In that way, the destination managers could easily determine which aspect of the site is most endangering and deserves a special attention with the aim of improving the current state. In order to explain and demonstrate the proposed model, the remaining paper is organized as

follows: in the second section the computational procedure of PIPRECIA method is given; the third section includes the illustrative numerical example; which is followed by a conclusion.

2. PIPRECIA METHOD

Stanujkic et al. (2017) proposed PIPRECIA method which represents an improvement of the SWARA method. This method is especially suitable for application in the group decision-making environment because facilitates decision-making process. The application of the PIPRECIA method could be explained through the following series of steps.

***Step* 1**. Selection of the evaluation criteria included in the decision process.

***Step* 2**. Determination of the relative significance s_j starting from the second criterion by using the following equation:

$$s_j = \begin{Bmatrix} >1 & when & C_j \succ C_{j-1} \\ 1 & when & C_j = C_{j-1} \\ <1 & when & C_j \prec C_{j-1} \end{Bmatrix}. \quad (1)$$

***Step* 3**. Identification of the coefficient k_j as follows:

$$k_j = \begin{Bmatrix} 1 & j=1 \\ 2-s_j & j>1 \end{Bmatrix}. \quad (2)$$

***Step* 4**. Determination of the recalculated value q_j by applying the Eq. (3):

$$q_j = \begin{Bmatrix} 1 & j=1 \\ \dfrac{q_{j-1}}{k_j} & j>1 \end{Bmatrix}. \quad (3)$$

***Step* 5**. Calculation of the relative weights of the considered criteria as follows:

$$w_j = \frac{q_j}{\sum_{k=1}^{n} q_k}, \quad (4)$$

where w_j is the relative weight of the criterion j.

3. ILLUSTRATIVE NUMERICAL EXAMPLE

In this part, the illustrative numerical example will be presented. Despite the fact that the PIPRECIA method is especially suitable for group decision-making, in this case only one decision-maker (hereinafter marked as *DM*) is involved in the procedure. The set of the sustainable indicators, which is submitted to the assessment, is adopted from the paper of the Ngamsomsuke et al. (2011) and it is presented in the Table 1. The assessment and prioritization of the given indicators do not connect to any particular cultural heritage site. By using this example, we wanted to present the possibilities of the given method as well as its potential for resolving real problems in the area of tourism planning and decision-making.

Table 1. The specific areas and sustainable indicators

	Specific area		Indicators
C_1	Economic aspect	C_{11}	Accessibility
		C_{12}	Availability of bus, railway and airport terminals
		C_{13}	Tourism facilities support
		C_{14}	Tourism services support
		C_{15}	Tourism leisure support
C_2	Social environment	C_{21}	Satisfaction of tourists
		C_{22}	Attitutudes of tourists
		C_{23}	Public perception of potential criminality
		C_{24}	Public regulation prints
C_3	Management	C_{31}	Preservation condition
		C_{32}	Maintenance
		C_{33}	Promotion activities
		C_{34}	Facilities and services
		C_{35}	Received experience
		C_{36}	Information technology
		C_{37}	Site narration
C_4	Surroundings	C_{41}	Air pollution
		C_{42}	Disposal and control of garbage
		C_{43}	Architectual characteristic of environment
		C_{44}	Urban design of surroundings

Source: (Ngamsomsuke et al., 2011)

As can be seen from Table 1, there are four specific areas that are reconsidered. *DM*, involved in the assessment, defined their importance by using Eqs. (1)-(4). Table 2 shows the obtained results.

Table 2. Relative importance of the specific areas

Specific area	s_j	k_j	q_j	w_j
C_1		1	1	0.28
C_2	0.90	1.10	0.91	0.26
C_3	0.90	1.10	0.83	0.23
C_4	1.00	1.00	0.83	0.23
			3.56	1.00

Defined relative importance shows that the most important area that should be targeted is C_1 - *Economic aspect*s, while the least significant are C_3 – *Management* and C_4 – *Surroundings*. The differences among gained results relative to the importance of the considered areas are not very large which leads to the conclusion that every aspect contributes to the achievement of the sustainability of the certain location.

Every of the given specific area involves a certain number of indicators. In this phase the relative importance of the indicators that cover the appropriate area is determined by using the Eqs. (1)-(4). Table 3 shows the results for the indicators that belong to the group – *Economic aspects.*

Table 3. Relative importance of the indicators – *Economic aspects*

Indicator	s_j	k_j	q_j	w_j
C_{11}		1	1	0.22
C_{12}	0.80	1.20	0.83	0.18
C_{13}	1.10	0.90	0.93	0.20
C_{14}	1.00	1.00	0.93	0.20
C_{15}	1.00	1.00	0.93	0.20
			4.61	1.00

As the most important indicator for this group stand up the indicator C_{11} – *Accessibility*.

Table 4 contains relative importance of the indicators of the group – *Social environment*.

Table 4. Relative importance of the indicators – *Social environment*

Indicator	s_j	k_j	q_j	w_j
C_{21}		1	1	0.28
C_{22}	1.00	1.00	1.00	0.28
C_{23}	0.70	1.30	0.77	0.21
C_{24}	1.10	0.90	0.85	0.24
			3.62	1.00

Table 4 shows that the most important indicators are C_{21} – *Satisfaction of tourists* and C_{22} – *Attitudes of tourists*.

The relative importance of the indicators of the group – *Management* is shown in the Table 5.

Table 5. Relative importance of the indicators – *Management*

Indicator	s_j	k_j	q_j	w_j
C_{31}		1	1	0.21
C_{32}	1.00	1.00	1.00	0.21
C_{33}	0.80	1.20	0.83	0.17
C_{34}	1.10	0.90	0.93	0.19
C_{35}	1.10	0.90	1.03	0.21
C_{36}	0.80	1.20	0.86	0.18
C_{37}	0.70	1.30	0.66	0.14
			4.79	1.00

In this case, three indicators are the most significant and they are: C_{31} – *Preservation condition*, C_{32} – *Maintenance* and C_{35} – *Received experience*.

Finally, the significance of the last group of indicators - *Surroundings* is determined and shown in the Table 6.

Table 6. Relative importance of the indicators – *Surroundings*

Indicator	s_j	k_j	q_j	w_j
C_{41}		1	1	0.26
C_{42}	1.00	1.00	1.00	0.26
C_{43}	0.90	1.10	0.91	0.24
C_{44}	1.00	1.00	0.91	0.24
			3.82	1.00

In this situation, the two indicators are the first ranked and they are: C_{41} – *Air pollution* and C_{42} – *Control and disposal of garbage*.

By multiplying the local importance of the specific areas and indicators the global significance of the indicators is obtained (Table 7).

Table 7. Global importance of the sustainable indicators

Specific area	Importance	Indicators	Local indicator importance	Global indicator importance
Economic aspect	0.28	C_{11}	0.22	0.0609
		C_{12}	0.18	0.0507
		C_{13}	0.20	0.0564
		C_{14}	0.20	0.0564
		C_{15}	0.20	0.0564
Social environment	0.26	C_{21}	0.28	0.0704
		C_{22}	0.28	0.0704
		C_{23}	0.21	0.0542
		C_{24}	0.24	0.0602
Management	0.23	C_{31}	0.21	0.0485
		C_{32}	0.21	0.0485
		C_{33}	0.17	0.0404
		C_{34}	0.19	0.0449
		C_{35}	0.21	0.0499
		C_{36}	0.18	0.0415
		C_{37}	0.14	0.0320
Surroundings	0.23	C_{41}	0.26	0.0608
		C_{42}	0.26	0.0608
		C_{43}	0.24	0.0552
		C_{44}	0.24	0.0552

Table 8 presents the final ranking order of the assessed sustainable indicators which is given in ascending order.

Table 8. The overall ranking order of the sustainable indicators

	Indicators	Global importance	Rank
C_{21}	Accessibility	0.0704	1
C_{22}	Availability of bus, railway and airport terminals	0.0704	1
C_{11}	Tourism facilities support	0.0609	2
C_{41}	Tourism services support	0.0608	3
C_{42}	Tourism leisure support	0.0608	3
C_{24}	Satisfaction of tourists	0.0602	4
C_{13}	Attitutudes of tourists	0.0564	5
C_{14}	Public perception of potential criminality	0.0564	5
C_{15}	Public regulation prints	0.0564	5
C_{43}	Preservation condition	0.0552	6
C_{44}	Maintenance	0.0552	6
C_{23}	Promotion activities	0.0542	7
C_{12}	Facilities and services	0.0507	8
C_{35}	Received experience	0.0499	9
C_{31}	Information technology	0.0485	10
C_{32}	Site narration	0.0485	10
C_{34}	Air pollution	0.0449	11
C_{36}	Disposal and control of garbage	0.0415	12
C_{33}	Architectual characteristic of environment	0.0404	13
C_{37}	Urban design of surroundings	0.0320	14

The gained results show that the most significant indicators in this case are the C_{21} – *Satisfaction of tourists* and C_{22} – *Attitudes of tourists*. The remained indicators very often have the similar position which represents the fact that they have the similar importance to the *DM*. It is evident that all of the considered indicators are important for the assessment of the certain cultural heritage site, but it is very significant to estimate their significance which could vary according to the present conditions and characteristics of the estimated destination. In that way, the *DM* could define which indicator is currently the most important and which requires the special treatment.

4. CONCLUSION

It is evident that tourism experienced rapid growth in the last few decades that is followed by its changes. The mass tourism leaves inevitable footprints on the tourism sites. Because of that, the question about sustainability in the tourism industry becomes very important and gains a significant attention. There are different types of tourism, and from the aspect of sustainability, especially interesting is the cultural heritage tourism.

Sustainability of the cultural heritage tourism does not involve only sustainability and preservation of the given locations, but already the economic aspect, social aspect and environment aspect of such a destination. In order of better monitoring the situation relative to the sustainability, appropriate set of indicators is proposed that enables a better assessment of the present conditions and planning the future actions that will contribute to the improvement of the different critical aspects.

In this paper the application of the PIPRECIA method in the estimation and the ranking of the given sustainable indicators is proposed. The given method is very simple and easy to use, so it could be helpful in the process of the detection what aspects of the sustainability of certain cultural heritage site are jeopardized and should have specific attention. In the estimation process, by introducing the queries, the managers could easily investigate what aspects tourists appreciate and what aspects should be improved. Also, from the side of an investor interesting in investing in a destination that depends on a cultural heritage site, this method could be used in the evaluation of sites according to the given sustainable indicators.

The main shortage of this paper is reflected through the fact that only one *DM* is involved in the decision process. Besides, the procedure is based on the crisp numbers and by introducing the grey or fuzzy sets the vagueness and uncertainty of the environment will be appreciated in higher degree. Additionally, the preposition is that the possibilities of the PIPRECIA method should be further examined and tested in the tourism as well as in others business fields.

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