

VIŠEKRITERIJUMSKI MODEL ZA VREDNOVANJE KVALITETA WEB SAJTOVA REGIONALNIH TURISTIČKIH ORGANIZACIJA

MULTI-CRITERIA MODEL FOR EVALUATING QUALITY OF WEBSITES OF THE REGIONAL TOURISM ORGANIZATIONS

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Sadržaj – U ovom radu je prikazana primena jednog višekriterijumskog modela zasnovanog na poređenju u parovima i primeni ARAS metode u cilju evaluacije websajtova regionalnih turističkih organizacija u ruralnim područjima, sa ciljem povećanja njihove efikasnosti u smislu promociji turističkih potencijala.

Abstract - This paper presents the use of a multiple criteria decision-making models for evaluating quality of regional tourism organizations websites from some Serbian rural areas, in order to increase their efficiency in terms of promotion of tourism potentials. The proposed model is based on the use of the pairwise comparisons and the ARAS method.

INTRODUCTION

In many rural areas, development and improvement of tourism have been identified as a very important activities for achieving sustainable development. It is similar in the area known as Timocka Krajina, in the Eastern Serbia, which is located on the borders with Bulgaria and Romania.

The mentioned rural area has a number of attractive, but also almost unknown, tourist destinations. From many, here are mentioned some of them such as: Stara Planina (Old Mountain), Soko Banja (Sokobanja Spa), Gamzigradska banja (Gamzigrad Spa), Borsko jezero (Bor Lake), ancient complex of Roman palaces and temples Felix Romuliana, and so on. The list of potential tourist locations is too long to be listed here, which is why many significant destinations have to be omitted.

After mentioning names of these potential tourist destinations, someone probably wants to learn more about them. The Internet has brought significant opportunities for the promotion of the less known tourist destinations. However, here arise some questions: How much regional tourism organizations, from the rural areas, use the benefits that the Internet provides, and how much these websites provide the information necessary for attracting attention of potential tourists, especially tourists from the other countries?

The answers to the above questions can be obtained by measuring the quality of the websites of the some regional tourism organizations that are located in Timocka Krajina.

For these reasons, this paper is organized as follows. In the first section, the criteria for evaluating the websites of the regional tourism organizations are considered. The second section of the paper is devoted to multiple criteria

decision-making (MCDM), with an emphasis on group decision-making. In the first subsection of this section an effective and simply to use MCDM method is presented, and in the second subsection the use of pairwise comparisons process for determining the weights of criteria is considered. Based on considerations made in the previous sections, in the third section websites of some regional tourism organizations have been evaluated. Finally, the conclusions are given.

1. THE CRITERIA FOR EVALUATING QUALITY OF WEBSITES OF THE REGIONAL TOURISM ORGANIZATIONS

Website can help in obtaining an advantage over competence. However, the only existence of a website does not automatically provide the competitive advantages. So, here also arise two questions: How much a website actually meets the requirements of its users and how to measure the level of satisfaction of their requirements, i. e. the quality of website?

In the literature, numerous studies have been devoted to the evaluation of website quality. Boyd Collins developed the first formal approach to the evaluation of websites in late 1995. His model, intended for librarians, has been based on six criteria, developed by combining evaluation criteria for printed media, and considering what was relevant for websites [1]. These criteria are: Contents, Authority, Organizations, Searchability, Graphic design and Innovation use.

Studies that are intended for the identification of key evaluation criteria, and/or their significances, are still actual. For example, Dumitrache [2] has gave an overview of criteria used for evaluation of e-Commerce sites in Romania, during the period from 2006 to 2009 year. It has stated navigability, response time, personalization, tele-presence and security as very important criteria. Davidaviciene and Tolvaisas [3] have identified the list of criterions for quality evaluation of e-Commerce websites. They also have provided a comprehensive overview of the criteria that have been recently proposed by different authors. In accordance with [3] criteria: easy to use, navigation, security assurance, help (real time) and design have been discussed by numerous authors, such as [4, 5, 6].

Zafiroopoulos and Vrana [7], based on survey of Greek hotels web sites, have identified six dimensions, i.e. criteria, that are relevant for measuring the quality of the hotels websites. These criteria are: facilities information, guest contact information, reservation and prices

information, surrounding area information, management of the website and company profile. For these criteria they have also identified a number of sub-criteria.

Compared to other types of e-Commerce, the websites of regional tourism organizations have its own peculiarities. Therefore, for their evaluation the appropriate set of criteria and their significances also, have to be identified and determined.

In the previously published papers, to determining quality of websites of regional tourism organizations has not been devoted significant attention. Therefore, in this paper, such type of websites has been considered as website positioned between the websites primary intended to provide information and hotels' websites.

It is known that a larger number of criteria allow more precise evaluation of alternatives. However, a larger number of criteria can lead to the formation of complex MCDM models, which may be too complex for ordinary users. In contrast, too few numbers of criteria can lead to the formation of too simple, and/or practically unusable, MCDM models.

Assuming that one of the main goals of the regional tourism organizations is promotion of new tourist destinations to the potential tourists from other countries, i.e. probably the first-time visitors to these websites, on the basis of previously published papers, for evaluating quality of regional tourism organizations websites the criteria shown in Table 1 have been selected.

Table 1. Criteria for websites evaluation

	Criteria
C1	<i>Design</i>
C2	<i>Authority</i>
C3	<i>Accuracy</i>
C4	<i>Adaptability</i>
C5	<i>Currency</i>
C6	<i>Navigability</i>

The meaning of the selected criteria is the following:

Design. The design of website is one of the frequently used criteria for evaluating the quality of websites, but in different types of websites this criterion has a different significance. In the case of websites that promote natural beauties and the new tourist destinations the design can be of the great importance, especially for the first-time visitors.

Authority. Criterion authority refers to the ability of easily and reliable identification of the website owner. On the Internet, a significant number of sites that are engaged to the promotion of tourism potentials of Serbia can be found. However, it is also evident that some of them have not been updated a long time ago, and that some information on them is outdated or even inaccurate.

Accuracy. Criterion accuracy refers to the accuracy of the information contained on the site. It is known that, in order to increase the popularity of a tourist destination, some unconfirmed or partially accurate information can be placed on websites. For visitors of the website hyperlinks that enable verification of information provided on the site can be very useful.

Adaptability. Some websites, in order to increase the satisfaction of their visitors, allow some adjustment in accordance with the needs and requirements of their visitors. If the target group of the regional tourism organizations are the visitors from other countries, then it may be very useful to allow them to obtain information on their spoken languages, as for example English, German, Russian, etc.

Currency. Criterion currency refers to the up to date of the websites, and there can be identified two sub-categories, namely:

- up to date of information provided on websites, and
- dead links.

The websites which promote the tourism potentials and the tourist destinations, mainly containing a large number of static information. However, they may contain some types of dynamic information - which is often related with the some events of a local character, such as some manifestations, festivals and so on. For the visitors of the websites it can be useful not only that such information is up to date. Sometimes it can be very helpful to get out there a visible proof of their accuracy, as for example the date when the information is updated.

The dead links can occur as a result of badly organized modification of the structure of the website, and they are also very undesirable occurrence.

The existence of not up to date information, or lack of evidence of their accuracy, as well as the existence of dead links, can negatively affect the satisfaction of the website visitors.

Navigability. Ease of finding the necessary information on the selected website can have a positive effect on the growth of interest of the website visitors. In contrast, the inability, or difficulty to find the required information may lead to the abandonment of website site.

Adequate and well-organized menu system, well organized hyperlinks, site map and the ability to search the entire of website can help to ensure that potential tourists become real visitors.

2. MULTIPLE CRITERIA GROUP DECISION-MAKING

Ordinary MCDM models are usually based on the opinion of a single decision maker, and they can be precisely shown in the following form

$$\begin{matrix} D = [x_{ij}]_{m \times n} \\ W = [w_j] \end{matrix}, \tag{1}$$

where D is a decision matrix, where W is a weight vector, x_{ij} is the performance rating of i -th alternative to the j -th criterion, w_j is the weight of j -th criterion, $i = 1, 2, \dots, m$; m is a number of alternatives, $j = 1, 2, \dots, n$; n is a number of criteria.

For solving a number of complex decision-making problems, it is necessary to take into account opinions of

more decision makers, i.e. usually of relevant experts. In such cases, the Multiple Criteria Group Decision Making (MCGDM) approach is commonly used, and it can be precisely shown in the following form

$$\begin{aligned} D &= [x_{ij}^k]_{m \times n \times K} \\ W &= [w_j^k]_{n \times K} \end{aligned} \quad (2)$$

where x_{ij}^k is the performance rating of i -th alternative to the j -th criterion given by k -th decision maker; $k = 1, 2, \dots, K$; K is a number of decision makers and/or experts involved in MCGDM.

2.1 ADDITIVE RATIO ASSESSMENT METHOD

The Additive Ratio ASsessment (ARAS) method has been proposed by Zavadskas and Turskis [8]. The process of solving decision-making problems using the ARAS method, similarly to the use of other MCDM, begins with forming the decision matrix and determining weights of criteria. After these initial steps, the remaining part of solving MCDM problems using ARAS method can be precisely expressed using the following steps:

Step 1. Determine the optimal performance rating for each criterion. In this step, the decision maker sets the optimal performance rating for each criterion. If the decision maker does not have preferences, the optimal performance ratings are calculated as

$$x_{0j} = \begin{cases} \max_i x_{ij}; & j \in \Omega_{\max} \\ \min_i x_{ij}; & j \in \Omega_{\min} \end{cases} \quad (3)$$

where x_{0j} denotes the optimal performance rating of j -th criterion, Ω_{\max} denotes the benefit criteria, i.e. the higher the values are, the better it is; and Ω_{\min} denotes the set of cost criteria, i.e. the lower the values are, the better it is.

Step 2. Calculate the normalized decision matrix. The normalized performance ratings are calculated as follows

$$r_{ij} = \begin{cases} \frac{x_{ij}}{\sum_{i=0}^m x_{ij}}; & j \in \Omega_{\max} \\ \frac{1/x_{ij}}{\sum_{i=0}^m 1/x_{ij}}; & j \in \Omega_{\min} \end{cases} \quad (4)$$

where r_{ij} denotes the normalized performance rating of i -th alternative in relation to the j -th criterion, $i = 0, 1, \dots, m$.

Step 3. Calculate the overall performance rating, for each alternative. The overall performance ratings can be calculated as follows

$$S_i = \sum_{j=1}^n w_j r_{ij} \quad (5)$$

where S_i denotes the overall performance rating of i -th alternative, $i = 0, 1, \dots, m$.

Step 4. Calculate the degree of utility, for each alternative. The degree of utility can be calculated as follows

$$Q_i = \frac{S_i}{S_0} \quad (6)$$

where Q_i denotes the degree of utility of i -th alternative, and S_0 is the overall performance index of optimal alternative, $i = 1, 2, \dots, m$.

After that, the alternative with the largest value of Q_i the most acceptable alternative.

2.1.1 Group decision-making approach based on the ARAS method

The ARAS method can be classified as a relatively newly MCDM method. Therefore, in comparison with other MCDM methods, for this method a smaller number of extensions has been proposed. However, some extensions formed with the aim to enable its usage in a fuzzy environment and/or enable group decision-making approach have also been proposed for the ARAS method.

One of the simplest approaches, which provide the adaptation of the ARAS method in order to allow group decision-making approach can be formulated as follows: For group that contains K decision-makers the transformation of individual into group performance ratings can be made using geometric mean, as follows:

$$x_{ij} = \left(\prod_{k=1}^K x_{ij}^k \right)^{1/K} \quad (7)$$

where x_{ij}^k denotes the performance rating of i -th alternative in relation to the j -th criterion obtained from the k -th decision maker. After that, the previously mentioned procedure of the ARAS method remains as previously stated.

2.2 DETERMINING THE WEIGHTS OF CRITERIA

In the multiple criteria group decision-making, it is very important how to aggregate individual criteria weights and individual performance ratings into the group (aggregated) criteria weights and performance ratings.

Many published papers have also indicated that the use of the group decision-making approaches and pairwise comparison procedure provides an efficient approach for precisely determining the relative importance of criteria i.e. weights of criteria.

2.2.1 Pairwise comparison

The pairwise comparison procedure is quite simple and understandable, even for decision makers who are not familiar with the MCDM. For a decision-making problem that contains n criteria, the process of determining

weights of criteria begins by forming reciprocal square matrix

$$A = [a_{ij}]_{n \times n}, \tag{8}$$

where A denotes a pairwise comparison matrix, a_{ij} is the relative importance of criterion C_i in relation to criterion C_j , $i=1,2,\dots,n$, $j=1,2,\dots,n$, and n is the number of criteria. In the matrix A , $a_{ij} = 1$ when $i = j$ and $a_{ji} = 1/a_{ij}$.

The nine-point scale, shown in Table 2, proposed by Saaty [9], is used to assign a relative importance of criteria.

Table 2. The scale of relative importance for pairwise comparison

Intensity of Importance	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Extreme importance
2, 4, 6, 8	For interpolation between the above values

After forming, the matrix A , by using one of several available procedures, weights of criteria can be calculated. Using the Normalization of the Geometric Mean of the Rows procedure, the weights of criteria are calculated as follows

$$w_i = \left(\prod_{j=1}^n a_{ij} \right)^{1/n} / \sum_{i=1}^n \left(\prod_{j=1}^n a_{ij} \right)^{1/n}. \tag{9}$$

While forming the matrix A , it is very important that the each decision maker should perform its comparisons consistently. The decision about the consistency of performed comparisons and their acceptability, are made on the basis of the Consistency Ratio. If the consistency ratio is higher than 0.1, then the pairwise comparison matrix A is inconsistent, and therefore the comparisons should be reviewed and improved.

The Consistency Ratio is calculated as follows

$$CR = CI / RI, \tag{10}$$

where CR denotes the consistency ratio of the pairwise comparison matrix A , CI is the Consistency Index and RI is the Random Consistency Index.

The values of CI can be calculated as follows

$$CI = (\lambda_{\max} - n) / (n - 1), \tag{11}$$

where λ_{\max} denotes the maximum eigenvalue of the pairwise comparison matrix and it can be calculated as follows

$$\lambda_{\max} = \sum_{j=1}^n \left\{ \left(\prod_{i=1}^n a_{ij} \right) w_j \right\}, \tag{12}$$

where w_j is the weight of criterion C_j and n is the number of criteria

The values for RI are determined based on matrix size n . Table 3. shows the value of the Random Consistency Index RI for different matrix sizes [9].

Table 3. The Random Consistency Index for different matrix sizes

Matrix size (n)	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.9	1.12	1.24	1.32	1.41	1.46	1.49

Thanks to this controlling mechanism, the above mentioned procedure for calculation of criteria weights has become very popular and frequently used.

2.2.2 Group decision-making approach to determine criteria weights

In many published papers, the use of the different group decision-making approaches to determine the group criteria weights, have been considered. In this approach, the simplest and the most efficient one is accepted and used.

For a group that contains K decision makers, the group weight of each criterion w_j is calculated using the geometric mean, as follows

$$w_j = \left(\prod_{k=1}^K w_j^k \right)^{1/K}, \tag{13}$$

where: w_j^k is the weight of criterion C_j , obtained on the basis of pairwise comparisons performed by decision maker k .

3. NUMERICAL EXAMPLE

To present the effectiveness of the ARAS method, in this paper, the partial results, adopted from the study which performed to determine the quality of the websites of the regional tourism organizations from the Timockka krajina, have been used. The aim of this paper is not to promote any of them, which is why these are, in this example, simply labeled as alternatives A_1, A_2, A_3, A_4 .

Criteria weights, obtained on based on the opinions of the three stakeholders on the basis of the use of pairwise comparison, are shown in the Tables 4, 5 and 6.

Table 4. The criteria weights obtained from the first stakeholder

Criteria	D	A_u	A_c	A_d	C	N	w_i	
C_1	D	1	5	3	1	3	1	0.26
C_2	A_u	1/5	1	1/3	1/5	1/5	1/3	0.04
C_3	A_c	1/3	3	1	1	3	3	0.20
C_4	A_d	1	5	1	1	3	3	0.25
C_5	C	1/3	5	1/3	1/3	1	1/3	0.09
C_6	N	1	3	1/3	1/3	3	1	0.15

$$CR = 0.1 (0.095\%) < 10\%$$

Table 5. The criteria weights obtained from the second stakeholder

Criteria	D	A _u	A _c	A _d	C	N	w _i
C ₁	D	1	5	3	1	3	0.15
C ₂	A _u	1/5	1	1/3	1/5	1/3	0.03
C ₃	A _c	1/3	3	1	1	3	0.24
C ₄	A _d	1	5	1	1	3	0.14
C ₅	C	1/3	5	1/3	1/3	1	0.12
C ₆	N	1/3	3	1/3	1/3	1	0.31

CR = 0.08 (0.0809%) < 10%

Table 6. The criteria weights obtained from the third stakeholder

Criteria	D	A _u	A _c	A _d	C	N	w _i
C ₁	D	1	5	3	1	3	0.30
C ₂	A _u	1/2	1	1/3	1/5	1/3	0.04
C ₃	A _c	1/3	3	1	1	3	0.20
C ₄	A _d	1	5	1	1	3	0.25
C ₅	C	1/3	5	1/3	1/3	1	0.10
C ₆	N	1/3	3	1/3	1/3	1	0.12

CR = 0.08 (0.084%) < 10%

The resulting criteria weights, obtained by Eq(13), are shown in Table 7.

Table 7. The resulting criteria weights

Criteria	w _i
C ₁	0.24
C ₂	0.05
C ₃	0.21
C ₄	0.21
C ₅	0.11
C ₆	0.18

The performances ratings of examined regional tourism organization websites on the basis of the selected criteria, obtained from the three stakeholders, are shown in Tables 8, 9 and 10.

Table 8. The performance ratings obtained from the first stakeholder

	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆
A ₁	4	3	4	2	4	4
A ₂	4	3	4	2	5	4
A ₃	3	3	3	4	4	4
A ₄	2	3	2	2	1	3

Table 9. The performance ratings obtained from the second stakeholder

	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆
A ₁	5	4	4	3	5	3
A ₂	4	4	3	3	5	5
A ₃	3	4	3	4	4	4
A ₄	2	4	2	2	2	3

Table 10. The performance ratings obtained from the third stakeholder

	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆
A ₁	4	4	4	4	5	3
A ₂	4	4	3	3	4	4
A ₃	3	4	3	4	5	4
A ₄	3	4	2	2	2	3

The group performance ratings, obtained using Eq. (7), are shown in Table 11.

Table 11. The group performance ratings of alternatives

	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆
A ₁	4.31	3.63	4.00	2.88	4.64	3.30
A ₂	4.00	3.63	3.30	2.62	4.64	4.31
A ₃	3.00	3.63	3.00	4.00	4.31	4.00
A ₄	2.29	3.63	2.00	2.00	1.59	3.00

In Table 12 are given weighted normalized performance ratings, overall performance rating and degree of utility, for each alternative.

Table 12. The group performance ratings of alternatives

	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	S _i	Q _i	Rank
A ₀	0.06	0.01	0.05	0.05	0.02	0.04	0.231		
A ₁	0.06	0.01	0.05	0.04	0.02	0.03	0.207	0.90	1
A ₂	0.05	0.01	0.04	0.04	0.02	0.04	0.200	0.86	2
A ₃	0.04	0.01	0.04	0.05	0.02	0.04	0.197	0.85	3
A ₄	0.03	0.01	0.03	0.03	0.01	0.03	0.125	0.54	4

From Table 12 it can be seen that the significant part of the considered regional tourism organizations has a high value of Q_i, which indicates that their managers have become aware of the benefits that using the website can be achieved.

However, of the four evaluated websites only one of them had the English version. The remain significant languages also have not been present.

If the promotion of tourism potential outside of Serbia is one of the important goals of tourism organizations, then their managers should seriously consider implementation of multilingual web presentations. Similar websites in surroundings countries already have that.

CONCLUSION

It is known that some Serbian rural areas have significant tourism potentials. Therefore, in this paper, an approach primarily intended to evaluate the quality of regional tourism organizations websites based on the combined use of proven MCDM method - ARAS method and pairwise comparisons has been presented.

The proposed model is effective and easy to use, and it can also be used to compare quality of website of a regional tourism organization with the sites of competitive organizations, as well as to determine the degree of satisfaction based on requirements of website users.

This model may be particularly useful if it is used for comparison with similar organizations from the surrounding countries, and for comparison with competitors in order to perform the correction that will lead to forming a websites that are in a greater extent aligned with the needs of users, and thus better promote tourism potentials.

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