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EVALUATION OF WEBSITE QUALITY OF NATIONAL PARKS IN SERBIA USING AN INTEGRATED AHP-VIKOR METHODOLOGY

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Abstract: Due to their widespread use, the Internet and websites are effective tools that can be used to educate local residents and tourists about the function of protected areas and national parks, their ecological importance, visitor restrictions, and ecotourism activities, as well as to inform and raising awareness about the importance and preservation of the same. In today's competitive environment, evaluating the website quality of the national park and its comparison with other competitive organizations is an important issue for visitors, the local community, and other stakeholders. Therefore, the aim of this paper is to assess and contrast the website quality of National Parks in Serbia using a multi-criteria decision-making model based on Analytic Hierarchy Process (AHP) and VIKOR (Vlse Kriterijumska Optimizacija Kompromisno Resenje) method. The assessment performed in this study can help decision-makers in protected nature areas to frame long-term promotion policies directed at competitiveness.

Keywords: national parks, website evaluation, AHP method, VIKOR method

1. INTRODUCTION

The Internet is a network that connects numerous computer networks and thus provides multiple users with fast access to information (Dreyfus, 2008). The advantages of the Internet and the World Wide Web were quickly recognized by companies operating in a competitive environment. Later, other companies, organizations, and even individuals recognized the advantages of having a presence on the Internet- the advantages that can be realized by having your own website (Glukhov et al., 2015).

When it comes to the role of a website in the business of companies, it is possible to identify different parts of websites that affect the business of organizations, which range from providing basic information to website visitors to providing customized information and support to website visitors, with the aim that they retain and even acquire new potential visitors, i.e., customers (Simoes et al., 2015; Rivera-Trigueros et al., 2022; Bergmann et al., 2023).

The recent rises of new knowledge, rapid environmental changes, and the increasing use of information and communication technologies have significantly changed all aspects of life. Nowadays, modern organizations communicate with users via the Internet, mainly to promote their products and services (Hernández et al., 2009). As a result, almost all organizations today are present on the Internet and promote their products and services through the Internet and web presentations.

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A web presence can help organizations gain an edge over their competitors. However, having a website cannot automatically provide a competitive advantage. One important question arises: "How well does a website meet the demands of its users, and how to measure its quality?". For example, websites belonging to hotels and organizations from popular tourist destinations often rank high in Internet searches and have many visitors. In addition, website visitors already have a preconceived opinion about a certain quality of services and content on those sites.

In contrast, web presentations belonging to hotels and organizations with lesser-known tourist destinations, such as national parks, are often ranked worse in Internet searches, which is to be expected because they have fewer visitors (Vyas, 2019). Therefore, the quality of web presentations of such websites becomes much more important (Lee & Kozar, 2006). Such web presentations should attract and retain the attention of their visitors long enough for them to become familiar with the tourist potential and the quality of services they can get at those destinations.

Therefore, the subject of this research is the examination of the possibility of applying a website in order to better competitive positioning and attract a more significant number of users (especially foreign tourists) in National parks as tourist destinations in Serbia. In this paper, the websites of four national parks in Serbia will be evaluated to see whether they fulfill their purpose, i.e., whether they are designed according to the needs of their visitors or were created with the aim of passive presence on the Internet. In addition, this paper aims to define a set of basic criteria for evaluating websites of tourist organizations and indicate the applicability of multi-criteria decision-making methods in evaluating websites. Additionally, a scientific description of the application of the proposed multi-criteria model AHP-VIKOR will enable managers in national parks to analyse the quality of website and compare them with competitors in order to improve the quality of their web presentations, achieve a competitive advantage, and attract more visitors, especially foreign tourists.

2. THE CONCEPTS OF WEBSITE EVALUATION

Choosing an appropriate set of evaluation criteria is a very important step for successfully solving any multi-criteria problem (Vyas, 2019). Reviewing the literature that primarily considers the evaluation of the quality of websites, it is noticeable that the criteria differ from author to author, that is, in some cases, the criteria overlap, while in some cases, the difference is evident.

Websites can significantly help in gaining an advantage over the competition. However, the mere existence of a website does not automatically ensure the achievement of a competitive advantage (Hu et al., 2019). Therefore, the following two questions arise: „How well does the website really satisfy the needs of website visitors?" and „How to measure the level of satisfaction of their needs, i.e. website quality?".

In the literature, numerous studies and papers were devoted to evaluating the quality of websites (Shehu et al., 2021; Ng et al., 2021). Boyd Collins developed the first formal approach to website evaluation in 1995. His model, intended for librarians, is based on six criteria, created by extracting the criteria designed for printed media (newspapers, magazines, etc.) while respecting the specificity of websites (Merwe & Bekker, 2003). Those criteria are content and quality of information on the website, evidence of the website's owner, website organization, the possibility of searching the website, graphic design, and innovation use. Further, some studies focused on the evaluation of travel-related websites (Bronner & de Hoog, 2016; Agag & El-Masry, 2017; Huang & Mou, 2021), government websites (Lee-Geiller & Lee, 2019;

Puron-Cid et al., 2022), e-learning and education websites (Thowfeek et al., 2014; Garg, 2017; Acosta-Vargas et al., 2018; Gong et al., 2021).

Studies aimed at identifying key criteria for evaluation and/or their importance are still current. For example, Dumitrache (2010) provided an overview of the criteria used to evaluate e-commerce sites. It mentions navigation, response time/website loading time, personalization, and various types of communication with sellers, including telepresence and security, as very important criteria. In addition, Davidavičienė and Tolvaišas (2011) identified a list of criteria for determining the quality of e-commerce sites. They have also provided a summary of what various authors have proposed in the past. The applied criteria were easy to use, navigation, security of transactions and security assurance, and timely help/real-time (Davidavičienė & Tolvaišas, 2011). Additionally, they considered the design, as many other authors such as Cyr, (2013), Garett et al. (2016), Dianat et al. (2019), and Cohen et al. (2021). Zafiropoulos and Vrana (2006), based on the research of websites of hotels, identified six dimensions, that is, criteria, which are relevant for measuring the quality of hotel websites. These criteria are facilities information, guest contact information, reservation and price information, surrounding area information, management of the website, and company profile. In addition, for these criteria, they identified several sub-criteria.

Also, the notion of usability is closely linked to the concept of website quality, which is considered in this paper (Nathan & Yeow, 2011). Usability has been defined and measured in many different ways (Tsai et al., 2010). According to the International Organisation for Standardization (ISO) usability is defined as „the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use“ (ISO, 1998). Nielsen (1994) proposed that usability has five attributes: learnability, efficiency, memorability, low error rate or easy error recovery, and satisfaction. He also suggested that „usability is a quality attribute that assesses how easy user interfaces are to use“ (Nielsen, 2012). Nielsen (2012) extended information system design principles for the Web and suggested four parameters for usability: navigation, content, response time, and credibility. Web usability was defined by Hassan and Li (2005) as consistencies in screen appearance, accessibility, navigation, media use, interactivity, and content. Kim and Kim (2008) identified four usability criteria: satisfaction, usefulness, supportiveness, and effectiveness. Conversely, Tarafdar and Zhang (2005) proposed that website availability, information content, and navigational simplicity all improve website usability. Also, five web usability factors, such as navigation, customization and personalization, download speed, accessibility, and ease of use, were examined by Pearson et al. (2007). They stated that the most crucial criterion is the ease of use. Agarwal and Venkatesh (2002) utilized the Microsoft Usability Guidelines to define website usability through five categories (content, ease of use, made-for-the-medium, promotion, and emotion), while Palmer (2002) defined usability based on five basic design elements extracted from usability and design as well as media richness literature (navigability, interactivity, content, responsiveness, and download delay).

2.1. Identification of criteria for website evaluation

The existence of a greater number of criteria in multi-criteria decision-making undoubtedly leads to a more precise evaluation of alternatives. However, a larger number of criteria also leads to the formation of complex models that may be too complex for ordinary respondents. For this reason, and based on previously researched literature, and experts that participated in this research, the set of criteria for evaluating web presentations of National Parks in Serbia is given in Table 1. These criteria refer to the Visual Design (C_1), Structure and Navigability (C_2), Content (C_3), Innovations (C_4), Personalization (C_5), and Update (C_6).

Table 1. Criteria for evaluating web presentations of National Parks

ID	Criteria
C_1	Visual Design
C_2	Structure and Navigability
C_3	Content
C_4	Innovations
C_5	Personalization
C_6	Update

The meaning of the aforementioned criteria is as follows:

Visual design - The visual design criterion refers to the appearance of the website pages, with a special emphasis on the first page of the web presentation (home page), because it is very important to keep the attention of users who access the site for the first time. This criterion is complex because it includes an adequate selection and arrangement of text and graphic elements on the website pages with the aim of providing visitors with an attractive appearance (Valizadeh-Haghi et al., 2017; Hartono & Holsapple, 2019).

Structure and navigability - It was mentioned earlier that it is important for website visitors to find the information they are interested in quickly. Therefore, a well-designed and organized website should provide the visitor to easily navigate around the site, easily return to the home page of the site, and easy to find relevant information (Valizadeh-Haghi et al., 2017).

Content - This criterion refers to the information needed by website visitors, their organization, and up-to-dateness. Evidence of the time of updating the website's web pages is especially important on the pages where information about manifestations and events is published (Thongpapanl & Ashraf, 2011).

Innovations - The Web is a very current field, subject to frequent changes and the introduction and application of new technologies. Companies and organizations that want to maintain their position in the market must adapt their websites because this proves they are actively using websites to meet their visitors' needs. In contrast, applying new trends and technologies is not so important for companies that are only passively present on the Internet (Rezaeean et al., 2012).

Personalization - Personalization, or adaptation of a website to visitors' needs, can be vital for gaining and maintaining visitors' trust. For example, the ability to change the language in which the text is displayed or display web pages on mobile devices adequately indicates to visitors that these companies or organizations take care of their users (Thongpapanl & Ashraf, 2011; Rivera-Trigueros et al., 2022).

Update - Web sites offering new topics and information are advantageous over others. Keeping the site updated is about providing the latest information on all the issues discussed. For the site to be interesting for Internet users and for them to visit it more often, the information must be the freshest, most interesting, and most important for monitoring market trends (Davidavičienė & Tolvaišas, 2011).

3. APPLIED METHODOLOGY

Over the years, numerous multi-criteria decision-making methods have been proposed in the literature. Methods differ depending on which research questions are being considered, the type of problem, the theoretical basis, and the type of results obtained. For now, no method can be applied to all kinds of problems, primarily because the methods are created for specific cases, with certain advantages and limitations (Zavadskas et al., 2014). This section below briefly

describes the applied VIKOR (Vlse Kriterijumska Optimizacija Kompromisno Resenje) method (Opricovic & Tzeng, 2004).

3.1. VIKOR method

In this research, the VIKOR (VIšekriterijumska optimizacija i KOmpromisno Rešenje) method was used for selecting national parks website in Serbia based on website quality criteria (Tsai et al., 2010).

VIKOR method is often used for multi-criteria ranking due to being suitable for solving various decision-making problems (Opricovic & Tzeng, 2004). It is especially suitable for situations where they prevail criteria of a quantitative nature (Hezer et al., 2021). This method is based on a compromise solution. It is characteristic of the presence of conflicting criteria and refers to the ranking and selection of alternatives. The ideal is used as a reference point, but there is no alternative that satisfies all the criteria simultaneously, so the solution closest to the ideal solution is sought. That solution is called a compromise solution (Opricovic & Tzeng, 2007; Jati, 2012). Based on the literature review, in many studies, the VIKOR method is used in decision-making analyses such as the energy systems (Zheng & Wang, 2020), the banking sector (Toloie-Eshlaghy & Bayanati, 2012), safety assessment (Hezer et al., 2021), sustainable development (Mateusz et al., 2018), evaluation of countries in various ways (Dang, 2019), tourism sector (Hosseini et al., 2021), construction sector (Gao et al., 2019).

The compromise solution F^c is the result closest to the ideal F*. Compromise means an agreement with mutual concessions by $\Delta f_1 = f_1^* - f_1^c$ and $\Delta f_2 = f_2^* - f_2^c$ as shown in Figure 2.

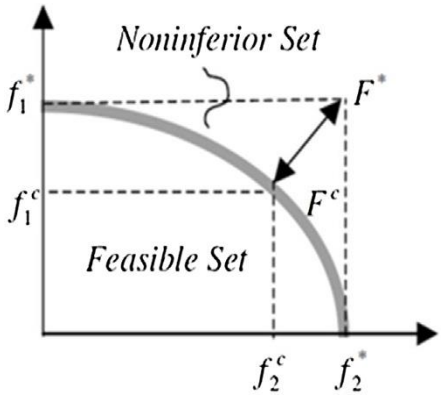

Figure 2. Ideal and compromise solutions (Hezer et al., 2021)

The phases of the VIKOR method for obtaining the compromise ordering are as follows (Opricovic & Tzeng, 2004):

Phase 1. For all criteria functions were defined the best (fi*) and worst (fi^-) values: Where i = 1, 2, . . ., n, and the i-th function represents a benefit. Values of fi* and fi^- are performed by equations (1) and (2), respectively:

$$f_i^* = \max_j f_{ij} \tag{1}$$

$$f_i^- = \min_j f_{ij} \tag{2}$$

Phase 2. Values of Si and Ri are calculated using equations (3) and (4), respectively (j = 1, 2, . . ., n):

$$S_i = \sum_{j=1}^{n} W_j \cdot \frac{f_j^* - f_{ij}}{f_j^* - f_i^-} = \sum_{j=1}^{n} W_j \cdot d_{ij} \qquad i = 1, 2, ..., m \tag{3}$$

$$R_i = \max W_j \cdot \frac{f_j^* - f_{ij}}{f_j^* - f_i^-} = \max W_j \cdot d_{ij} \qquad i = 1, 2, ..., m \tag{4}$$

where W_i is the criterion weight, whose relative significance is defined.

Phase 3. Value of Q_j is calculated using equations (5-7), respectively (j = 1, 2, . . ., n):

$$S^* = \min_j S_j \qquad S^- = \max_j S_j \tag{5}$$

$$R^* = \min_j R_j \qquad R^- = \max_j R_j \tag{6}$$

$$Q_i = v \cdot \frac{S_j - S^*}{S^- - S^*} + (1 - v) \cdot \frac{R_j - R^*}{R^- - R^*} \tag{7}$$

where *x* represents the strategic weight of the majority of criteria (or maximum group utility). In this research v = 0.5. Value of this coefficient can be contained from 0 to 1 (San Cristóbal, 2011). For example, higher values for v (v > 0.5) indicate that the decision maker gives more relative importance to the strategy of satisfying the majority criteria (Fajdek-Bieda, 2021).

Phase 4. By calculating the values of alternatives S^*, R^*, and *Qi* for each alternative in ascending order, three independent rankings can be formed. The value of S^* is a measure of deviation that expresses the demand for maximum group benefit (first ranking list). The value of R^* is a measure of deviation that expresses the requirement for minimization of the maximum distance of some action from the „ideal“ actions (second ranking list). The value of *Qi* represents establishing a compromise ranking that unifies sizes S^* and R^* (third ranking list).

Phase 5. If the two conditions listed below are met, alternative (a´**)**, which ranks according to the best Q (minimum) values is suggested as a compromise solution.

Condition 1. “Acceptable advantage” - *a´´* is the second alternative in the ranking list. Equations (8) and (9) need to be satisfied to fulfil Condition 1, where *m* is the number of alternatives.

$$Q(a'') - Q(a') \geq \mathrm{DQ} \tag{8}$$

$$\mathrm{DQ} = \frac{1}{m-1} \tag{9}$$

Condition 2. “Acceptable stability in decision making” - the best alternative is *a´* and must also be ranked according to the *S* or/and *R* values. During the decision-making process, this compromise solution is stable. If one of these conditions is not satisfied, in that case, it needs to suggest a compromise set of solutions. This set of solutions includes the following: alternative *a´* and a´´ only if *Condition 2* is not met, and alternatives *a´* and a´´, . . ., $a^{(M)}$ if *Condition 1* is not satisfied and $a^{(M)}$ is determined for the maximum *M* with $Q(a^{(M)}) - Q(a') < DQ$ relation (closeness to the positions of these alternatives).

According to *Q* values, the best-ranked alternative is the alternative with a minimum *Q* value. A compromise solution with a compromise ranking list of alternatives and an “advantage ratio” was obtained as the main ranking result.

4. EVALUATION OF THE NATIONAL PARK WEBSITES

4.1. Calculation of the weights of evaluation criteria

Group AHP methodology was used to determine the criteria weights in the defined research model (Coffey & Claudio, 2021). The Analytical Hierarchical Process or AHP method is one of the most famous methods for multi-criteria decision-making. It is used for solving

complex problems, the elements of which are goals, criteria, sub-criteria, and alternatives (Li et al., 2023). The AHP method was developed by Thomas L. Saaty, a professor at the Wharton School of Business (Saaty, 1980). AHP is a multi-criteria technique based on breaking complex problems into a hierarchy. The goal is at the top of the hierarchy, while the criteria, sub-criteria, and alternatives are lower. The AHP method has so far been applied in various areas of strategic management where decisions have far-reaching importance and where decision-makers are happy to choose a quality and reliable advisor in the phase of considering alternatives and determining their effects in relation to the set goals (Saaty, 2004). The AHP has been employed to evaluate websites using subjective approaches based the individual preferences of experts (e.g., Tsai et al., 2010; Akincilar & Dagdeviren, 2014; Kabassi et al., 2019).

In the first proposed model in the research, which was created as a result of the analysis of scientific papers dealing with this topic, experts pointed to more criteria (Section 2), making evaluating a website's quality complex and challenging. Therefore, based on the joint decision of experts, six relevant criteria were identified as key factors for website quality, while the others were excluded from further analysis. Three experts participated in the study and expressed their opinion on calculating a weight for each criterion. The experts answered the questionnaire by comparing the relative importance of various elements on Saaty's one-nine scale through pair-wise comparisons (Saaty, 2004). Their scores were quantified, and the weights of all criteria were defined. The weighting coefficients obtained by the analysis of each of the experts are presented in Table 2. Additionally, the consistency ratio values were smaller than the acceptable threshold value (i.e., CR < 0.1) after computing the results of experts' assessments.

Table 2. Weighting coefficients of each expert

Criteria	**Expert I**	**Expert II**	**Expert III**
C_1	0.15	0.13	0.22
C_2	0.17	0.22	0.18
C_3	0.19	0.13	0.14
C_4	0.07	0.20	0.18
C_5	0.12	0.14	0.12
C_6	0.30	0.19	0.15
Consistency ratio (CR)	**0.077**	**0.085**	**0.076**

All obtained CR values are less than 0.1, which means that the consistency of the estimates obtained from the experts is acceptable, and thus, the complete comparison matrix is considered consistent. Analyzing the individual assessments of each expert can be concluded that their attitudes differed a lot. Namely, expert I evaluated criterion C_6 (0.30) as the most important, expert II assigned the highest relevance for criterion C_2 (0.22), while expert III gave the highest marks to criterion C_1 (0.22). Based on the values obtained in the initial aggregate comparison matrix, the values of weight coefficients for each criterion were obtained, shown in Table 3.

Table 3. Values of weighting coefficients for each criterion

Criteria	**C_1**	**C_2**	**C_3**	**C_4**	**C_5**	**C_6**
Weighting coefficient (AHP)	0.15	0.18	0.19	0.14	0.13	0.20

Based on the subjective assessments of the three experts who participated in the research, it can be concluded that criterion Update of information has the highest weight (0.20), followed by C_3 (Content) with value of the weight (0.19) and C_2 (Navigation), while on the other hand criterion C_5 (personalization) is the lowest rated (0.13).

4.1. Application of the VIKOR method

After calculating the weights for each criterion, the VIKOR method was applied to calculate comprehensive performance variance rates for each alternative. In the defined model, alternatives represent national parks in Serbia: National Park Kopaonik (A_1), National Park Fruska Gora (A_2), National Park Djerdap (A_3), and National Park Tara (A_4). National Park Sara is excluded from the analysis because it has no website. A total of 30 respondents from Serbia, who are also users of national park services, participated in the process of evaluating alternatives. This research aimed not to promote any of the considered presentations or diminish their importance or access to visitors. Bearing in mind that the weights of the criteria were determined in the previous part, this part will present the evaluation of alternatives in relation to the previously defined set of criteria. The decision matrix with initial data is shown in Table 4.

Table 4. Decision matrix

Criteria →	C_1	C_2	C_3	C_4	C_5	C_6
Altenratives ↓	max	max	max	max	max	max
National Park Kopaonik	3.57	4.27	3.60	3.60	3.40	4.53
National Park Fruska Gora	3.60	4.07	3.60	3.87	4.60	3.97
National Park Djerdap	3.50	3.83	3.27	3.30	4.50	4.33
National Park Tara	4.00	4.57	4.47	3.30	3.20	4.63

This research applied VIKOR objective weight (using the AHP method) and VIKOR equal weight (0.17) because this method considers two prioritizations. In this case, for both applications, the values of S*, R*, and Q_i were calculated by selecting $v = 0.5$ and are revealed in Table 5.

Table 5. VIKOR ranking of the websites ($v = 0.5$)

Alternatives	**ID**	**VIKOR**							
		AHP weight				**Equal weight**			
		S*	**R***	**Q_i**	**Rank**	**S***	**R***	**Q_i**	**Rank**
National Park Kopaonik	A1	0.552	0.135	0.284	2	0.579	0.144	0.293	3
National Park Fruska Gora	A2	0.583	0.201	0.316	3	0.534	0.167	0.239	2
National Park Djerdap	A3	0.764	0.187	0.500	4	0.754	0.167	0.500	4
National Park Tara	A4	0.274	0.141	0.000	1	0.333	0.167	0.000	1

Obtained results for AHP weight indicate that the values of R* were A_1(0.135), A_2(0.201), A_3(187), and A_4(0.141), while the results of R* for equal weights were A_1(0.144), A_2(0.167), A_3(0.167), and A_4(0.167). From the Table 5, it can be seen that the views of respondents from Serbia and experts are similar. However, what is much more important is the final rank given to the evaluated websites. According to both prioritizations (objective and equal weights), results show that A_4 had the best overall performance and was the closest to the ideal solution, followed by A_2, A_1, and A_3. It is obvious that the owners, or administrators, of this website A_4 are aware of the importance that websites have in modern business and that they strive to make their websites meet the demands of their visitors. Unfortunately, something similar cannot be claimed for the owners of websites that are labelled as A_2, A_1, and A_3. Their very low ratings indicate the fact that their owners are not sufficiently familiar with all the advantages that the

Internet, that is, the web, provides, or they are not familiar with ways to evaluate the quality of websites.

5. CONCLUSION

The Internet has brought significant opportunities to many different tourist destinations. Tourism development is often mentioned in many protected natural areas as a priority development direction. National parks are repositories of unique natural scenery, cultural assets, and historic resources that are popular and significant as tourism destinations (Tsai et al., 2010).

Serbian national parks provide important recreational and tourism-related resources for domestic and international tourists (Arsić et al., 2017; Arsić et al., 2018). Therefore, based on the existing scientific literature in which the application of multi-criteria decision-making methods was discussed, a set of criteria was formed to evaluate the quality of the websites of National Parks in Serbia. During the formation of the group of criteria, care was taken to select criteria whose meaning would be apparent to the respondents, that is, to the persons surveyed. In addition, care was taken to ensure that the set of criteria contains a small number of criteria to make the survey easier to conduct, even when it comes to respondents unfamiliar with the application of multi-criteria decision-making methods.

The research study involved experts from information and communication technologies. According to experts' opinion, the most important criterion is the Update of information within the first phase of the defined model. Thereafter, based on the implemented VIKOR method, the results showed that one national park stands out and is more aware of the role of the website and is adapted to the needs of visitors. This website belongs to the National Park Tara. Unlike them, the management of the other analyzed national parks should make a significant effort to modernize their websites.

From a theoretical point of view, the paper's contribution is reflected in the definition of a set of criteria for evaluating national parks' websites and a proposed procedure for determining their significance. The paper proposes a multi-criteria model AHP-VIKOR, which enables managers in national parks to analyze the quality of websites and compare them with competitors to improve their overall quality and attract more visitors.

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