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EVALUATION OF SUSTAINABLE RURAL TOURISM POTENTIAL IN BRCKO DISTRICT OF BOSNIA AND HERZEGOVINA USING MULTI-CRITERIA ANALYSIS

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Abstract. *For investment decisions to be made in tourism sector, it is necessary to determine tourism potential on the first place. Tourism potential is the ability of a particular location to attract and host tourists. Tourism development should be based on strengthening sustainability, and thus tourism will provide good effects. Since rural settlements have experienced recession in the past few decades, these areas need to be revitalized. This can be achieved through development of rural tourism. Sustainability of rural tourism potential in Brcko District of Bosnia and Herzegovina is in focus of this study. Based on sustainability criteria, we assessed the rural potential in Brcko District of Bosnia and Herzegovina for certain rural settlements. Assessment of the sustainability of rural tourism potential in Brcko District of Bosnia and Herzegovina was carried out with expert evaluation and used methods of FUCOM, ARAS and CRITIC, and a decision model will be created for this purpose. The findings from this study will provide guidelines for improvement of rural tourism in Brcko District of Bosnia and Herzegovina through examination of good and bad sides of the examined rural settlements. The model with certain corrections can also be used in determining sustainable tourism potential in other branches of tourism.*

Key words: *rural tourism, sustainable tourism, tourism potential, multi-criteria analysis, Brcko District Bosnia and Herzegovina*

1. Introduction

Tourism represents an economic branch which provides a basis for economic growth and development of the world economy. In some regions tourism contributes to the increase of employment and improvement of economy (Ullah, et al, 2010). Tourism development should be based on the principles of sustainability (Weaver,

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2014). Sustainability in tourism includes three basic criteria: economic, environmental and social. The assessment of these criteria is a requirement to improve tourism. In particular, this is significant in rural areas.

Tourism in rural areas is accepted as a tool for development of these areas (Rozman, et al, 2009). Rural tourism represents a form of tourism in rural areas, all in a natural environment where tourist are being offered various offers and activities (Jesus & Franco, 2016), all of it in an attempt to further develop that rural community and develop the living standard of that population. The main importance of rural tourism is to attract tourists on the basis of a rural tourist offer so that the population's income and living standard could increase, whilst using the already existing resources. Rural tourism attracts tourists that are searching for emotional experiences. The starting point of rural tourism has to be intercultural interaction and a way to bring the rural way of life to the tourists. Thus tourist won't just be passive consumers and the rural population won't be just powerless people who have had tourism imposed on them, instead, a social capital in tourism will develop (Steel, 2012).

The criteria of rural tourism potential can be different. Therefore, it is necessary to apply the principle of a complete evaluation of sustainable tourism potential. This evaluation is performed using the method of multi-criteria analysis. The aim of this paper is to research sustainable rural tourism potential in Brcko District of Bosnia and Herzegovina (hereinafter: Brcko District). This research was done using the decision model. In cooperation with the Government of Brcko District, three experts were engaged in evaluating sustainable rural tourism potential. Based on evaluation from the experts, good and bad side alternatives will be considered. The significance of this paper is to present the new model of research on sustainable rural tourism potential. In this study is presented the new research methodology using multi-criterion analysis methods.

Based on this, the following research objectives are set:

1. Create the model of sustainable rural tourism potential
2. Test the model on the example of the rural settlements of the Brcko District.

This paper will first present methods of multi-criteria analysis and it will explain the model and research methodology. Then, the results of the research will be presented that will be a basis for sensitivity analysis to examine these results. Finally, we will provide the conclusion from the study.

2. Multi-criteria analysis methods

The decision model used in this study is based on the application of the following multi-criteria analysis models: FUCOM, CRITIC and ARAS methods. The advantage of this model is that it takes advantage of these methods. The advantages of the FUCOM method are that it uses a simple algorithm, allows to obtain optimal values of weight coefficients with the ability to confirm the consistency of results, uses a simple mathematical apparatus that favors certain criteria, reduces subjective influence and inconsistency of experts' preferences, gets the same results as the BWM and AHP methods but with by performing a n-1 criterion comparison alone (Pamučar et al, 2018). The CRITIC method allows the criteria to be weighted in an objective manner

without subjective evaluations. Criterion weighting using the CRITIC method is performed using statistical parameters standard deviation and correlation coefficient. The ARAS method allows you to determine the ranking of the utility function. This allows the ratio of the optimal alternative to be used in seeking to rank alternatives and to find ways to improve the alternative projects that were the subject of observation (Zavadskas and Turskis 2010). Based on these advantages, the model formation was performed. These methods will be explained below.

2.1. FUCOM method

The FUCOM (Full Consistency Method) method was developed by Pamučar, et al. (2018) for determining the weights of criteria. The FUCOM provides a possibility to validate the model by calculating the error size for obtained weight vectors, by determining the degree of consistency (Mujkanović, et al, 2019). The FUCOM method uses the following steps (Zavadskas, et al., 2018):

Step 1. In the first step, the criteria from the predefined set of the evaluation criteria C = {C_1,C_2, … , C_n} are ranked. The ranking is performed according to the significance of the criteria, from the most significant to the less significant.

$$C_{j(1)} > C_{j(2)} > \ldots > C_{j(k)} \quad (1)$$

If there is a judgment of the existence of two or more criteria with the same significance, the sign of equality is placed instead of ">" between these criteria in the expression (1)

Step 2. Comparison of the ranked criteria is carried out and the comparative priority ($\varphi_{k/(k+1)}$, k = 1,2,3,…,n , where k represents the rank of the criteria) of the evaluation criteria is determined.

$$\Phi = (\varphi_{1/2}, \varphi_{2/3}, \ldots, \varphi_{k/(k+1)}) \quad (2)$$

Step 3. The final values of the weight coefficients of the evaluation criteria (w_1, w_2, … w_n)^T are calculated. The final values of the weight coefficients should satisfy the following 2 conditions:

a) the ratio of the weight coefficients is equal to the comparative priority among the observed criteria ($\varphi_{k/(k+1)}$) defined in Step 2, i.e. the following condition is met:

$$\frac{w_k}{w_{k+1}} = \varphi_{k/k+1} \quad (3)$$

b) In addition to the Condition (2), the final values of the weight coefficients should satisfy the condition of mathematical transitivity, i.e. $\varphi_{k/k+1} \otimes \varphi_{(k+1)/(k+2)} = \varphi_{k/k+2}$. Since $\varphi_{k/k+1} = \frac{w_k}{w_{k+1}}$ and $\varphi_{(k+1)/(k+2)} = \frac{w_{k+1}}{w_{k+2}}$ $\frac{w_k}{w_{k+1}} \otimes \frac{w_{k+1}}{w_{k+2}} = \frac{w_k}{w_{k+2}}$ is obtained.

Thus, another condition, that the final values of the weight coefficients of the evaluation criteria need to meet, is obtained, namely:

$$\frac{w_k}{w_{k+2}} = \varphi_{k/k+1} \otimes \varphi_{(k+1)/(k+2)} \quad (4)$$

Based on the defined settings, the final model for determining the final values of the weight coefficients of the evaluation criteria can be defined.

min χ, s.t.

$$\left|\frac{w_{j(k)}}{w_{j(k+1)}} - \varphi_{k/(k+1)}\right| = \chi, \forall j$$

$$\left|\frac{w_{j(k)}}{w_{j(k+2)}} - \varphi_{k/k+1} \otimes \varphi_{(k+1)/(k+2)}\right| = \chi, \forall j \quad (5)$$

$$\sum_{j=1}^{n} w_j = 1, \forall j$$

$$w_j \geq 0, \forall j.$$

2.2. CRITIC method

The CRITIC method is used in order to determine weight values of objective criteria which include intensity and contrast of the conflict inherent in the structure of decision problem. It belongs to a class of correlation method and is based on analytical testing decision matrix in order to determine information contained in the criteria by which to evaluate the variants. In order to determine the contrast criteria, a standard deviation of normalized criterion is used, as well as value variants, by columns and the correlation coefficients of all pairs of the columns.

The CRITIC method steps are (Puška, et al., 2018a):

Step 1. There is a complex linear normalization. Thus, the initial matrix is converted into a matrix with the generic elements x_{ij}.

Step 2. Each vector has a standard deviation σ_j, which represents a measure of deviation values of variants for a given criterion of some average values. Standard deviation is, in fact, the size which is still used in this method.

Step 3. Then, a symmetrical matrix of dimension m x m with elements R_{JK} is constructed, which represents the coefficients of linear correlation vector X_J and X_K. The greater the discrepancy between the criterion (value) for (criteria) variants j and k, the lower the coefficient value R_{JK} is. The Spearman correlation coefficient can be used instead of Pearson correlation coefficient.

$$\sum_{k=1}^{m}\left(1 - r_{jk}\right) \quad (6)$$

Step 4. The previous term is a measure of conflict criterion j in relation to the other criteria in the crucial situation (Milicevic & Zupac, 2011). The subsequent evaluation of the amount of information C_j which is contained or given in the criteria j, therefore it is determined by the combination of the above size and σ_j r_{jk} as follows:

$$C_j = \sigma_j \sum_{k=1}^{m}\left(1 - r_{kj}\right) \quad (7)$$

Step 5. The objective criteria weights are obtained by normalizing the size *Cj*.

2.3. ARAS method

The Additive Ratio Assessment (ARAS) method is developed by Zavadskas and Turskis (2010). The process of solving decision making problems using the ARAS method, similarly to the other methods of MCDM, starts with forming the decision matrix and determining weights of criteria. After these initial steps, the remaining part of solving MCDM problem using the ARAS method can be precisely expressed using the following steps (Karabasević, et al., 2015):

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 a preference, the optimal performance ratings are calculated as:

$$x_{0j} = \begin{cases} max_i\, x_{ij};\ j \in \Omega_{max} \\ min_i\, x_{ij};\ j \in \Omega_{min} \end{cases} \tag{8}$$

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.

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{\sum_{i=1}^{m} x_{ij}};\ j \in \Omega_{max} \\ \dfrac{1/x_{ij}}{\sum_{i=1}^{m} 1/x_{ij}};\ j \in \Omega_{min} \end{cases} \tag{9}$$

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

Step 3. Calculate the weighted normalized decision matrix.

$$v_{ij} = w_j r_{ij}, \tag{10}$$

where v_{ij} denotes the weighted normalized performance rating of *i*-th alternative in relation to the *j*-th criterion, *i* = 0,1,...,m.

Step 4. Calculate the overall performance rating, for each alternative.

$$S_{ij} = \sum_{j=1}^{n} v_{ij} \tag{11}$$

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

Step 5. Calculate the degree of utility for each alternative. When evaluating alternatives, it is not only important to determine the best ranked alternative. It is also important to determine relative performances of considered alternatives, in relation to the optimal alternative.

$$Q_i = \frac{S_i}{S_0} \tag{12}$$

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,...,m.

Step 6. Rank alternatives and/or select the most efficient one. The considered alternatives are ranked by ascending Q_i , i.e. the alternative with the largest value of Q_i is the best placed.

3. Model and methodology

Evaluation of sustainable rural tourism potential requires assessment of alternatives by criteria of sustainability: environmental (C1), social (C2) and economic (C3) criteria. These criteria are the main criteria of the model. To see a sustainable rural tourism potential, each of these criteria is further developed into a sub-criterion. Identifying these sub-criteria was based on the following paper: Do & Chen, (2013), Zhou (2014), Zhou, et al. (2015), Mikulić, et al. (2016), Topolansky Barbe, et al. (2016), Peng & Tzeng (2019) and Yan et al. (2017) The model for sustainable rural tourism potential is presented in Figure 1. This model is formed to assess current sustainable tourist potential in the rural area of Brcko District. Four rural settlements make up a sample of four alternatives: Gornji Zovik (A1), Brezovo Polje (A2), Maoča (A3) and Bijela (A4).

To evaluate these alternatives we used expert evaluations. The experts were appointed in cooperation with the Government of Brcko District in the following way. First, we set the list of potential experts which was a basis for selection of experts. In order to conduct the study, three experts were appointed who visited selected areas. Furthermore, all the materials that the Government of the Brcko District has about these areas are presented and used by the experts. Based on this, the experts carried out an assessment of the sustainable rural tourism potential of the Brcko District.

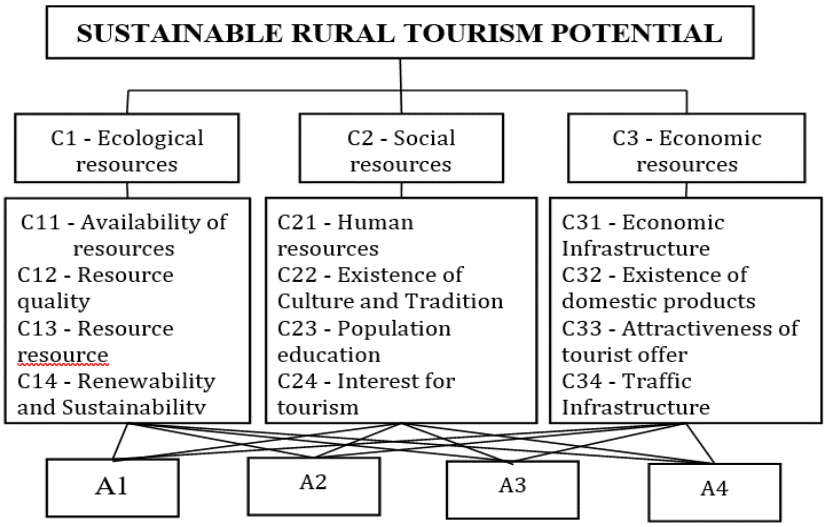

Figure 1. Model of sustainable rural tourism potential

The methodology of the study is presented in Table 1. Based on this methodology one can see how it will be used to particular methods of multi-criteria analysis.

- The FUCOM method will determine the weights of the main criteria;
- The CRITIC method will determine by the weight of sub criteria;
- The ARAS method will rank the alternatives.

Table 1. Methodology of the research

Research Phase	- The decision to study sustainable rural tourism potential. - Selection of criteria based on paper review. - Determining four rural settlements in cooperation with the Government of Brcko District. - Determining experts in tourism in cooperation with the Government of Brcko District.
Determining criteria and alternatives	- Expert evaluation of the weight main criteria using the FUCOM method. - Evaluation of sustainable rural tourism potential rural settlements of Brcko District - Application of the CRITIC - method for determining the weight of the sub criteria
Ranking alternatives	- Use of the ARAS method for ranking sustainable rural tourism potential of Brcko District. - Performing sensitivity analysis of the results.

Four rural settlements in Brcko District area have been used in this study. Each of selected rural settlements will be presented below.

Gornji Zovik is located in the southeastern part of Brcko District. This rural settlement has a variety of natural resources that are intact, preserved and pure, with a large number of potable water sources and uncultivated caves. Above this settlement is the hill Granaš which provides the possibility of applying mountain tourism. In the area of this settlement there are small gardens, decorated orchards and meadows. Nearby is the site of the Svatovsko cemetery with twenty-nine tombstones. In this settlement the sport-cultural and spiritual event called Zovik Summer has been organized. This area also has a large number of old houses dominated by Begova House.

Brezovo Polje is located on the banks of the Sava River. In this settlement is located the Aziza Mosque, which has been placed under the protection of the state. From the old buildings there is Nakic's Tower, which was a strategically military place. The resort is famous for its fishing activities and fishing tradition and is known for its gastronomic offer based on fish. It has swimming pools and swimming beaches. Nearby forests are full of wild game and birds, of which the well-known eagles are the Counts that were here before extinction. Every year, a seven-day event is organized under the name Brezovo Polje Summer of Culture.

Maoča is located below the slopes of Majevica Mountain. Through the settlement flow two rivers along which there are plenty of picnics locations and pine forests. Along the river is the Nožin-agina mosque that has been rearranged to be the museum. This area has rich evergreen and deciduous forests giving clean air. Above

Maoča, there is a locality of Dovište, where they used to learn prayers for rain during the dry days. Residents of this settlement care about customs and traditions. At the end of this village there are rocks with caves, and the area above Maoča is attractive for development of mountain tourism. Every year, the traditional manifestation Trešnjarevo is held, when a wine picking has been organized.

Bijela is located on the Tinja River, which is rich with fish. The local streams that contain two ancient watermills are poured into this river. The famous monument of Beg's tower is known, which is currently being reconstructed and preserved. Above Bijela are the wooded slopes of Majevica. There is the Katina cave, and on the other side are the Dark Caves that are unclean. Above the hamlet of Kalajdžija is the hill Kukavičluk, which springs from the fields of the Ivory Coast. The terrain above Bijela is attractive for development of mountain tourism.

4. Results

For this paper, the FUCOM method for determining the weighting of the criteria was applied.

Step 1. The criteria were ranged from the defined set of criteria, which is shown in the Table 1. Ranking of the criteria according to its significance was carried out by three experts.

Table 2. Rank of criteria

Expert	Rank
E1	C2>C3>C1
E2	C2>C1=C3
E3	C2>C1>C3

Step 2. Comparison of the ranked criteria was done and comparative significance of the evaluation criteria was determined. Expert evaluation of comparative significance is shown in Table 3.

Table 3. Comparative significance of criteria

Expert	Rank		
E1	C2	C3	C1
	1	2	2.3
E2	C2	C1	C3
	1	2.7	2.7
E3	C2	C1	C3
	1	2	2.5

Step 3. Following the steps the FUCOM method and using the Lingo 17 software, the results for the main criteria were obtained. The results are presented in Table 4. The results have shown that the experts favored the social criterion in relation to the other two sustainability criteria. At least importance is given to economic criterion.

Table 4. Weight coefficients of criteria

Expert	w_1	w_2	w_3	DFC (x)
E1	0.225	0.517	0.258	0.000
E2	0.213	0.574	0.213	0.000
E3	0.263	0.526	0.211	0.000
Average	0.234	0.539	0.227	-

After having determined the weights of the main criteria, the alternatives were evaluated according to the sub-criteria. The results of evaluation of the alternative are presented in Table 5. The experts evaluated alternatives ranging from 1 to 7. The score 1 represents the lowest rating, while 7 represents the highest rating.

Table 5. Expert evaluation of the alternative

DM1	C11	C12	C13	C14	C21	C22	C23	C24	C31	C32	C33	C34
A1	5	6	5	4	2	2	3	2	4	5	4	7
A2	4	5	6	3	3	3	3	2	5	5	6	7
A3	4	5	5	5	3	2	3	2	5	4	3	5
A4	5	4	6	5	4	3	3	4	5	5	6	7
DM2	C11	C12	C13	C14	C21	C22	C23	C24	C31	C32	C33	C34
A1	5	5	6	5	2	2	3	5	3	4	5	4
A2	5	4	5	4	3	3	3	5	4	5	5	6
A3	4	3	4	4	4	4	5	3	5	6	4	5
A4	5	5	5	4	3	3	4	4	4	4	5	6
DM3	C11	C12	C13	C14	C21	C22	C23	C24	C31	C32	C33	C34
A1	5	5	6	5	3	3	4	6	4	4	6	4
A2	4	4	5	4	4	4	4	6	5	5	6	6
A3	4	4	5	4	5	4	5	4	5	5	5	4
A4	5	4	5	4	4	4	4	5	5	4	6	6

After evaluating the alternatives by sub-criteria it is necessary to match the evaluation of the experts, since group decision-making was used where there were three tourism experts. This will be done by the applied aggregate geometric mean on an initial matrix of decision-making. The initial decision matrix is presented in Table 6. This matrix was used to determine the weight sub-criteria with the CRITIC method, and was used for ranking the alternate with the ARAS method.

Table 6. Initial decision matrix

	C11	C12	C13	C14	C21	C22	C23	C24	C31	C32	C33	C34
A1	5.00	5.31	5.65	4.64	2.29	2.29	3.30	3.91	3.63	4.31	4.93	4.82
A2	4.31	4.31	5.31	3.63	3.30	3.30	3.30	3.91	4.64	5.00	5.65	6.32
A3	4.00	3.91	4.64	4.31	3.91	3.17	4.22	2.88	5.00	4.93	3.91	4.64
A4	5.00	4.31	5.31	4.31	3.63	3.30	3.63	4.31	4.64	4.31	5.65	6.32

Before alternating ranking was performed, it was necessary to determine the weight of the sub-criteria using the CRITIC method. All weight sub-criteria were calculated for the main criteria using the steps CRITIC method. First, normalization of the initial decision matrix was performed. Second, standard deviation values and

correlation coefficients were calculated. Third, the values $(1-r_{jk})$ were calculated and these values were compiled. Fourth, these values were multiplied with the standard deviation. Fifth, normalization of weight sub-criteria was performed. Finally, weights of sub-criteria were multiplied by the weights of the main criteria and the final weight was formed.

Table 7. Steps of CRITIC method

	C11	C12	C13	C14	C21	C22	C23	C24	C31	C32	C33	C34
Normalized decision matrix	1.00	1.00	1.00	1.00	0.59	0.69	0.78	0.91	0.73	0.86	0.87	0.76
	0.86	0.81	0.94	0.78	0.84	1.00	0.78	0.91	0.93	1.00	1.00	1.00
	0.80	0.74	0.82	0.93	1.00	0.96	1.00	0.67	1.00	0.99	0.69	0.73
	1.00	0.81	0.94	0.93	0.93	1.00	0.86	1.00	0.93	0.86	1.00	1.00
σ_j	0.10	0.11	0.07	0.09	0.18	0.15	0.10	0.14	0.12	0.08	0.15	0.15
r_{jk}	1.00	0.72	0.83	0.50	1.00	0.89	0.75	-0.39	1.00	0.65	-0.21	0.24
	0.72	1.00	0.86	0.51	0.89	1.00	0.37	-0.05	0.65	1.00	-0.29	0.00
	0.83	0.86	1.00	0.15	0.75	0.37	1.00	-0.78	-0.21	-0.29	1.00	0.90
	0.50	0.51	0.15	1.00	-0.39	-0.05	-0.78	1.00	0.24	0.00	0.90	1.00
$(1-r_{jk})$	0.00	0.28	0.17	0.50	0.00	0.11	0.25	1.39	0.00	0.35	1.21	0.76
	0.28	0.00	0.14	0.49	0.11	0.00	0.63	1.05	0.35	0.00	1.29	1.00
	0.17	0.14	0.00	0.85	0.25	0.63	0.00	1.78	1.21	1.29	0.00	0.10
	0.50	0.49	0.85	0.00	1.39	1.05	1.78	0.00	0.76	1.00	0.10	0.00
$\sum_{k=1}^{m}(1-r_{jk})$	0.95	0.91	1.16	1.83	1.75	1.79	2.65	4.22	2.31	2.64	2.60	1.86
$\sigma_j \sum_{k=1}^{m}(1-r_{jk})$	0.10	0.10	0.09	0.17	0.32	0.26	0.27	0.60	0.27	0.20	0.38	0.27
w_j	0.21	0.23	0.19	0.37	0.22	0.18	0.19	0.41	0.24	0.18	0.34	0.24
Final w_j	0.049	0.053	0.045	0.087	0.118	0.098	0.101	0.222	0.055	0.041	0.077	0.055

After calculating the weights for sub-criteria, ranking of the alternatives was performed using the ARAS method. First, normalization of the initial decision matrix was performed (Table 8). Second, the decision-making matrix was made more difficult and S_0 values were determined (Table 9). The third ranking was formed (Table 10).

Table 8. Normalized decision matrix

	C11	C12	C13	C14	C21	C22	C23	C24	C31	C32	C33	C34
A1	0.273	0.298	0.270	0.275	0.174	0.190	0.228	0.261	0.203	0.232	0.245	0.218
A2	0.235	0.241	0.254	0.215	0.251	0.274	0.228	0.261	0.259	0.270	0.280	0.286
A3	0.218	0.219	0.222	0.255	0.298	0.263	0.292	0.192	0.279	0.266	0.194	0.210
A4	0.273	0.241	0.254	0.255	0.277	0.274	0.251	0.287	0.259	0.232	0.280	0.286
S_0	0.273	0.298	0.270	0.275	0.298	0.274	0.292	0.287	0.279	0.270	0.280	0.286
w	0.049	0.053	0.045	0.087	0.118	0.098	0.101	0.222	0.055	0.041	0.077	0.055

Table 9. Weighted normalized matrix

	C11	C12	C13	C14	C21	C22	C23	C24	C31	C32	C33	C34
A1	0.014	0.016	0.012	0.024	0.021	0.019	0.023	0.058	0.011	0.009	0.019	0.012
A2	0.012	0.013	0.011	0.019	0.030	0.027	0.023	0.058	0.014	0.011	0.021	0.016
A3	0.011	0.012	0.010	0.022	0.035	0.026	0.029	0.043	0.015	0.011	0.015	0.012
A4	0.014	0.013	0.011	0.022	0.033	0.027	0.025	0.064	0.014	0.009	0.021	0.016
S_0	0.014	0.016	0.012	0.024	0.035	0.027	0.029	0.064	0.015	0.011	0.021	0.016

The results of the ARAS method have shown that the best alternative is A4 which is the rural settlement of Bijela, while the worst ranked rural settlement is A1 which is Gornji Zovik.

Table 10. Results and ranking alternatives

	S_i	K_i	Rank
A1	0.237	0.834	4
A2	0.254	0.896	2
A3	0.240	0.846	3
A4	0.269	0.949	1
S_0	0.284	1.000	

Table 10 shows the summary results of the research conducted, which were obtained on the basis of a compromise of all criteria and sub-criteria used in the study. In order to gain a better understanding of the results, an alternative ranking will be made by major criteria. These results are shown in Table 11. The results of the analysis by the main criteria show the following. When looking at environmental resources, alternative A1 shows the best results, while alternative A2 shows the worst results. This shows that the best environmental resources are in rural settlement Gornji Zovik. The reason for this is the fact that it is located on the slopes of Majevica and that there are many natural beauties in the area that are not contaminated. However, it can be seen from the results that other rural settlements have good results with this criterion, so it can be concluded that all have good ecological resources, since the results are close to 1. Looking at social resources, one can see that A4 has the best results, while A1 has the worst results. Thus, rural settlement Bijela has the best social resources over other rural settlements observed. It can be observed that no rural settlement has a value of 1 that is best in all sub-criteria within social resources. Considering only economic resources, the best alternative is A2, while the worst alternative is A4. These results show that rural settlement Brezovo Polje invests most in tourism compared to other rural settlements.

Table 11. Results of partial analysis according to the main criteria

	Ecological resources			Social resources			Economic resources		
	S_i	K_i	Rank	S_i	K_i	Rank	S_i	K_i	Rank
A1	0.279	1.000	1	0.223	0.774	4	0.226	0.809	4
A2	0.233	0.835	4	0.255	0.886	2	0.275	0.983	1
A3	0.233	0.836	3	0.247	0.857	3	0.232	0.829	3
A4	0.256	0.917	2	0.276	0.958	1	0.268	0.959	2
S_0	0.279	1,000		0.288	1.000		0.279	1.000	

The following conclusions are drawn from the results obtained. Alternative A1 - Gornji Zovik must work on social and economic resources. More investment in tourism is needed to create a better environment in this area for the population to remain in the countryside and to engage in tourism. Thus, with the strengthening of economic infrastructure, social resources will also improve. Alternative A2 - Brezovo Polje must work on ecological resources. It must use the location of the Sava River flowing past this village to make up for the lack of mountains, hills and pastures located near to other rural settlements in the Brcko District. Alternative A3 - Maoča must empower the most of all resources and, above all, economic resources, because these resources have the worst results of all. Alternative A4 must work on environmental and economic resources. This research has shown that in rural settlements, there are certain potentials that need to be upgraded. The Brcko District Government should pay greater attention to rural tourism and invest more in tourism in order to exploit the tourism potential available in these areas.

5. Sensitivity analysis

In the framework of the sensitivity analysis, a change in the weights of the criteria is made, and the effect on the result of the analysis is examined (Puška, et al., 2018b). The main objective of the sensitivity analysis is not to consider the impact of different criteria on changing the value of alternatives, but also to consider the impact of these changes on the overall rating of alternatives (Maksimović, & Puška, 2015).

Table 12. Sensitivity analysis scenarios

	C11	C12	C13	C14	C21	C22	C23	C24	C31	C32	C33	C34
Scenario 1	0.45	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Scenario 2	0.05	0.45	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Scenario 3	0.05	0.05	0.45	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Scenario 4	0.05	0.05	0.05	0.45	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Scenario 5	0.05	0.05	0.05	0.05	0.45	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Scenario 6	0.05	0.05	0.05	0.05	0.05	0.45	0.05	0.05	0.05	0.05	0.05	0.05
Scenario 7	0.05	0.05	0.05	0.05	0.05	0.05	0.45	0.05	0.05	0.05	0.05	0.05
Scenario 8	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.45	0.05	0.05	0.05	0.05
Scenario 9	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.45	0.05	0.05	0.05
Scenario 10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.45	0.05	0.05
Scenario 11	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.45	0.05
Scenario 12	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.45

In this study, the total weight was evaluated so that a sub-criterion will be taken and given greater importance in relation to other sub-criterion and it will be assigned a weight of 0.45 while the other criterion will assign the importance of 0.05. In this way, it will be examined how each criterion has an influence on ranking the alternatives, taking into account other criterion. Thus, 12 different scenarios were obtained in the sensitivity analysis. The weights of each scenario are shown in Table 12. In the first scenario, criterion C11 gained a weight of 0.45, while the other

criteria gained a weight of 0.05. In the second scenario, criterion C12 gained a weight of 0.45, while other criteria gained a weight of 0.05. In the 12th scenario, criterion C34 gained a weight of 0.45, while other criteria gained a weight of 0.05. The sensitivity analysis results are shown in Figure 2.

The results of the sensitivity analysis show that in most scenarios, the best results were obtained by A4 alternative - Bijela. Other alternatives have the best results in one scenario. Alternative A1 performed best in scenario 2 in which is ranked at the first place. This shows that alternative A1 has the best performance under C12 - Resource quality criteria, and when this criterion is given with highest priority, alternative A1 is the best. However, in five scenarios, alternative A1 shows the worst results (scenarios 5,6,7,9 and 10). Alternative A2 shows the best results for scenario 10. This indicates that the alternative has the best results for criteria C32 - Existence of domestic products. However, in scenario 4, alternative A2 shows the worst results. Alternative A3 shows the best results in scenario 7, while worst case results in scenarios 1, 2, 3, 8, 11 and 12. Alternative A4 has the best results in scenarios 1, 3, 4, 5, 6, 8, 9, 11 and 12. However, the alternative A4 did not take the last place in either scenario. It had the worst results in scenario 10 in which is ranked at the third place. The results of the sensitivity analysis show that the A4 alternative is least sensitive to the application of different scenarios, while other alternative indicators are more sensitive for different scenarios. This points out that the alternative A4 - Bijela has the best indicators of sustainable rural tourism potential in Brcko District.

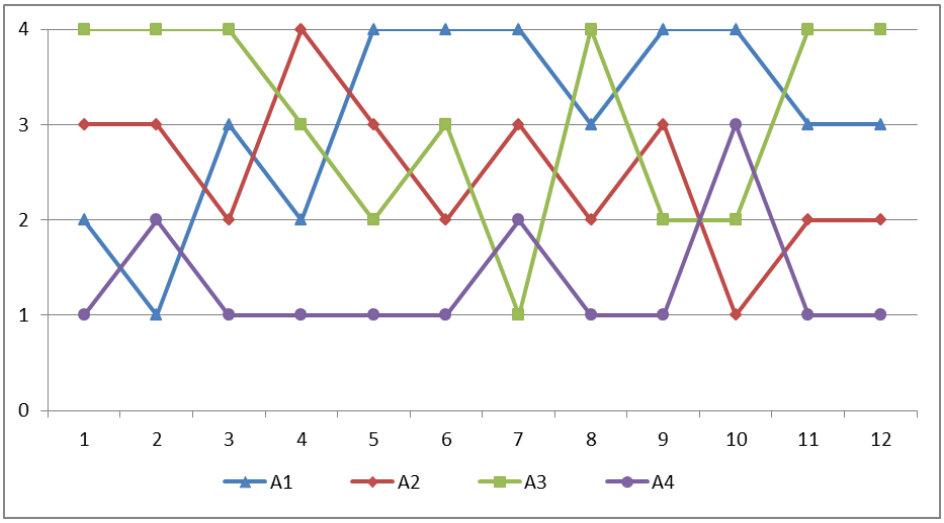

Figure 2. Sensitivity analysis

6. Conclusion

This paper reviews sustainability of rural tourism potential of Brcko District. For this purpose, expert decision-making was used by different methods of multi-criteria analysis. A unique decision-making model and an innovative methodology for this research were formed. The FUCOM method was used to calculate the weights of the main criteria, the CRITIC was calculated by the weight of the sub-criteria, and the

ARAS method was used to rank alternatives. Three experts were engaged to evaluate the four alternatives. The results of this analysis have shown that the best-ranked is the rural settlement of Bijela. Sensitivity analysis has confirmed these results.

The advantage of the model is in the following. Weight for the main criteria was subjectively determined using the advantages of the FUCOM method. The experts compared three criteria, and had to compare 2 pairs. The alternatives were evaluated for sub-criteria. The experts did not have to determine the weight of the sub-criteria, but it is rather determined by using the CRITIC method. In this way the questionnaire completed by the experts was reduced, their task was simplified and the ranking was accelerated using the ARAS method. The questionnaire consisted of two parts. The part one was intended for the subjective determination of the weights of the main criteria (table with one row and three columns); the second section was for evaluating alternatives by sub criteria (table with twelve rows and four columns). In this way, the experts filled only 13 columns. The model used in this way reduced the number of lines in the questionnaire and facilitated the work of experts. The model used took full advantage of the methods used and showed very good flexibility. Thus, the set goals of the research were achieved.

The flipchart of this study is that only four alternatives have been taken. In future research it is necessary to increase the number of settlements that determine sustainability of tourism potential of Brcko District. This would give the overall rating of rural tourism potential. In addition, the lack of this study is that no linguistic values are used that are closer to human thinking.

In the following research it is necessary to extend this model and methodology to other methods using fuzzy logic. It is also necessary to apply this model and methodology in other areas of tourism. In this way, the method and methodology used in this research would be of multiple benefits for future research.

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