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Dragan Mihajlović
Bojan Đorđević

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Gabrijela Popović, MSc

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„SUSTAINABLE DEVELOPMENT AND GREEN ECONOMY IN TRANSITION COUNTRIES – CHALLENGES AND PERSPECTIVES“

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FOREWORD

Environmental issues have become increasingly incorporated in scientific agendas of the most diverse fields of knowledge. Its growing relevance originates from the widespread understanding that environmental sustainability is indispensable to the long term development of societies. The challenge of moving towards a more egalitarian and sustainable society is on the agenda, more than ever. This is the context in which the concept of green economy has emerged. Green economy will be one of the key topics of 4th International Symposium on Natural Resources Management in Zaječar, Republic of Serbia.

The challenge is not simple and discussions are only beginning. Despite having a formal conceptualization, precise delineations are still to be determined. After all, what is a green economy? Which economies are closer to reaching it? How to measure the degree of "greening" of an economy? What does it mean, concretely, to achieve transition to a green economy? What is the role of the state in this transition? How to finance the transition? Which sectors will be most affected? Which will be most benefited? How would the transition affect the daily lives of citizens? And in the case of Serbia, what has the country done and what is left to do to advance towards a green economy? How is the country doing, compared to the others? What are the main obstacles and challenges? How to address them? What would a transition mean for society, productive sectors, for government, for consumers? How can developed and developing countries cooperate in this transition? How can international promotion and cooperation organizations align themselves with these objectives? How can United Nations priority international initiatives, such as the Climate Change and the Biodiversity Conventions, encourage and implement common agendas aimed at achieving these objectives?

Green economy raises many questions that do not have simple and straight answers. We know, however, that the transition requires substantial efforts and engagement from all segments of society, especially government and the private sector. It demands that governments level the playing field for greener products by removing perverse incentives, revising policies and incentives, strengthening market infrastructure, introducing new market mechanisms, redirecting public investment and "greening" public procurement. The private sector, on the other hand, will need to respond to these policy reforms through increased financing and investments, as well as by creating innovation skills and capabilities to make the best of green economy opportunities.

The contributions to the international symposium have come from the professors and associates of Megatrend university as well as from authors from other universities in the country and abroad. Professors and doctoral students from universities in Italy, Ukraine, Bulgaria, Bosnia and Herzegovina and Macedonia, have also made contributions to this conference. The Proceedings are intended for the scientific and professional community as well as students of doctoral studies. The contents allow readers to learn about contemporary approaches, perspectives and challenges in the sustainable development and green economy of transition countries.

Enjoy the reading!

Zaječar, May 2014 Editors

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STRATEGIES OF GAMZIGRAD SPA DEVELOPMENT TOWARDS GREEN ECONOMY

Biljana Ilić[1],
Dragan Mihajlović[2]
Gabrijela Popović[3]

[1]*Faculty of Management, Zajecar, biljana.ilic@fmz.edu.rs*
[2]*Faculty of Management, Zajecar, gabrijela.popovic@fmz.edu.rs*
[3] *Faculty of Management Zajecar, dragan.mihajlovic@fmz.edu.rs*

ABSTRACT

Tourism is integral part of modern business, and also part of green economy. Spa tourism must bee seen as a major part of the tourism in the countries that are rich in spas. In this case it must be considered as tool of achieving important economic goals. The paper proposes an evaluation model based on TOPSIS, and ELECTRE mathematical methods to help the decision makers in selection of the optimal strategy for Gamzigrad spa development. AHP method is used as ancillary method to determine the weights of criteria. A real case study is used for determination of the development strategies, towards green economy.

KEYWORDS

Modern society, economic goals, green economy, TOPSIS, ELECTRE.

1. INTRODUCTION

In the last few years, there have been more and more proofs pointing to the fact that doing tourism means being highly concerned with sustainability of natural resources. Green economy is the growth in income and employment growth, through investments that reduce emissions of harmful elements in the eco-system, increasing the efficiency of nature and maintaining biodiversity. Harmful elements, such as waste gases, hazardous substances, formed as by-products of modern human activity. In order to reduce the harmful effects to the environment, mankind would have to think of finding the ways to help a sustainable economy, and to compliance it with environmental objectives. The main goal of the economy is realization of economic gain, regardless of other factors, while the main goal of environmental protection, is protection of natural resources and the environment in which human activity is performed. Based on that facts, it can be concluded that the green economy as a new branch of economics, encompasses the achievement of economic goals, but with maximum consideration of environmental objectives, too. The paper is based on finding the adequate development of spa tourism strategies, in case studies of Gamzirad spa, using the appropriate mathematical methods to help decision makers in the selection of appropriate solutions. In that case development strategies of Gamzigrad spa contained both economic component, as well as environmental factors, taking into account the concept and objectives of a green economy.

2. POTENTIAL OF GAMZGRAD SPA

Gamzigrad spa has a great potential for the tourism development, and because of that it is necessary to determine appropriate strategies for achieving the desirable improvement. But choosing the appropriate strategy is not easy task and very important question is: *Which strategy is the appropriate choice for present conditions?* The answer to this question could be obtained by using MCDM (Multi-Criteria Decision-Making) methods. Many authors have discussed MCDM methods in the papers and example of that are reviews include: [1-7]. This paper presents the possibility of finding adequate strategy for sustainable development of Gamzigrad spa by using TOPSIS and ELECTRE. Criteria weights are determined by using AHP method. The paper is organized as follows: in section 2 the methods are explained; section 3 contains numerical example; and conclusions are discussed in section 4.

3. THE AHP METHOD

AHP was proposed by Saaty [8, 9] to model subjective decision-making processes based on multiple criteria in a hierarchical system. This method is very convenient for determining the relative criteria weights. Three of the most used methods for determining the weights in AHP are: average of normalized columns (ANC), normalization of row average (NRA), and normalization of the geometric mean of the rows (NGM) [10]. The AHP method includes following steps: **Step 1.** Construct a pairwise comparison matrix using the fundamental scale of the AHP (Table 1).

Table 1. Fundamental scale of AHP

The evaluation scale	Definition
1	Equally important
3	Slightly more importance
5	Strongly more importance
7	Demonstrably more importance
9	Absolutely more importance
2, 4, 6, 8	The medium value of the adjacent scale

Table 2. Pairwase comparison matrix

	C_1	C_2	C_3	$\dots$	C_j
C_1	a_{11}	a_{12}	a_{13}	$\cdots$	a_{1j}
C_2	a_{21}	a_{22}	a_{23}	$\dots$	a_{2j}
.	.	.	.	.	.
C_j	a_{j1}	a_{j2}	a_{j3}	$\dots$	a_{jj}

In the pairwase comparison matrix where a_{ij} denotes the comparative importance of criterion C_i with respect to criterion C_j. In the matrix $a_{ij} = 1$, when $i = j$ and $a_{ji} = a_{ij}$. **Step 2.** Calculate relative normalized weight w_j of each criterion by using the following formulae:

$$GM_i = \left(\prod_{i=1}^{n} a_{ij} \right)^{1/n}, \tag{1}$$

$$w_j = GM_i / \sum_{i=1}^{n} GM_i, \tag{2}$$

where *GM* is geometric mean.

Step 3. Determine the maximum eigenvalue $\lambda_{\max}$ and calculate the consistency index CI :

$$CI = (\lambda_{\max} - n)/(n-1). \tag{3}$$

Step 4. Obtain the random index RI for the number of criteria used in the decision making (Table 3).

Table 3. Random index details

Number of criteria	1	2	3	4	5	6	7	8	9
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45

Step 5. Calculate the consistency ratio CR by using following formula:

$$CR = CR/RI. \tag{4}$$

Judgment is appropriate when the value of CR is 0.1.

4. THE TOPSIS METHOD

The TOPSIS was first introduced by Hwang and Yoon 1981 [11]. According to this method the most suitable alternative would have the shortest distance from the ideal solution and largest distance from the anti-ideal solution [12]. There are a lot of examples of using TOPSIS for improving the decision making process in many different fields and one example of that is paper of Dağdeviren et al. [13]. The TOPSIS method consists of following steps: **Step 1.** Establish decision matrix. Criteria shown as qualitative values need to be changed into quantitative values. A numerical scale, which is using for that purpose, is shown in Table 4:

Table 4. Transformation of linguistic scales into quantitative values

Linguistic scale	Quantitative value	
	Benefit - max	Cost - min
Very high	9	1
High	7	3
Average	5	5
Low	3	7
Very low	1	9

Step 2. Calculate the normalized decision matrix. The normalized value r_{ij} is calculated as:

$$r_{ij} = x_{ij} / \sqrt{\sum_{i=1}^{m} x_{ij}^2}\ , \tag{5}$$

where x_{ij} is the rating of alternative A_i with respect to the criteria C_j, w_j is the weight of the criteria C_j, $i = 1,...,m,$ m is number of alternatives, and $j = 1,...,n,$ n is number of criteria [14]. **Step 3.** Create the weighted normalized decision matrix. The weighted normalized value v_{ij} is calculated as:

$$v_{ij} = w_j r_{ij}. \tag{6}$$

Step 4. Determine ideal solution A^+ and anti-ideal solution A^- using formulae:

$$A^+ = \{v_1^+,...,v_n^+\} = \left\{\left(\max_i v_{ij} \mid i \in I'\right), \left(\min_i v_{ij} \mid i \in I''\right)\right\} \tag{7}$$

$$A^- = \{v_1^-,...,v_n^-\} = \left\{\left(\min_i v_{ij} \mid i \in I'\right), \left(\max_i v_{ij} \mid i \in I''\right)\right\} \tag{8}$$

where I' is associated with set of benefit criteria, and I'' is associated with set of cost criteria.Step 5. Calculate the separation of each alternative from ideal solution D_i^+, and anti-ideal solution D_i^- using the n-dimensional Euclidean distance using formulae:

$$D_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+\right)}, \tag{9}$$

$$D_i^- = \sqrt{\sum_{j=1}^{n}\left(v_{ij} - v_j^-\right)}. \tag{10}$$

Step 6. Calculate the relative closeness to the ideal solution (where $0 \le C^+ \le 1$) as follows.
:

$$C_i^+ = D_i^- / \left(D_i^+ + D_i^-\right), \tag{11}$$

5. THE ELECTRE METHOD

The ELECTRE method was developed by Roy 1968 [15] as response to the existing decision making methods. This method could be viewed as a philosophy of a decision aid. The main steps of the ELECTRE method include: **Step 1, 2** and **3** are equal to the TOPSIS methodology. **Step 4.** Determine concordance C_{pr} and discordance D_{pr} sets by using follows formulae:

$$C_{pr} = \left\{j \middle| \ xpj \ge xrj\right\}, \tag{12}$$

$$D_{pr} = J - S_{pr} = \left\{j \middle| \ xpj < xrj\right\}. \tag{13}$$

Step 5. Define the concordance matrix c_{pr} on the basis of the concordance sets. The elements of this matrix are the concordance indices and it is calculated as:

$$c_{pr} = \sum_{j \in Cpr} w_j. \tag{14}$$

Step 6. Determine the discordance matrix d_{pr} on the basis of the discordance sets. The elements of the matrix are the discordance indices determined by the following formula:

$$d_{pr} = \frac{\max\limits_{j \in Dpr}\left\lfloor w_{pj} - w_{rj}\right\rfloor}{\max\limits_{j \in J}\left\lfloor w_{pj} - w_{rj}\right\rfloor}. \tag{15}$$

Step 7. Determine the matrix of concordance domination, on the basis of the average index of concordance - *AIC* by using formula (where $p \ne r$).
:

$$AIC = \sum_{p=1}^{m}\sum_{r=1}^{m} \frac{c_{pr}}{m(m-1)}, \tag{16}$$

Step 8. Analogously to the matrix of concordance domination, there is a need for determination of the matrix of discordance domination on the basis of the average index of discordance-*AID*, (where $p \ne r$) as follows:

$$AID = \sum_{p=1}^{m}\sum_{r=1}^{m} \frac{d_{pr}}{m(m-1)}, \tag{17}$$

Step 9. Determine the matrix of aggregate domination $-mad_{pr}$ whose elements are equal to the product of the elements on a certain position in matrices of agreement and disagreement domination:

$$mad_{pr} = msd_{pr} \cdot mnsd_{pr}. \tag{18}$$

Step 10. Less desirable actions are eliminated, while one or more alternatives are separated as most desirable. Therefore, the ELECTRE I method provides a partial order of actions.

6. A NUMERIC APPLICATION OF PROPOSED METHODS

Tourism potential of Gamzigrad spa is not properly used. Future development of this spa requires realization of suitable projects which could promote different tourism capacities of this area. TOPSIS and ELECTRE are used in ranking of the development strategies in order to improve the presence position of this spa and East Serbia region as well. The available alternative projects, defined by management team of the spa, are: A_1 – **health tourism**; A_2 – **sports tourism**; A_3 – **recreation tourism**; A_4 – **country tourism**; A_5 – **congress tourism.** The following five criteria were defined for evaluation of the projects: C_1 – **financial investments (€).** Project that requires less investments are more desirable; C_2 – **solution delivery (€).** Second best investment solution for the observed projects. As previous, project that requires less investment has the advantage; C_3 - **strategic contribution.** Project with higher contribution to the development of the Gamzigrad spa is desirable; C_4 - **risk management**. The project with the least risk has the advantage; C_5 – **environment.** Project that more relies on the environment potentials is more desirable. Presented methods are applicable to any decision making problem, not only to strategies determination presented here.

Determination of the criteria weights

Three experts in the field of tourism resources management are consulted in order to determine the relative importance of all possible pairs of criteria with respect to the overall goal. Their judgments are arranged into the matrixes and presented in Tables 8, 9 and 10. The relative normalized weight w_j of each criterion j is calculated by using formulae (1) and (2). The consistency ratio CR is checked by formulae (3) and (4). Three different judgments and therefore, different weights, are reduced to a common weight by using formula (1).

Table 5. Pairwise matrix - Expert 1

	C_1	C_2	C_3	C_4	C_5	w_j
C_1	1	1/7	1	5	1	0.136
C_2	7	1	3	7	7	0.539
C_3	1	1/3	1	5	3	0.190
C_4	1/5	1/7	1/5	1	1/3	0.042
C_5	1	1/7	1/3	3	1	0.093
						$\boldsymbol{CR}$ = 9.30%

Table 6. Pairwise matrix - Expert 2

	C_1	C_2	C_3	C_4	C_5	w_j
C_1	1	1/7	1/3	1	1	0.072
C_2	7	1	5	7	7	0.580
C_3	3	1/2	1	3	3	0.188
C_4	1	1/7	1/3	1	1/3	0.061
C_5	1	1/7	1/3	3	1	0.099
						$\boldsymbol{CR}$ = 7.39%

Table 7. Pairwise matrix - Expert 3

	C_1	C_2	C_3	C_4	C_5	w_j
C_1	1	1/7	1/3	3	1	0.091
C_2	7	1	5	7	7	0.569
C_3	3	1/2	1	5	3	0.204
C_4	1/3	1/7	1/2	1	1/3	0.045
C_5	1	1/7	1/3	3	1	0.091
						$\boldsymbol{CR}$ = 9.50%

Table 8 presents final weights of observed criteria calculated by formula (1).

Table 8. Weights of criteria

Criteria	Weights
C_1	0.100
C_2	0.094
C_3	0.049
C_4	0.194
C_5	0.563
Σ	1

Ranking by TOPSIS Method

Table 9 presents the raw data which are base for decision making process. Qualitative data is changed into quantitative by using numerical scale shown in the Table 4 (see Table 10). Normalized decision matrix (Table 11) is calculated by using formula (5).

Table 9. Raw data

	Financial invest. (€)	Solution delivery (€)	Strategic contribut.	Risk managem.	Environ.
	min	min	max	min	max
Health tourism	200.000	250.000	High	Average	Very High
Sports tourism	70.000	90.000	Very high	Average	High
Recreation tourism	60.000	70.000	Very high	Low	Very high
Country tourism	120.000	140.000	High	Low	High
Congress tourism	40.000	60.000	High	Low	Very high

Table 10. Initial decision matrix

Alternatives	Criteria				
	C_1	C_2	C_3	C_4	C_5
	min	min	max	min	max
A_1	200.000	250.000	7	5	9
A_2	70.000	90.000	9	5	7
A_3	60.000	70.000	9	3	9
A_4	120.000	140.000	7	3	7
A_5	40.000	60.000	7	3	9

Table 11. Normalized decision matrix

Alternatives	Criteria				
	C_1	C_2	C_3	C_4	C_5
	min	min	max	min	max
A_1	0.7875	0.7958	0.3982	0.5698	0.4874
A_2	0.2756	0.2865	0.5120	0.5698	0.3791
A_3	0.2362	0.2228	0.5120	0.3419	0.4874
A_4	0.4725	0.4456	0.3982	0.3419	0.3791
A_5	0.1575	0.1910	0.3982	0.3419	0.4874

Steps 1 and **2** are done. **Step 3.** The weighted normalized decision matrix is calculated by formula (6) and shown in Table 12. **Step 4.** The ideal A^+ and anti-ideal solutions A^- are determined by formulae (7) and (8), and they are as in Table 13. **Step 5.** The separation measures D_i^+ and D_i^- are determined by using the formulae (9) and (10). The results are shown in Table 14.

Table 12. Weighted normalized decision matrix

	Criteria				
	C_1	C_2	C_3	C_4	C_5
Weights	0.100	0.094	0.049	0.194	0.563
Alternatives	min	min	max	min	max
A_1	0.0787	0.0748	0.0195	0.1105	0.2744
A_2	0.0276	0.0269	0.0251	0.1105	0.2134
A_3	0.0236	0.0209	0.0251	0.0663	0.2744
A_4	0.0472	0.0419	0.0195	0.0663	0.2134
A_5	0.0157	0.0180	0.0195	0.0663	0.2744

Table 13. The ideal A^+ and anti-ideal solutions A^-

A^+	0.0157	0.0180	0.0251	0.0663	0.2744
A^-	0.0787	0.0748	0.0195	0.1105	0.2134

Table 14. The separation measures and relative closeness to the ideal solution

Alternative	D_i^+	D_i^-
	I	II
A_1	0.0958	0.0610
A_2	0.0768	0.0703
A_3	0.0084	0.1079
A_4	0.0729	0.0635
A_5	0.0056	0.1135

Step 6. Relative closeness of a particular solution to the ideal solution C_i is calculated by using formula (11), and it is given in Table 15. According to the results, the rank is followed:

Table 15. Ranking results

Alternative	C_i	Rank
A_1	0.3888	5
A_2	0.4780	3
A_3	0.9276	2
A_4	0.4655	4
A_5	0.9532	1

Ranking by ELECTRE Method

Available alternatives for improving the conditions in the Gamzigrad spa are ranked by using ELECTRE method. **Step 1**, **2** and **3** of this method are the same as in TOPSIS. **Step 4.** Concordance C_{pr} and discordance sets D_{pr} are determined by applying the formulae (12) and (13) and they are shown in Table 16.

Table 16. Concordance and discordance sets

C_{pr}	D_{pr}
C_{12} = 1, 2, 4, 5	D_{12} = 3
C_{13} = 1, 2, 4, 5	D_{13} = 3
C_{14} = 1, 2, 3, 4, 5	D_{14} = -
C_{15} = 1, 2, 3	D_{15} = 4, 5
C_{21} = 3, 4	D_{21} = 1, 2, 5
C_{23} = 1, 2, 3, 4	D_{23} = 5
C_{24} = 3, 4, 5	D_{24} = 1, 2
C_{25} = 1, 2, 3, 4	D_{25} = 5
C_{31} = 3, 5	D_{31} = 1, 2, 4
C_{32} = 3, 5	D_{32} = 1, 2, 4
C_{34} = 3, 4, 5	D_{34} = 1, 2
C_{35} = 1, 2, 3, 4, 5	D_{35} = -
C_{41} = 3	D_{41} = 1, 2, 4, 5
C_{42} = 1, 2, 5	D_{42} = 3, 4
C_{43} = 1, 2, 4	D_{43} = 3, 5
C_{45} = 1, 2, 3, 4	D_{45} = 5
C_{51} = 3, 5	D_{51} = 1, 2, 4
C_{52} = 5	D_{52} = 1, 2, 3, 4
C_{53} = 4, 5	D_{53} = 1, 2, 3
C_{54} = 3, 4, 5	D_{4} = 1, 2

Step 5. Concordance matrix c_{pr} is calculated by using formula (14) and data from tab. 8 and it is as in tab. 17.

Table 17. Concordance matrix

0	0.757	0.563	0.612	0.612
0.437	0	0.049	0.806	0.049
1	1	0	1	0.806
0.437	0.757	0.194	0	0.243
1	0.951	0.951	1	0

Step 6. Discordance matrix d_{pr} is calculated by using formula (15) and it is presented in table 18.

Table 18. Discordance matrix

0	0.840	1	0.725	1
1	0	1	1	1
0	0	0	0	1
1	0.045	1	0	1
0	0.092	0.708	0	0

Step 7. The matrix of concordance domination is calculated by using formula (16) and presented in table 19.

Table 19. Matrix of concordance domination

0	1	0	0	0
0	0	0	1	0
1	1	0	1	1
0	1	0	0	0
1	1	1	1	0

Step 8. The matrix of discordance domination is obtained by using formula (17) and it is presented in tab. 20.

Table 20. Matrix of discordance domination

0	0	0	0	0
0	0	0	0	0
1	1	0	1	0
0	1	0	0	0
1	1	0	1	0

Step 9. Matrix of aggregate domination mad_{pr} is determined by using formula (18) (table 21):

Table 21. Matrix of aggregate domination

A_1	0	0	0	0
0	A_2	0	0	0
1	1	A_3	1	0
0	1	0	A_4	0
1	1	0	1	A_5

Step 10. Table 22 shows recommended projects that are obtained by eliminating less desirable alternatives.

Table 22. Ranking results

$A_3 \rightarrow A_1, A_2, A_4$	Dominate under A_1, A_2, A_4
$A_5 \rightarrow A_1, A_2, A_4$	Dominate under A_1, A_2, A_4
A_2	Not dominant
$A_4 \rightarrow A_2$	Dominate under A_2
A_1	Not dominant

7. CONCLUSION

A decision model presented in the paper is provided for strategy determination for improvement the business position of Gamzigrad spa. TOPSIS and ELECTRE decision-making methods have been used in the proposed model as the tools that can help in making the right choice. The obtained results are not completely identical. TOPSIS shows alternative A_5 – congress tourism as the most appropriate choice for the present conditions and alternative A_3 – recreation tourism is in the second place. The first two places are the same in the ELECTRE but other three alternatives have different ranking. Application of the ELECTRE method was relative successful because precise ranking was not determined. But, solution gained by the TOPSIS is more accurate and elegant because it gives the precision ranks of observed alternatives. Efficiency of the strategy selection is significantly increased by using the proposed methods. These methods could consider any number of different criteria and offers a more objective, simple and reliable strategy selection approach. Proposed methods could be combined with different mathematical models for improving the decision making quality.

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