

Selection of a Study Program Using the Multi-Criteria Decision-Making Method

Abstract: *One of the most significant decisions an individual makes in their life is the choice of a higher education institution to study at. This choice depends on a large number of factors, some of which relate to success during previous schooling, entrance exam results, the possibility of enrolling as a state-funded student, employment opportunities, prestige, and more. The goal of this paper is to determine the optimal study program by using criteria that influence the choice of a study program, as well as the criteria and relationships of alternatives. The paper first describes multi-criteria decision-making and then details the methods used in this research. Afterwards, these methods were applied to a specific example to help in the right choice of a study program. The weights of the criteria were determined by conducting a survey involving 100 students from two faculties: the Faculty of Hotel Management and Tourism in Vrnjačka Banja (study programs: Tourism and hospitality, and Gastronomy) and the Faculty of Economics in Kragujevac (study programs: Economics and business management, and Business informatics). The research results show that the criterion with the highest weight is the possibility of budget subscription, and the best-ranked study program is Tourism and Hotel Management from the Faculty of Hotel Management and Tourism in Vrnjačka Banja, University of Kragujevac. The results of this research supplement both domestic and foreign literature regarding the use of multi-criteria decision-making methods.*

Keywords: *study program, multi-criteria decision-making, Analytical Hierarchical Process (AHP), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS)*

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- ¹ Toplica Academy of Applied Studies (TAAS), Prokuplje, Serbia.
E-mail: olgica.andrejic@gmail.com
ORCID iD: <https://orcid.org/0009-0008-8506-7410>
 - ² Toplica Academy of Applied Studies (TAAS), Prokuplje, Serbia.
E-mail: sandradramicanin@hotmail.com
ORCID iD: <https://orcid.org/0000-0001-6533-2071>
 - ³ Toplica Academy of Applied Studies (TAAS), Prokuplje, Serbia.
E-mail: mihajlo.djurovic23@gmail.com
ORCID iD: 0009-0003-5356-319X

INTRODUCTION

In ordinary life, individuals find themselves in conditions where they need to make a proper choice. These choices most frequently relay to individual, career, medical, financial, educational decisions, and more. Starting from a standardizing approach, the choice as an outcome of the decision-making process should denote a balanced choice by a fully informed decision-maker (32). The process of making those decisions is specific, given that some choices are easy and simple, others are complicated and require several steps in order to make an adequate decision (43). The decision-making process includes two factors: one of which is the criteria that shape the assessment of the person making the decision, and the other is the alternatives for choosing between several options. People need more than one alternative to talk about the decision-making process (26). Decision-making can be influenced by various factors that include previous experiences, bias, differences in the nature of people, and more (17). Effective decision-making includes seven factors: identifying a decision, gathering information, defining alternatives, evaluating criteria, choosing between alternatives, taking action, and reviewing the decision (2). Other authors state similar steps in MCDM analysis: definition of problems and objectives, identification of alternatives, definition of criteria, determination of the weight of criteria, evaluation of alternatives according to criteria, application of the MCDM method and analysis of results and decision-making (38).

Multi-criteria decision-making implies decision-making in cases where there are multiple and mutually conflicting criteria and the decision-maker must take into account multiple goals, while the decision-maker retains the freedom to accept, change or reject the solution obtained on the basis of the decision-making model (11). Knowledge and proper application of appropriate decision-making methods make an exceptional contribution to a quality approach to decision-making (33).

Given that there is relatively little research in domestic and foreign literature dealing with multi-criteria decision-making when choosing a study program, this paper seeks to fill that research gap. At the center of the research is the application of AHP and TOPSIS methods in the process of making a decision on choosing a study program. In the first part of the paper, through a review of the literature, these methods are presented, while in the empirical part, the same methods are used to identify the criteria with the greatest weight, and then to rank the study programs in order to determine the most favorable choice.

LITERATURE REVIEW

Multi-criteria decision-making emerged as part of operational research and is aimed at designing computer and mathematical tools to support the subjective assessment of criteria by decision-makers (58). Multi-Criteria Decision Making (MDCM) methods enable a comprehensive analysis of decision options in order to identify the most desirable

values (1). They are applied in cases when it is not possible to make a decision based only on one existing criterion, but it is necessary to use several factors. However, these methods include a wide range of techniques that are used in different ways to transform calculations, and this can lead to different and divergent results (57). On the other hand, the results obtained by these methods need to be consistent and reliable. Multi-criteria decision analysis methods are a popular tool used to evaluate a set of alternatives (30). MDCMs use a set of criteria and corresponding weighting coefficients that determine their relevance to a specific problem (52). The MCDM procedure consists of generating alternatives, establishing and ranking criteria, evaluating criteria weights and applying a compromise ranking method (20). The purpose of selection is to determine the best alternative or to compare the available alternatives with each other in order to make a choice. Alternatives are classified according to certain criteria, and then the ranked alternatives are classified from good to bad in a measurable way (60).

The most well-known methods of multi-criteria analysis include: AHP (Analytic Hierarchy Process), which is characterized by the hierarchical structure of the problem, comparative comparison of criteria and calculation of criteria weights and evaluation of alternatives; ANP (Analytic Network Process) which is similar to AHP, but takes into account dependencies and feedback links between criteria; TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) which chooses the alternative that is closest to the ideal and farthest from the worst solution; VIKOR (Multi-Criteria Optimization and Compromise Solution) which balances between the best value criteria; PROMERHEE (Preference Ranking Organization Method for Enrichment Evaluations), which serves to compare alternatives based on preferences for each criterion; ELECTRE (Elimination and Choice Expressing Reality), which represents the method of elimination and dominance of alternatives and SAW (Simple Additive Weighting), which represents linear weighting, i.e. the product of ratings and weights (54; 15; 28; 4; 9; 59; 14).

Different MCDM methods use different formulas in calculating the preferences of alternatives (57). In this paper, AHP and TOPSIS will be used, given that a methodical and objective approach is necessary for the selection of a study program, which enables the consideration of several criteria at the same time. That is why AHP (Analytic Hierarchy Process) and TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) are suitable methods for this type of decision-making. AHP enables a complex problem to be hierarchically structured, as well as to precisely determine the relative importance of each criterion through side-by-side comparisons, thus providing a reliable basis for further analysis. TOPSIS, on the other hand, enables the ranking of available study programs according to their distance from the ideal solution, clearly showing which alternative is closest to optimal conditions. The combination of these methods achieves a balance between the systematic determination of the importance of the criteria and the practical ranking of alternatives, which makes the process of making a decision on choosing a study program transparent, rational and reliable.

The essence of the Analytic Hierarchy Process (AHP), a decision support method, is to compare the elements of the hierarchy in pairs and form the corresponding local, reciprocal numerical matrices. Based on those matrices, by applying certain mathematical procedures, the weights of the compared elements are determined. These matrices and the obtained weights contain information about the consistency of the decision-maker himself, which can be assessed in different ways - directly or indirectly (49). AHP is an effective tool for solving complex decision-making problems and helps the decision maker to prioritize and make the best decision (19; 36; 27; 51). By conducting complex decisions using a series of pairwise comparisons and then synthesizing the results obtained, AHP helps to capture the subjective and objective aspects of the decision (53). In addition, AHP integrates a useful technique for checking the consistency of decision-makers' judgments, thus reducing bias in the decision-making process. It is one of the most commonly used MCDM methods (20).

The AHP method determines the weight of each criterion based on pairwise comparisons made by the decision maker. The higher the assigned weight, the more important the criterion is in the decision-making process. Then, for already defined criteria, AHP evaluates each option through pairwise comparisons, with a higher score indicating better performance of the option in relation to the given criterion. Finally, the AHP combines the criteria weights with the option ratings, which calculates the overall (global) value for each decision and regulates their position (51).

The AHP method uses a classified problem structure with multiple stages, with the objective at the top, the criteria and sub-criteria in the middle, and the substitutions at the bottom. This construction lets multifaceted problems be broken down into reduced, comprehensible mechanisms. This is important because many problems in practice cannot be solved immediately globally - hierarchy facilitates the perception of problems by layers (50). For pairwise comparisons within the AHP method, the scale of the author Saaty (2021) is used. This scale is from 1 to 9, where 1 = equal importance; 3 = moderate importance; 5 = strong importance; 7 = very strong importance; 9 = absolute importance. While odd numbers indicate the intensity of preference, even numbers serve as an intermediate value. This scale is psychologically based and allows subjective assessments to be quantified (42). AHP involves checking the consistency of the decision maker's responses. The so-called is calculated. a consistent relationship that shows how logical the decisions are when compared. If $CR < 0.10$ (or 10%), comparisons are considered to be acceptably consistent. This check distinguishes AHP from many other MCDM methods - because it indicates the reliability of the input (50; 40).

The AHP method is used in many extent, such as: strategic development, risk management, resource distribution, assortment of positions, associates, workforces, universities, appraisal of venture projects (20; 37; 35; 12; 31; 34; 39; 27; 13).

The TOPSIS method is a multi-criteria decision-making system that assists in appraising substitute explanations grounded on multiple principles, choosing the solution that is contiguous to the ideal (best) and furthest from the negative ideal (worst) solution. This

method uses a simple mathematical structure, is suitable for numerical data and requires known (or expert-defined) criteria weights (46; 55). This method was first developed by Hwang and Yoon (21) and it ranks alternatives according to their distance from the ideal solution and the negative ideal solution. The most favorable alternative is the one that is at the same time closest to the ideal solution and farthest from the negative ideal solution. An ideal solution represents an imagined alternative with the best values for all observed criteria, while a negative ideal solution denotes an alternative with the most unfavorable values of all criteria (29; 56; 10; 16; 45).

The TOPSIS method is used in many fields, such as personal choice, supplier selection, safety assessment, educational institution selection, health management, environmental management and others (8; 7; 23; 18; 24; 48; 3).

MATERIALS, METHODS AND DATA COLLECTION

Choosing a study program is one of the most important decisions in the life of every student, because it directly affects their future career, personal development and life direction (one of many questions: whether educational programs in these areas are adapted to the requirements of practice and another (25). That choice is frequently very multifaceted, seeing that it includes many influences - personal benefits, predilections, capabilities, industry market, predictable income, measurement and struggle of studies, close inspiration, accessibility of educational institutions, as well as social or cultural pressures. Many scholars face indecision, imperfect information and inner dilemmas, which make it even more problematic to make a balanced decision. Therefore, this process is ideal for the application of multi-criteria decision-making methods, which can help in structuring the problem and more objectively comparing several possible options.

In this paper, the alternative set of study programs consisted of the study program Tourism and Hotel Management and the study program Gastronomy from the Faculty of Hotel Management and Tourism in Vrnjačka Banja and the study programs Economics and Business Management and Business Informatics from the Faculty of Economics in Kragujevac. Both faculties are state-owned and belong to the University of Kragujevac. This paper addresses several criteria for selecting a study program. All criteria were determined and evaluated using the brainstorming method (group generation of ideas), so the number of criteria was reduced with this technique. After the elimination, six criteria for choosing a study program were defined as: prestige, the possibility of enrolling on the budget, social content, international expansion and connections, business opportunities and accessibility. The survey was conducted among 100 students from different study programs to determine the weights of the criteria. The survey was conducted in direct contact with students of undergraduate studies, master's studies, as well as graduated students of the Faculty of Hotel Management and Tourism in Vrnjačka Banja and the Faculty of Economics in Kragujevac. Respondents filled out questionnaires specially

adapted to the AHP method and then evaluated the options required for the application of the TOPSIS method.

The number of respondents was chosen to ensure sufficient representativeness in the evaluations of criteria and alternatives, and at the same time to be logistically feasible within the time and available resources. In the phase of determining the weights of the criteria, the Analytical Hierarchy Process (AHP) was applied. Group decision-making in AHP requires a large enough sample that individual subjective judgments are balanced and that the weights obtained by aggregation reflect the views of the majority rather than the extreme opinions of individuals. A sample of 100 respondents is in the range most often used in the literature for similar multi-criteria decision-making problems (most often from 50 to 200 participants) (47). In the second phase, the ranking of alternatives was performed using the TOPSIS method. Although the literature for TOPSIS usually does not specify the recommended number of participants, in most empirical cases in MCDM approaches, a sample of several dozen to hundreds of evaluators is used, which indicates that the number of 100 respondents in this research is methodologically grounded and in line with practice (5). The stability of results in TOPSIS depends on the quality and reliability of the input data, and a sufficient number of independent assessments (in this case, 100) reduces the impact of random variations and enables a reliable comparison of alternatives. In this way, a balance was achieved between representativeness, robustness of the obtained results and practical feasibility of the research.

The AHP method is a multi-step process (41; 40). In the first step, the decision-making hierarchy is structured, where the goal of the study is defined and the criteria and sub-criteria are determined. In the second step, a pairwise comparison matrix is established in which each element is compared to the others using a fundamental pairwise comparison scale. The third step involves calculating the relative importance of the factors by determining the eigenvectors corresponding to the maximum eigenvalues of the matrix. In the fourth step, the consistency of the estimates is checked through the consistency index (CI) and the consistency ratio (CR), whereby the CI is calculated as:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (1)$$

where λ_{\max} is the eigenvalue corresponding to the matrix of pairwise comparisons, and n is the number of elements to be compared, which in this paper is six. The consistency ratio (CR) is defined as:

$$CR = \frac{CI}{RCI} \quad (2)$$

where RCI is the random consistency index. If the value of $CR < 0.1$, the estimates are considered acceptably consistent; otherwise, the pairwise comparison matrix must be revised to reduce the incoherence. Table 1 presents the pairwise comparison scale for AHP, it is the first step in the AHP technique.

Table 1. Scale of pairwise comparisons

Relative importance	Definition
1	Equal importance
3	Weak significance
5	Strong significance
7	Greater importance compared to others
9	Absolute importance

Source: Saaty (2008).

Table 2 presents the average RCI values, and it is a standard value that depends only on the number of criteria n , which in this work is six, $RCI = 1.24$.

Table 2. Average RCI values

n	RCI
1	0.00
2	0.00
3	0.58
4	0.90
5	1.12
6	1.24

Source: Independent processing by the author

Table 3. Consistency of the AHP matrix

$\lambda \max$	CI	RCI (n=6)	CR
6.1851	0.0370	1.24	0.0299

Source: Authors

The CR value is 0.0299, which is < 0.1 , so the consistency is acceptable (the answers are not contradictory, the confidence system in the calculated weights is high).

The TOPSIS method consists of several consecutive steps (22). First, a decision matrix is established for ranking the alternatives, and then its normalization is performed using the appropriate equation:

$$e' = \left[\frac{g_j(a_i)}{\sqrt{\sum_{i=1}^m [g_i(a_i)]^2}} \right]; \quad i = 1, 2, \dots, m; \text{ and } j = 1, 2, \dots, n \quad (3)$$

Where g_i is the deterministic value of alternative i for criterion j .

After that, a weighted normalized decision matrix formed by multiplying the normalized matrix by the associated weights:

$$e_{ij}^* = \pi_j \times e'_{ij}; \quad i = 1, 2, \dots, m; \text{ and } j = 1, 2, \dots, n \quad (4)$$

where π_j is the weight of the j th criterion.

The next step involves identifying the positive ideal solution (A^*) and the negative ideal solution (A^-).

Positive:

$$A^* = \{e_j^*, j = 1, 2, \dots, n\} = \{e_1^*, e_2^*, \dots, e_n^*\}; e_j^* = \text{Max}_i \{e_{ij}''\}$$

$$A^- = \{\text{Min}_i e_{ij}^*, i = 1, \dots, m; \text{ and } j = 1, \dots, n\}$$
(5)

Negative:

$$A^- = \{\text{Min}_i e_{ij}'', i = 1, \dots, m; \text{ and } j = 1, \dots, n\}; e_j^* = \text{Min}_i \{e_{ij}''\}$$

$$A^- = \{e_j^*, j = 1, 2, \dots, n\} = \{e_1^*, e_2^*, \dots, e_n^*\}$$
(6)

Then, the Euclidean distance of each alternative from both ideal solutions is determined, and based on that, the relative closeness coefficient is calculated:

$$D_i^* = \sqrt{\sum_{j=1}^n (e_{ij}^* - e_j^*)^2}, \quad i = 1, 2, \dots, m$$
(7)

$$D_i^- = \sqrt{\sum_{j=1}^n (e_{ij}^* - e_j^*)^2}, \quad i = 1, 2, \dots, m$$
(8)

Then the coefficient of relative closeness of the i -th alternative to the ideal solution is calculated using the following equation:

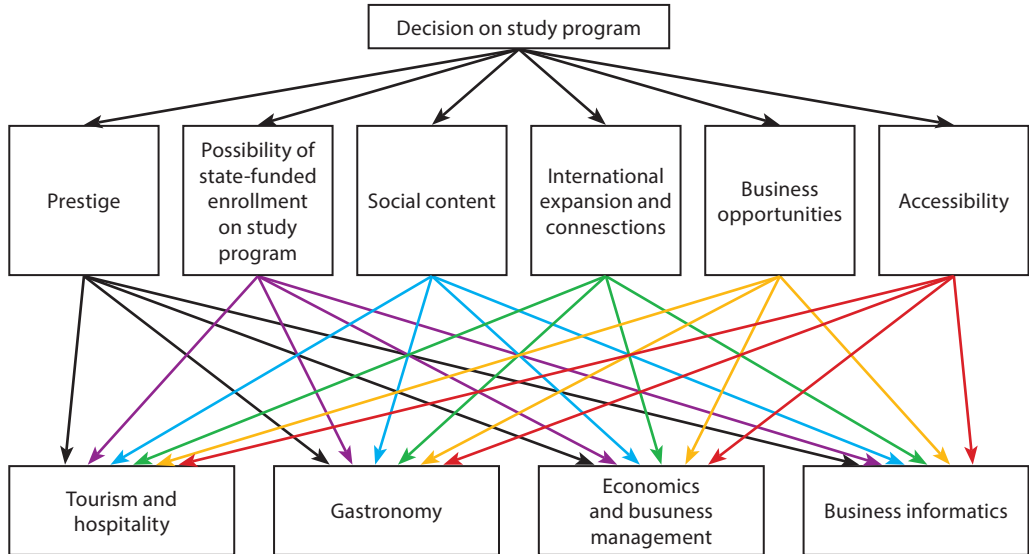
$$C_i^* = \frac{D_i^-}{D_i^* + D_i^-}, \quad i = 1, 2, \dots, m$$
(9)

with $0 \leq C_i^* \leq 1$. Finally, all alternatives are ranked based on decreasing values, and the optimal solution is the alternative with the highest value of this coefficient.

The proposed methodology is designed to ensure the efficient application of MCDM techniques is as efficient as possible in the process of choosing a study program. For this purpose, two different techniques, AHP and TOPSIS, are combined. The AHP technique is used to structure the decision-making hierarchy and define the relevant selection criteria, while TOPSIS is used to rank the available study programs. In this way, a systematic and reliable approach is ensured, which enables the selection of the optimal study program in accordance with the established priorities. The integrated methodology is applied step by step to solve the problem of choosing a study program. In the following, the main steps of applying the proposed multi-criteria decision-making methodology for choosing a study program are elaborated.

Creating a hierarchical structure of the problem itself is an essential element of the AHP technique. Once a hierarchical structure is created, it is possible to understand the problem to be solved and make it easier to see pairwise comparisons. Figure 1 shows the hierarchical structure of this work problem.

Figure 1. Hierarchical structure of the problem



Source: Authors

RESULTS AND DISCUSSION

The identification of criteria is the first step of the proposed methodology. Based on the literature review, in order to identify the general attributes of decision-making, six criteria were proposed, which are the most important when choosing a study program. The six main criteria are: prestige, possibility of enrollment on the budget, social content, international expansion and connections, business opportunities and accessibility.

Table 4 shows the alternatives and criteria identified and used.

Table 4. Identified and used alternatives and criteria

Study programs		Criteria	
A1	Tourism and hospitality - TH	C1	Prestige
A2	Gastronomy - G	C2	Possibility of state-funded enrollment
A3	Economics and business management - EBM	C3	Social content
A4	Business informatics - BI	C4	International expansion and connections
		C5	Business opportunities
		C6	Accessibility

Source: Authors

In the following, decision makers follow the calculation procedure of the weights for the selected criteria using the AHP method and then rank the alternatives using the TOPSIS method. After the hierarchy is constructed using the AHP technique, the next

step is devoted to obtaining the weights of the elements at each level of the hierarchy. A set of comparison matrices of all elements is realized for each level of the hierarchy in relation to the elements of a higher level. Decision makers' preferences are identified using the aforementioned Satty scale.

The initial pairwise comparison matrix for the main criteria given by the decision makers is shown in Table 5.

Table 5. Criteria comparison matrix

Criteria	C1	C2	C3	C4	C5	C6	Weight
C1	1	1/5	4	2	1/3	1/2	0.095
C2	5	1	7	6	2	4	0.417
C3	1/4	1/7	1	1/2	1/6	1/7	0.034
C4	1/2	1/6	2	1	1/4	1/3	0.057
C5	3	1/2	6	4	1	2	0.239
C6	2	1/4	7	3	1/2	1	0.158

Source: Authors

Criterion weights are obtained from the matrix of pairwise comparisons. The matrix of pairwise comparisons (according to the Saaty scale) expresses how much one criterion is more important than the other. A consistent logic is used here - the lower a criterion is on the priority list, the less important it is.

It is noted that C2 (possibility of entering the budget) has the highest weight (0.417), which means that it has the greatest influence on the decision. The criterion weight limit of 0.350 in multi-criteria decision-making is not a strict mathematical rule, but an empirical rule based on the literature in the field of MCDM. Namely, if one criterion has a weight greater than 0.350, its value becomes dominant to such an extent that it practically suppresses the importance of all other criteria, so the decision is effectively reduced to a single-criterion decision. Setting this threshold ensures a balance between the criteria and guarantees that the decision really remains multi-criteria, and not just formally so. The fact that one of the criteria has a weight greater than 0.350 does not mean that the research is not valid, but only indicates that this criterion has a dominant influence in the decision-making process. In the case where six criteria are used as in this paper, it is natural that one of them should be more pronounced, especially if the respondents consider it to be crucial. The threshold of 0.350 is seen in the literature as a heuristic rule that warns of an imbalance between the criteria, but is not treated as a strict limit. Therefore, the research can continue unhindered, with a note that one criterion has a significantly greater weight, such as here the possibility of entering the budget and that it has a decisive influence on the decision, while additionally a sensitivity analysis can be carried out to check how changes in its weight affect the final results.

In the last step, the TOPSIS method is applied in order to rank the study programs. The global weights of each criterion calculated by AHP can be used as input to the TOPSIS method. Then, using the scale from Table 1, the decision makers (students) are asked to

evaluate the alternatives according to each criterion (Table 6). The second step in the TOPSIS technique is to normalize the matrix of aggregate scores, using equations (3), (4), as illustrated in Table 7, and then, using equations (5), (6), the positive and negative ideal solutions (A^* and A^-) are calculated.

Table 6. Evaluations of alternatives according to each criterion

	Weight	C1	C2	C3	C4	C5	C6
TH	5.916	3	7	3	4	6	6
G	4.590	2	5	3	4	5	5
EBM	4.569	5	5	4	5	4	4
BI	5.640	6	6	4	5	7	3

Source: Authors

Table 7. Normalization of the matrix of aggregate grades

	C1	C2	C3	C4	C5	C6
TH	0.349	0.602	0.424	0.442	0.535	0.647
G	0.233	0.430	0.424	0.442	0.445	0.539
EBM	0.581	0.430	0.566	0.552	0.356	0.431
BI	0.697	0.516	0.566	0.552	0.624	0.324

Source: Authors

The normalized TOPSIS score matrix has values ranging from 0 to 1, and this allows comparison between different units.

Table 8. Ideal positive and ideal negative solution - TOPSIS method

Criteria	A* (ideal)	A- (ideal negative)
C1	0.066	0.022
C2	0.251	0.179
C3	0.019	0.014
C4	0.031	0.025
C5	0.149	0.085
C6	0.102	0.051

Source: Authors

A^+ is the best value according to each criterion, which in this case is the possibility of entering the budget with a value of 0.251. These solutions are used to calculate how close each alternative is to the ideal.

The ranking of alternative study programs is calculated using equations (7), (8) and (9). Table 9 shows the evaluation results and the final ranking of study program alternatives. Therefore, the best alternative is the one with the shortest distance from the positive ideal solution and the largest distance from the negative ideal solution. The results of the proposed model show that the Tourism and Hotel Management study program at the Faculty of Hotel Management and Tourism in Vrnjačka Banja is the best alternative, with a C_i value of 0.711.

Table 9. Final evaluation and ranking of alternatives

	D* (distance from ideal)	D- (distance from ideal negative)	Ci (relative speed)	Rang
TH	0.040	0.099	0.711	1
BI	0.063	0.086	0.579	2
G	0.096	0.040	0.295	3
EBM	0.103	0.038	0.270	4

Source: Authors

The closer the Ci value is to 1, the better the alternative. From the table, it can be concluded that the study program Tourism and Hospitality, with a value of 0.711, is the closest to number 1, and in this regard, it is also the best alternative. Based on Tables 6-9, all obtained values correspond to the calculations, and it is concluded that the ranking is valid. Table 10 shows the final ranking of the study program from best to worst.

Table 10. Ranking of the study program according to the TOPSIS method

Rang	Study program	Ci value	Results interpretation
1	Tourism and hospitality	0.711	The best balance of grades and importance of criteria; it excels in key criteria such as the possibility of entering the budget and business opportunities.
2	Business informatics	0.579	The second option in terms of quality, thanks to its high prestige and good business opportunities.
3	Gastronomy	0.295	Mean values; it does not have a significant advantage in any of the most important criteria, but it is slightly better than EBM.
4	Economics and business management	0.270	The lowest placed; lower scores in key criteria limit its competitiveness.

Source: Authors

The Tourism and Hospitality study program has the best balance of grades and the importance of criteria, and stands out in key criteria such as the possibility of enrolling in the budget and business opportunities.

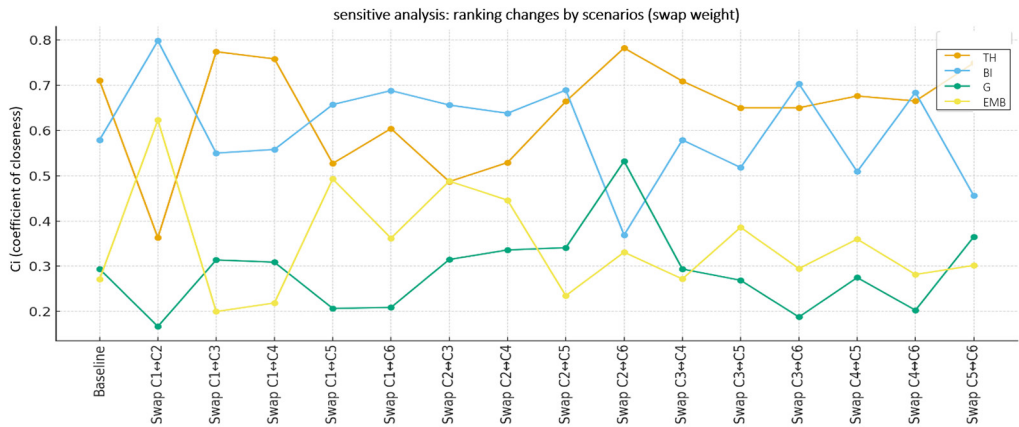
Table 11. Sensitive analysis (exchange of weights between pairs)

Scenario	TH (Ci)	BI (Ci)	G (Ci)	EBM (Ci)	Rang
Baseline (no swap)	0.710	0.579	0.294	0.271	TH → BI → G → EBM
Swap C1 ↔ C2	0.363	0.798	0.167	0.623	BI → EBM → TH → G
Swap C1 ↔ C3	0.774	0.550	0.314	0.200	TH → BI → G → EBM
Swap C1 ↔ C4	0.758	0.558	0.309	0.219	TH → BI → G → EBM
Swap C1 ↔ C5	0.527	0.657	0.207	0.493	BI → TH → EBM → G
Swap C1 ↔ C6	0.604	0.688	0.209	0.362	BI → TH → EBM → G
Swap C2 ↔ C3	0.487	0.656	0.315	0.488	BI → EBM → TH → G
Swap C2 ↔ C4	0.529	0.638	0.336	0.446	BI → TH → EBM → G
Swap C2 ↔ C5	0.664	0.689	0.341	0.235	BI → TH → G → EBM

Swap C2 ↔ C6	0.782	0.369	0.532	0.331	TH → G → BI → EBM
Swap C3 ↔ C4	0.709	0.579	0.294	0.272	TH → BI → G → EBM
Swap C3 ↔ C5	0.650	0.518	0.269	0.386	TH → BI → EBM → G
Swap C3 ↔ C6	0.650	0.703	0.188	0.295	BI → TH → EBM → G
Swap C4 ↔ C5	0.676	0.509	0.275	0.360	TH → BI → EBM → G
Swap C4 ↔ C6	0.665	0.684	0.203	0.282	BI → TH → EBM → G
Swap C5 ↔ C6	0.749	0.456	0.365	0.302	TH → BI → G → EBM

Source: Authors

Figure 2. Closeness coefficients with ranking alternatives



Source: Authors

The coefficients of closeness to the ranking of the alternatives are presented in Table 11 and graphically presented in Figure 2. The results of the sensitivity analysis show that the ranking of the alternatives changed significantly according to the equal weights of the criteria. Therefore, it can be said that, based on the obtained estimates, the decision-making process is relatively insensitive to the weights of the criteria.

In this paper, two MCDM methods - AHP and TOPSIS for choosing a study program are described and applied. The most important criteria that influence the process of choosing study programs have been taken into account. The level of importance of the criteria enables the identification of the weight of the criteria, and in this paper, the criterion with the highest weight is the possibility of entering the budget, and the criterion with the lowest weight is the social content. Alternative study programs were chosen from two faculties of the University of Kragujevac. According to the AHP and TOPSIS methods, the study program Tourism and Hotel Management from the Faculty of Hotel Management in Vrnjačka Banja is the most suitable alternative according to both methods. Evaluation of these two methods indicates similarities in results

CONCLUSION

Theoretical and practical implications

The results of this research have both theoretical and practical implications. Theoretical ones are reflected in the expansion of domestic and foreign literature. Especially when it comes to domestic literature, because the research did not reveal a large number of works dealing with this topic. As far as foreign literature is concerned, the results of this research can help in the further use of MDCM methods. The practical implications are reflected in the fact that two higher education institutions from this work can use the results in order to improve their position and see what it is that students use when choosing a study program and making decisions and adapt their study programs to the needs of students, and at the same time help them to make an easier and faster decision about the study program to attend.

Research limitations

The limitations of the research are reflected in the smaller number of respondents. Subsequent research should include a larger number of respondents, so that the results are more representative. It is possible to include other study programs. The number of students enrolled in certain study programs should also be taken into account. Future research could be done on study programs that receive approximately the same number of students, so that the results are more representative. It is also possible to compare colleges with colleges and universities.

It is also possible to include additional criteria, not only the six mentioned in the paper: the possibility of living in a home, quality of life, standard of living in the cities where the study programs are conducted, the weight of the subjects in the programs, the possibility of further advancement in the academic world and the like.

Future research can include other MDCM methods, in order to compare the obtained results among them: ANP, VIKOR, PROMERHEE, ELECTRE and SAW.

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Izbor studijskog programa korišćenjem metode višekriterijumskog odlučivanja

Rezime: Tokom života, jedna od najbitnijih odluka koje osoba donosi odnosi se na izbor visokoškolske ustanove, na kojoj će studirati. Ovaj izbor zavisi od velikog broja faktora, a neki od njih se odnose na uspeh tokom prethodnog školovanja, kao i rezultata prijemnih ispita, mogućnosti upisa na budžet, mogućnosti zaposlenja, prestiža i drugo. Cilj ovog rada je da odredi optimalan studijski program koristeći kriterijume koji utiču na izbor studijskog programa i kriterijume i odnose alternativa. U radu je prvenstveno opisano višekriterijumsko odlučivanje, a potom detaljno opisane metode koje su korišćene u ovom istraživanju: AHP i TOPSIS. Nakon toga su navedene metode primenjene na konkretnom primeru, koje imaju za cilj pravi izbor studijskog programa. Težine kriterijuma su određene sprovođenjem ankete u kojoj je učestvovalo 100 studenata sa dva fakulteta: Fakultet za hotelijerstvo i turizam u Vrnjačkoj Banji (studijski programi: Turizam i hotelijerstvo i Gastronomija) i Ekonomski fakultet u Kragujevcu (studijski programi: Ekonomija i poslovno upravljanje i Poslovna informatika). Rezultati istraživanja pokazuju da je kriterijum sa najvećom težinom mogućnost upisa na budžet, a najbolje rangiram studijski program Turizam i hotelijerstvo sa Fakulteta za hotelijerstvo i turizam u Vrnjačkoj Banji, Univerziteta u Kragujevcu. Rezultati ovog istraživanja upotpunjuju kako domaću, tako i inostranu literaturu kada se govori o korišćenju metoda za višekriterijumsko odlučivanje.

Ključne reči: studijski program, višekriterijumsko odlučivanje, AHP (Analytical Hierarchical Process), TOPSIS (technique for order of preference by similarity to ideal solution)