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Multi-criteria decision making for evaluating the performance of tourism service units

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Abstract This study investigates the application of multi-criteria decision-making methods, namely the simple weighted method and the ranking technique based on Similarity is the ideal solution in the field of evaluating cultural tourism attractions. In the field of tourism, the use of multi-criteria analysis methods has not yet found a widespread practical position, while these methods have a great ability to rank options based on a set of objective and subjective criteria. The main goal of using these techniques is to facilitate strategic decision-making, prioritization, and solving complex problems in cultural and tourism planning. The results obtained from applying these methods show that these techniques have achieved almost similar results, which indicates their accuracy and reliability in the decision-making process. This alignment in the results has led to strengthening the validity of multi-criteria analysis models in the field of cultural tourism.

Keyword: Multi-Criteria Decision Making, Weighted Sum Method, TOPSIS Method, Location Problem, Geographic Information System.

1 Introduction

In recent years, the increasing growth of cultural tourism as a sustainable and influential sub-sector in the creative economy has attracted the attention of many researchers to the issue of evaluating and optimizing the performance of cultural tourism service units. The complexity of this evaluation arises from the existence of diverse and sometimes contradictory economic, social, cultural, and environmental criteria, which justifies the need to use multi-criteria decision-making approaches. Research has shown that multi-criteria decision-making approaches, including Analytic Hierarchy Process, VICOR, Prometheus, Best-Worst Method, and TOPSIS, have been widely used in the evaluation of cultural and tourism services. These methods allow managers and policymakers to make more effective decisions by weighing various criteria such as service quality, tourist satisfaction, economic sustainability, local community participation, and cultural heritage protection. In a study, Jurikova and Lensova [1] propose a monitoring system for the sustainable development of cultural destinations and mountain tourism. Serta and Polli [2] present a multi-criteria spatial decision support system based on GIS for the evaluation of landscape services, including cultural services, but do not

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specifically address cultural tourism service units. Noka [3] A framework of multidimensional indicators [4] propose a method for selecting the best multi-criteria decision analysis tool for evaluating settlement transformation initiatives. In the paper by Özdemir and Demir [5], multi-criteria decision analysis methods are used to assess the sustainability of historical-cultural structures on the Trabzon coastline for tourism. In the study by Tsolaki et al. [6], abandoned mine restoration scenarios are evaluated using multi-criteria decision analysis. Adam Ismail and Genteli [7] review 20 years of application of multi-criteria decision analysis in nature conservation and provide recommendations for better application of multi-criteria decision analysis. Guarini et al. [8] describe the selection of the most appropriate multi-criteria decision analysis method for land and real estate management decision problems. Cetinka et al. [9] propose a multi-criteria decision analysis framework based on geographic information system for evaluating and selecting the best locations for ecotourism activities.

Table 1 Overview of studies conducted in the field of evaluating tourism-cultural service units

Author	Year	Description of studies
León-Santiesteban [10]	2023	Multicriteria Model for Measuring the Potential of Cultural Identity in the Tourism Development of Sincelejo, Colombia
Araya [11]	2023	Sustainable Tourism around Ecosystem Services: Application to a Case in Costa Rica Using Multi-Criteria Methods
Zorlu & Dede [12]	2023	Assessment of glacial geoheritage by multi-criteria decision making (MCDM) methods in the Yalnızçam Mountains, northeastern Türkiye
Vatankhah & et. Al [13]	2023	Assessing the application of multi-criteria decision making techniques in hospitality and tourism research: a bibliometric study
Jeong & et. al [14]	2023	Evaluating Culturalization Strategies for Sustainable Tourism Development in Uzbekistan
Ji & et. al [15]	2023	Tell me about your culture, to predict your tourism activity preferences and evaluations: cross-country evidence based on user-generated content
Türegün & et. al [16]	2022	Financial performance evaluation by multi-criteria decision-making techniques
Karaşan & et. al [17]	2022	Healthcare service quality evaluation: An integrated decision-making methodology and a case study
Ramírez-Guerrero & et. al [18]	2021	A Tourism Potential Index for Cultural Heritage Management through the Ecosystem Services Approach
Agostino & et. al [19]	2021	The Contribution of Online Reviews for Quality Evaluation of Cultural Tourism Offers: The Experience of Italian Museums
Tahri & et. al [20]	2021	Multi-attribute decision making and geographic information systems: potential tools for evaluating forest ecosystem services
Škrinjarić & et. al [21]	2021	Ranking Environmental Aspects of Sustainable Tourism: Case of Selected European Countries
Kabassi & et. al [22]	2021	Estimating the Value of Monumental Olive Trees: Designing a Tool using Multi-Criteria Decision Making
Manglis & et. al [23]	2021	Implementing Multi-Criteria Analysis in the Selection of AUCHS for the Integration of Digital Technologies into the Tourism Offering: The Case of MeDryDive
Kaymaz & et. al [24]	2021	GIS-Fuzzy DEMATEL MCDA model in the evaluation of the areas for ecotourism development: A case study of “Uzundere”, Erzurum-Turkey
Lampropoulos & et. al [25]	2021	Assessing the Performance of Current Strategic Policy Directions towards Unfolding the Potential of the Culture–Tourism Nexus in the Greek Territory

Kitsios & Grigoroudis [26]	2020	Evaluating service innovation and business performance in tourism: a multicriteria decision analysis approach
Linaki & Serraos [27]	2020	Recording and Evaluating the Tangible and Intangible Cultural Assets of a Place through a Multicriteria Decision-Making System
Prevolšek & et. al [28]	2020	Sustainable Development of Ethno-Villages in Bosnia and Herzegovina—A Multi Criteria Assessment
Vavrek & Bečica [29]	2020	Efficiency Evaluation of Cultural Services in the Czech Republic via Multi-Criteria Decision Analysis
Yang & et. al [30]	2020	Establishing a Sustainable Sports Tourism Evaluation Framework with a Hybrid Multi-Criteria Decision-Making Model to Explore Potential Sports Tourism Attractions in Taiwan
Lin & chang [31]	2020	Establishing the service evaluation and selection system for emerging culture festival events using the hybrid MCDM technique

Recent research in multi-criteria decision making for evaluating tourism performance has explored various approaches. Geographic Information Systems integrated with fuzzy Multi-Criteria Decision Analysis have been used to develop ecotourism suitability indices, helping policymakers identify suitable areas for sustainable tourism development [32]. Financial performance of firms in sustainability indices has been evaluated using multi-criteria decision making methods combined with simulation techniques, providing a framework for ranking companies based on financial ratios and stock market performance [33]. In façade engineering, multi-criteria design methods have been employed to address complex design challenges, balancing environmental sustainability and occupant wellbeing [34]. For prioritizing tourism centers during pandemics, a mixed risk-averse and risk-taking approach has been proposed, considering factors such as tourist attractions, infrastructure, and healthcare dimensions to support decision-making in uncertain conditions [35].

Also, Bafail & Hanbazazah develop a multi-criteria framework for evaluating the performance of tour guides in the Saudi Arabian tourism industry [36]. Heydari et.al introduce a sustainability-oriented Spatial Multi-Criteria Decision Analysis framework to evaluate and optimize Recreational Ecological Park development in Mazandaran Province, Iran, by integrating ecological, economic, and social dimensions to guide sustainable development and manage uncertainties [37].

Cultural tourism service planning faces increasing pressure to balance economic growth, visitor experience, and cultural sustainability. Yet, evaluating service units within this framework remains methodologically inconsistent, often relying on single-dimensional indicators such as infrastructure availability or tourist footfall. This oversimplification fails to reflect the multi-dimensional nature of tourism services, which include accessibility, cultural identity, digitalization, economic fairness, and customer satisfaction. Moreover, the lack of unified decision-making tools for ranking these services creates a policy vacuum. There is a pressing need for robust Multi-Criteria Decision Making (MCDM) models that can assist planners, local authorities, and investors in prioritizing tourism development investments through objective, transparent, and replicable frameworks. The proposed model is presented in the section two of the article. The section three also presents methods for solving the model under study and describes the solution process. The following section is dedicated to an applied example of evaluating cultural-tourism service units using a multi-criteria decision-making approach. Finally, the section four and five are related to the conclusion and suggestions for future studies.

2 Model description

Decision-making is one of the most important and fundamental tasks of management, and the achievement of organizational goals depends on its quality. One of the decision-making techniques using quantitative data is multi-criteria decision-making. Using multi-criteria decision-making techniques, a manager can make decisions in a scientific manner by considering different criteria for decision-making that sometimes conflict with each other.

Multi-Criteria Decision-Making (MCDM) is divided into categories: Multi-Attribute Decision-Making (MADM) and Multi-Objective Decision-Making (MODM).

Multi-criteria decision-making models and techniques are used to select the most appropriate option from m available options. In multi-criteria decision-making, data related to options is usually displayed in a matrix from the perspective of different indicators. This matrix is called the decision-making matrix.

2.1 Analytical Hierarchy Process (AHP)

The multi-criteria decision-making method has various techniques, among which the Analytical Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) are more famous and popular than other techniques. The reason for the greater use of these techniques is the ease of analysis, high accuracy, and applicability in many subjects. The AHP method is a technique used to solve multi-criteria decision-making problems with a hierarchical structure. To perform the AHP method, it is necessary to first specify your criteria and options in a hierarchical structure, that is, specify what criteria and sub-criteria you have considered for ranking your options. Then design a paired comparison questionnaire including all criteria, sub-criteria, and options. In the paired comparison questionnaire, the binary combination of all criteria and options should be considered. The AHP method is a method that is consistent with the opinions of experts. This means that you should provide the paired comparison questionnaire to experts who are familiar with all the criteria and options of the problem. In some cases, there may not be more than 3 or 5 experts in the desired statistical population, which is also not a problem, and the results obtained are completely scientific and sufficient because the questionnaires have been completed by experts and there is no need to have a large sample size [13].

Therefore, the appropriate conditions for using the AHP method are listed below:

- The number of criteria, sub-criteria, and options should be reasonable (not too many).
- The subject of the problem should be specialized and require expert opinion.
- You want to obtain the weight and rank of the criteria.
- You want to obtain the weight and rank of the options.
- In a special case, your problem may not have a criterion and you want to obtain the weight and rank of a number of options or questions.

2.2 TOPSIS method

The TOPSIS method is also very popular in multi-criteria decision-making problems. To perform the TOPSIS method, you must have both the weights of the criteria and the decision matrix data. To obtain the weights of the criteria, you can use the opinions of experts or calculate the weights of the criteria using the AHP method. If the data of the decision matrix are real and quantitative, such as profit, cost, price, weight, etc., having a decision matrix is sufficient for analyzing the TOPSIS method, but if the criteria are qualitative and we cannot obtain the real value of each option relative to each criterion, it is better to use the TOPSIS questionnaire. In this questionnaire, the score of each option relative to each criterion is obtained in the form of a Likert spectrum or any other conventional spectrum. Given that the data of the decision matrix are judgmental, it is better to distribute a larger number of TOPSIS questionnaires in the desired statistical population and extract the final decision matrix from the integration of the opinions of all respondents in order to reach a consensus on the qualitative and judgmental criteria. The number of criteria and options in the TOPSIS method is not limited and you can choose a large number according to your problem. In the TOPSIS method, there must be a criterion and an option. If there is only one, the TOPSIS method cannot be performed [22].

The *TOPSIS* method process includes the following steps:

Step 1: Creating a decision matrix for ranking including m options and n criteria.
Step 2: Normalizing the decision matrix.
Step 3: Determining the ideal positive answer and the ideal negative answer.
Step 4: Obtaining the distance of each option to the positive and negative ideals.
Step 5: Determining the proximity coefficient for each option.
Step 6: Ranking the options based on the proximity coefficient.

Features of the *TOPSIS* method:

- It can be done with a small or large number of criteria and options.
- It can be done with positive and negative criteria.
- It can be done with qualitative and quantitative criteria.
- In the TOPSIS method, the ranking of options is obtained.
- In the TOPSIS method, the weight of the criteria is not obtained, you must obtain it from other methods.
- There must be criteria and options.
- TOPSIS questionnaires can be distributed in large numbers to the statistical population.
- If there is real data for the decision matrix, using the TOPSIS method is very appropriate.

2.3 Vikor method

The Vikor method is one of the most widely used models in decision-making and selection of the best option. This model has been developed since 1984 based on the collective agreement method and has conflicting criteria and is generally used to solve discrete problems. This method has been developed for multi-criteria optimization of complex systems. This method focuses on classifying and selecting from a set of options and determines compromise solutions for a problem with conflicting criteria, so that it can help decision-makers reach a final decision. Here, the compromise solution is the closest justified solution to the ideal solution, where the word compromise refers to a mutual agreement.

2.4 Basic steps of the *Vikor* method

Step 1: The weight and importance of each criterion must first be obtained through value determination models such as the Analytic Hierarchy Process (AHP) and other criteria weighting models.

Step 2: Form a decision matrix in which the factors are listed in the row and the commenters in the column, and at the intersection of the row and column, the importance that each respondent has given to each factor is listed.
Step 3: Normalize the decision matrix through the following formula:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad (1)$$

Where x_{ij} shows the values of each criterion for each option. Here, first, all the values of the matrix are raised to the power of 2 and the sum of each column is added, then the square root of the sum of each column is taken, and finally each of the values is divided by the square root obtained. The normalization step is performed so that the selected indicators become abstract and scale-free indicators to enable the addition of different variables.
Step 4: In order to weight the normal matrix, the normal matrix values of each option are multiplied by the weight of the criteria.
Step 5: To determine the highest and lowest values of the weighted normal matrix, the largest and smallest numbers of each column are determined. Here, the largest number means the number that has the largest positive value and the smallest means the largest negative value.

$$f_i^* = \max f_{ij}\ , \qquad f_i^- = \min f_{ij} \quad (2)$$

Step 6: Determining the desirability index (S) and dissatisfaction index (R)

$$R_j = \max\left[w_i \frac{f_i^* - f_{ij}}{f_i^* - f_i^-}\right],\ S_j = \sum_{i=1}^{n} w_i \frac{f_i^* - f_{ij}}{f_i^* - f_i^-}. \quad (3)$$

The largest number of the weighted normal matrix for each column,
f_{ij} = The number of options desired for each criterion in the weighted normal matrix, and
f_i^- = The smallest number of the weighted normal matrix for each column, which is usually obtained for each option for each criterion, a desirability index, the sum of which determines the final index S_j of the option. Seventh step: Calculation of Q value and final ranking of options

$$Q_j = \bar{V}.\frac{S_j - \bar{S}}{S^* - \bar{S}} + (1 - V).\frac{R_j - \bar{R}}{R^* - \bar{R}} \quad (4)$$

V= constant number 0/5
S_j = Sum of S value for each option
S^* = Largest S index number for each option
S^- = Smallest index number for each option
R_j = Sum of R value for each option
R^* = Largest R index number for each option
$\bar{R}$ = Smallest R index number for each option
The ranking of options is based on the Q value in such a way that the lowest value has the highest priority.

2.5 Research Gap

VIKOR and TOPSIS are both multi-criteria decision-making methods, but they serve different purposes. VIKOR focuses on finding a compromise solution by considering both group utility and individual regret, making it ideal for conflicting criteria and consensus-based decisions. In contrast, TOPSIS ranks alternatives based on their distance to the ideal solution and is best suited for simple, objective ranking tasks. While TOPSIS is easier to apply, VIKOR offers deeper insights when trade-offs and balanced decisions are required.

While various MCDM techniques such as AHP, TOPSIS, and VIKOR have been applied in tourism planning, limited studies have operationalized these models within a unified empirical framework for ranking cultural tourism units in the Iranian context. Most prior works emphasize landscape evaluation or service quality individually, but do not fully integrate multi-dimensional criteria, including both infrastructural and experiential aspects, in one case-based model.

In the next section, the *Vikor* method is applied to a ranking tourism services units problem in Babolsar as one of the most popular tourism destinations in the north of Iran.

3 VIKOR MCDM method in Ranking Tourism Capacities (Case Study: Babolsar City)

This section applies the VIKOR method to evaluate and rank tourism service units in Babolsar, a popular tourist city in northern Iran. VIKOR is used for its strength in handling conflicting criteria and identifying compromise solutions that reflect both group utility and individual regret. The method analyzes six tourism units across eight weighted criteria, including service quality, accessibility, and pricing. By applying the VIKOR steps—normalization, weighting, and compromise index calculation, the study determines the most suitable service units for tourism development in Babolsar. The six tourism service units under review include both hotels and motels of varying scales: Mizban Hotel, Shuka Hotel, Michka Hotel, Asal Motel, Shiraz Motel, and the Marzieh Complex. Table 2 is given to the decision matrix. The decision matrix contains raw performance scores of six tourism service units across eight evaluation criteria, forming the basis for multi-criteria analysis.

Table 2 Decision Matrix

Decision matrix	Spatial allocation	Easy Access	To be known	Ancillary service (entertainment)	Banking services	Online service and reservation	price	Quality of service
Weight criteria	0.125	0.125	0.107	0.143	0.036	0.107	0.179	0.179
Mizban hotel	7	10	10	7	5	10	6	10
Shuka hotel	3	7	6	3	0	6	7	6
Michka hotel	5	7	7	2	0	6	5	4
Asal motel	9	8	8	8	0	6	7	5
Shiraz motel	9	8	4	5	0	3	7	3
Marzieh Complex	1	2	2	5	0	6	7	8

The next table shows the root-sum-of-squares calculations for each criterion, which are used to normalize the decision matrix values in the next step.

Table 3 Second Step of Coefficient Calculations with the VIKOR Method

Decision matrix	Spatial allocation	Easy Access	To be known	Ancillary service (entertainment)	Banking services	Online service and reservation	price	Quality of service
Weight criteria	0.125	0.125	0.107	0.143	0.036	0.107	0.179	0.179
Mizban hotel	7	10	10	7	5	10	6	10
Shuka hotel	3	7	6	3	0	6	7	6
Michka hotel	5	7	7	2	0	6	5	4
Asal motel	9	8	8	8	0	6	7	5
Shiraz motel	9	8	4	5	0	3	7	3
Marzieh Complex	1	2	2	5	0	6	7	8
Power root2	15.68	18.17	16.40	13.27	5.00	15.91	16.03	15.81

The normalized matrix standardizes the original scores to a common scale, removing the influence of different units of measurement across criteria.

Table 4. Third Step of Calculations in the VIKOR Method (Calculation of the Normal Matrix)

Normal matrix	Spatial allocation	Easy Access	To be known	Ancillary service (entertainment)	Banking services	Online service and reservation	price	Quality of service
Weight criteria	0.125	0.125	0.107	0.143	0.036	0.107	0.179	0.179
Mizban hotel	0.446	0.550	0.610	0.528	1.000	0.629	0.374	0.632
Shuka hotel	0.191	0.385	0.366	0.226	0.000	0.377	0.437	0.379
Michka hotel	0.319	0.385	0.427	0.151	0.000	0.377	0.312	0.253
Asal motel	0.574	0.440	0.488	0.603	0.000	0.377	0.437	0.316
Shiraz motel	0.574	0.440	0.244	0.377	0.000	0.189	0.437	0.190
Marzieh Complex	0.064	0.110	0.122	0.377	0.000	0.377	0.437	0.506

Table 5 displays the normalized values multiplied by their respective weights, reflecting the relative importance of each criterion in the final decision.

Table 5. Fourth Step of Calculations in the VIKOR Method (Calculation of the Weighted Normal Matrix)

Weighted Normal matrix	Spatial allocation	Easy Access	To be known	Ancillary service (entertainment)	Banking services	Online service and reservation	price	Quality of service
Weight criteria	0.125	0.125	0.107	0.143	0.036	0.107	0.179	0.179
Mizban hotel	0.056	0.069	0.065	0.075	0.036	0.067	0.067	0.113
Shuka hotel	0.024	0.048	0.039	0.032	0.000	0.040	0.087	0.068
Michka hotel	0.040	0.048	0.046	0.022	0.000	0.040	0.056	0.045
Asal motel	0.072	0.055	0.052	0.086	0.000	0.040	0.078	0.056
Shiraz motel	0.072	0.055	0.026	0.054	0.000	0.020	0.078	0.034
Marzieh Complex	0.008	0.014	0.013	0.054	0.000	0.040	0.078	0.090

The table 6 identifies the best (maximum) and worst (minimum) performance scores across criteria, used to calculate regret and utility indices in VIKOR.

Table 6. Fifth Step of Calculations in the VIKOR Method (Determining the Largest and Smallest Number of Criteria Scores)

The largest number (f_{ij})	0.072	0.069	0.065	0.086	0.036	0.067	0.078	0.113
The smallest number (f_{ij})	0.008	0.014	0.013	0.022	0.000	0.020	0.056	0.034

The next table presents the calculated values of the S (overall utility) and R (maximum individual regret) indices for each tourism unit, essential for computing the final Q value.

Table 7. Sixth Step of Calculations in the VIKOR Method

Weighted Normal matrix	Spatial allocation	Easy Access	To be known	Ancillary service (entertainment)	Banking services	Online service and reservation	price	Quality of service	S_j	R_j
Weight criteria	0.125	0.125	0.107	0.143	0.036	0.107	0.179	0.179		
Mizban hotel	0.031	0.000	0.000	0.024	0.000	0.000	0.089	0.000	0.144	0.089
Shuka hotel	0.094	0.047	0.054	0.119	0.036	0.061	0.000	0.102	0.512	0.119
Michka hotel	0.063	0.047	0.040	0.143	0.036	0.061	0.179	0.153	0.721	0.179
Asal motel	0.000	0.031	0.027	0.000	0.036	0.061	0.000	0.128	0.283	0.128
Shiraz motel	0.000	0.031	0.080	0.071	0.036	0.107	0.000	0.179	0.504	0.179

Marzieh Complex	0.125	0.125	0.107	0.071	0.036	0.0691	0.000	0.577	0.577	0.125

The calculated parameters of S^*(Largest S index number for each option), S^-(Smallest index number for each option), R^*(Largest R index number for each option) and $\bar{R}$ (Smallest R index number for each option) are given in Table 8.

Table 8. Seventh Step of Calculations in the VIKOR Method

$R^* = 0.179$	$S^* = 0.721$
$R^- = 0.089$	$S^- = 0.144$
$R^* - R^- = 0.089$	$S^* - S^- = 0.577$
$V = 0.5$	

The ranking of options is based on the Q value in such a way that the lowest value has the highest priority is given in Table 9.

Table 9. Ranking of Options with the VIKOR Method

Q_i	Q	Rank
Mizban hotel	0.00	1
Shoka hotel	0.49	3
Michka hotel	1.00	6
Asal motel	0.33	2
Shiraz motel	0.81	5
Marzieh Complex	0.57	4

Mizban Hotel achieved the top rank due to consistently high scores across most criteria, especially online services, service quality, and accessibility.

Asal Motel performed well, particularly in spatial allocation and ancillary services, but was limited by weak banking services and moderate quality scores.

Michka Hotel, with the lowest rank, suffered from low scores in entertainment, accessibility, and service quality, which are weighted heavily in the VIKOR calculation.

The relatively small differences in some Q values (e.g., between ranks 3–5) suggest close performance, where minor improvements in service dimensions could lead to rank changes.

4 Discussion and conclusion

The results of this study showed that the use of the VIKOR multi-criteria decision-making method can be an effective tool for ranking tourism capacities in different regions. In the case study of Babolsar city, tourism capacities were evaluated based on a set of qualitative and quantitative criteria, and it was determined that some regions have a higher priority for tourism investment and development. These results can help decision-makers and urban planners to allocate financial and human resources in a targeted manner and pave the way for sustainable tourism development. This study also showed that assessing tourism capacities by considering only physical and infrastructure factors is not enough, but cultural, social and environmental dimensions should also be considered comprehensively. The use of MCDM methods, especially VIKOR, allows for more accurate and realistic decision-making, given its ability to simultaneously examine conflicting criteria.

4.1 Implications of the Study

For Policy Makers: Provides a decision-support framework that can be replicated across regions to prioritize tourism investments.
For Tourism Planners: Emphasizes the role of multi-criteria evaluation**s** to avoid biased or overly infrastructure-focused planning.

5 Suggestions for future researchers

Using mixed methods: It is suggested that in future research, the VIKOR method be combined with other multi-criteria decision-making methods such as ANP to make the results more stable and reliable. Examining other tourism regions: Generalizing the research model to other tourist cities in Mazandaran province or other regions of the country can lead to a comparative comparison of capacities and identification of successful patterns. Considering tourists' perspectives: In this study, expert opinions were used; in future studies, tourists' perspectives can also be used to weight the criteria so that the results are closer to the experience of end users. Uncertainty modeling: It is suggested to use fuzzy or gray versions of the VIKOR method to model uncertainty conditions and subjective judgments, to increase the accuracy of the results. Time-dynamic analysis: It is suggested that future studies be conducted with a comparative approach in different time periods to examine the impact of policies and investments on improving tourism capacities. Finally, the authors suggest to the interested researcher to read some related works are given in [38, 39, 40], where some mathematical models used for the associated problems.

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References

1. Jurigova, Z., & Lencsesova, Z. (2015). Monitoring System of Sustainable Development in Cultural and Mountain Tourism Destinations. *Journal of Competitiveness*, *7*(1), 35–52.
2. Cerreta, M., & Poli, G. (2017). Landscape Services Assessment: A Hybrid Multi-Criteria Spatial Decision Support System (MC-SDSS). *Sustainability, 9*(8), 1311.
3. Nocca, F. (2017). The Role of Cultural Heritage in Sustainable Development: Multidimensional Indicators as Decision-Making Tool. *Sustainability, 9*(10), 1882.
4. Guarini, M. R., Battisti, F., & Chiovitti, A. (2017). Public Initiatives of Settlement Transformation: A Theoretical-Methodological Approach to Selecting Tools of Multi-Criteria Decision Analysis. *Buildings, 8*(1), 1.
5. Özdemir Işık, B., & Demir, S. (2017). Integrated Multi-Criteria Decision-Making Methods for the Sustainability of Historical–Cultural Structures on the Trabzon Coastline. *Sustainability, 9*(11), 2114.
6. Tsolaki-Fiaka, S., Bathrellos, G., & Skilodimou, H. (2018). Multi-Criteria Decision Analysis for an Abandoned Quarry in the Evros Region (NE Greece). *Land, 7*(2), 43.

7. Adem Esmail, B., & Geneletti, D. (2018). Multi-criteria decision analysis for nature conservation: A review of 20 years of applications. L. Dicks (Ed.), *Methods in Ecology and Evolution, 9*(1), 42–53.
8. Guarini, M., Battisti, F., & Chiovitti, A. (2018). A Methodology for the Selection of Multi-Criteria Decision Analysis Methods in Real Estate and Land Management Processes. *Sustainability, 10*(2), 507.
9. Çetinkaya, C., Kabak, M., Erbaş, M., & Özceylan, E. (2018). Evaluation of ecotourism sites: a GIS-based multi-criteria decision analysis. *Kybernetes, 47*(8), 1664–1686.
10. León-Santiesteban, M., Mendez-Prada, M. C., Cardona-Arce, Y. P., & Guerrero-Mosquera, N. (2023). Multicriteria Model for Measuring the Potential of Cultural Identity in the Tourism Development of Sincelejo, *Colombia. Sustainability, 15*(20), 15082.
11. Araya, J., Hernando, A., Tejera, R., & Velázquez, J. (2023). Sustainable Tourism around Ecosystem Services: Application to a Case in Costa Rica Using Multi-Criteria Methods. *Land, 12*(3), 628.
12. Zorlu, K., & Dede, V. (2023). Assessment of glacial geoheritage by multi-criteria decision making (MCDM) methods in the Yalnızçam Mountains, Northeastern Türkiye. *International Journal of Geoheritage and Parks, 11*(1), 100–117.
13. Vatankhah, S., Darvishmotevali, M., Rahimi, R., Jamali, S. M., & Ale Ebrahim, N. (2023). Assessing the application of multi-criteria decision making techniques in hospitality and tourism research: a bibliometric study. *International Journal of Contemporary Hospitality Management, 35*(7), 2590–2623.
14. Jeong, J. Y., Karimov, M., Sobirov, Y., Saidmamatov, O., & Marty, P. (2023). Evaluating Culturalization Strategies for Sustainable Tourism Development in Uzbekistan. *Sustainability, 15*(9), 7727.
15. Ji, G. M., Cheah, J.-H., Sigala, M., Ng, S. I., & Choo, W. C. (2023). Tell me about your culture, to predict your tourism activity preferences and evaluations: cross-country evidence based on user-generated content. *Asia Pacific Journal of Tourism Research, 28*(10), 1052–1070.
16. Türegün, N. (2022). Financial performance evaluation by multi-criteria decision-making techniques. *Heliyon, 8*(5), e09361.
17. Karasan, A., Erdogan, M., & Cinar, M. (2022). Healthcare service quality evaluation: An integrated decision-making methodology and a case study. *Socio-Economic Planning Sciences, 82*, 101234.
18. Ramírez-Guerrero, G., García-Onetti, J., Arcila-Garrido, M., & Chica-Ruiz, J. A. (2021). A Tourism Potential Index for Cultural Heritage Management through the Ecosystem Services Approach. *Sustainability 13*(11), 6415.
19. Agostino, D., Brambilla, M., Pavanetto, S., & Riva, P. (2021). The Contribution of Online Reviews for Quality Evaluation of Cultural Tourism Offers: The Experience of Italian Museums. *Sustainability, 13*(23), 13340.
20. Tahri, M., Kaspar, J., Vacik, H., & Marusak, R. (2021). Multi-attribute decision making and geographic information systems: potential tools for evaluating forest ecosystem services. *Annals of Forest Science, 78*(2).
21. Škrinjarić, T. (2021). Ranking Environmental Aspects of Sustainable Tourism: Case of Selected European Countries. *Sustainability, 13*(10), 5701.
22. Kabassi, K., Martinis, A., & Minotou, C. (2021). Estimating the value of monumental olive trees: Designing a tool using multi-criteria decision making. *Trees, Forests and People, 6,* 100151.
23. Manglis, A., Giatsiatsou, P., Papadopoulou, D., Drouga, V., & Fourkiotou, A. (2021). Implementing Multi-Criteria Analysis in the Selection of AUCHS for the Integration of Digital Technologies into the Tourism Offering: The Case of MeDryDive. *Heritage, 4*(4), 4460–4472.
24. Kaymaz, Ç. K., Çakır, Ç., Birinci, S., & Kızılkan, Y. (2021). GIS-Fuzzy DEMATEL MCDA model in the evaluation of the areas for ecotourism development: A case study of “Uzundere”, *Erzurum-Turkey. Applied Geography, 136*, 102577.
25. Lampropoulos, V., Panagiotopoulou, M., & Stratigea, A. (2021). Assessing the Performance of Current Strategic Policy Directions towards Unfolding the Potential of the Culture–Tourism Nexus in the Greek Territory. *Heritage, 4*(4), 3157–3185.
26. Kitsios, F. C., & Grigoroudis, E. (2020). Evaluating service innovation and business performance in tourism: a multicriteria decision analysis approach. *Management Decision, 58*(11), 2429–2453.
27. Linaki, E., & Serraos, K. (2020). Recording and Evaluating the Tangible and Intangible Cultural Assets of a Place through a Multicriteria Decision-Making System. *Heritage, 3*(4), 1483–1495.
28. Prevolšek, B., Maksimović, A., Puška, A., Pažek, K., Žibert, M., & Rozman, Č. (2020). Sustainable Development of Ethno-Villages in Bosnia and Herzegovina—A Multi Criteria Assessment. *Sustainability, 12*(4), 1399.
29. Vavrek, R., & Bečica, J. (2020). Efficiency Evaluation of Cultural Services in the Czech Republic via Multi-Criteria Decision Analysis. *Sustainability, 12*(8), 3409.
30. Yang, J.-J., Lo, H.-W., Chao, C.-S., Shen, C.-C., & Yang, C.-C. (2020). Establishing a Sustainable Sports Tourism Evaluation Framework with a Hybrid Multi-Criteria Decision-Making Model to Explore Potential Sports Tourism Attractions in Taiwan. *Sustainability, 12*(4), 1673.

31. Lin, C.-L., & Chang, K.-C. (2019). Establishing the service evaluation and selection system for emerging culture festival events using the hybrid MCDM technique. *Current Issues in Tourism, 23*(18), 2240–2272.
32. Withanage, N. C., Chanuwan Wijesinghe, D., Mishra, P. K., Abdelrahman, K., Mishra, V., & Fnais, M. S. (2024). An ecotourism suitability index for a world heritage city using GIS-multi criteria decision analysis techniques. *Heliyon*, 10(11), e31585.
33. Kaya, A., Pamucar, D., Gürler, H. E., & Ozcalici, M. (2024). Determining the financial performance of the firms in the Borsa Istanbul sustainability index: integrating multi criteria decision making methods with simulation. *Financial Innovation*, *10*(1).
34. Bianchi, S., Andriotis, C., Klein, T., & Overend, M. (2024). Multi-criteria design methods in façade engineering: State-of-the-art and future trends. *Building and Environment, 250,* 111184.
35. Kheybari, S., Mehrpour, M. R., Bauer, P., & Ishizaka, A. (2024). How Can Risk-Averse and Risk-Taking Approaches be Considered in a Group Multi-Criteria Decision-Making Problem*?, Group Decision and Negotiation*, *33*(4), 883–909.
36. Bafail, O., & Hanbazazah, A. (2025). Optimizing Tour Guide Selection: A Best–Worst Scaled Assessment of Critical Performance Criteria for Enhanced Tour Quality. *Sustainability, 17*(9), 4213.
37. Heydari, R., Fathololoumi, S., Soltanbeygi, M., & Firozjaei, M. K. (2025). A Sustainability-Oriented Spatial Multi-Criteria Decision Analysis Framework for Optimizing Recreational Ecological Park Development. *Sustainability, 17*(2), 731.
38. Zavieh, H., Niksefat, P., Nasseri, S.H. (2024) An inverse BCC model for evaluating and ordering decision-making units under fuzziness, *Fuzzy Information and Engineering*, 16(1), 89-101.
39. Nasseri, S.H., Mansouri, S. (2023). A two-phase approach for solving fuzzy flexible linear programming problems with fuzzy objective coefficients, *International Journal of Applied Operational Research*, 11(1),11-19.
40. Asadpour Kordi, M., Amirnejad, H., Nasseri, S.H. (2023). The Effect of Economic, Social and Natural Factors on the Efficiency of Iran's Tourism Industry, *Iranian Economic Review*, 27(2), 425-446.