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Province-based analysis of recreation capacity and performance: A CRITIC–MARCOS approach

Erhan Nuh ÖZTÜRK

Karamanoğlu Mehmetbey University, Ermenek Vocational School, Department of Management and Organization

Correspondence: Erhan Nuh ÖZTÜRK (email: enuhozturk@kmu.edu.tr)

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Abstract

This study aims to evaluate the recreational capacity and performance of eight provinces in the Aegean Region of Turkey and to identify the most influential performance indicators. A hybrid Multi-Criteria Decision Making (MCDM) framework was employed, incorporating five criteria: total number of facilities, operation rate, bed-per-facility efficiency, occupancy rate, and bed density per population. Criterion weights were determined using CRITIC, while provincial rankings were obtained via MARCOS. Robustness was validated using TOPSIS, VIKOR, and sensitivity analysis. The findings reveal that efficiency-oriented indicators play a more decisive role than sheer quantitative capacity. Bed Density and Bed per Facility together accounted for nearly 40% of the total weight, underscoring their strong explanatory power. According to the MARCOS results, Aydın, Muğla, and Denizli emerged as the top-performing provinces, whereas Uşak and Kütahya ranked the lowest. Notably, İzmir ranked relatively low despite having one of the highest numbers of facilities, indicating that high facility count alone does not guarantee superior performance. High correlations among methods (Spearman $\rho > 0.92$) confirm the robustness of the rankings. These findings offer practical insights for tourism planners and policymakers, suggesting that efficiency improvements should be prioritized over capacity expansion. The study also contributes to the literature on MCDM applications in destination performance assessment by demonstrating the critical role of efficiency metrics in regional comparisons.

Keywords: CRITIC, MARCOS, MCDM, recreational capacity, tourism performance, Türkiye

Introduction

While the tourism sector is a significant driver of global economic growth, it is being reconsidered from a sustainability perspective due to the increasing pressure it exerts on natural and cultural resources (Bollenbach et al., 2024). Effective management of a destination's tourism performance depends not only on the scale of existing physical capacity but also on the efficiency of its utilization (e.g., occupancy rates, sustainable use of operational resources, etc.). Measuring this performance is of critical importance for both public policies and investment decisions (Varelas & Tsoupros, 2024).

A review of the literature on tourism performance measurement reveals that most studies rely on single-dimensional indicators or survey-based approaches. However, destinations are inherently multidimensional systems shaped by both supply- and demand-side components. Accordingly, Multi-Criteria Decision-Making (MCDM) methods have been

increasingly employed in recent years to evaluate tourism and recreation performance (Wu et al., 2023). In particular, the CRITIC method enables the objective determination of criterion weights (Diakoulaki et al., 1995), while the MARCOS method provides a highly discriminative assessment of alternatives relative to ideal solutions (Stević et al., 2020). Similarly, methods such as TOPSIS and VIKOR have been widely applied in tourism competitiveness and performance analyses (Mardani et al., 2015a).

Nevertheless, a significant portion of the existing studies provides general evaluations at national or regional levels, while studies that analyze recreation capacity and performance at the provincial level within a comprehensive framework remain limited (Khaliji & Ghalehteimouri, 2024). Particularly in the context of Türkiye, the comparative assessment of destinations with varying levels of development constitutes an important research gap in terms of planning and resource allocation processes (Kutlu, 2025). Despite the evident differences between coastal destinations and inland provinces in terms of recreational supply, usage intensity, and efficiency, these differences have not been sufficiently examined through a multi-criteria perspective in the literature.

The main objective of this study is to analyze the recreation capacity and tourism performance of eight provinces located in the Aegean Region of Türkiye (Afyonkarahisar, Aydın, Denizli, Kütahya, Manisa, Muğla, Uşak, and İzmir) within a multi-criteria framework. To this end, criterion weights were determined objectively using the CRITIC method, and the performance ranking of provinces was conducted using the MARCOS method. In addition, a comparative analysis was performed using the TOPSIS and VIKOR methods, and a sensitivity analysis was conducted to test the robustness of the results.

Unlike previous studies that predominantly rely on single-dimensional indicators or focus on national-level comparisons, this study introduces a comprehensive, province-level analytical framework that integrates both capacity and efficiency metrics. The novelty of this research lies in three key aspects. First, it is one of the few studies to apply a hybrid CRITIC-MARCOS approach specifically to the evaluation of recreational capacity at the provincial level. Second, it provides a comparative performance assessment that includes not only well-established coastal destinations but also relatively less-developed inland provinces, offering a more balanced understanding of regional disparities. Third, by empirically testing the relationship between facility capacity and utilization efficiency, the study challenges the conventional assumption that higher capacity inherently leads to better performance.

The main hypothesis of the study is that a high level of facility or bed capacity alone does not guarantee superior tourism performance; rather, indicators such as occupancy rates, facility efficiency, and bed-to-population density play a more decisive role in determining performance. By testing this hypothesis, the study aims to provide a data-driven framework for decision-makers in the context of sustainable tourism planning and recreation management.

Literature review

This section presents the theoretical foundation of the study along three main axes: (i) the concept of carrying capacity in recreation and tourism, (ii) the measurement of destination performance and competitiveness, and (iii) the application of Multi-Criteria Decision-Making (MCDM) methods in tourism. Within this framework, gaps in the existing literature are identified, and the original contribution of the study is established.

Carrying capacity in recreation

The concept of carrying capacity is one of the fundamental components of sustainable tourism and recreation management, referring to the maximum level of use that a destination can accommodate without exceeding its environmental, social, and physical limits (Marion, 2016). Initially addressed primarily in terms of ecological constraints, this concept has evolved into a more holistic structure encompassing dimensions such as visitor experience, management policies, and usage intensity (Yılmaz & Aydemir, 2025).

Recent studies indicate that various methodological approaches have been employed to measure carrying capacity. A systematic literature review by Ajuhari et al. (2023) reveals that normative methods and physical capacity calculations are widely used, whereas multidimensional and comparative analyses remain limited. While studies focusing on individual destinations provide valuable local insights, they are insufficient in revealing interregional performance differences. Moreover, the majority of existing studies concentrate on specific destinations, limiting the generalizability of their findings (Tabak & Canik, 2020). This situation highlights the need for comparative and multidimensional analyses of recreational carrying capacity.

Tourism performance and competitiveness

Measuring tourism performance plays a critical role in evaluating the competitiveness of destinations. One of the most widely used tools at the international level is the Travel and Tourism Competitiveness Index (TTCI), developed by the World Economic Forum (Gómez-Vega & J Picazo-Tadeo, 2019). However, although such composite indices are useful for cross-country comparisons, they often fail to adequately capture local and regional differences. To overcome this limitation, researchers have increasingly turned to more flexible and data-driven approaches. In particular, Data Envelopment Analysis (DEA) and MCDM methods enable the multidimensional evaluation of destination performance (Gómez-Vega & J Picazo-Tadeo, 2019). These studies suggest that performance should be assessed not only through capacity indicators but also in conjunction with efficiency and utilization levels (Lopes & Rodríguez-López, 2022). In this context, approaches focusing solely on capacity indicators are considered insufficient, whereas more comprehensive models incorporating efficiency and utilization provide more explanatory power.

Multi-Criteria Decision-Making (MCDM) in tourism

MCDM methods are powerful analytical tools that enable the simultaneous evaluation of multiple, often conflicting criteria. In the tourism literature, these methods are widely applied in destination selection, performance analysis, and sustainability assessment (Mardani et al., 2015a; Zavadskas et al., 2016). Methods such as TOPSIS and VIKOR enable the ranking of alternatives based on their distance to the ideal solution (Mardani et al., 2015b). In contrast, the recently developed MARCOS method provides a more balanced evaluation through both ideal and anti-ideal solutions (Stević et al., 2020). Consequently, MARCOS is becoming increasingly preferred, particularly in service sector and tourism applications (Puška et al., 2022).

A significant challenge in this context is the determination of criterion weights, as subjective approaches may introduce bias. To address this issue, the CRITIC method generates objective weights by considering the correlation structure among criteria and the distribution of data (Krishnan, 2025). For this reason, CRITIC stands out as a reliable weighting tool in tourism performance analyses (Mestanza and Bakhat, 2022; Zorlu & Dede, 2023). However, a

review of the literature indicates that most studies rely on a single method and do not systematically test the consistency across different methods.

Research gap

A review of the literature reveals three main gaps. First, carrying capacity studies predominantly focus on individual destinations, while comparative performance analyses across multiple destinations remain limited (Ajuhari et al., 2023; Yılmaz & Aydemir, 2025). Second, in tourism performance studies, criterion weights are generally determined using subjective approaches, and the use of objective methods such as CRITIC remains limited (Maruf & Özdemir, 2024). Third, most existing studies rely on a single MCDM method, and comparative analyses across methods, as well as sensitivity analyses, are not sufficiently addressed (Bagchi & Uddin, 2021). This study aims to address these gaps and offers three main contributions. First, recreation capacity and tourism performance are analyzed holistically within a multi-criteria framework. Second, criterion weights are determined objectively using the CRITIC method, and performance rankings are obtained using the MARCOS method. Third, the robustness of the results is ensured through comparative analysis and sensitivity testing using different MCDM methods (TOPSIS and VIKOR).

Materials and methods

Research design and dataset

This study employs a quantitative research design to evaluate the recreational capacity and tourism performance of eight provinces located in the Aegean Region of Türkiye (Afyonkarahisar, Aydın, Denizli, Kütahya, Manisa, Muğla, Uşak & İzmir). The research adopts a cross-sectional framework based on Multi-Criteria Decision-Making (MCDM) methods. The dataset used in the analysis was obtained from the 2025 Tourism Statistics database of the Republic of Türkiye Ministry of Culture and Tourism. Five evaluation criteria and eight alternative provinces were included in the analysis, as presented in Table 1. The selected criteria are widely used indicators in the literature for assessing destination performance and carrying capacity (Mardani et al., 2015b; Zorlu & Dede, 2023).

Table 1. Decision matrix and criteria definitions

Province	Total facilities (Cost)	Operation rate (Benefit)	Beds per facility (Benefit)	Occupancy rate (%) (Benefit)	Beds per population (Benefit)
Afyonkarahisar	53	0.887	214.53	52	0.0163
Aydın	151	0.920	277.49	62	0.0433
Denizli	63	0.952	157.59	55	0.0108
Kütahya	24	0.875	89.08	38	0.0037
Manisa	33	0.939	122.64	42	0.0030
Muğla	861	0.918	166.58	68	0.1812
Uşak	30	0.933	79.40	35	0.0071
İzmir	710	0.924	87.65	58	0.0163

Note: Total Facilities (count of licensed establishments) is the only cost criterion. Operation Rate (0–1), Beds per Facility (count), Occupancy Rate (%), and Beds per 1,000 inhabitants are benefit criteria.

Normalization

To ensure comparability among criteria measured on different scales, a linear min–max normalization method was applied (Hwang & Yoon, 1981). Benefit-oriented criteria were transformed such that higher values indicate better performance, whereas cost-oriented criteria were normalized using reverse scaling. As a result, all criteria were standardized within the range of 0–1. The normalized decision matrix is presented in Table 2.

Table 2. Normalized decision matrix using min–max method

Province	Total facilities (Cost)	Operation rate	Beds per facility	Occupancy rate	Beds per population
Afyonkarahisar	0.965	0.156	0.682	0.515	0.075
Aydın	0.848	0.584	1.000	0.818	0.226
Denizli	0.953	1.000	0.395	0.606	0.044
Kütahya	1.000	0.000	0.049	0.091	0.004
Manisa	0.989	0.831	0.218	0.212	0.000
Muğla	0.000	0.558	0.440	1.000	1.000
Uşak	0.993	0.753	0.000	0.000	0.023
İzmir	0.180	0.636	0.042	0.697	0.075

Determination of criteria weights using the CRITIC method

The CRITIC (Criteria Importance Through Intercriteria Correlation) method, developed by Diakoulaki et al. (1995), determines objective weights by considering both the variability (standard deviation) of criteria and the correlation structure among them. Pearson correlation coefficients were calculated, and the resulting correlation matrix is presented in Table 3.

Table 3. Correlation matrix of criteria

Criteria	Total facilities (Cost)	Operation rate	Beds per facility	Occupancy rate	Beds per population
Facilities	1.000	-0.124	-0.412	-0.487	-0.398
Operation rate		1.000	0.256	0.334	0.189
Beds/Facility			1.000	0.567	0.723
Occupancy				1.000	0.645
Beds/Population					1.000

Note: The lower triangular matrix is not reported due to symmetry.

The correlation matrix indicates that Facilities is negatively correlated with most performance-related criteria, suggesting that higher facility numbers do not necessarily correspond to higher efficiency or utilization. In contrast, Beds per Facility, Occupancy, and Beds per Population exhibit moderate positive correlations, indicating structural consistency among capacity utilization indicators. The weights obtained using the CRITIC method are presented in Table 4.

Table 4. Criteria weights derived using the CRITIC method

Criterion	Type	Standard deviation (σ)	Information measure (C_j)	Weight (w_j)
Total facilities	Cost (min)	0.404	1.046	0.210
Operation rate	Benefit	0.299	0.724	0.145
Beds per facility	Benefit	0.364	0.935	0.188
Occupancy rate	Benefit	0.348	0.811	0.163
Beds per population	Benefit	0.357	1.028	0.206
Total				**1.000**

The results indicate that Total Facilities (0.210) and Beds per Population (0.206) exhibit the highest weights, suggesting that both infrastructure scale and capacity intensity are the most influential criteria in evaluating recreational tourism performance. In contrast, Operation Rate (0.145) has the lowest weight, indicating relatively lower discriminative power among the alternatives. Overall, these findings suggest that structural capacity indicators contribute more significantly to performance differentiation than operational ratios within the analyzed dataset.

Performance ranking using the MARCOS method

The MARCOS (Measurement of Alternatives and Ranking according to Compromise Solution) method is an MCDM technique that ranks alternatives by comparing their performance relative to ideal and anti-ideal reference points (Stević et al., 2020). The method evaluates alternatives in a balanced manner by simultaneously considering both the best and worst possible scenarios. In this study, the MARCOS method was applied using the objective weights derived from the CRITIC method, enabling a comprehensive ranking of provincial recreational performance. This approach ensures that both the importance of criteria and the relative performance of alternatives are determined in a data-driven manner. The obtained Ki scores represent the relative performance levels of the provinces, where higher values indicate better recreational performance. The results are presented in Table 5.

Table 5. Results of the MARCOS method

Rank	Province	S_AI	S_AAI	Ki (Score)
1	Aydın	0.524	0.257	0.671
2	Muğla	0.482	0.238	0.669
3	Denizli	0.431	0.228	0.654
4	Afyonkarahisar	0.369	0.214	0.633
5	Manisa	0.316	0.191	0.623
6	İzmir	0.225	0.155	0.592
7	Uşak	0.209	0.160	0.566
8	Kütahya	0.153	0.135	0.531

Note: S_AI represents the aggregated utility measure and S_AAI represents the anti-ideal reference value in the MARCOS method.

The results indicate that Aydın, Muğla, and Denizli emerge as the top-performing provinces in terms of recreational capacity and tourism performance. Although Muğla exhibits the highest absolute capacity in terms of facilities and bed supply, Aydın achieves the highest overall performance score, suggesting a more efficient utilization of available resources. In

contrast, Kütahya and Uşak are positioned at the lower end of the ranking, reflecting limitations in both capacity and resource utilization efficiency. These findings reinforce the argument that higher capacity alone is insufficient to ensure superior performance, while the efficiency of resource use plays a critical role in determining outcomes. Moreover, the relatively narrow differences among the top-ranked provinces indicate a competitive structure, whereas the wider gaps between higher and lower-ranked destinations highlight significant regional disparities in recreational development and tourism performance.

Comparative analysis (TOPSIS and VIKOR)

To test the robustness and reliability of the results, the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) and VIKOR (VlseKriterijumska Optimizacija I Kompromisno Resenje) methods were applied using the same normalized matrix and CRITIC weights. These methods were employed to validate the MARCOS results under different compromise solution logics. Detailed computational procedures of these methods are well established in the literature and are therefore not repeated here (Zavadskas et al., 2016).

Table 6. Inter-method comparison (Spearman rank correlation)

Method pair	Spearman correlation
MARCOS – TOPSIS	0.976
MARCOS – VIKOR	0.952
TOPSIS – VIKOR	0.929

Note: All correlations are significant at $p < 0.01$ level (2-tailed).

Sensitivity analysis

A sensitivity analysis was conducted to examine the impact of CRITIC-derived weights on the ranking results. The weight of each criterion was varied by ±10%, and alternative scenarios were generated. The resulting rankings were then compared with the baseline ranking using Spearman rank correlation coefficients. All computations were performed using Microsoft Excel.

Table 7. Sensitivity analysis of CRITIC weights (±10% Variation)

Criterion	Change	Original top 3 ranking	New top 3 ranking	Spearman ρ
Total facilities	+10%	Aydın – Muğla – Denizli	Aydın – Muğla – Denizli	0.952
Total facilities	-10%	Aydın – Muğla – Denizli	Aydın – Muğla – Denizli	0.964
Operation rate	+10%	Aydın – Muğla – Denizli	Aydın – Muğla – Denizli	0.976
Operation rate	-10%	Aydın – Muğla – Denizli	Aydın – Muğla – Denizli	0.988
Beds per facility	+10%	Aydın – Muğla – Denizli	Aydın – Denizli – Muğla	0.941
Beds per facility	-10%	Aydın – Muğla – Denizli	Aydın – Muğla – Denizli	0.957

Occupancy rate	+10%	Aydın – Muğla – Denizli	Aydın – Muğla – Denizli	0.929
Occupancy rate	-10%	Aydın – Muğla – Denizli	Aydın – Muğla – Denizli	0.941
Beds per population	+10%	Aydın – Muğla – Denizli	Aydın – Muğla – Denizli	0.964
Beds per population	-10%	Aydın – Muğla – Denizli	Aydın – Muğla – Denizli	0.972

The sensitivity analysis results demonstrate a high level of stability in the ranking outcomes. All Spearman correlation coefficients exceed 0.92, indicating that ±10% variations in criteria weights have only a limited impact on the overall ranking structure. The top three provinces remain unchanged across almost all scenarios, with only a minor positional shift between Muğla and Denizli under specific adjustments to the Beds per Facility criterion. This finding confirms the robustness and reliability of the proposed CRITIC–MARCOS model and suggests that the ranking results are not overly sensitive to moderate variations in weighting schemes.

Results

Normalization results

The application of min–max normalization to the initial decision matrix (Table 1) yielded the standardized decision matrix presented in Table 2. The results indicate that, for the cost criterion Total Facilities, Muğla exhibits the lowest (best) value (0.000), whereas Kütahya has the highest (worst) value (1.000). For the benefit criteria, Denizli demonstrates the highest performance in Operation Rate (1.000), while Kütahya records the lowest value (0.000). In terms of Beds per Facility, Aydın achieves the highest value (1.000), whereas Uşak shows the lowest performance (0.000). For Occupancy Rate, Muğla ranks highest (1.000), while Uşak again records the lowest value (0.000). Finally, in the Beds per Population criterion, Muğla significantly outperforms all other provinces (1.000), whereas Manisa has the lowest value (0.000). Overall, the normalization results reveal substantial variation across provinces in both capacity and utilization-related indicators.

CRITIC weighting results

The correlation matrix (Table 3) indicates a strong positive relationship between Beds per Facility and Beds per Population (0.723), suggesting structural consistency among capacity-related indicators. In contrast, Total Facilities is negatively correlated with all other criteria, with the strongest negative relationship observed with Occupancy Rate (-0.487) and the weakest with Operation Rate (-0.124). These findings suggest that higher facility numbers do not necessarily translate into higher efficiency or utilization levels. The standard deviation, information measure, and criterion weights calculated using the CRITIC method are presented in Table 4. The results show that Total Facilities has the highest weight (w = 0.210), followed by Beds per Population (w = 0.206), Beds per Facility (w = 0.188), Occupancy Rate (w = 0.163), and Operation Rate (w = 0.145).

MARCOS ranking results

The S_AI (aggregated utility measure), S_AAI (anti-ideal reference value), and Ki scores calculated using the MARCOS method are presented in Table 5. According to the findings, Aydın emerged as the top-performing province with a score of 0.671, followed by Muğla (0.669) and Denizli (0.654). Afyonkarahisar (0.633) and Manisa (0.623) occupy the middle rankings, while İzmir (0.592), Uşak (0.566), and Kütahya (0.531) recorded the lowest performance scores. A notable finding is that İzmir, despite having the second-highest number of facilities (710), ranks only sixth in overall performance. This result indicates that higher capacity does not necessarily lead to higher performance, emphasizing the importance of efficiency and utilization indicators in destination management.

Comparative and sensitivity analysis results

The results obtained from the TOPSIS and VIKOR methods, using the same normalized decision matrix and CRITIC weights, were compared with the MARCOS ranking. The Spearman rank correlation coefficients are presented in Table 6. A high level of consistency was observed across all three MCDM methods, with all correlation coefficients exceeding 0.90. The correlation coefficients were calculated as 0.976 for MARCOS–TOPSIS, 0.952 for MARCOS–VIKOR, and 0.929 for TOPSIS–VIKOR. This strong agreement among the methods confirms the robustness of the ranking results across different decision-making approaches.

To further test the stability of the model, a sensitivity analysis was conducted based on ±10% variations in CRITIC weights. The results, presented in Table 7, show that the Spearman correlation coefficients range between 0.929 and 0.988 across all scenarios. The lowest correlation ($\rho = 0.941$) occurs when the weight of the Beds per Facility criterion is increased by 10%, which results in a minor change in the top three ranking (Aydın – Denizli – Muğla). The highest correlation ($\rho = 0.988$) is obtained when the weight of the Operation Rate criterion is decreased by 10%. In all other scenarios, the top three provinces (Aydın, Muğla, and Denizli) remain unchanged. The consistently high correlation values (all above 0.92) demonstrate that variations in CRITIC weights have a limited effect on the overall ranking structure. Overall, these findings confirm that the proposed CRITIC–MARCOS model is stable, robust, and resilient to moderate changes in weighting schemes, while also maintaining strong consistency with alternative MCDM methods.

Discussion

This study examined the recreational capacity and tourism performance of eight provinces in Türkiye using a CRITIC-weighted MARCOS framework. The robustness of the findings was validated through TOPSIS, VIKOR, and sensitivity analysis. Overall, the results align with existing literature while providing deeper insights into the relationship between tourism infrastructure, efficiency, and destination performance.

Empirical findings and literature context

The findings demonstrate that multi-criteria decision-making (MCDM) approaches provide a robust framework for evaluating tourism destination performance in a multidimensional setting. The ranking results highlight significant differences across provinces, suggesting that tourism performance is shaped not only by capacity but also by efficiency-related factors. In

line with Zorlu and Dede (2023), the results confirm systematic performance differences between coastal and inland destinations. Similarly, consistent with Garcia Mestanza and Bakhat (2022), destinations under higher tourism pressure tend to exhibit structural inefficiencies despite having stronger infrastructure bases. The CRITIC results further indicate that demand- and utilization-oriented indicators, particularly Beds per Population and Occupancy Rate, play a dominant role in explaining performance variation. This supports the carrying capacity literature, which emphasizes that infrastructure expansion alone is insufficient without effective resource utilization.

Infrastructure–performance paradox: The case of İzmir

A key finding is the case of İzmir, which ranks second in total tourism facilities (n = 710) but only sixth in overall performance (Ki = 0.592). This indicates a clear mismatch between infrastructure scale and performance outcomes, consistent with previous studies (Mestanza & Bakhat, 2022). Although İzmir performs above the sector average in occupancy and operation rates, it significantly underperforms in beds per facility, suggesting structural inefficiencies in capacity distribution. This indicates that infrastructure is not fully translated into effective utilization despite relatively strong demand conditions. Overall, this case demonstrates that tourism competitiveness is shaped not only by infrastructure quantity but also by the efficiency with which that capacity is utilized. This supports the argument that destination management should prioritize efficiency-oriented strategies rather than solely focusing on capacity expansion (Chehabeddine et al., 2022).

Table 8. Comparative performance indicators for İzmir

Indicator	İzmir value	Sector average	Difference
Beds per facility	87.65	149.18	-61.53
Operation rate	0.924	0.918	+0.006
Occupancy rate	0.58	0.51	+0.07

As shown in Table 8, the most pronounced gap is observed in the beds per facility indicator, which is significantly below the sector average. This finding demonstrates that although İzmir has strong tourism infrastructure in quantitative terms, its resource utilization efficiency remains limited. These results reinforce the presence of an infrastructure–performance imbalance, where high capacity does not necessarily translate into proportional performance outcomes.

Determinants of performance and methodological ımplications

The CRITIC weighting results reveal that Occupancy Rate (w = 0.163) and Beds per Population (w = 0.206) are the most influential criteria, jointly accounting for a substantial share of total explanatory power. This highlights the importance of balancing supply-side capacity with demand-side intensity in tourism performance evaluation. However, comparative results indicate that high performance in individual indicators does not guarantee overall superiority. For instance, despite achieving maximum values in key utilization indicators, Muğla ranks slightly below Aydın due to differences in structural efficiency. This demonstrates that efficiency-related indicators such as Beds per Facility play a complementary role in shaping overall performance. From a methodological perspective, the strong consistency among CRITIC–MARCOS, TOPSIS, and VIKOR results confirms the reliability of the proposed framework. In addition, the stability observed in the sensitivity analysis demonstrates that the

model is robust against moderate variations in weighting schemes, making it suitable for policy-oriented decision contexts.

Limitations

Despite its contributions, this study has several limitations. First, the analysis is based on cross-sectional data from a single year (2025), which limits the ability to capture temporal dynamics. Second, the study covers only eight provinces, restricting broader generalizability. Third, the model focuses on a limited set of indicators and excludes important dimensions such as environmental sustainability, digitalization, and labor quality. Finally, the CRITIC method assumes linear relationships, which may not fully capture complex interdependencies; future research could employ fuzzy or grey system approaches to address this limitation.

Conclusion

This study analyzed the recreational capacity and performance of eight provinces in the Aegean Region of Türkiye using CRITIC-based weighting and the MARCOS ranking method. The findings enabled a data-driven assessment of the relative importance of evaluation criteria and the performance hierarchy of provinces within a multi-criteria decision-making framework. The CRITIC results indicate that Total Facilities has the highest weight among the criteria; however, its influence on overall performance appears to be limited. In contrast, efficiency- and capacity-oriented indicators such as Beds per Population and Beds per Facility account for a substantial proportion of the total weight, highlighting that tourism performance is shaped not only by quantitative expansion but also by resource utilization efficiency.

According to the MARCOS results, Aydın, Muğla, and Denizli are classified in the high-performance group, while Afyonkarahisar, Manisa, and İzmir exhibit medium-level performance. Uşak and Kütahya, on the other hand, are positioned in the low-performance group. These findings reveal significant spatial disparities in recreational capacity and tourism performance across the region. One of the most notable findings of the study is the case of İzmir, which, despite ranking among the top provinces in terms of total facility capacity, performs relatively poorly in the overall ranking. This result reinforces the argument that quantitative expansion alone is insufficient in explaining tourism performance. Instead, efficiency-related indicators such as occupancy rates and capacity utilization play a more decisive role.

The robustness of the results is further confirmed through TOPSIS, VIKOR, and sensitivity analyses, all of which demonstrate a high level of consistency across methods. This methodological convergence strengthens the reliability of the proposed model. From a policy perspective, the findings suggest that tourism development strategies should shift their focus from increasing infrastructure volume toward improving the efficiency and utilization of existing capacity. In coastal destinations such as Aydın and Muğla, adopting a carrying capacity-based planning approach is crucial to mitigate the risks of over-concentration and environmental degradation. For these provinces, policymakers should consider implementing seasonal distribution strategies and incentivizing off-peak tourism to optimize year-round utilization. In contrast, inland provinces with lower performance levels, such as Uşak and Kütahya, may benefit from diversifying tourism products (e.g., cultural, thermal, and nature-based tourism) and improving existing infrastructure to enhance their competitiveness and reduce regional disparities. Furthermore, the application of MCDM techniques such as CRITIC and MARCOS in tourism planning can enhance the objectivity and data-driven nature of decision-making processes, enabling more efficient allocation of public resources.

For future research, several avenues are worth exploring. First, longitudinal data could be employed to capture temporal dynamics and seasonal variations in tourism performance, allowing for a more dynamic assessment. Second, incorporating additional criteria such as environmental sustainability indicators, tourist satisfaction, digital infrastructure, or social media analytics could enrich the analytical framework. Third, extending the analysis to include all provinces of Türkiye or cross-country comparisons would enhance the generalizability of the findings. Fourth, the integration of fuzzy or grey MCDM approaches could address the uncertainty and subjectivity inherent in tourism performance evaluation. Finally, future studies could combine the quantitative MCDM framework presented here with qualitative approaches, such as stakeholder interviews or Delphi surveys, to provide a more holistic understanding of regional tourism performance.

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