



Assessing The Environmental Performance of Top Tourist Destinations Based on CRITIC - TOPSIS Model

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Abstract

Tourism and the environment are closely interlinked in a reciprocal relationship. As environmental concerns become increasingly central to global tourism agendas, assessing the ecological performance of leading destinations is essential. This study aims to evaluate the environmental performance of the world's top 15 tourist destinations and determine their sustainability-based competitiveness. The Environmental Performance Index (EPI), which includes 11 categories, was used as the main data source. To ensure objectivity, the CRITIC method was employed to calculate the weights of the criteria, and the TOPSIS was used to rank the countries based on their environmental performance. The findings reveal that air pollution, fisheries, waste management, and water and sanitation infrastructure are the most influential criteria in distinguishing environmental performance across countries. According to the TOPSIS results, Japan, the United Kingdom, and France ranked highest in environmental performance, while Mexico, Türkiye, and Malaysia ranked lowest. The results highlight significant differences in environmental policy effectiveness and infrastructure quality among the countries.

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INTRODUCTION

Today, the tourism industry has evolved into a competitive arena not only among businesses but also between destinations due to the impact of globalization. This transformation has led destinations to place greater emphasis on differentiation and sustainability strategies. The significant role of environmental factors in determining a destination's attractiveness has positioned environmental awareness at the core of tourism policies (Uca & Yüncü, 2020). The increasing adoption of eco-friendly practices at both the enterprise and destination levels reflects the sector's efforts to align with sustainable development goals. In this context, environmental sustainability is considered a critical factor not only for the preservation of natural resources but also for maintaining the long-term competitiveness of tourist destinations (Malheiro et al., 2020).

A reciprocal interaction with the environment characterizes the tourism sector. It is both influenced by and has an impact on the natural and cultural surroundings. Nature stands as one of the foremost determinants of destination competitiveness (Rheeders, 2022). Physical environmental features such as natural landscapes, climate, forests, beaches, and national parks, alongside cultural elements like historical structures, heritage sites, and local lifestyles, are the primary components of a destination's touristic attractiveness. In this regard, the development of tourism largely depends on the existence, conservation, and accessibility of environmental resources. While advancements in technology and the emergence of low-cost airlines have boosted tourism and stimulated growth in developing economies, uncontrolled demand in some destinations has resulted in adverse impacts on local regions and communities (Capocchi, Vallone, Pierotti & Amaduzzi, 2019).

While the tourism industry offers significant growth potential in destinations, it also gives rise to a variety of issues, particularly environmental impacts; this underscores the need for environmentally sensitive alternative approaches in development, planning, and policy-making processes (Saarinen, 2006). In today's highly competitive tourism sector, the influx of tourists, reaching up to 100 million per year, can put significant pressure on environmental resources and potentially cause environmental degradation. Moreover, if sustainable environmental policies are not effectively implemented, destinations can gradually lose their attractiveness, leading to a decline in tourist arrivals. Therefore, a country's environmental performance not only reflects its current sustainability efforts but also has a direct impact on future tourism revenues. In this context, comparing countries' environmental performance is important to understand their relative positions in global tourism competition. France, Spain, the United States, Italy, and Türkiye are among the most popular tourist destinations (see Table 1). However, the environmental policies adopted by these countries may differ significantly. Tourism data for the year 2023 are presented in Table 1.

Table 1. Most Visited Destinations By International Tourist Arrivals (2023)

Rank	Country	Region	Arrivals (million)	Tourist Receipts (USD billion)	Receipts per Arrival (USD)	Tourism Exports (USD billion)
1	France	Europe	100	71.2	712	79.5
2	Spain	Europe	85.2	92.2	1080	92
3	United States	Americas	66.3	189.1	2851	225.9
4	Italy	Europe	57.4	55.9	974	57.8
5	Türkiye	Europe	55.2	50.1	908	70.3

Table 1. Most Visited Destinations By International Tourist Arrivals (2023) (cont.)

6	Mexico	Americas	41.9	30.7	732	33.5
7	United Kingdom	Europe	37.2	73.4	1971	73.4
8	Germany	Europe	34.8	37.8	1087	37.8
9	Greece	Europe	32.7	22.3	680	24.7
10	Austria	Europe	30.9	24.7	799	27.4
11	Thailand	Asia Pacific	28.2	29.7	1054	32.6
12	Utd Arab Emirates	Middle East	28.1	51.9	1845	51.9
13	Saudi Arabia	Middle East	27.4	36	1312	40.9
14	Portugal	Europe	26.5	27.5	1036	32.9
15	Japan	Asia Pacific	25.1	38.6	1539	42.3
16	Netherlands	Europe	20.3	20.8	1025	23.8
17	Malaysia	Asia Pacific	20.1	14.9	741	18
18	Poland	Europe	19	15	791	17.5
19	India	South Asia	18.9	32.2	1704	33.9
20	Canada	Americas	18.3	45.4	2477	45.4

Reference (UNWTO, 2025)

In the highly competitive tourism sector, comparing the environmental performance of destinations has become increasingly important. However, the literature reveals a limited number of comparative analyses based on the environmental performance of the world's top tourist destinations. In particular, studies that evaluate the level of environmental sustainability of these countries using objective multi-criteria decision-making methods are relatively scarce (Uca and Yuncu, 2020; Škrinjaric, 2021). The main objective of this study is to analyze the environmental performance of the 15 most-visited countries in the world and to determine their sustainability-based competitiveness. In the study, Environmental Performance Index (EPI) indicators were objectively weighted using the CRITIC method, and countries were ranked according to their environmental performance using the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method.

Literature Review

In recent years, numerous studies have examined the environmental impacts of tourism activities in leading tourist destinations, focusing on various dimensions of the tourism–environment interaction within the framework of sustainable development goals. The relationship between tourism development and environmental sustainability has become a key theme in research related to environmental economics and policy. Recent empirical studies increasingly utilize indicators such as the Ecological Footprint (EF) and carbon dioxide (CO₂) emissions to assess the environmental impact of tourism in destination countries (e.g. Katircioğlu, Gökmenoğlu, and Eren, 2018; Shaheen et al. (2019), Özcan, Bozoklu, and Khan; 2021).

In a study conducted by Katircioğlu et. al. (2018), the effects of tourism development on environmental quality were analyzed for the ten most visited countries, using the ecological footprint as an indicator of environmental quality. The findings emphasize that tourism development may enhance environmental sustainability after reaching a certain economic threshold. Similarly, in their study covering twenty tourism-focused countries, Özcan et. al. (2021) found that tourism development has a mitigating effect on CO₂ emissions and ecological footprint. However, their results also indicate that energy consumption exacerbates environmental degradation, while financial development contributes only to the reduction of CO₂ emissions.

Nathaniel and Adedoyin (2022) revealed that tourism revenues increase the ecological footprint, whereas the rising number of tourists appears to reduce this impact. Country-specific analyses indicate that the direction of this relationship varies; for example, tourism revenues negatively affect the environment in China and Italy, while positive environmental effects are observed in Türkiye, Mexico, and the United States. These findings suggest that the environmental impacts of tourism can vary significantly depending on country-specific conditions.

Shaheen et al. (2019) demonstrated a strong causal relationship between energy demand, economic growth, and tourism revenues, highlighting that tourism directly influences energy consumption and carbon emissions. Roumiani et al. (2023) estimated the development of ecological footprints over the last two decades in eight major tourism countries using penalized regression models, identifying an upward trend in EF particularly in countries such as China, the United States, and Thailand. The modeling results emphasize the importance of carefully selecting the variables affecting EF in formulating effective policy recommendations. Ozturk et al. (2023), using the quantile-on-quantile regression method, examined the effects of tourist arrivals on CO₂ emissions based on quarterly data, showing that this relationship can be either positive or negative. Cross-country differences were also identified; for instance, tourist growth led to an increase in CO₂ emissions in the United States, Spain, and Hong Kong, whereas the opposite effect was observed in France, Germany, and Canada.

The Environmental Performance Index (EPI) is a data-driven index that provides a summary of the state of global sustainability. EPI evaluates 180 countries based on 58 performance indicators grouped under 11 categories, including climate change performance, environmental health, and ecosystem vitality (Block et al., 2024). Prior to 2006, the EPI was published under the name “Environmental Sustainability Index (ESI)” and has since been revised biennially by Yale University and Columbia University in collaboration with the World Economic Forum and the European Commission's Joint Research Centre. While the ESI originally aimed to measure countries' levels of environmental sustainability, the EPI has evolved into a more practical and comparative tool designed for use by policymakers and analysts (Arcagök, 2024).

In the last several years, studies investigating the relationship between environmental sustainability and tourism have frequently utilized the EPI as a primary reference for assessing environmental performance. In this context, Sun et al. (2023) analyzed the multidimensional relationship between green tourism and sustainable development in a sample of 30 countries using the advanced Generalized Method of Moments (GMM). In their study, the EPI was used as a control variable alongside GDP per capita, literacy rate, and population growth rate. The findings revealed a significant and positive relationship between the EPI and sustainable development, emphasizing the role of green tourism in achieving sustainable growth.

In another study conducted by Yassin, Aralas, and Basa (2020) focusing on ASEAN countries for the period 2002–2017, the impact of tourism intensity on environmental performance was examined using panel data analysis techniques. The results indicated a significant negative relationship between tourism intensity and EPI, suggesting that excessive tourism activity adversely affects environmental quality and highlighting the need for sustainable tourism policies.

Similarly, Lv and Xu (2023) investigated the impact of tourism on environmental performance using a threshold regression model in a study encompassing 97 countries. According to their results, tourism exerts a negative impact on environmental performance regardless of tourism development level. However, this negative effect diminishes

beyond a certain level of socioeconomic development. These findings suggest that policymakers should maintain tourism development at an optimal level to minimize environmental damage.

Another noteworthy study in this field was conducted by Uca and Yuncu (2020), who explored the relationship between environmental sustainability and tourism competitiveness in Mediterranean countries. The study emphasized that as competition in the tourism sector intensifies, destinations begin to view environmental sustainability as a strategic advantage. It was further observed that environmental degradation is more prominent in regions dominated by mass tourism. Using the Environmental Performance Index 2020 data, the study applied multidimensional scaling analysis to compare the ecological performance and sustainable competitiveness levels of these countries. The findings indicate that environmental awareness and sustainability are among the key determinants of tourism competitiveness.

Environmental performance analysis has been conducted in a limited number of studies using various Multi-Criteria Decision-Making (MCDM) methods. Karahan et al. (2025) and Senir (2024) comparatively analyzed Turkey's environmental performance in relation to Eastern European countries by employing different methodological approaches. In addition, the TOPSIS method has been widely used in several studies to evaluate environmental performance. Bajdor and Korpysa (2025) applied the TOPSIS method to compare the performance of European countries based on Environmental Performance Index (EPI) data from 2022; however, no weighting method was employed to determine the criteria weights in their study. Ekinçi and Oturakçı (2025), on the other hand, differed from other studies by analyzing the environmental performance of a single country across different years using the TOPSIS method. In another study, Škrinjarić (2021) utilized the Grey Relational Analysis method to rank the environmental dimensions of sustainable tourism in European countries. The analysis was based on data retrieved from an online database, including indicators such as nights spent at tourist accommodation establishments, tourism pressure, waste treated, investments related to circular economy sectors, water exploitation, and share of renewable energy consumption.

Taken together, these studies demonstrate that the EPI serves as a reliable measurement tool in the context of sustainability and tourism. In addition, environmental performance is a critical factor influencing both competitiveness and development policies. In the existing literature, most studies analysing environmental performance of countries have employed econometric (statistical) analysis methods (e.g. Yassin et. al., 2020; Sun et al., 2023). Although a limited number of studies have used Multi-Criteria Decision-Making (MCDM) methods to compare levels of environmental sustainability (e.g. Škrinjarić, 2021; Karahan et. al., 2025), the application of these methods within the context of tourism remains notably underexplored. While some research has compared the environmental performance of countries (e.g. Karahan et. al. 2025), these comparisons have often been conducted independently of tourism-related contexts. In addition, although some studies have applied some techniques (e.g., Škrinjarić, 2021; Bajdor & Korpysa, 2025), CRITIC has not been employed as a weighting method. By integrating the CRITIC method for objective weight determination with the TOPSIS ranking approach, this study addresses this methodological gap and provides a more rigorous evaluation of environmental performance among the most visited tourism destinations.

Method

Multi-Criteria Decision-Making (MCDM) represents a fundamental approach in decision sciences that seeks to

identify the most suitable alternative by evaluating multiple, and often conflicting, criteria within the decision-making process (Taherdoost & Madanchian, 2023). In this study, the CRITIC–TOPSIS model was employed to evaluate the environmental performance of tourist destinations. CRITIC and TOPSIS were chosen because they offer an objective and systematic approach to weighting criteria and ranking alternatives, making them particularly suitable for evaluating environmental performance in multi-criteria contexts. The CRITIC method is used for the objective weighting of criteria in decision-making problems. The TOPSIS method, which utilizes these weights to rank alternatives and is commonly integrated with CRITIC in previous studies (e.g., Gaur, Dosapati, & Tawalare, 2023; Du, Wang, & Chen, 2024), was applied to rank countries according to their environmental performance. Both the CRITIC and TOPSIS methods were implemented using Microsoft Excel software.

CRITIC (Criteria Importance Through Intercriteria Correlation)

CRITIC was developed by Diakoulaki et al. (1995) to provide an objective approach to weighting criteria in multi-criteria decision-making. In this method, the weights are determined based on the contrast intensity and conflict assessment of the decision problem. Moreover, the evaluation process does not require human intervention (Şahin, 2021).

The CRITIC method was used to determine the weights of the Environmental Performance Indicators. The steps of the CRITIC method are as follows (Yin et al., 2023):

The data are normalized to standardize their units, with values constrained between 0 and 1. In this study, all indicators are positive and are processed using Equation (1).

$$x'_{ij} = \frac{x_{ij} - x_{min}}{x_{max} - x_{min}} \tag{1}$$

Here, x_{ij} represents the score given by the i -th expert for the j -th indicator. After normalization, this score is denoted as x'_{ij} . The maximum score among the n -th experts for the j -th indicator is represented by x_{max} , while x_{min} denotes the minimum score for the same indicator.

b) The standard deviation for each criterion is then calculated.

$$\bar{x}_j = \frac{1}{n} \sum_{i=1}^n x'_{ij} \tag{2}$$

$$S_j = \sqrt{\frac{\sum_{p=1}^n (x'_{pj} - \bar{x}_j)^2}{n}} \tag{3}$$

\bar{x}_j represents the mean score of the j -th indicator in the evaluation of sustainability of tourism destinations. S_j denotes the standard deviation of the j -th indicator. n is the total number of tourism destinations, while m represents the total number of indicators. Lastly, x'_{pj} is the normalized value of the p -th expert's score for the j -th indicator.

(c) Correlation coefficients are calculated.

$$r_{ij} = \frac{\sum_{p=1}^n (x_{pi} - \bar{x}_i)(x_{pj} - \bar{x}_j)}{\sqrt{\sum_{p=1}^n (x_{pi} - \bar{x}_i)^2 \sum_{p=1}^n (x_{pj} - \bar{x}_j)^2}} \tag{4}$$

r_{ij} represents the correlation coefficient between the i -th and j -th indicators. x_{pi} is the score assigned by the p -th touristsim destinations for the i -th indicator in the evaluation of sustainability of tourist destinations, while x_{pj} is the score given by the same expert for the j -th indicator. Lastly, \bar{x}_i denotes the mean score of the i -th indicator.

(d) The conflict of indicators for the evaluation of sustainability of tourist destinations (R_j) is calculated.

$$R_j = \sum_{j=1}^n (1 - r_{ij}) \tag{5}$$

(e) The information content of r_{ij} (C_j) is calculated.

$$C_j = S_j \sum_{j=1}^n (1 - r_{ij}) = S_j \times R_j \tag{6}$$

(f) The objective weight (W_j) of the j -th indicator.

$$W_j = \frac{C_j}{\sum_{j=1}^m C_j}, \quad \sum_{j=1}^n W_j = 1 \tag{7}$$

TOPSIS (Technique for Order Preference by Similarity to Ideal Solution)

TOPSIS is a multi-criteria decision-making (MCDM) method developed by Ching-Lai Hwang and Yoon Kwangsun in 1981. It ranks alternatives based on their distance to an ideal solution, identifying the best option by measuring the relative closeness of each alternative to the positive ideal solution while considering its distance from the negative ideal solution (Hwang and Yoon, 1981). The TOPSIS method consists of the following sequential steps (Roszkowska, 2011; Jozaghi et.al., 2018; Yin et.al., 2023).

Step 1: Determination of the Weight of Criteria and Construction of the Decision Matrix

The first step involves forming the decision matrix. In this stage, the performance values, denoted as r_{ij} , are determined and used to construct the decision matrix R , represented as $D = [r_{ij}]_{m \times n}$. This matrix serves as the basis for evaluation, where each row corresponds to an alternative from the set $A = \{A_1, A_2, \dots, A_m\}$ and each column represents a criterion from the set $C = \{C_1, C_2, \dots, C_n\}$.

$$R = (r_{ij})_{m \times n} = \begin{matrix} & \begin{matrix} u_1 & u_2 & \dots & u_n \end{matrix} \\ \begin{matrix} A_1 \\ A_2 \\ \vdots \\ A_m \end{matrix} & \begin{pmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{pmatrix} \end{matrix} \tag{8}$$

The decision matrix R comprises n criteria and m alternatives, where C represents the criteria and A represents the alternatives.

Step 2: Decision Matrix Normalization

To ensure uniformity in the measurement of utility preferences and minimize the impact of extreme values on similarity distance calculations, statistical normalization techniques are applied to the performance values. The normalized performance value, denoted as r_{ij} is computed as follows:

where,

$$r_{ij} = x_{ij} / \sqrt{\sum_{i=1}^m (x_{ij})^2} \tag{9}$$

for benefit attribute (Equation 9),

$$r_{ij} = 1 - (x_{ij} / \sqrt{\sum_{i=1}^m (x_{ij})^2}) \tag{10}$$

for the cost attribute (Equation 10).

Step 3: Calculation of the weighted normalized decision matrix

In this step, the weighted normalized value v_{ij} is obtained by multiplying each element of the normalized decision matrix by the corresponding normalized criterion weights.

$$v_{ij} = w_j \times r_{ij} \tag{11}$$

where $i = 1, \dots, m; j = 1, \dots, n, m$ is the number of attribute value in each criterion, n is the number of criteria, and w_j is the normalized weight of the j th criterion.

Step 4: Identifying the Positive-Ideal and Negative-Ideal Solutions

The positive-ideal solution aims to minimize cost criteria while maximizing benefit criteria. Conversely, the negative-ideal solution seeks to maximize cost criteria and minimize benefit criteria. The negative-ideal solution A^- and the positive-ideal solution A^+ are determined as follows:

$$A^+ = [v_1^+, \dots, v_j^+, \dots, v_n^+]$$

$$A^- = [v_1^-, \dots, v_j^-, \dots, v_n^-]$$

v_j denotes the attribute values of each cell for the j th layer.

$$\begin{cases} v_j^+ = \max_i \{v_{ij}\} & i = 1, 2, \dots, m \\ v_j^- = \min_i \{v_{ij}\} & i = 1, 2, \dots, m \end{cases} \text{ if the } j\text{th criterion is a beneficial criterion} \tag{12}$$

$$\begin{cases} v_j^+ = \min_i \{v_{ij}\} & i = 1, 2, \dots, m \\ v_j^- = \max_i \{v_{ij}\} & i = 1, 2, \dots, m \end{cases} \text{ if the } j\text{th criterion is a cost criterion} \tag{13}$$

Step 5: Calculation of the separation of each alternative from the positive ideal solution and the negative ideal solution

The separation (distance) between the alternatives is measured. The distance of each alternative from the positive and negative ideal solution is calculated:

$$S_i^+ = \sum_{j=1}^n |v_{ij} - v_j^+| = \sum_{j=1}^n D_{ij}^+ \tag{14}$$

$$S_i^- = \sum_{j=1}^n |v_{ij} - v_j^-| = \sum_{j=1}^n D_{ij}^- \tag{15}$$

Step 6: Calculation of the relative closeness to the positive ideal solution

The relative proximity of the i -th alternative A_j to the positive ideal solution can be determined as follows:

$$C_i^+ = (S_i^-)/(S_i^+ + S_i^-) \quad \text{where } 0 \leq C_i^+ \leq 1, i=1,2,\dots,m. \tag{16}$$

Step 7: Ranking of Alternatives Based on Relative Closeness

In the final step, the values of "relative closeness to the positive ideal solution," obtained in Step 6, are determined for the most popular tourist destinations based on environmental performance. Countries can then be ranked in descending order according to the value of C_i^+ .

Application and Findings

Within the scope of this research, the top 15 countries that had complete data for all EPI criteria based on 2023 tourism statistics were included in the analysis. Although ranked among the most popular destinations (see Table 1), Austria (in the Fisheries category) and Saudi Arabia and the United Arab Emirates (in the Forests category) were excluded from the study due to the unavailability of accessible data. The environmental performance index values of the selected countries are presented in Table 2.

In this study, the CRITIC (Criteria Importance Through Intercriteria Correlation) method was applied to determine the relative importance of the criteria that define environmental sustainability performance. This method provides an objective weighting by considering both the variance of each criterion and the correlation between them.

Table 2. EPI Criteria and Scores

	Air Quality (C1)	Sanitation and Drinking Water (C2)	Heavy Metals (C3)	Waste Management (C4)	Water Resources (C5)	Agriculture (C6)	Fisheries (C7)	Pollution Emissions (C8)	Forests (C9)	Biodiversity and Habitat (C10)	Climate Change Mitigation (C11)
France	65.2	88.2	98.9	59.6	82.5	72.8	43.2	92.8	58.6	61.5	61.3
Spain	56.2	93.8	81.7	50.8	78.7	54.1	33.7	89.3	44.5	66.9	57.2
United States	50.1	65.8	96.2	82.5	41.7	63.9	83	46.5	89.1	51.9	40.7
Italy	52.2	98.6	83.6	57.5	72.7	56.4	34	89.5	55	58.5	53.2
Greece	53.7	96.6	71.1	39.4	83.1	61.4	47.8	88	58.2	62.4	71.3
Portugal	61.1	96.4	75.4	50.8	85.5	49.7	31.1	88.7	16.5	59.8	55.3
Mexico	46.4	29.7	58.2	52.8	26.3	69.5	56.8	38.4	89.1	48.8	31.7
United Kingdom	67.8	69.9	100	99.8	65.4	78.3	76.9	38.1	92	46.4	71.5
Germany	64.9	66.9	100	98.7	67.4	89.1	78.8	36.4	92.6	38.5	82.4
Netherlands	60.7	67.4	91.1	100	69.6	89.2	68	22.5	92.6	62	60.5
Türkiye	34.8	63	55.8	29.7	67.9	59.2	49.6	50	54.7	20	37
Thailand	46	25.4	51.3	79.3	33.6	21.7	58.8	44.2	75.8	45.9	45.7
Japan	59.9	78.1	100	73.6	76.5	63.3	48.5	86.4	80.1	47.4	59.7
Poland	53.5	38.5	80.1	69.1	58.8	77.5	68.3	57.8	93.5	48.4	81.4
Malaysia	28	41	60.7	52	63.6	46.8	35.4	54.9	53.5	43.2	39.9

As part of the analysis, the normalization of the criteria was carried out using the CRITIC method. Initially, the Environmental Performance Index (EPI) values were compiled and presented in Table 2. Based on Equation 1, the normalized decision matrix was derived and is shown in Table 3. Subsequently, the correlation matrix was constructed using Equations 2, 3, and 4, with the results displayed in Table 4. Finally, after calculating the CJ values (Table 5), the corresponding weights of the criteria were obtained.

Table 3. Normalized Matrix

	Max										
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
Referance	1.00	0.71	1.00	1.00	0.95	1.00	0.34	1.00	0.71	0.84	0.71
France	0.79	0.87	0.63	0.81	0.89	0.50	0.22	0.92	0.47	0.95	0.59
Spain	0.54	0.79	0.95	0.87	0.76	0.57	0.26	1.00	0.71	0.91	0.60
United States	0.69	1.00	0.67	0.96	0.79	0.56	0.23	0.92	0.64	0.78	0.47
Italy	0.73	0.94	0.40	0.57	0.96	0.69	0.40	0.89	0.70	0.85	1.00
Greece	0.90	0.94	0.49	0.81	1.00	0.38	0.19	0.90	0.00	0.80	0.53
Portugal	0.78	0.74	0.40	0.41	0.75	0.00	0.35	0.78	0.74	0.63	0.16
Mexico	0.42	0.62	0.42	0.56	0.81	0.87	0.58	0.96	0.76	1.00	0.55
United Kingdom	0.32	0.23	0.06	0.08	0.25	0.40	0.00	0.57	0.77	0.61	0.65
Germany	0.29	0.96	0.16	0.00	0.32	0.20	0.40	0.87	0.86	0.45	0.18
Netherlands	0.00	0.44	0.00	0.11	0.00	0.45	0.92	0.59	1.00	0.52	0.26
Türkiye	0.40	0.00	0.30	0.51	0.37	0.40	1.00	0.29	0.54	0.07	0.03
Thailand	0.28	0.01	0.07	0.36	0.71	0.63	0.42	0.00	0.64	0.00	0.00
Japan	1.00	0.71	1.00	1.00	0.95	1.00	0.34	1.00	0.71	0.84	0.71
Poland	0.79	0.87	0.63	0.81	0.89	0.50	0.22	0.92	0.47	0.95	0.59
Malaysia	0.54	0.79	0.95	0.87	0.76	0.57	0.26	1.00	0.71	0.91	0.60

Table 4. Correlation Matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
C1	1.00	0.50	0.79	0.22	0.39	0.53	0.27	0.16	0.19	0.48	0.19
C2		1.00	0.53	-0.20	0.84	0.14	-0.41	0.70	-0.53	0.51	0.31
C3			1.00	0.61	0.40	0.66	0.37	0.10	0.32	0.32	0.59
C4				1.00	-0.22	0.45	0.75	-0.58	0.71	0.05	0.43
C5					1.00	0.17	-0.49	0.64	-0.56	0.33	0.49
C6						1.00	0.53	-0.32	0.54	0.02	0.54
C7							1.00	-0.75	0.87	-0.29	0.49
C8								1.00	-0.74	0.48	0.29
C9									1.00	-0.24	0.24
C10										1.00	0.23
C11											1.00

Table 5. Cj values

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
CJ	2.31	4.10	3.23	4.29	3.45	2.08	4.61	5.77	3.85	2.46	2.60

According to the analysis conducted using the CRITIC method, Air Pollution emerged as the most influential criterion, with the highest weight of 0.149. This was followed by Fisheries (0.119), Waste Management (0.111), and Sanitation & Drinking Water (0.106). These findings suggest that these four criteria possess the highest information value and discriminative power in assessing environmental sustainability among countries. Criteria with moderate weight values include Forests (0.099), Water Resources (0.089), and Heavy Metals (0.083). The relative importance of these criteria stems from their direct impact on ecosystem health and natural resource management. On the other hand, lower weight values were observed for Climate Change (0.067), Biodiversity & Habitat (0.063), Air Quality (0.060), and Agriculture (0.054). This result indicates that the indicators in these areas exhibit lower variance or discriminative capacity compared to other criteria. Overall, the results highlight which criteria are more influential in decision-making processes aimed at evaluating environmental performance. The results regarding the weighting of the environmental performance criteria are summarized in Table 6.

Table 6. Criteria Weights

Criteria	Weights
Air Pollution	0.149
Fisheries	0.119
Waste Management	0.111
Sanitation & Drinking Water	0.106
Forests	0.099
Water Resources	0.089
Heavy Metals	0.083
Climate Change Mitigation	0.067
Biodiversity & Habitat	0.063
Air Quality	0.060
Agriculture	0.054

Ranking of Tourist Destinations Based on Environmental Performance

The TOPSIS method was used to rank tourist destinations according to their environmental performance. Accordingly, the EPI data presented in Table 2 were first normalized. Since the values of the criteria represent scores out of 100, all criteria were considered as benefit criteria, and normalization was performed using Equation 9 (see Table 7).

Table 7. Normalized Decision Matrix

Country/Criteria	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
France	0.31	0.32	0.31	0.22	0.32	0.29	0.20	0.36	0.21	0.30	0.27
Spain	0.27	0.34	0.26	0.19	0.30	0.21	0.15	0.35	0.16	0.33	0.25
United States	0.24	0.24	0.30	0.31	0.16	0.25	0.38	0.18	0.31	0.26	0.18
Italy	0.25	0.35	0.26	0.21	0.28	0.22	0.15	0.35	0.19	0.29	0.23
Greece	0.25	0.35	0.22	0.15	0.32	0.24	0.22	0.34	0.21	0.31	0.31
Portugal	0.29	0.35	0.24	0.19	0.33	0.20	0.14	0.35	0.06	0.30	0.24
Mexico	0.22	0.11	0.18	0.20	0.10	0.27	0.26	0.15	0.31	0.24	0.14
United Kingdom	0.32	0.25	0.31	0.37	0.25	0.31	0.35	0.15	0.32	0.23	0.32
Germany	0.31	0.24	0.31	0.37	0.26	0.35	0.36	0.14	0.33	0.19	0.36
Netherlands	0.29	0.24	0.29	0.37	0.27	0.35	0.31	0.09	0.33	0.31	0.27
Türkiye	0.17	0.23	0.18	0.11	0.26	0.23	0.23	0.20	0.19	0.10	0.16
Thailand	0.22	0.09	0.16	0.29	0.13	0.09	0.27	0.17	0.27	0.23	0.20
Japan	0.28	0.28	0.31	0.27	0.29	0.25	0.22	0.34	0.28	0.24	0.26
Poland	0.25	0.14	0.25	0.26	0.23	0.30	0.31	0.23	0.33	0.24	0.36
Malaysia	0.13	0.15	0.19	0.19	0.24	0.18	0.16	0.21	0.19	0.21	0.18

Using the normalized data and the weights obtained through the CRITIC method, the weighted decision matrix was constructed based on Equation 11 (see Table 8). Subsequently, positive and negative ideal solutions were determined by applying Equations 12, 13, 14, and 15. The results corresponding to the positive and negative ideal solutions are presented in Tables 9 and 10, respectively.

Table 8. Weighted Decision Matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
France	0.02	0.03	0.03	0.02	0.03	0.02	0.02	0.05	0.02	0.02	0.02
Spain	0.02	0.04	0.02	0.02	0.03	0.01	0.02	0.05	0.02	0.02	0.02
United States	0.01	0.02	0.03	0.03	0.01	0.01	0.04	0.03	0.03	0.02	0.01
Italy	0.01	0.04	0.02	0.02	0.02	0.01	0.02	0.05	0.02	0.02	0.02
Greece	0.02	0.04	0.02	0.02	0.03	0.01	0.03	0.05	0.02	0.02	0.02
Portugal	0.02	0.04	0.02	0.02	0.03	0.01	0.02	0.05	0.01	0.02	0.02
Mexico	0.01	0.01	0.02	0.02	0.01	0.01	0.03	0.02	0.03	0.02	0.01
United Kingdom	0.02	0.03	0.03	0.04	0.02	0.02	0.04	0.02	0.03	0.01	0.02
Germany	0.02	0.03	0.02	0.04	0.02	0.02	0.04	0.01	0.03	0.02	0.02
Netherlands	0.01	0.02	0.01	0.01	0.02	0.01	0.03	0.03	0.02	0.01	0.01
Türkiye	0.01	0.01	0.01	0.03	0.01	0.00	0.03	0.03	0.03	0.01	0.01
Thailand	0.02	0.03	0.03	0.03	0.03	0.01	0.03	0.05	0.03	0.01	0.02
Japan	0.02	0.01	0.02	0.03	0.02	0.02	0.04	0.03	0.03	0.02	0.02
Poland	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.03	0.02	0.01	0.01
Malaysia											

Table 9. Negative Ideal Solutions

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
S_i^-	0.00985	0.00963	0.01344	0.01216	0.00900	0.00458	0.01681	0.01311	0.00578	0.00629	0.00937
France	0.00007	0.00057	0.00016	0.00015	0.00037	0.00012	0.00004	0.00168	0.00022	0.00017	0.00008
Spain	0.00004	0.00067	0.00006	0.00007	0.00032	0.00005	0.00000	0.00151	0.00010	0.00022	0.00006
United States	0.00002	0.00023	0.00014	0.00047	0.00003	0.00008	0.00079	0.00020	0.00065	0.00010	0.00001
Italy	0.00002	0.00077	0.00007	0.00013	0.00025	0.00005	0.00000	0.00152	0.00018	0.00015	0.00004
Greece	0.00003	0.00073	0.00003	0.00002	0.00038	0.00007	0.00008	0.00146	0.00021	0.00018	0.00014
Portugal	0.00006	0.00072	0.00004	0.00007	0.00041	0.00003	0.00000	0.00149	0.00000	0.00016	0.00005
Mexico	0.00001	0.00000	0.00000	0.00009	0.00000	0.00010	0.00019	0.00009	0.00065	0.00008	0.00000
United Kingdom	0.00009	0.00028	0.00016	0.00082	0.00018	0.00014	0.00061	0.00008	0.00070	0.00007	0.00014
Germany	0.00007	0.00025	0.00016	0.00080	0.00020	0.00020	0.00066	0.00007	0.00071	0.00003	0.00022
Netherlands	0.00005	0.00025	0.00011	0.00083	0.00022	0.00020	0.00040	0.00000	0.00071	0.00017	0.00007
Türkiye	0.00000	0.00020	0.00000	0.00000	0.00020	0.00006	0.00010	0.00026	0.00018	0.00000	0.00000
Thailand	0.00001	0.00000	0.00000	0.00041	0.00001	0.00000	0.00022	0.00016	0.00043	0.00007	0.00002
Japan	0.00005	0.00040	0.00016	0.00032	0.00030	0.00008	0.00009	0.00139	0.00050	0.00007	0.00007
Poland	0.00003	0.00002	0.00006	0.00026	0.00012	0.00014	0.00040	0.00042	0.00073	0.00008	0.00022
Malaysia	0.00000	0.00003	0.00001	0.00008	0.00016	0.00003	0.00001	0.00036	0.00017	0.00005	0.00001

Table 10. Positive Ideal Solutions

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
S_i^+	0.0099	0.0096	0.0134	0.0122	0.0090	0.0046	0.0168	0.0131	0.0058	0.0063	0.0094
France	0.0086	0.0238	0.0125	0.0122	0.0192	0.0108	0.0065	0.0409	0.0148	0.0130	0.0088
Spain	0.0061	0.0259	0.0080	0.0086	0.0179	0.0068	0.0014	0.0389	0.0098	0.0147	0.0075
United States	0.0043	0.0153	0.0118	0.0216	0.0053	0.0089	0.0281	0.0140	0.0255	0.0100	0.0027
Italy	0.0049	0.0278	0.0085	0.0114	0.0159	0.0073	0.0016	0.0390	0.0135	0.0121	0.0064
Greece	0.0054	0.0270	0.0052	0.0040	0.0194	0.0084	0.0090	0.0382	0.0146	0.0133	0.0117
Portugal	0.0074	0.0269	0.0063	0.0086	0.0203	0.0059	0.0000	0.0386	0.0000	0.0125	0.0070
Mexico	0.0033	0.0016	0.0018	0.0095	0.0000	0.0101	0.0139	0.0093	0.0255	0.0091	0.0000
United Kingdom	0.0093	0.0169	0.0128	0.0287	0.0134	0.0120	0.0248	0.0091	0.0265	0.0083	0.0118
Germany	0.0085	0.0157	0.0128	0.0283	0.0141	0.0142	0.0258	0.0081	0.0267	0.0058	0.0150
Netherlands	0.0073	0.0159	0.0104	0.0288	0.0148	0.0143	0.0199	0.0000	0.0267	0.0132	0.0085
Türkiye	0.0000	0.0143	0.0012	0.0000	0.0142	0.0079	0.0100	0.0160	0.0134	0.0000	0.0016
Thailand	0.0032	0.0000	0.0000	0.0203	0.0025	0.0000	0.0150	0.0126	0.0208	0.0081	0.0041
Japan	0.0071	0.0200	0.0128	0.0180	0.0172	0.0088	0.0094	0.0372	0.0223	0.0086	0.0083
Poland	0.0053	0.0050	0.0075	0.0161	0.0111	0.0118	0.0201	0.0206	0.0270	0.0089	0.0147
Malaysia	-	0.0059	0.0025	0.0091	0.0128	0.0053	0.0023	0.0189	0.0130	0.0073	0.0024
	0.0019										

Finally, country rankings were determined using Equation 16 (see Table 11). According to the evaluation conducted with the TOPSIS method, the top three countries demonstrating the highest environmental sustainability performance were Japan (0.166), the United Kingdom (0.165), and France (0.153). These were followed by Greece (0.130), Italy (0.128), and Germany (0.123). Portugal (0.122), the United States (0.120), Spain (0.119), the Netherlands (0.116), Thailand (0.115), and Poland (0.108) ranked in the middle tier in terms of environmental performance. According to the findings, the countries with the weakest environmental performance were identified as Mexico (0.087), Türkiye (0.074), and Malaysia (0.073).

Table 11. Country Rankings Based on Environmental Performance

Country	Value	Rank
Japan	0.166	1
United Kingdom	0.165	2
France	0.153	3
Greece	0.130	4
Italy	0.128	5
Germany	0.123	6
Portugal	0.122	7
United States	0.120	8
Spain	0.119	9
Netherlands	0.116	10
Thailand	0.115	11
Poland	0.108	12
Mexico	0.087	13
Türkiye	0.074	14
Malaysia	0.073	15

Conclusion and Discussion

Today, tourism and the environment have a strong and reciprocal interaction. Tourism activities can generate various negative impacts on the natural environment; environmental degradation such as deforestation, waste accumulation, water and air pollution can significantly reduce the attractiveness of destinations. Conversely, environmental deterioration can also lead to a decline in tourist numbers by reducing a country's overall touristic appeal. In particular, the destruction of natural areas influences tourists' travel preferences, driving them towards destinations with higher environmental quality.

The tourism sector is a globally competitive industry. For countries aiming to stand out in this competition, promotional efforts and infrastructure investments alone are no longer sufficient; policies aimed at environmental protection and the adoption of sustainable practices are equally critical. This study aimed to objectively assess the environmental performance of the 15 most visited countries. Within this scope, a model based on CRITIC–TOPSIS approach was applied to rank the countries accordingly.

The weights determined using the CRITIC method reveal the extent to which environmental indicators play a role in tourism competitiveness across countries. The high weights assigned to criteria such as air pollution, waste management, and water and sanitation infrastructure, which directly affect human health, emphasise the importance of environmental quality in shaping destination appeal (Giusti, 2009; Rheingans et. al., 2006; Tan et. al., 2023). These indicators are particularly relevant in sustainable tourism markets targeting high-income groups, where countries offering a clean, healthy, and safe environment gain a competitive edge in global tourism flows. Conversely, criteria such as agriculture, biodiversity, and air quality received lower weights, likely due to limited variance or discriminatory power across countries. However, this does not imply that they are unimportant for tourism. In

particular, biodiversity and habitat quality remain strategic factors for the long-term competitiveness of nature-based tourist destinations. Therefore, policies aimed at improving environmental performance should be regarded not only as ecological imperatives but also as critical investments supporting the sustainable competitiveness of destinations in global tourism markets.

The TOPSIS analysis revealed significant variations in environmental performance among countries. Leading nations such as Japan, the United Kingdom, and France stood out not only due to their robust environmental policies but also through the alignment of their tourism infrastructure with sustainability principles. Their implementation of high standards in areas such as air quality and waste management may positively influence tourist perceptions. Previous studies have shown that while economic growth may increase carbon emissions, renewable energy adoption can reduce them (Nawaz et al., 2025). Japan's commitment to reducing greenhouse gas emissions by 46% by 2030, along with its clean energy transition strategies (JapanGo, 2024), exemplifies how environmental policy can foster low-carbon tourism and support the development of eco-tourism markets. Similarly, the United Kingdom has made significant progress in reducing greenhouse gas emissions, expanding marine protected areas, and advancing towards a circular economy, thereby taking substantial steps in environmental sustainability (OECD, 2022). In addition, France enacted its target of achieving net-zero emissions by 2050 in 2019 and, the following year, updated its energy transition framework with a new National Low-Carbon Strategy and a ten-year energy plan (IEA, 2021). These proactive measures may contribute to the sustainability of tourism and help these countries maintain their positions as some of the world's most visited destinations.

Mediterranean destinations such as Greece, Italy, and Portugal also ranked highly due to strong performance in areas such as biodiversity conservation, water resource management, and air pollution control. These measures not only reduce environmental risks, particularly in coastal tourism regions of the Mediterranean basin, but also enhance destination attractiveness. In contrast, countries such as Türkiye, Mexico, and Malaysia ranked lower, raising concerns about the sustainability of their nature-based tourism sectors. In Türkiye's case, poor water resource management, air pollution, and habitat degradation may pose long-term threats to tourism potential. Given the strategic importance of freshwater and marine ecosystems in tourism products (Çakır & Çakır, 2010), such environmental shortcomings could hinder sectoral growth. Similarly, Malaysia's weak deforestation control and climate resilience performance jeopardizes the sustainability of its eco-tourism offerings. Without adequate planning and regulatory frameworks, the uncontrolled expansion of mass tourism has led to the overexploitation of natural areas, threats to biodiversity, and a decline in both environmental aesthetics and functionality (Deniz, 2019). Environmental quality remains a key determinant of destination choice among international tourists (Huybers & Bennett, 2000), underscoring the need for comprehensive strategies to preserve resources and improve infrastructure in low-performing countries.

Another important finding of the study is that top tourist-receiving destinations can exhibit varying levels of environmental performance. For instance, France is the most visited country in terms of tourist arrivals and demonstrates a high environmental performance. In contrast, popular destinations such as Turkey and Mexico display relatively lower environmental performance. These results indicate that the impact of tourism development on the environment can vary significantly across countries. Supporting this view, various studies emphasize the need for country-specific policies to ensure environmental sustainability (Koçak & Cavuşoğlu, 2024).

In conclusion, countries aiming to enhance their competitive advantage in tourism should consider environmental protection policies not merely as obligations, but as strategic assets. Environmentally sensitive and long-term planning-oriented practices are crucial in ensuring ecological integrity and economic prosperity. Since the 1992 Rio Conference, the concept of sustainability has gained widespread acceptance, emphasizing the importance of using natural resources in a manner that ensures their preservation for future generations. This perspective has been embraced by governments, environmental organizations, and international institutions, and has been supported through various laws and agreements (Erdoğan, 2010).

The research findings reveal that environmental performance is not only determined by the presence of environmental policies, but also closely linked to institutional and socio-economic conditions that influence the implementation of such policies. Accordingly, it has been observed that developed countries exhibit higher levels of environmental performance. In contrast, developing countries such as Thailand, Turkey, Mexico, and Malaysia have demonstrated lower environmental performance levels than developed nations. This may be attributed to the challenges in implementing environmental protection policies like sustainable tourism due to the prevailing socio-economic and political conditions in developing countries. Tosun (2001) identifies several structural barriers contributing to these challenges, including differences in national economic priorities, the functioning of public administration, the rise of environmental problems, the excessive commercialization of tourism, and the existing structure of the international tourism system. The findings underscore the importance of structural reforms and international cooperation in effectively implementing sustainable tourism policies in developing countries.

The main theoretical contribution of this study is the application of the integrated CRITIC-TOPSIS approach to assess the environmental performance of tourism destinations and the presentation of a systematic and comparative analysis of the most visited countries. By objectively determining the relative weights of environmental indicators (e.g., air pollution, waste management, water and sanitation infrastructure), the study reveals the importance of environmental factors that may influence the competitiveness of tourism destinations. Furthermore, it explains the differences in environmental performance between developed and developing countries by considering policy implementation and socioeconomic context. Thus, it offers original theoretical contributions to understanding the structural factors that influence the success of sustainable tourism policies. In this way, the study develops both conceptual and practical insights in the areas of sustainable tourism and destination competitiveness.

Limitations and Recommendations for Future Research

This study has several limitations. First, the environmental performance assessment was limited to the 15 countries with the highest number of international tourist arrivals, based on the Environmental Performance Index (EPI) data (Block et al., 2024). This limitation may affect the generalizability of the findings. Future studies may enhance the reliability and validity of the results by including a broader sample of countries in similar analyses.

The research presents a general evaluation without considering regional distinctions. However, more meaningful results could be achieved by comparing destinations that share similar tourism products and environmental conditions (e.g., the Mediterranean Basin, Northern Europe). Therefore, future studies could classify destinations by geographic region and conduct region-specific analyses, which would contribute to more targeted and effective policy recommendations.

In this study, the criteria weights were determined objectively using the CRITIC method. Nonetheless, future research may apply other objective weighting methods such as the Entropy method for comparative analysis. Moreover, subjective methods like the Analytic Hierarchy Process (AHP), which incorporates expert opinions, could provide valuable qualitative insights into the evaluation process.

The TOPSIS method was used in this study to rank the countries. However, to test the robustness of the results, future studies could benefit from employing alternative multi-criteria decision-making (MCDM) methods such as DEMATEL, VIKOR or PROMETHEE. In addition, the application of statistical methods such as cluster analysis could help group countries with similar environmental characteristics, allowing for a more in-depth interpretation of the findings. All these recommendations would contribute to the development of more holistic and country-specific sustainable tourism policies.

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