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Performance Analysis of Airports Located Within Tourism Development Corridors in Türkiye: An Evaluation Using the CILOS and AROMAN Methods

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Abstract

This study aims to evaluate the performance of airports located in tourism development corridors in Türkiye. There are seven tourism development corridors in Türkiye: Olive, Winter, Faith, Silk Road, Western Black Sea Coastal, Plateau and Trakya Culture Corridors. The study analyses the performance data of 18 airports in these corridors for the years 2020-2023. For the performance analyses of the airports, the data obtained from the annual reports of the State Airports Authority (DHMI) were evaluated by CILOS and AROMAN methods. According to the criteria weights determined by the CILOS method, 'Distance to the City' is the most important criterion, while 'Cargo Traffic' is the least important criterion. In the ranking by AROMAN method, the Silk Road Corridor has the highest performance, while the Western Black Sea Coastal Corridor has the lowest performance. The literature review revealed that there is no academic study on the evaluation of airports in tourism development corridors using multi-criteria decision-making methods. In this respect, the study makes an original contribution by analysing the effectiveness of airports in the context of tourism development corridors.

1. Introduction

Tourism plays a significant role in the development of countries through its economic (Bull, 1991; Çolak & Batman, 2021), cultural (Murphy, 1985; Smith, 1989), and social (Sharpley, 2018; Avcıkurt, 2023) dimensions. However, the equitable distribution of these multifaceted contributions across all regions is only possible through robust infrastructure and effective transportation planning (Kozak et al., 2010; Kavaklı & Karakaş, 2022). Enhancing transportation connectivity between tourist destinations encourages the balanced distribution of tourism demand and supports the sustainable development of the tourism sector.

In countries like Türkiye, which possess high tourism potential, strategic planning efforts have been undertaken to prevent the concentration of tourism activity in certain regions and to ensure the dispersion of tourist flows across wider geographies. Within this context, Tourism Development Corridors were established under the scope of the *Türkiye Tourism Strategy 2023*, aiming to achieve transportation integration among thematic destinations and promote regional development (Ministry of Culture and Tourism, 2007). These strategically designed corridors not only seek to diversify the tourism product portfolio but also aim to contribute to local economies and broaden the distribution of tourism revenues. The success of these tourism corridors is closely tied to the quality of transportation infrastructure. In this regard, air transport and the performance of airports have become key determinants of destinations' competitiveness in the international tourism market (Dobruszkes, 2013; Graham, 2018).

The aim of this study is to analyze the performance of airports located within Türkiye's Tourism Development Corridors. In this context, performance indicators of the relevant airports—such as terminal capacity, flight traffic, passenger volume, and number of employees—were evaluated using data published by the General Directorate of State Airports Authority (DHMI) for the period 2020–2023. Based on the findings obtained, strategic recommendations were proposed.

In the existing literature, there are many studies on airport performance evaluation (Martin & Roman, 2001; Sarkis, 2000; Yu, 2010; Özsoy & Örkcü, 2021). These studies are generally based on technical efficiency, capacity utilisation and operational outputs. However, there is no study that integrates airport performance with tourism planning, especially at the spatial level. However, air transport plays a pivotal role in development of tourism destinations

(Dobruszkes, 2013; Graham, 2018) and the efficiency of transport infrastructure directly shapes tourism flows (Hall & Page; 2014). In this context, Tourism Development Corridors developed by the Ministry of Culture and Tourism aim to support regional development by providing transport integration between thematic destinations (Ministry of Culture and Tourism, 2007). Considering this strategic approach, this study's analysis of airport performance at the scale of tourism corridors fills the gap in the literature and makes a unique contribution to regional tourism policies.

2. Literature Review

2.1. Tourism Corridors

Tourism corridors are spatial planning tools aimed at enhancing tourism mobility by connecting geographically proximate or thematically related destinations (Sharpley & Sharpley, 1997; Ministry of Culture and Tourism, 2007). This approach not only fosters cooperation among destinations but also enables tourists to explore a broader range of areas. Rather than promoting isolated destinations, offering multi-point routes contributes to the diversification of tourism experiences and supports the spatial dispersion of tourism activity (Page & Getz, 1997). Examples from Europe and the Americas demonstrate the success of this strategy. The Camino de Santiago, originally established for religious purposes, has evolved into a multidimensional route supporting the development of cultural tourism (Council of Europe, n.d.). Under the Council of Europe's "Cultural Routes Programme," thematic itineraries such as the Viking Routes, Olive Tree Route, Mozart Route, and the Roman Emperors and Danube Wine Route offer integrated tourism experiences across history, culture, and nature. Similarly, Australia's Queensland Heritage Trails Network illustrates the economic impact of tourism in rural areas (Meyer, 2004; Cook, n.d.). In Türkiye, the Olive, Winter, Faith, Silk Road, Western Black Sea Coastal, Highland, and Trakya Cultural corridors were established under the leadership of the Ministry of Culture and Tourism to revitalize regional tourism and diversify tourism revenues. These corridors aim to ensure the sustainability of both touristic and economic activity by connecting destinations under specific thematic umbrellas (Ministry of Culture and Tourism, 2007).

2.2. Air Transportation and the Tourism Nexus

The relationship between tourism and transportation plays a critical role, particularly in shaping tourist mobility. Hall and Page (2014) outline four fundamental functions of transportation in tourism: facilitating access to destinations, enabling intra-destination mobility, increasing accessibility to attractions, and integrating transport as an element of the tourism experience itself. Within this framework, air transport is considered indispensable, especially for international and long-distance tourism flows (Duval, 2013; Graham, 2018). Accordingly, the influence of air transportation on tourism is not limited to physical access but is further reinforced by the structural and functional characteristics of airports.

Airports are not merely transportation hubs; they also directly affect the attractiveness of tourist destinations through service quality, accessibility, and the overall passenger experience (Kasarda & Lindsay, 2011). The quality of airport infrastructure shapes the operational choices of airlines while providing passengers with comfort, speed, and ease of access (Dobruszkes, 2013). In particular, low-cost carriers (LCCs) contribute to the spatial expansion of tourism by making lesser-known destinations more accessible (Yıldırım & Köse, 2022).

The literature frequently emphasizes the impact of airports on regional development (Green, 2007; Halpern & Graham, 2013; Güngör & İlban, 2020). While Duval (2013) explores the economic and logistical effects of airports on tourism destinations, Page (2004) highlights their direct influence on tourist experience. Halpern & Graham (2013) further define airports as strategic development tools for tourism destinations. From this perspective, airport integration also plays a critical role in facilitating access to intra-destination attractions once tourists arrive. These findings have been intergrated to support the framework of this study, particulary in terms of quantitive indicator selection.

2.3. Tourism Development Corridors and Airports in Türkiye

With its rich cultural heritage, geographical diversity, and natural beauty, Türkiye holds a prominent position as a global tourism destination. However, to distribute this potential more evenly across regions and ensure the sustainable management of tourism, spatial planning strategies are essential. In this regard, the Tourism Development Corridors initiated by the Ministry of Culture and Tourism aim to diversify regional tourism and strengthen inter-destination linkages (Ministry of Culture & Tourism, 2007).

Each corridor covers geographically proximate regions under a specific theme, offering thematic tourism routes and aligning with local development objectives. The seven main tourism development corridors in Türkiye are as follows:

Olive Corridor: Encompassing Bursa, Balıkesir, and Çanakkale provinces, this corridor emphasizes gastronomy and cultural heritage.

Winter Corridor: Consisting of Erzurum, Erzincan, Ağrı, and Kars, it supports winter and ski tourism.

Faith Corridor: Covers regions rich in religious tourism potential, such as Mersin, Hatay, Gaziantep, Şanlıurfa, and Mardin.

Silk Road Corridor: Centered around Ankara Esenboğa Airport, this route integrates historical trade and cultural pathways with modern tourism.

Western Black Sea Coastal Corridor: Extending from Şile to Sinop, it focuses on coastal tourism and natural landscapes.

Highland Corridor: Spanning from Samsun to Artvin, this corridor supports nature and highland tourism.

Trakya Cultural Corridor: Covering Edirne and its surroundings, it offers tourism routes centered on history, culture, and gastronomy.

The effectiveness of these tourism corridors is highly dependent on the quality of transportation infrastructure. In particular, air transport enhances the visibility and accessibility of destinations within these thematic corridors, thereby increasing tourist mobility and revealing the full tourism potential of the regions (Bahar & Kozak, 2018).

The airports associated with these tourism corridors in Türkiye are as follows:

Olive Corridor: Çanakkale, Balıkesir Koca Seyit, and Bursa Yenişehir Airports.

Winter Corridor: Erzurum, Erzincan Yıldırım Akbulut, Ağrı Ahmed-i Hani, and Kars Harakani Airports.

Faith Corridor: Hatay, Gaziantep Oğuzeli, Şanlıurfa GAP, and Mardin Airports.

Silk Road Corridor: Ankara Esenboğa Airport.

Western Black Sea Coastal Corridor: Zonguldak Çaycuma Airport.

Highland Corridor: Samsun Çarşamba, Ordu-Giresun, Trabzon, and Rize-Artvin Airports.

Trakya Cultural Corridor: Tekirdağ Çorlu Airport.

The accessibility provided by these airports not only facilitates tourists' arrival at destinations but also plays a strategic role in the sustainability of regional tourism (Bahar & Kozak, 2018). The performance of airports is a key determinant in the effective functioning of corridors and in unlocking regional tourism potential. Therefore, strengthening air transport infrastructure, increasing the number of direct flights, and developing integrated transportation systems are critical to the success of corridor strategies (Duval, 2013; Halpern & Graham, 2013).

3. Materials and Methods

In this study, the activity reports of the General Directorate of State Airports Authority (DHMI) for the period 2020–2023 were examined, and seven criteria were determined. A total of 18 airports located within Türkiye's Tourism Development Corridors were evaluated using the CILOS and AROMAN methods. The CILOS method was employed to determine the weights of the criteria, while the AROMAN method was utilized to rank the tourism development corridors. The criteria evaluated in the study, the airports, and the respective corridors to which these airports belong are presented in Table 1.

Table 1. Criteria and Alternatives Used in the Study

Tourism Development Corridors	Airports	IATA Code	Criteria
Olive Corridor	Bursa Yenişehir Airport	YEI	Terminal Area
	Çanakkale Airport	CKZ	Distance to City Center
	Balıkesir Koca Seyit Airport	BZI	Commercial Aircraft Traffic
	Erzincan Yıldırım Akbulut Airport	ERC	Number of Passengers
Winter Corridor	Erzurum Airport	ERZ	Freight Traffic
	Ağrı Ahmed-i Hani Airport	AJI	Cargo Traffic
	Kars Harakani Airport	KYS	Number of Employees
	Hatay Airport	HTY	
Faith Corridor	Gaziantep Oğuzeli Airport	GZT	
	Şanlıurfa GAP Airport	GNY	
	Mardin Airport	MQM	
Silk Road Corridor	Ankara Esenboğa Airport	ESB	
Western Black Sea Coastal Corridor	Zonguldak Çaycuma Airport	QNQ	
	Samsun Çarşamba Airport	SZF	
Plateau Corridor	Ordu-Giresun Airport	OGU	
	Trabzon Airport	TZX	
	Rize-Artvin Havalimanı	RZV	
Trakya Cultural Corridor	Tekirdağ Çorlu Airport	TEQ	

3.1. CILOS (Criterion Impact Loss) Method

The recently introduced CILOS (Criterion Impact Loss) method is employed to determine the comparative impact loss experienced by other evaluation criteria when a particular criterion is regarded as the most significant (Mazman İtik & Sel, 2021). This method focuses on the loss of effectiveness among criteria, and its procedural steps are outlined as follows (Çilek, 2023; Macit, 2023):

Step 1: Construction of the Initial Decision Matrix

The decision matrix is constructed in accordance with Equation (1).

$$A = [a_{ij}]_{m*n} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}, i = 1,2,\ldots,m; j = 1,2,\ldots n. \quad (1)$$

Step 2: Conversion of Cost-Oriented Criteria into Benefit-Oriented Criteria

Since all criteria are required to be benefit-oriented in this method, any cost-oriented criteria must be converted into benefit-oriented ones using Equation (2) (Podvezko et al., 2020).

$$a_{ij} = \frac{\min a_{ij}}{a_{ij}} \quad (2)$$

Step 3: Normalization Calculation

If any cost-oriented criteria existed in the initial decision matrix, they were previously converted into benefit-oriented criteria using Equation (2). Each element of the resulting decision matrix is then normalized using Equation (3), thus producing the normalized decision matrix.

$$x_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \quad (3)$$

Step 4: Construction of the S Criterion Square Matrix

The maximum value of each criterion in the normalized decision matrix is calculated using Equation (4). The rows containing these maximum values are then combined to form the S square matrix.

$$s_j = max_i q_{ij} = s_{k_{ij}} \qquad i,j \in \{1, 2, ..., n\} \quad (4)$$

To formulate the S square matrix, the maximum value of the j-th criterion taken from the decision matrix with k_l rows corresponds to s_{kj}^{j}. $s_{ij} = s_{k_{ij}}$ ve $s_{ij} = s_j$

Step 5: Construction of the Relative P Loss Matrix

Using the data obtained in the fourth step of the method, each element of the relative loss matrix is calculated using Equation (5), resulting in the formation of the P matrix. Here, p_{ij} represents the relative impact loss of the j-th criterion.

$$p_{ij} = \frac{s_{jj} - s_{ij}}{s_{jj}}, p_{ii} = 0, \quad i,j \in \{1,2,\ldots,n\} \quad (5)$$

Step 6: Construction of the F Matrix

The F matrix is constructed by applying the format of Equation (6) to the elements of the relative P loss matrix.

$$F = \begin{bmatrix} -\sum_{i=1}^{m} p_{i1} & p_{12} & \cdots & p_{1m} \\ p_{21} & -\sum_{i=1}^{m} p_{i2} & \cdots & p_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ p_{m1} & p_{m2} & \cdots & -\sum_{i=1}^{m} p_{im} \end{bmatrix} \quad (6)$$

Step 7: Solving the Linear Equation System

In the final step of the method, the linear equation presented in Equation (7) is solved to obtain the W weight vector, which contains the normalized weight elements (w_1, w_2, ..., w_m) corresponding to the criteria.

$$F \cdot W^T = 0 \quad (7)$$

3.2. AROMAN Method

The AROMAN method was introduced into the literature by Bošković et al. (2023). Unlike other multi-criteria decision-making (MCDM) methods, this approach combines the normalized data obtained from a two-step normalization process and generates an averaged matrix from the resulting normalized values. The key advantage of this method lies in the application of dual normalization, which enhances the objectivity of the results (Bošković et al., 2023a; Bošković et al., 2023b). Furthermore, the method offers a robust and practical alternative for ranking by avoiding complex formulas and computations (Kara et al., 2024). The procedural steps of the method are outlined below (Bakır & İnce, 2024; Macit, 2023):

Step 1: Construction of the Initial Decision Matrix

In this step, the decision matrix is formed using Equation (1).

Step 2: Normalization of the Decision Matrix

Using Equations (8) and (9), both linear normalization for benefit criteria and vector normalization for cost criteria are applied accordingly.

Step 2.1: Linear Normalization

$$t_{ij} = \frac{x_{ij} - x_{min}}{x_{mak} - x_{min}}, i = 1,2,\ldots,m; j = 1,2,\ldots,n. \quad (8)$$

Step 2.2: Vector Normalization

$$t_{ij}^{*} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, i = 1,2,\ldots,m; j = 1,2,\ldots,n. \quad (9)$$

Step 2.3: Construction of the Combined and Averaged Normalization Matrix

In this step, an arithmetic mean is utilized to merge the normalized values obtained from Equations (8) and (9) by applying Equation (10). The parameter β appearing in this formulation represents a weighting factor that ranges between 0 and 1. Bošković et al. (2023b) recommend using a value of 0.5 for the β parameter.

$$t_{ij}^{norm} = \frac{\beta t_{ij} + (1-\beta) t_{ij}^{*}}{2}, i = 1,2,\ldots,m; j = 1,2,\ldots,n. \quad (10)$$

Step 3: Weighting the Combined and Averaged Normalized Matrix

The elements of the normalized matrix obtained in Step 2.3 are multiplied by the corresponding criterion weights using Equation (11).

$$\hat{t}_{ij} = W_{ij} \times t_{ij}^{norm}, i = 1,2,\ldots,m; j = 1,2,\ldots,n. \quad (11)$$

Step 4: Aggregation of Weighted Normalized Values for Benefit (A_i) and Cost (L_i) Criteria

In this step of the method, the weighted normalized values related to the criteria are aggregated using Equation (12) for benefit-oriented criteria and Equation (13) for cost-oriented criteria.

$$L_i = \sum_{j=1}^{n} \hat{t}_{ij}^{(min)}, i = 1,2,\ldots,m; j = 1,2,\ldots,n. \quad (12)$$

$$A_i = \sum_{j=1}^{n} \hat{t}_{ij}^{(mak)}, i = 1,2,\ldots,m; j = 1,2,\ldots,n. \quad (13)$$

Step 5: Exponentiation of A_i and L_i Values by the Power of λ

In the formula, the parameter λ represents the coefficient reflecting the type of criterion. In other words, λ denotes the ratio of cost-oriented criteria to the total number of criteria. In this study, seven criteria were used, three of which are cost-oriented; thus, the value of λ is 3/7. The corresponding operations are carried out using Equations (14) and (15), respectively.

$$L_i^{\wedge} = L_i^{\lambda} = \left(\sum_{j=1}^{n} \hat{t}_{ij}^{(min)}\right)^{\lambda}, \; i = 1,2,\ldots,m; j = 1,2,\ldots,n. \quad (14)$$

$$A_i^{\wedge} = A_i^{1-\lambda} = \left(\sum_{j=1}^{n} \hat{t}_{ij}^{(mak)}\right)^{1-\lambda}, \; i = 1,2,\ldots,m; j = 1,2,\ldots,n. \quad (15)$$

Step 6: Final Ranking of the Alternatives

In the final step of the method, the R_i value is calculated using Equation (16). The obtained R_i value reflects the benefit score of each alternative. Accordingly, the alternative with the highest R_i value is considered the most optimal option.

$$R_i = L_i^{\lambda} + A_i^{(1-\lambda)} = 1,2,\ldots,m; j = 1,2,\ldots,n. \quad (16)$$

4. Findings

This section presents the findings obtained through the implementation of the integrated methods applied in the study, following a step-by-step approach.

4.1. Findings from the CILOS Method Analysis

The first step of the method, the construction of the decision matrix, was performed in accordance with Equation (1). The resulting decision matrix is presented in Table 2. The same decision matrix was used for both the CILOS and AROMAN methods. While constructing the matrix, the annual averages of the relevant criteria for each airport during the period 2020–2023 were calculated. Some studies using multi-criteria decision-making methods and average values are as follows; Temizel & Bayçelebi (2016) analysed the financial ratios of enterprises operating in the textile manufacturing sector using for year averages. Avcı & Çınaroğlu (2018) used five year averages of financial ratios of airline companies. Akçakanat et al. (2018) worked with six year averages in their research evaluating banks. Subsequently, the data were organized according to the tourism development corridors, which constitute the core focus of the study, and an average decision matrix was obtained accordingly.

Table 2. Initial Decision Matrix

Tourism Corridors	Terminal Area	Distance to City Center	Commercial Aircraft Traffic	Passenger Traffic	Freight Traffic	Cargo Traffic	Number of Employees
Olive Corridor	15785.33	47.33	14534.83	154350.33	1386.83	11.36	168.83
Winter Corridor	24926.00	9.13	3505.50	455082.75	4118.81	54.63	123.94
Faith Corridor	37245.06	24.00	8373.88	981564.31	9932.19	403.19	160.50
Silk Road Corridor	182000.00	28.00	70434.00	8205673.25	87537.50	12211.50	772.00
Western Black Sea Coastal Corridor	1430.00	8.00	895.50	75976.50	1422.25	0.50	10.00
Plateau Corridor	21038.67	30.30	12496.43	1459040.07	14637.07	346.79	174.27
Trakya Cultural Corridor	6521.00	51.00	24529.00	27115.00	2592.25	1059.50	158.00

Since terminal area, distance to the city center, and number of employees in Table 2 are cost-oriented criteria, they were converted into benefit-oriented criteria using Equation (2). The decision matrix resulting from this transformation is presented in Table 3.

Table 3. Decision Matrix After Cost-to-Benefit Criteria Transformation

	min→max	min→max	max	max	max	max	min→max
Tourism Corridors	**Terminal Area**	**Distance to City Center**	**Commercial Aircraft Traffic**	**Passenger Traffic**	**Freight Traffic**	**Cargo Traffic**	**Number of Employees**
Olive Corridor	0.091	0.169	14534.833	154350.333	1386.833	11.358	0.059
Winter Corridor	0.057	0.877	3505.500	455082.750	4118.813	54.625	0.081
Faith Corridor	0.038	0.333	8373.875	981564.313	9932.188	403.188	0.062
Silk Road Corridor	0.008	0.286	70434.000	8205673.250	87537.500	12211.500	0.013
Western Black Sea Coastal Corridor	1.000	1.000	895.500	75976.500	1422.250	0.500	1.000
Plateau Corridor	0.068	0.264	12496.429	1459040.071	14637.071	346.786	0.057
Trakya Cultural Corridor	0.219	0.157	24529.000	27115.000	2592.250	1059.500	0.063

Based on the decision matrix presented in Table 3, normalization was performed using the formula defined in Equation (3), and the resulting normalized decision matrix is shown in Table 4.

Table 4. Normalized Decision Matrix

Tourism Corridors	Terminal Area	Distance to City Center	Commercial Aircraft Traffic	Passenger Traffic	Freight Traffic	Cargo Traffic	Number of Employees
Olive Corridor	0.061	0.055	0.108	0.014	0.011	0.001	0.044
Winter Corridor	0.039	0.284	0.026	0.040	0.034	0.004	0.060
Faith Corridor	0.026	0.108	0.062	0.086	0.082	0.029	0.047
Silk Road Corridor	0.005	0.093	0.523	0.722	0.720	0.867	0.010
Western Black Sea Coastal Corridor	0.675	0.324	0.007	0.007	0.012	0.000	0.749
Plateau Corridor	0.046	0.086	0.093	0.128	0.120	0.025	0.043
Trakya Cultural Corridor	0.148	0.051	0.182	0.002	0.021	0.075	0.047

Each element in the normalized decision matrix was processed using Equation (4) to determine the maximum values for each criterion. The rows containing these maximum values were then combined to form the S square matrix, which is presented in Table 5.

Table 5. S Criterion Square Matrix

Criterions	Terminal Area	Distance to City Center	Commercial Aircraft Traffic	Passenger Traffic	Freight Traffic	Cargo Traffic	Number of Employees
Terminal Area	0.675	0.324	0.007	0.007	0.012	0.000	0.749
Distance to City Center	0.675	0.324	0.007	0.007	0.012	0.000	0.749
Commercial Aircraft Traffic	0.005	0.093	0.523	0.722	0.720	0.867	0.010
Passenger Volume	0.005	0.093	0.523	0.722	0.720	0.867	0.010
Freight Traffic	0.005	0.093	0.523	0.722	0.720	0.867	0.010
Cargo Traffic	0.005	0.093	0.523	0.722	0.720	0.867	0.010
Number of Employees	0.675	0.324	0.007	0.007	0.012	0.000	0.749

Following the construction of the S criterion square matrix presented in Table 5, Equation (5) was employed in the fourth step of the method to generate the relative P loss matrix, which is provided in Table 6.

Table 6. Construction of the Relative P Loss Matrix

Criterions	Terminal Area	Distance to City Center	Commercial Aircraft Traffic	Passenger Traffic	Freight Traffic	Cargo Traffic	Number of Employees
Terminal Area	0.000	0.000	0.987	0.991	0.984	1.000	0.000
Distance to City Center	0.000	0.000	0.987	0.991	0.984	1.000	0.000
Commercial Aircraft Traffic	0.992	0.714	0.000	0.000	0.000	0.000	0.987
Passenger Traffic	0.992	0.714	0.000	0.000	0.000	0.000	0.987
Freight Traffic	0.992	0.714	0.000	0.000	0.000	0.000	0.987
Cargo Traffic	0.992	0.714	0.000	0.000	0.000	0.000	0.987
Number of Employees	0.000	0.000	0.987	0.991	0.984	1.000	0.000

The elements of the relative P matrix were transformed according to the format of Equation (6) to construct the F matrix, which is presented in Table 7. Furthermore, based on the F matrix in Table 7, the linear equation system defined in Equation (7) was solved, and the weights of the criteria were determined accordingly.

Table 7. F Matrix and the Derived Weight Values

Criterions	Terminal Area	Distance to City Center	Commercial Aircraft Traffic	Passenger Traffic	Freight Traffic	Cargo Traffic	Number of Employees
Terminal Area	-3.969	0.000	0.987	0.991	0.984	1.000	0.000
Distance to City Center	0.000	-2.857	0.987	0.991	0.984	1.000	0.000
Commercial Aircraft Traffic	0.992	0.714	-2.962	0.000	0.000	0.000	0.987
Passenger Traffic	0.992	0.714	0.000	-2.972	0.000	0.000	0.987
Freight Traffic	0.992	0.714	0.000	0.000	-2.951	0.000	0.987
Cargo Traffic	0.992	0.714	0.000	0.000	0.000	-3.000	0.987
Number of Employees	0.000	0.000	0.987	0.991	0.984	1.000	-3.948
w_j	0.1351	0.1877	0.1358	0.1353	0.1363	0.1341	0.1358

Upon examining Table 7, it was determined that the criterion “distance to the city center” holds the highest level of importance compared to the other criteria, with a weight value of 0.1847. The obtained criterion weights were subsequently integrated into the AROMAN method and used in the ranking of the alternatives.

4.2. Findings from the AROMAN Method Analysis

The initial phase of the method, the construction of the decision matrix, is presented in Table 2. In the second step, the decision matrix was normalized. At this stage, two distinct normalization procedures were applied: linear normalization, performed using Equation (8), and vector normalization, applied using Equation (9). The results from both normalization techniques were then combined using Equation (10). The resulting Combined and Averaged Normalization Matrix is presented in Table 8.

Table 8. Combined and Averaged Normalization Matrix

Tourism Corridors	Terminal Area	Distance to City Center	Commercial Aircraft Traffic	Passenger Traffic	Freight Traffic	Cargo Traffic	Number of Employees
Olive Corridor	0.0407	0.2776	0.0937	0.0092	0.0078	0.0005	0.0994
Winter Corridor	0.0654	0.0535	0.0226	0.0271	0.0230	00022	0.0730
Faith Corridor	0.0988	0.1408	0.0540	0.0584	0.0555	0.0164	0.0945
Silk Road Corridor	0.4902	0.1642	0.4541	0.4881	0.4892	0.4977	0.4546
Western Black Sea Coastal Corridor	0.0019	0.0469	0.0058	0.0045	0.0079	0.0000	0.0059
Plateau Corridor	0.0549	0.1777	0.0806	0.0868	0.0818	0.0141	0.1026
Trakya Cultural Corridor	0.0157	0.2991	0.1582	0.0016	0.0145	0.0432	0.0930

Equation (11) was used to weight the values in Table 8. In this weighting process, the criterion weights obtained from the CILOS method were employed. The results of the weighting of the Combined and Averaged Normalization Matrix are presented in Table 9.

Table 9. Weighting of the Combined and Averaged Normalized Matrix

Tourism Corridors	Terminal Area	Distance to City Center	Commercial Aircraft Traffic	Passenger Traffic	Freight Traffic	Cargo Traffic	Number of Employees
Olive Corridor	0.0055	0.0521	0.0127	0.0012	0.0011	0.0001	0.0135
Winter Corridor	0.0088	0.0100	0.0031	0.0037	0.0031	0.0003	0.0099
Faith Corridor	0.0133	0.0264	0.0073	0.0079	0.0076	0.0022	0.0128
Silk Road Corridor	0.0662	0.0308	0.0617	0.0660	0.0667	0.0667	0.0617
Western Black Sea Coastal Corridor	0.0003	0.0088	0.0008	0.0006	0.0011	0.0000	0.0008
Plateau Corridor	0.0074	0.0334	0.0109	0.0117	0.0111	0.0019	0.0139
Trakya Cultural Corridor	0.0021	0.0561	0.0215	0.0002	0.0020	0.0058	0.0126

In the fourth step of the method, the values of A_i (for benefit-oriented criteria) and L_i (for cost-oriented criteria) were calculated using Equation (12) and Equation (13), respectively. The obtained A_i and L_i values were then exponentiated using Equation (14) for benefit criteria and Equation (15) for cost criteria, according to the power of λ. Finally, the final ranking of the alternatives was determined using Equation (16). The corresponding values are presented in Table 10.

Table 10. Values of L_i, A_i, L_i^λ, A_i^λ, and R_i

Tourism Corridors	L_i	A_i	$L_i^{\wedge}$	$A_i^{\wedge}$	R_i
Olive Corridor	3.9878	2.3222	1.8090	1.6184	3.4275
Winter Corridor	3.9881	2.2556	1.8091	1.5917	3.4008
Faith Corridor	3.9899	2.3310	1.8094	1.6219	3.4313
Silk Road Corridor	3.9943	2.5000	1.8103	1.6880	3.4984
Western Black Sea Coastal Corridor	3.9855	1.9886	1.8086	1.4811	3.2898
Plateau Corridor	3.9907	2.3170	1.8096	1.6163	3.4259
Trakya Cultural Corridor	3.9885	2.2792	1.8092	1.6012	3.4104

An analysis of the obtained R_i values revealed that the Silk Road Corridor, with a score of 3.4984, emerged as the most optimal alternative among the corridors. In contrast, the Western Black Sea Coastal Corridor was found to have a comparatively lower performance score than the other alternatives.

This study evaluated the airports located within Türkiye's Tourism Development Corridors. In Türkiye, there are seven designated tourism development corridors, within which 18 airports are situated. Based on the criteria identified through the review of the 2020–2023 activity reports published by the General Directorate of State Airports Authority (DHMI), relevant datasets were compiled. Since the study includes multiple criteria and multiple alternatives, the data were analyzed using multi-criteria decision-making (MCDM) methods. The CILOS method was utilized to determine the weight of each criterion, and these weights were then integrated into the AROMAN method to rank the alternatives, i.e., the tourism corridors.

According to the findings obtained from the CILOS method, "distance to the city center" was identified as the most important criterion, while "cargo traffic" was found to be the least significant. The overall ranking of criteria from most to least important is as follows, Table 11:

Table 11. The Relative Importance of the Criteria

Rank	Criteria	Weight
1	Distance to the City	0.1877
2	Freight Traffic	0.1363
3	Number of Employees	0.1358
4	Commercial Aircraft Traffic	0.1358
5	Passenger Volume	0.1353
6	Terminal Area	0.1351
7	Cargo Traffic	0.1341

After determining the criterion weights, they were integrated into the AROMAN method to rank the tourism development corridors. The resulting order of performance among the corridors is as follows, Table 12:

Table 12. Ranking of Alternatives

Rank	Alternatives	Weight
1	Silk Road Corridor	3.4984
2	Faith Corridor	3.4313
3	Olive Corridor	3.4275
4	Plateau Corridor	3.4259
5	Trakya Cultural Corridor	3.4104
6	Winter Corridor	3.4008
7	Western Black Sea Coastal Corridor	3.2898

The superior performance of the Silk Road Corridor can be primarily attributed to the proximity of the airport to the city center, which emerged as the most significant criterion. While this finding may appear to contradictory to conventional expectations regarding tourism-related airport preferences, it highlights the weight of the accessibility in the analysed MCDM framework. Especially for tourists who prioritise comfort and convenience, access time and ease of ground transport may influence airport selection, even if total travel time is not be primary concern (Kasarda & Lindsay, 2011; Halpern & Graham, 2013; Graham, 2018).

In addition to its proximity, the airport's accessibility to other transportation modes and its function as a transit hub are also believed to have contributed. Therefore, a passenger or tourist arriving at Ankara Esenboğa Airport likely prefers this location due to the ease of reaching other corridors or destinations.

In contrast, the Western Black Sea Coastal Corridor showed lower performance compared to other corridors, which may be explained by its geographical characteristics. The perpendicular orientation of mountains to the coastline impedes access via certain modes of transportation. It is also known that airport construction in this region has occasionally required land reclamation from the sea, a method that increases construction costs and is therefore not commonly preferred.

5. Conclusion

5.1. Theoretical Contrubitions

This study supports existing literature emphasizing the critical role of transportation infrastructure in the success of tourism development corridors (Kozak et al., 2010; Graham, 2018; Halpern & Graham, 2013). The physical and operational characteristics of airports (e.g., passenger volume, flight traffic, terminal capacity) were empirically tested using MCDM techniques in relation to tourism mobility. Notably, distance from the airport to the city center was found to be more influential than many traditional performance indicators. This finding aligns with studies highlighting the impact of accessibility on tourist preferences (Hall & Page, 2014; Kasarda & Lindsay, 2011).

Moreover, although variables such as passenger numbers and commercial flight frequency are frequently prioritized in airport performance assessments (Graham, 2018; Green, 2007), this study offers a critical perspective by identifying distance to the city as a more heavily weighted criterion. It contributes a novel dimension to the debate by suggesting that ease of access to tourist destinations may outweigh the physical capacity of an airport. Accordingly, spatial integration is emphasized as a key variable in tourism planning.

From a methodological perspective, the combined use of CILOS and AROMAN—both advanced MCDM techniques—introduces an innovative approach to tourism and transportation research. These methods are rarely applied together in tourism studies, and as such, the present research not only assesses airport performance but also provides a quantitative, systematic, and transparent framework for strategic tourism decision-making. The study offers a reconceptualized framework that reexamines the tourism–transportation relationship on both spatial and operational levels, thereby addressing conceptual gaps in the literature.

5.2. Practical Contrubitions

By emphasizing the critical role of airport performance in the effectiveness of tourism development corridors, this study yields important insights for transport and tourism policy-making. The analysis revealed that distance to the city center is the most decisive criterion, indicating that airport accessibility directly influences tourist choices. Therefore, enhancing intra-destination transport links and facilitating easier access to airports is a strategic necessity for improving regional tourism mobility.

The variation in corridor performance also indicates a regional disparity in transportation infrastructure, suggesting that some routes may require significant improvement. In this regard, the study offers a data-driven framework for policymakers to reassess investment priorities and supports strategic planning aimed at reinforcing transport–tourism integration.

6. Limitations and Directions for Future Research

This study has certain methodological and data-related limitations. First, the dataset used in the analysis was limited to the activity reports published by DHMI for the 2020–2023 period. As data for 2024 were not yet available, they could not be included in the study, which limits the interpretation of the results in terms of recent developments.

Moreover, provinces such as Ardahan, Mersin, Sakarya, Bolu, Karabük, Bartın, Kırklareli, and Edirne, which are part of the tourism development corridors but do not host active airports, were excluded from the analysis. Furthermore, major airports such as Antalya, Dalaman, Bodrum, İzmir Adnan Menderes, Istanbul Airpot and Sabiha Gökçen Airport, which are significant tourism gateways, were not included in the analysis since they are not explicitly associated with the corridors defined int he Türkiye Tourism Strategy 2023. This is a conscious limitation of the study, aligned with the objective of evaluating corridor-based airport performance. However, this point opens space for further research that compares corridor-integrated and high-capacity tourism airports. This exclusion may have impacted the representativeness of the geographic scope in corridor-based comparisons.

The criteria selection process was based on the airport performance evaluation model proposed by Kiracı and Durmuşçelebi (2022). However, due to the unavailability of income and expenditure data for Zonguldak Çaycuma Airport during 2020–2023, financial indicators were not included for this airport. This exclusion was due to the airport being operated by a private entity under DHMI supervision, which limits the public availability of financial data.

Regarding the Rize–Artvin Airport, only complete data for 2022 and 2023 were accessible. Limited data for 2021 (e.g., terminal area, distance to the city center, number of employees) were included, while the airport was not yet operational in 2020, rendering data for that year unavailable.

Future research may extend the time frame of the analysis and incorporate qualitative variables such as passenger satisfaction, service quality, and environmental sustainability. In addition, adopting mixed-method approaches that include stakeholder perspectives could provide a more holistic evaluation of airport performance in terms of socio-economic and environmental dimensions.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

References

Akçakanat, Ö., Aksoy, E., & Teker, T. (2018). CRITIC ve MDL temelli EDAS yöntemi ile E Tr-61 bölgesi bankalarının performans değerlendirmesi. Süleyman Demirel Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 1 (32), 1-24.

Avcı, T., & Çınaroğlu, E. (2018). AHP temelli TOPSIS yaklaşımı ile havayolu işletmelerinin finansal performans değerlemesi. Cumhuriyet Üniversitesi İktisadi ve İdari Bilimler Dergisi, 19 (1), 316-335.

Avcıkurt, C. (2023). Turizm sosyolojisi: Genel ve yapısal yaklaşım (7. bs.). Detay Yayıncılık: Ankara.

Bahar, O., & Kozak, M. (2018). Turizm ekonomisi (3. Baskı). Detay Yayıncılık: Ankara.

Bakır, M., & İnce, F. (2024). Havayolu işletmelerinde yolcu memnuniyetinin LOPCOW-AROMAN modeliyle analizi: star alliance stratejik ortaklığı uygulaması. Dumlupınar Üniversitesi Sosyal Bilimler Dergisi, (81), 168-189.

Bošković, S., Švadlenka, L., Jovčić, S., Dobrodolac, M., Jovčić, S., & Zanne, M. (2023a). An extended AROMAN method for cargo bike delivery concept selection. Decision Making Advances, 1(1), pp.1-9.

Bošković, S., Švadlenka, L., Jovčić, S., Dobrodolac, M., Simić, V., & Bacanin, N. (2023b). An alternative ranking order method accounting for two-step normalization (AROMAN)— A case study of the electric vehicle selection problem. IEEE, 11(23037967), 39496 –39507.

Bull, A. (1991). The economics of travel and tourism. Pitman Publishing.

Çilek, A. (2023). Piyasa yapıcı bankaların performanslarının sıralanması: CILOS, MARCOS ve COPELAND çok kıstaslı karar verme analizi. Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, Sayı 54, Denizli, ss. 1-24.

Çolak, O., & Batman, O. (2021). Turizmin sosyo-kültürel etkileri: Taraklı'da bir araştırma. Güncel Turizm Araştırmaları Dergisi, 5, 149–174.

Cook, P. (n.d.). Alliances, linkages and challenges: The Queensland Heritage Trails Network. Australia ICOMOS. https://www.aicomos.com/wp-content/uploads/Alliances-Linkages-and-Challenges-the-Queensland-Heritage-Trails-Network.pdf

Council of Europe. (n.d.). The Santiago de Compostela Pilgrim Routes. Retrieved March 10, 2025, from https://www.coe.int/en/web/cultural-routes/the-santiago-de-compostela-pilgrim-routes

DHMİ 2020 Faaliyet Raporu (Access date: 21.01.2025). https://www.dhmi.gov.tr/Lists/FaaliyetRaporlari/Attachments/21/DHMI_2020_Faaliyet_Raporu.pdf

DHMİ 2021 Faaliyet Raporu (Access date: 20.01.2025). http://www.sp.gov.tr/upload/xSPRapor/files/xUR3Q+DHMI_21_FR.pdf

DHMİ 2022 Faaliyet Raporu (Access date: 19.01.2025). https://www.dhmi.gov.tr/Lists/FaaliyetRaporlari/Attachments/23/2022-faaliyet-raporu.pdf

DHMİ 2023 Faaliyet Raporu (Access date:.01.2025). https://www.dhmi.gov.tr/Lists/FaaliyetRaporlari/Attachments/24/Faaliyet-Raporu-2023.pdf

Dobruszkes, F. (2013). The geography of European low-cost airline networks: a contemporary analysis. Journal of Transport Geography, 28, 75-88.

Duval, D. T. (2013). Critical issues in air transport and tourism. Tourism Geographies, 15(3), 494–510.

Graham, A. (2018). Managing airports: An international perspective (5th ed.). Routledge.

Green, R. (2007). Airports and economic development. Real Estate Economics, 35, 91-112.

Güngör, A., & İlban, M. O. (2020). Havayolu ulaştırma hizmetlerinin turizm talebi üzerindeki etkisinin belirlenmesi: edremit ve Güllük Körfezi örneği. Güncel Turizm Araştırmaları Dergisi, 4(1), 70-86.

Hall, C. M., & Page, S. J. (2014). The geography of tourism and recreation: Environment, place and space (4th ed.). Routledge.

Halpern, N., & Graham, A. (2013). Airport marketing (1st ed.). Routledge.

Kara, K., Yalçın, G. C., Acar, A. Z., Simic, V., Konya, S., & Pamucar, D. (2024). The MEREC AROMAN method for determining sustainable competitiveness levels: A case study for Türkiye. Socio-Economic Planning Sciences, 91, 101762.

Kasarda, J. D. & Lindsay, G. (2011). Aerotropolis: The way we'll live next. Farrar, Straus and Giroux.

Kavaklı, E., & Karakaş, A. (2022). Turizmin bölgesel kalkınmaya etkisi üzerine bir inceleme. Bartın Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 13(25), 37–50.

Kiracı, K., & Durmuşçelebi, C. (2022). Türkiye'de havaalanı performansının CRITIC temelli EDAS yöntemiyle analizi. Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi, 10(2), 837-856.

Kozak, N., Kozak, M. A. & Kozak, M. (2010). Genel turizm: İlkeler- kavramlar. Detay Yayıncılık: Ankara.

Kültür ve Turizm Bakanlığı. (2007). Türkiye Turizm Stratejisi 2023 ve eylem planı (2007–2013). Ankara: T.C. Kültür ve Turizm Bakanlığı Yayınları.

Macit, N. Ş. (2023). Evaluation of the macroeconomic performance of selected European and central asıan countrıes by CILOS based AROMAN method.

Martín, J. C., & Roman, C. (2001). An application of DEA to measure the efficiency of Spanish airports prior to privatization. Journal of Air Transport Management, 7(3), 149-157

Mazman İtik, Ü. & Sel, A. (2021). Borsa İstanbul'da işlem gören perakende ticaret sektörü şirketlerinin finansal performansının CILOS ağırlıklandırma ve TOPSIS yöntemiyle incelenmesi: 2013-2019. Itobiad: Journal of the Human & Social Science Researches, 10(3), 2769-2795.

Meyer, D. (2004, April). Tourism routes and gateways: Key issues for the development of tourism routes and gateways and their potential for pro-poor tourism (Working Paper No. 220). Overseas Development Institute.

Murphy, P. E. (1985). Tourism. A Community Approach. New York-London: Methuen.

Page, S. J. (2004). Transport and tourism. In A. A. Lew, C. M. Hall, & A. M. Williams (Eds.), A companion to tourism (pp. 146–158). Blackwell Publishing.

Özsoy, V. S., & Örkcü, H. H. (2021). Structural and operational management of Turkish airports: a bootstrap data envelopment analysis of efficiency. Utilities Policy, 69, 101180.

Page, S., & Getz, D. (1997). The business of rural tourism: International perspectives. International Thomson Business Press.

Podvezko, V., Zavadskas, E. K., & Podviezko, A. (2020). An extensıon of the new objectıve weıght assessment methods CILOS and IDOCRIW to Fuzzy MCDM. Economic Computation & Economic Cybernetics Studies & Research, 54(2), 59-75.

Sharpley, R., & Sharpley, J. (1997). Rural tourism: An ıntroduction. International Thompson Business Press.

Sharpley, R. (2018). Tourism, tourists and society (5th ed.). Routledge.

Temizel, D. D. F., & Bayçelebi, B. E. (2016). Finansal oranların TOPSIS sıralaması ile yıllık getiriler arasındaki ilişki: Tekstil imalatı sektörü üzerine bir uygulama. Anadolu Üniversitesi Sosyal Bilimler Dergisi, 16 (2), 159-170.

Yıldırım, H. M., & Köse, C. M. (2022). Düşük maliyetli havayolu şirketlerinin web sitelerinin analizi ve görsel içerik çözümlemesi. Selçuk Turizm ve Bilişim Araştırmaları Dergisi, 1(2), 43-61.

Yu, M. M. (2010). Assessment of airport performance using the SBM-NDEA model. Omega, 38(6), 440-452.

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