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Measuring the Performance of Airport Operations in Türkiye with The MPSI Based MABAC Method

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ABSTRACT

Purpose: The purpose of this study is to evaluate the air transportation performances of airports in Türkiye with the MPSI-based MABAC method, using data between 2015 and 2024.

***Methodology*:** MPSI (Modified Preference Selection Index Method) based MABAC (Multi Attributive Border Approximation Area Comparison) method was used in the study. The MPSI method was applied to determine objective criterion weights, and the MABAC method was applied to rank airports according to their performance and compare their performances.

Findings: As a result of the analysis, the airport with the highest performance in the period covered by the study is Istanbul Airport. Sabiha Gökçen Airport is in second place. In third place is Ankara Esenboğa between 2015 and 2018, İzmir Adnan Menderes in 2020, and Antalya Airport in other periods. The airports with the lowest performance were Çanakkale Gökçeada Airport in 2015, 2016, 2019, 2022 and 2024, Siirt Airport in 2018, and Balıkesir Merkez Airport in 2017, 2020, 2021 and 2023.

Originality: In the literature review, no study was found in which the MPSI and MABAC methods used in the current study were used together in measuring the performance of airports in Türkiye and around the world.

Keywords*:* Performance Management, Airports, MPSI, MABAC.

JEL Codes: L23, L93, C02.

Türkiye'deki Havalimanları İşletmelerinin Performanslarının MPSI Tabanlı MABAC Yöntemi İle Ölçülmesi

ÖZET

Amaç: Bu çalışmanın amacı, Türkiye'deki havalimanlarının 2015-2024 yılları arasındaki verileri kullanılarak, hava taşımacılık performanslarının MPSI tabanlı MABAC yöntemi ile değerlendirilmesidir.

***Yöntem*:** Çalışmada MPSI (Değiştirilmiş Tercih Seçim İndeksi) tabanlı MABAC (Çok Nitelikli Sınır Yakınlık Alanı Kıyaslaması) yöntemi kullanılmıştır. MPSI yöntemi objektif kriter ağırlıklarının belirlenmesi, MABAC yöntemi de havalimanlarının performanslarına göre sıralanması ve performanslarının karşılaştırılması amacı ile uygulanmıştır.

Bulgular: Analizler sonucunda, çalışmanın kapsadığı dönemde en yüksek performansa sahip havalimanı İstanbul Havalimanı'dır. İkinci sırada Sabiha Gökçen Havalimanı yer almaktadır. Üçüncü sırada, 2015-2018 yılları arasında Ankara Esenboğa, 2020 yılında İzmir Adnan Menderes, diğer dönemlerde ise Antalya Havalimanı görülmektedir. En düşük performansa sahip havalimanları 2015, 2016, 2019, 2022 ve 2024 yıllarında Çanakkale Gökçeada Havalimanı, 2018 yılında Siirt Havalimanı, 2017, 2020, 2021 ve 2023 yıllarında da Balıkesir Merkez Havalimanı olmuştur.

Özgünlük: Yapılan literatür taramasında, Türkiye'deki ve dünyadaki havalimanlarının performanslarının ölçülmesinde, mevcut çalışmada kullanılan MPSI ve MABAC yöntemlerinin birlikte kullanıldığı bir çalışmaya rastlanmamıştır.

Anahtar Kelimeler*:* Performans Yönetimi, Havalimanları, MPSI, MABAC.

JEL Kodları: L23, L93, C02.

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1. INTRODUCTION

Air transportation is defined as “The airborne movement of people, load (cargo) and mail aerial displacement by an aircraft, in a way that provides space and time benefits.” In addition to flights made for profit purposes, flights made for personal purposes also fall within the scope of this definition (Gerede, 2015). The aviation industry continues to develop with increasing momentum day by day. The most important reason for this is that air transportation is fast and reliable. The increase in demand in air transportation has led to an increase in airport investments. With airport investments, the number of domestic flight destinations has increased. Additionally, with the addition of new destinations to the international flight network, the Turkish aviation sector has shown a significant development. There are currently 57 airports in Türkiye (SHGM, 2023).

Airport investments are very costly investments. The investment cost for vehicles used for air transportation is also quite high and the carrying capacity of these vehicles is limited. Therefore, effective and efficient operation of airports is very important for the aviation industry.

This study aims to measure the performance of airports in Türkiye using total movements traffic, commercial movements traffic, passenger traffic, freight traffic and cargo traffic criteria. For this purpose, analyzes were carried out using the MPSI-based MABAC method.

Unlike other multi-criteria decision-making techniques, the MPSI method does not require determining the relative weights of the criteria. For this reason, it is preferred in cases where it is difficult to determine relative criterion weights. Instead of relative criterion weights values, preference index values are usually calculated. The preference index value is determined for each alternative. It is based on the variation between normalized values and mean values for each criterion using Euclidean distance. Thus, criterion weights can be determined objectively (Gligorić et al., 2022).

The MABAC method is a method that has a simple calculation process and reliable results can be obtained. It also has a number of advantages, such as easy integration with other decision-making methods and taking into account the potential value of profit and loss (Wang et al., 2024).

The number of studies using these methods in the literature is quite limited. No study has been found in which both methods were used integratedly. For this reason, in this study, MPSI was preferred as the criterion weighting method and MABAC was preferred as the method of ranking airports according to their performance. In addition, these methods are used for the first time in evaluating the performance of airports. In the literature, it can be seen that Data Envelopment Analysis (DEA) is mainly used by researchers to evaluate the performance of airports in Türkiye. DEA is a method based on linear programming and used to evaluate the effectiveness of similar decision-making units. For this reason, DEA is used to compare production units that use similar inputs and produce similar outputs by considering inputs and outputs together. It also prolongs the solution process for large-sized problems. By applying the MPSI-based MABAC method, evaluation can be made by taking only inputs, only outputs, or inputs and outputs together as decision criteria, and solutions for large-scale problems can be easily obtained. For this reason, MPSI and MABAC methods were used in this study as an advantageous alternative to existing methods. Therefore, this study is expected to contribute to the literature.

In this context, within the scope of the study, firstly, general information about the subject and aims of the study is given in the introduction section. In the second section, the literature research, the literature on the performance measurement of airports and studies conducted using MPSI and MABAC methods was examined in detail, and information was given about previous studies on the subject. The third section includes the application steps of MPSI and MABAC methods. In the findings section; the purpose, scope, method, population and data collection process of the research are explained. To determine the performance of airports, analyzes were made with the MPSI based MABAC method and the findings were presented in detail. Finally, a general evaluation was made regarding the results achieved and suggestions were developed.

2. LITERATURE REVIEW

In this section, information is given about the performance measurement of airports and the studies carried out using MPSI and MABAC methods.

2.1. Literature Review on Airport Performance Measurement

Oum et al. (2005) evaluated the performance of 10 major airlines in North America during the period 1990-2001. For this purpose, indicators such as revenue, number of employees, average cost per employee, average stage length, weight load factor, passenger revenue, freight revenue and incidental revenue were used. Airlines' gross total factor productivity, cost competitiveness and average yields were measured and compared.

Ömürbek et al. (2013) divided 40 airports affiliated with the General Directorate of State Airports Authority in Türkiye into large, medium-sized and small airports according to flight traffic and passenger traffic and measured their efficiency with data envelopment analysis (DEA). As a result of the study, information was given about airports that can be reference for ineffective airports. Among the major airports, Atatürk and Antalya airports are effective, while Muğla Dalaman Airport is an ineffective airport. Among the medium-sized airports, Samsun Çarşamba, Kayseri, Van Ferit Melen and Malatya airports are effective airports. Among the small airports, Balıkesir Körfez, Adıyaman, Sinop and Amasya Merzifon airports are effective airports. There is no ineffective airport in medium-sized and small airports.

Using data from 2013-2014, Avcı and Aktaş (2015) investigated the activity in domestic and international flights, which shows the current performance of airports in Türkiye in summer and winter. For this purpose, operational data regarding the number of personnel, terminal area, number of passengers, load voltage and the total aircraft network are used. Analyzes were carried out using the data envelopment analysis (DEA) method. As a result of the study, the airport with the highest efficiency in the summer period of 2013 was determined as Atatürk Airport, the airport with the lowest efficiency as Esenboğa Airport, the airport with the highest efficiency in the summer period of 2014 as Atatürk Airport, the airport with the lowest efficiency as Erzurum Airport, the airport with the highest efficiency as Nevşehir Airport and the airport with the lowest efficiency as Şanlıurfa Airport. The airport with the highest efficiency in the winter period of 2013 was determined as Atatürk Airport, the airport with the lowest efficiency was Elazığ Airport, the airport with the highest efficiency in the winter period of 2014 was determined as Atatürk Airport, the airport with the lowest efficiency as Şanlıurfa Airport, the airport with the highest efficiency as Denizli Airport and the airport with the lowest efficiency as Kayseri Airport.

Kiracı and Bakır (2019) examined the financial performance of 13 airline companies (Air Canada, Air France, Air New Zealand, Alaska Air, China Eastern, China Southern, Delta Air, Lufthansa, Qantas Airways, Republic Airways, Singapore Airlines, Skywest and United Continental) with 10 million-150 million passengers in terms of the number of passengers carried, before and after the global financial crisis, using data for the period 2005-2012. The decision criteria were determined as seat miles offered, cost per seat mile offered, revenue per seat mile offered, paid passenger miles and revenue per passenger mile. The CRITIC method was used to determine the importance levels of the criteria used in the study, and the EDAS method was used to rank the airline companies according to their financial performance. As a result of the study, it was seen that the financial performance of all airline companies except China Eastern was higher before the global financial crisis, and that airline companies were also affected by the global financial crisis in the years after the crisis. In addition, it was determined that 2010 was the year in which the negative effects of the financial crisis were felt the most for airline companies.

Mercan and Atalay (2021) evaluated the performances of airports operating in Türkiye with clustering and TOPSIS methods, using the criteria of the number of domestic and international aircraft, the number of domestic and international passengers, the number of domestic and international commercial aircraft, and the amount of domestic and international cargo. In the study, airports were first divided into nine clusters using the hierarchical clustering method according to the criteria. Criteria weights were determined by taking expert opinion. The performances of the obtained clusters were evaluated with the TOPSIS method. As a result of the study, in terms of criteria, the effective airports are Istanbul Airport in Cluster 5, Istanbul Sabiha Gökçen Airport in Cluster 9, Antalya Airport in Cluster 6, Istanbul Atatürk Airport in Cluster 8, Ankara Esenboğa and İzmir Adnan Menderes Airport in Cluster 7; Airports in Cluster 4, Cluster 3 and Cluster 2 were determined as less efficient airports, and airports in Cluster 1 were determined as ineffective airports. In addition, intra-cluster performance values and airport rankings were made for each cluster.

Kaya et al. (2022) analyzed the efficiency of 39 international airports in Türkiye with an integrated method consisting of super-efficient data envelopment analysis (DEA) and eigenvector centrality analysis. Additionally, the Simar-Wilson bootstrapping approach was used to identify important factors affecting efficiency. As a result of the study, it was seen that the most effective airports were Istanbul Atatürk, Adana and Diyarbakır airports, which were closed in 2019.

In his study, Aydın (2023) proposed a hybrid efficiency analysis approach consisting of the integration of principal component analysis (PCA), categorical data envelopment analysis (DEA) and Simar-Wilson methods for airport efficiency analysis. It carried out an application with the data of the airports in Türkiye for the period 2013-2021. According to the results of the efficiency analysis, the airport that used its resources most effectively among large-scale airports was Atatürk Airport, while after the opening of Istanbul Airport, it became Sabiha Gökçen Airport. Uşak Airport is the only active small-scale airport. In addition, as a result of the application of the Simar-Wilson method used for the analysis of environmental impacts, it was stated that the GDP (Gross Domestic Product) values of the provinces where the airports are located do not have a statistically significant effect on the activities of the airports, on the other hand, although it has a small effect, the increase in the population of the provinces positively affects the airport performance and is statistically significant.

2.2. MPSI Method Literature Review

Gligorić et al. (2022) proposed a new method based on the hybrid MPSI-MARA decision-making model for support system selection in an underground mine. The proposed model was tested on a hypothetical sample and a comparative analysis was conducted. As a result of the study, it was seen that the model is a very useful and effective tool to solve different multi-criteria decision-making problems.

In his study, Yılmaz (2023) analyzed the financial data of multi-branch deposit banks in Türkiye with the MPSI-MARA integrated ranking model. Seven different financial ratios were used as performance criteria to carry out the analysis. The MPSI method was preferred for weighting the selected criteria, and the MARA method was preferred for ranking the banks according to their performance.

Akbulut and Aydın (2024) analyzed the multidimensional sustainability performances of deposit banks operating in the Turkish banking sector. For this purpose, a new approach consisting of MSD and MPSI methods for determining criterion weights and RAWEC methodologies for ranking has been developed. Additionally, sensitivity analyzes and benchmarking analyzes were conducted to test the proposed model.

2.3. MABAC Method Literature Review

Chatterjee et al (2018) applied hybrid D-ANP-MABAC methods for risk management in construction projects. They developed the extended MABAC method in D numbers to rank and select the best alternative risk response strategy. He also conducted sensitivity analysis of the resulting ranking of the hybrid D-ANP-MABAC model to check the feasibility of the proposed approach.

Božanić, Jovo and Tešić (2018) conducted a study based on fuzzification of the MABAC method in order to select the most suitable location for bridge construction.

In his study, Ulutaş (2019) proposed a multi-criteria decision-making model in which Entropy and MABAC methods were used together to determine the most suitable marketing manager for a furniture workshop.

In their work, Wang et al. (2020) introduced the q-step orthopair fuzzy MABAC model by taking into account some basic theories of the traditional MABAC model and the q-step orthopair fuzzy set.

Altın (2021) used the MABAC method to measure the financial performance of companies traded on Borsa Istanbul that declared profits in the 2020-9 balance sheet period. Market value / Book value, price / earnings, market value and net profit were taken as decision criteria.

Mandal and Seikh (2023) introduced a hybrid multi-attribute group decision-making method based on the entropy method, deviation-based method and MABAC method to select the most effective plastic waste management process. In this model, entropy and deviation-based methods were used to calculate the decision experts and attribute weights, respectively. They also used the MABAC method to evaluate the priority order of plastic waste management options.

Ran (2023) a new method for performance evaluation of sustainable microfinance group loans is proposed. A numerical example is given in the study and some comparisons are made to show the advantages of the SVNN-MABAC method.

Öksüzkaya and Atan (2023) used ENTROPİ-MABAC methods to rank development and investment banks operating in the Turkish Banking system according to their financial performance in the 2016-2021 period.

In their study, Apan and Tiyek (2023) evaluated Türkiye's macroeconomic performance for the 2008-2021 period with the integrated CRITIC-based MABAC approach, using criteria such as economic growth, investment rate, export rate, import rate, current account balance rate, unemployment rate, inflation rate and interest rate.

Yavuz and Sönmez (2023) ranked the financial performance of the companies in the BIST Corporate Governance Index using the data between 2019 and 2021 using the CRITIC-MABAC and ENTROPY-MABAC methods.

As seen from the literature research, Data Envelopment Analysis (DEA) is mainly used by researchers to evaluate the performance of airports in Türkiye. DEA is a method based on linear programming and used to evaluate the effectiveness of similar decision-making units. For this reason, DEA is used to compare production units that use similar inputs and produce similar outputs by considering inputs and outputs together. It also prolongs the solution process for large-sized problems. By applying the MPSI-based

MABAC method, evaluation can be made by taking only inputs, only outputs, or inputs and outputs together as decision criteria, and solutions for large-sized problems can be easily obtained. For this reason, MPSI and MABAC methods were used in this study as an advantageous alternative to existing methods. This situation is expected to contribute to the literature.

3. METHODOLOGY

MPSI method based MABAC method was used in the study. The MPSI method was applied to determine objective criterion weights, and the MABAC method was applied to rank airports according to their performance and compare their performances.

3.1. MPSI Method

The basis of the MPSI (Modified PSI) method is based on the PSI (Preference selection index) method. The PSI method was first developed by Maniya and Bhatt in 2010 to solve the material selection problem among multi-criteria decision-making problems (Maniya and Bhatt, 2010). In their study, Gligorić et al. (2022) improved the MPSI method by making some changes to the PSI method. With the MPSI method, weight coefficients can be easily determined to calculate the objective weights of the criteria. MPSI is a very useful and flexible method for solving multi-criteria decision-making problems.

The MPSI method is based on the change in preference value for each criterion. This change is expressed using Euclidean distance. Shows the distance between the normalized value and the average value for each criterion. The implementation steps of MPSI are listed below (Gligorić et al., 2022):

Step 1: A decision matrix expressed as $X = [x_{ij}]_{mxn}$ is created, where *m* represents the number of alternatives and *n* represents the number of criteria. The x_{ij} values in the matrix are $i.$ alternative $j.$ shows its performance in terms of criteria.

Step 2: The initial values in the decision matrix are expressed as values between [0, 1] by performing a linear normalization process according to the optimum goal. The new matrix is called the normalized matrix and is denoted as $[r_{ij}]_{mxn}$. If the optimum goal is benefit, Equation 1 is applied, if it is cost, normalized values (r_{ij}) are calculated by applying Equation 2.

$$r_{ij} = \frac{x_{ij}}{\max x_{ij}} \tag{1}$$

$$r_{ij} = \frac{\min x_{ij}}{x_{ij}} \tag{2}$$

Step 3: The average (v_j) of the normalized values of criterion j based on the alternatives is calculated by applying Equation 3.

$$v_j = \frac{1}{m}\sum_{i=1}^{m} r_{ij} \tag{3}$$

Step 4: Preference variation value (p_j) is calculated using Equation 4.

$$p_j = \sum_{i=1}^{m}\left(r_{ij} - v_j\right)^2 \tag{4}$$

Step 5: Criterion weights (w_j) are determined by dividing the *j.* preference variation value by the total variation value. Equation 5 shows how to do the calculation.

$$w_i = \frac{p_j}{\sum_{j=1}^{n} p_j} \tag{5}$$

3.2. MABAC Method

MABAC (Multi Attributive Border Approximation Area Comparison) method, which is among the multi-criteria decision-making methods, is based on calculating the distances of the decision criteria taken into consideration in the evaluation of alternatives to the border proximity area. The method is a multi-criteria decision-making method developed by Pamućar and Ćirović (2015). The application process of the MABAC method consists of six steps, detailed below (Pamućar and Ćirović, 2015).

Step 1: In the MABAC method, first the decision matrix $X = [x_{ij}]_{mxn}$ is created.

Step 2: In this step, necessary calculations are made to normalize the values in the decision matrix. The linear constant method is used for this purpose. According to the linear constant method, if the criterion objective is benefit, Equation 6 is applied, and if it is cost, Equation 7 is applied and the necessary calculations are made. Where n_{ij} represents the normalized value of the $i.$ alternative in terms of $j.$ criteria:

$$n_{ij} = \frac{x_{ij} - x_{jmin}}{x_{jmax} - x_{jmin}} \quad (6)$$

$$n_{ij} = \frac{x_{jmax} - x_{ij}}{x_{jmax} - x_{jmin}} \quad (7)$$

Step 3: Criterion weight being w_j, $i.$ alternative $j.$ In terms of the criterion, the weighted normalized value V_{ij} is calculated using Equation 8 and the weighted normalized decision matrix is obtained.

$$V_{ij} = w_j(n_{ij} + 1) \quad (8)$$

Step 4: j. If the boundary proximity value of the criterion is expressed as g_i, the boundary proximity values for each criterion are determined using Equation 9 and the boundary proximity area matrix is created.

$$g_j = \sqrt[m]{\Pi_{i=1}^{m} V_{ij}} \quad (9)$$

Step 5: Equation 10 is applied to calculate the distances of the values in the weighted normalized decision matrix from the border proximity field matrix values.

$$Q_{ij} = V_{ij} - g_j \quad (10)$$

Here, Q_{ij} indicates the distance of the alternative to the border proximity area in terms of criterion $j.$

Step 6: In this step, the sum of the distances (S_i) of the alternatives from the border proximity area is calculated using Equation 11.

$$S_i = \sum_{j=1}^{n} Q_{ij} \quad (11)$$

The largest value obtained as a result of this calculation indicates the best alternative in the decision problem.

4. FINDINGS

The operation of airports within the borders of Türkiye is carried out by General Directorate of State Airports Authority (DHMİ). Among the airports, Aydın Çıldır, Gazipaşa Alanya, Zafer and Zonguldak Çaycuma airports are operated by a private company under the supervision of DHMİ, Istanbul Sabiha Gökçen Airport is operated by a private company under the supervision of the Presidency of Defense Industries, and Eskişehir Hasan Polatkan Airport is operated by Eskişehir Technical University.

In this study, the air transportation performances of 55 airport operators in Türkiye between January 2015 and August 2024 were analyzed. For this purpose, data for the years in question were obtained from the comparative statistics of airports published by the General Directorate of State Airports Authority of Republic of Türkiye Ministry of Transport and Infrastructure (DHMİ, 2024). Since the data for 2024 covers an eight-month period, the data for all years were converted to monthly average values. Çukurova Airport was opened in August 2024 and Rize-Artvin Airport was opened in May 2022 which is included in the DHMİ report. Therefore, these airports were excluded from the analysis due to lack of data covering the study period. In addition, with the opening of Istanbul Airport in 2019, both domestic and international terminals of Istanbul Atatürk Airport were closed to scheduled passenger traffic. However, general aviation and cargo terminals with private flights continue their operations. For this reason, data from Istanbul Atatürk and Istanbul Airports were used together.

Recognition codes determined for airports are used in aviation. These codas are used in two different ways: IATA (International Air Transport Association) codes and ICAO (International Civil Aviation Organization) codes. ICAO codes were used in this study. Airport codes are included in Table 1.

Table 1. Airports and ICAO codes in Türkiye

Airports	*ICAO Code*	*Airports*	*ICAO Code*
İstanbul - İstanbul Atatürk	LTFM	Hakkari Yüksekova S. Eyyubi	LTCW
İstanbul Sabiha Gökçen	LTFJ	Hatay	LTDA
Ankara Esenboğa	LTAC	Iğdır Şehit Bülent Aydın	LTCT
İzmir Adnan Menderes	LTBJ	Isparta Süleyman Demirel	LTFC
Antalya	LTAI	Kahramanmaraş	LTCN
Gazipaşa Alanya	LTFG	Kapadokya	LTAZ
Muğla Dalaman	LTBS	Kars Harakani	LTCF
Muğla Milas-Bodrum	LTFE	Kastamonu	LTAL
Adana	LTAF	Kayseri	LTAU
Trabzon	LTCG	Kocaeli Cengiz Topel	LTBQ
Erzurum	LTCE	Konya	LTAN
Gaziantep	LTAJ	Malatya	LTAT
Adıyaman	LTCP	Mardin Prof. Dr. Aziz Sancar	LTCR
Ağrı Ahmed-i Hani	LTCO	Muş Sultan Alparslan	LTCK
Amasya Merzifon	LTAP	Ordu-Giresun	LTCB
Aydın Çıldır	LTBD	Samsun Çarşamba	LTFH
Balıkesir Koca Seyit	LTFD	Siirt	LTCL
Balıkesir Merkez	LTBF	Sinop	LTCM
Batman	LTCJ	Sivas Nuri Demirağ	LTAR
Bingöl	LTCU	Şanlıurfa Gap	LTCS
Bursa Yenişehir	LTBR	Şırnak Şerafettin Elçi	LTCV
Çanakkale	LTBH	Tekirdağ Çorlu Atatürk	LTBU
Çanakkale Gökçeada	LTFK	Tokat	LTAW
Denizli Çardak	LTAY	Uşak	LTBQ
Diyarbakır	LTCC	Van Ferit Melen	LTCI
Elazığ	LTCA	Zafer	LTBZ
Erzincan Yıldırım Akbulut	LTCD	Zonguldak Çaycuma	LTAS
Eskişehir Hasan Polatkan	LTBY		

Ten different performance criteria were used to conduct analysis in the study. Since the aim is to maximize the number of passengers, frright and cargo carried, the direction of all criteria has been determined as benefit. Performance criteria are shown in Table 2.

Table 2. Performance indicators and codes

Performance Criteria	*Domestic*	*International*
Total movements traffic	C1	C2
Commercial movements traffic	C3	C4
Passenger traffic	C5	C6
Freight traffic (tons)	C7	C8
Cargo traffic (tons)	C9	C10

4.1. MPSI Method Application

The MPSI method was applied to determine the criterion weights required to solve the decision problem with the MABAC method. The MPSI method is based on a number of numerical calculations. By using Euclidean distance, criterion weights can be determined objectively by taking into account the variation between normalized values and average values for each criterion. Thus, uncertainty regarding the subjective judgments of decision makers is eliminated.

The study covers the years 2015-2024. The steps to apply the MPSI method are shown using 2015 data. Calculations were also made for other years.

MPSI method application started with the creation of the decision matrix. In the decision matrix expressed as $X = [x_{ij}]_{mxn}$. There are (m) shows the airports, that is the alternatives, and (n) shows the decision criteria. The decision matrix is shown in Table 3.

After the decision matrix is created, the normalized decision matrix is prepared in the second step. For this purpose, since all criteria are beneficial, the necessary calculations were made using Equation 1. Thus, the unit difference between the criteria is eliminated. Table 4 shows the normalized decision matrix.

Table 3. Decision matrix (2015)

Airports	*C1*	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*	*C10*
LTFM	11997	26735	11073	26173	1611156	3499854	18554	127673	3647	62248
LTFJ	11366	6897	10760	6309	1543804	798591	11303	16148	513	3726
LTAC	6904	1313	6320	1011	880190	129263	6879	2540	937	369
LTBJ	5513	1736	5035	1596	795454	219.388	7237	3981	1790	263
LTAI	4246	10314	3798	9674	575530	1738587	5351	23640	443	206
LTFG	278	310	249	286	33649	42519	302	591	0	0
LTBS	1193	1612	759	1496	102443	262730	951	3551	6	0
LTFE	1799	1067	1365	826	192426	130730	1667	1804	13	13
LTAF	3229	657	2599	544	381849	60627	3211	971	433	62
LTCG	1921	195	1844	76	270760	9473	2363	203	154	0
LTCE	712	19	572	8	89091	1002	741	25	31	3
LTAJ	1350	118	1204	107	178010	16259	1577	292	134	0
LTCP	142	1	129	0	15956	13	136	0	5	0
LTCO	153	1	117	117	17644	17644	173	173	2	0
LTAP	95	3	89	2	11865	319	96	7	1	0
LTBD	1360	0	2	2	319	319	7	7	1	0
LTFD	666	10	255	7	25982	811	177	18	0	0
LTBF	13	13	0	0	24	24	0	0	0	0
LTCJ	134	0	113	0	16424	29	153	1	13	1
LTCU	101	2	89	89	11322	11322	113	113	1	0
LTBR	542	29	112	16	13246	2380	124	58	0	1
LTBH	377	6	132	0	13969	41	76	1	0	0
LTFK	10	10	0	0	41	41	1	1	0	0
LTAY	516	7	322	4	42240	631	329	14	28	0
LTCC	1180	12	1119	8	173760	1257	1378	32	60	5
LTCA	570	22	515	18	77444	2403	669	60	10	1
LTCD	220	1	180	0	24604	50	233	1	4	0
LTBY	381	42	2	35	199	4128	2	97	4	0
LTCW	16	16	15	15	1740	1740	18	18	0	0
LTDA	592	208	532	200	74151	23495	700	396	6	0
LTCT	129	1	115	115	17675	17675	202	202	2	0
LTFC	1858	89	56	73	6428	13686	53	199	1	0
LTCN	197	0	159	159	19064	19064	168	168	6	0
LTAZ	302	9	233	2	29926	296	303	5	1	0
LTCF	267	1	225	225	35672	35672	357	357	4	0
LTAL	69	0	62	62	6913	6913	49	49	1	0
LTAU	1083	171	1027	153	146399	17947	1399	431	51	0
LTBQ	70	3	30	0	3469	9	28	0	0	0
LTAN	660	67	602	53	81447	7690	660	177	20	0
LTAT	581	9	413	6	63061	894	560	23	32	3
LTCR	366	1	324	0	47362	30	438	1	6	1
LTCK	206	1	183	1	28392	97	271	2	4	0
LTCB	151	1	132	1	18448	130	152	3	0	0
LTFH	1357	68	944	42	136602	6168	1140	157	54	1
LTCL	92	92	76	76	5563	5563	51	51	1	1
LTCM	89	1	60	0	7658	43	75	1	1	1
LTAR	350	5	311	3	43722	523	367	12	6	6
LTCS	465	15	401	11	56426	1727	425	40	6	6
LTCV	217	1	152	0	22783	6	234	0	3	3
LTBU	2075	167	84	43	8143	4386	51	200	0	53
LTAW	98	98	68	68	4680	4680	35	35	0	53
LTBQ	149	1	13	13	918	918	6	6	53	53
LTCI	927	11	711	2	115205	322	1026	7	25	25
LTBZ	67	18	57	15	5881	1942	46	47	0	0
LTAS	15	19	15	18	1942	2303	47	50	0	0

Table 4. Normalized decision matrix

Airports	*C1*	*C2*	*C3*	*C4*	*C5*
LTFM	1	1	1	1	1
LTFJ	0.947449951	0.257982769	0.971732406	0.241069694	0.958196477
LTAC	0.575528974	0.049118498	0.570740482	0.038634576	0.546309681
LTBJ	0.459557649	0.064950002	0.454682291	0.060992578	0.493716029
LTAI	0.353915725	0.385784998	0.342981644	0.369620245	0.357215753
LTFG	0.023145640	0.011601666	0.022465061	0.010927465	0.02088521
LTBS	0.099410939	0.060293128	0.068554183	0.05715905	0.063583639
LTFE	0.149988191	0.039913845	0.123230453	0.031553375	0.119433649
LTAF	0.269196571	0.024581068	0.23470532	0.020766005	0.237002953
LTCG	0.160157824	0.007278315	0.16651991	0.002900618	0.16805324
LTCE	0.059329805	0.000695102	0.051620721	0.000289743	0.055296215
LTAJ	0.112539769	0.004413745	0.108765513	0.00408188	0.110486037
LTCP	0.011809000	3.42876E-05	0.011627644	3.18399E-06	0.009903706
LTCO	0.012725934	4.67558E-05	0.010536377	0.004457591	0.010950884
LTAP	0.007932869	9.66286E-05	0.008067854	7.64158E-05	0.007364174
LTBD	0.113331666	3.11705E-06	0.000180624	7.64158E-05	0.000198098
LTFD	0.055509246	0.00038028	0.023006931	0.000251535	0.01612636
LTBF	0.001083649	0.00048626	2.2578E-05	9.55198E-06	1.47927E-05
LTCJ	0.011156032	1.55853E-05	0.010205234	1.2736E-05	0.010193664
LTCU	0.008446908	5.9224E-05	0.008067854	0.003413241	0.007027252
LTBR	0.045200684	0.001087851	0.0101375	0.000595407	0.008221684
LTBH	0.031411940	0.000227545	0.011943736	9.55198E-06	0.008670172
LTFK	0.000819684	0.000367812	2.2578E-05	9.55198E-06	2.52924E-05
LTAY	0.042991706	0.000252481	0.029110504	0.000156016	0.026217303
LTCC	0.098368969	0.000461324	0.101096536	0.000292927	0.107847714
LTCA	0.047486072	0.000804199	0.046518104	0.000694111	0.0480674
LTCD	0.018303950	4.98728E-05	0.016256124	1.2736E-05	0.015270919
LTBY	0.031731477	0.001583462	0.000210728	0.001330909	0.000123566
LTCW	0.001361508	0.000610942	0.001377255	0.000582671	0.001079763
LTDA	0.049368566	0.007789512	0.048023300	0.0076384	0.046023267
LTCT	0.010760083	4.05217E-05	0.010423487	0.004409831	0.01097059
LTFC	0.154906292	0.003341479	0.005095091	0.00279873	0.003989837
LTCN	0.016407563	6.2341E-06	0.014382154	0.006084611	0.011832497
LTAZ	0.025139277	0.000333525	0.021012546	8.27838E-05	0.01857393
LTCF	0.022263438	4.67558E-05	0.020312629	0.008593598	0.022140468
LTAL	0.005786410	3.11705E-06	0.005599332	0.002368891	0.004290915
LTAU	0.090248545	0.006408658	0.092772798	0.00583626	0.090865757
LTBQ	0.005855875	0.000105980	0.002664198	3.18399E-06	0.002152957
LTAN	0.055022993	0.002512344	0.054397808	0.0020091	0.050552158
LTAT	0.048423846	0.000333525	0.037283722	0.00022288	0.039140011
LTCR	0.030488059	4.05217E-05	0.02923092	6.36799E-06	0.02939649
LTCK	0.017199461	4.98728E-05	0.016512008	2.54719E-05	0.017622077
LTCB	0.012545326	2.49364E-05	0.011921158	2.54719E-05	0.011449956
LTFH	0.113095486	0.002543514	0.085284445	0.001601549	0.084785185
LTCL	0.007682796	0.003447459	0.006863697	0.002903802	0.003452645
LTCM	0.007377152	2.49364E-05	0.005388604	9.55198E-06	0.004753005
LTAR	0.029133497	0.000202608	0.02804934	0.000124176	0.027137139
LTCS	0.038761305	0.000542367	0.036169876	0.000407551	0.035021902
LTCV	0.018046930	3.74046E-05	0.013689764	3.18399E-06	0.014140778
LTBU	0.173001848	0.006249688	0.007571139	0.001636573	0.005053824
LTAW	0.008175996	0.003668770	0.006096047	0.002579035	0.002905005
LTBQ	0.012455022	2.18194E-05	0.001143949	0.000483967	0.000569829
LTCI	0.077265591	0.000420802	0.064249321	7.64158E-05	0.071504297
LTBZ	0.005578016	0.000657698	0.005185403	0.000569935	0.003650071
LTAS	0.001236472	0.000698220	0.001347151	0.000668639	0.001205346

Table 4. (*Continued*)

Airports	*C6*	*C7*	*C8*	*C9*	*C10*
LTFM	1	1	1	1	1
LTFJ	0.228178288	0.609192772	0.126477316	0.140589778	0.059861996
LTAC	0.036933848	0.370754554	0.019891555	0.256902351	0.00593158
LTBJ	0.06268492	0.390040119	0.031182644	0.490793666	0.004232146
LTAI	0.496759734	0.288392456	0.185163157	0.121367928	0.003309332
LTFG	0.01214872	0.016262591	0.004631376	3.2859E-05	1.92508E-06
LTBS	0.075068959	0.051261134	0.027813318	0.001596451	4.62529E-06
LTFE	0.037352936	0.089865124	0.014130924	0.00347851	0.000203792
LTAF	0.01732265	0.173055944	0.007605274	0.118861067	0.000988037
LTCG	0.002706756	0.127361141	0.001587968	0.042360277	5.6532E-06
LTCE	0.000286179	0.039930531	0.000198817	0.008492689	4.14628E-05
LTAJ	0.004645527	0.085015665	0.002286825	0.036656858	1.19213E-06
LTCP	3.64301E-06	0.007310032	1.42356E-06	0.001331659	6.50139E-06
LTCO	0.005041234	0.009343862	0.001357897	0.000503237	2.45689E-06
LTAP	9.11943E-05	0.0051503	5.44843E-05	0.000226906	1.10779E-06
LTBD	9.11943E-05	0.000374913	5.44843E-05	0.000226905	1.10779E-06
LTFD	0.000231795	0.009530757	0.00014203	1.32076E-05	6.44817E-08
LTBF	6.80981E-06	7.6039E-06	1.10504E-06	1.32076E-05	6.44817E-08
LTCJ	8.33368E-06	0.008226987	5.82348E-06	0.003491695	1.70471E-05
LTCU	0.003234992	0.006110916	0.00088807	0.000326442	1.59375E-06
LTBR	0.000680028	0.006706957	0.000453849	6.58323E-05	9.03638E-06
LTBH	1.16433E-05	0.004092254	5.46318E-06	6.2519E-05	3.05228E-07
LTFK	1.16433E-05	3.75928E-05	5.46318E-06	6.2519E-05	3.05228E-07
LTAY	0.000180412	0.017739975	0.000105837	0.007745683	1.9735E-07
LTCC	0.000359229	0.074263299	0.000248865	0.016433905	8.02332E-05
LTCA	0.000686695	0.036051519	0.000472303	0.002791327	1.36277E-05
LTCD	1.41434E-05	0.012540508	7.91737E-06	0.00100035	4.88388E-06
LTBY	0.001179478	0.000108709	0.000756731	0.001000349	4.55277E-07
LTCW	0.000497068	0.000981042	0.00014257	4.40329E-05	2.14976E-07
LTDA	0.006713208	0.037747363	0.003100032	0.001694868	5.57801E-08
LTCT	0.005050306	0.010878313	0.001580892	0.000635793	3.10405E-06
LTFC	0.003910353	0.002847599	0.001557628	0.000170625	8.3302E-07
LTCN	0.005447084	0.009056364	0.001316117	0.001523306	7.43704E-06
LTAZ	8.45035E-05	0.016313241	4.27336E-05	0.000303569	1.48208E-06
LTCF	0.010192353	0.019258855	0.002798794	0.001116682	5.45183E-06
LTAL	0.00197532	0.002661086	0.000386723	0.000148643	7.25699E-07
LTAU	0.005127856	0.075426494	0.003376465	0.013992099	1.2748E-06
LTBQ	2.45248E-06	0.001532632	1.15203E-06	5.0591E-05	2.46994E-07
LTAN	0.002197091	0.035562678	0.001384987	0.005567664	1.1156E-08
LTAT	0.000255368	0.030180187	0.000178948	0.008718178	4.25636E-05
LTCR	8.61941E-06	0.023618193	5.97752E-06	0.001696605	8.28312E-06
LTCK	2.76916E-05	0.014595164	1.72074E-05	0.001061269	5.1813E-06
LTCB	3.72396E-05	0.008185868	1.99187E-05	3.59439E-05	1.75484E-07
LTFH	0.001762478	0.061457823	0.001230279	0.014868279	1.49803E-05
LTCL	0.001589423	0.002749633	0.000399591	0.000255697	1.49803E-05
LTCM	1.231E-05	0.004016511	6.28494E-06	0.00016626	9.74054E-06
LTAR	0.000149411	0.019760187	9.51155E-05	0.001772126	0.000103822
LTCS	0.000493306	0.022924868	0.000315507	0.001767716	0.000103564
LTCV	1.69055E-06	0.012618357	3.68128E-07	0.000697443	4.08605E-05
LTBU	0.001253147	0.002771003	0.001564776	4.19535E-05	0.000857741
LTAW	0.001337318	0.001876595	0.000272716	6.85515E-06	0.000857741
LTBQ	0.00026232	0.000344529	5.00687E-05	0.014640684	0.000857741
LTCI	9.20515E-05	0.055285703	5.67303E-05	0.006826933	0.000399963
LTBZ	0.00055488	0.002489857	0.000370919	9.1402E-05	5.35489E-06
LTAS	0.000657908	0.00255234	0.000393745	9.1402E-05	5.35489E-06

In the third step of the MPSI method, the average of the normalized criterion values is calculated using Equation 3. Calculation results for all periods in which the study was conducted are given in Table 5.

Table 5. Average of normalized criterion values

Years	C1	C2	C3	C4	C5
2015	0.105202149	0.035504237	0.091546473	0.034566359	0.091284756
2016	0.109574346	0.032790539	0.090839222	0.031179487	0.092309184
2017	0.116063131	0.033762423	0.096512782	0.032781243	0.094502357
2018	0.111720020	0.036033030	0.092544536	0.035113601	0.091184368
2019	0.112947198	0.037528420	0.085851000	0.036873807	0.084516119
2020	0.124735967	0.033387323	0.080183812	0.032579887	0.077378662
2021	0.120447368	0.037283682	0.079837415	0.036793594	0.077339582
2022	0.113201563	0.038883976	0.084995818	0.038777888	0.088692305
2023	0.110566802	0.038120703	0.085920593	0.037970613	0.091595553
2024	0.119884001	0.038526727	0.090413826	0.038437623	0.088004397

Years	C6	C7	C8	C9	C10
2015	0.037011159	0.071207649	0.026294494	0.042443905	0.019601266
2016	0.032006618	0.076077824	0.023840607	0.046181122	0.019650044
2017	0.034161767	0.078475952	0.023801501	0.047711660	0.019611193
2018	0.036092219	0.082908728	0.024152725	0.018678594	0.018729947
2019	0.038426683	0.082395889	0.024466316	0.049115499	0.019034137
2020	0.036366862	0.089338450	0.021329259	0.045813989	0.018840231
2021	0.040944014	0.080062812	0.022465734	0.040103676	0.018818354
2022	0.038731486	0.068826952	0.024064862	0.041204952	0.018860593
2023	0.038470724	0.072059658	0.024398736	0.042548601	0.018846504
2024	0.039180110	0.07290725	0.024219761	0.042684736	0.018745492

After normalized values and the average of normalized values are determined, preference variation values are calculated in the fourth step. For this, Equation 4 is applied. Preference variation values calculated over the years in terms of decision criteria are shown in Table 6.

Table 6. Preference variation value

Years	C1	C2	C3	C4	C5
2015	2.233139065	1.158923499	2.297542887	1.139365631	2.295206233
2016	2.281570553	1.075180349	2.218400757	1.06532519	2.289151107
2017	2.449674817	1.125960679	2.455904429	1.117636982	2.351324127
2018	2.340384038	1.188189675	2.249332339	1.179486964	2.1824074
2019	2.124276212	1.234074237	1.965066812	1.228773431	1.910977668
2020	1.985387423	1.101744747	1.666587647	1.107157335	1.571356825
2021	1.947109828	1.224268842	1.662320933	1.233903982	1.58524195
2022	1.80735126	1.257995341	1.933508039	1.2730766	2.100805042
2023	1.782203481	1.24749192	1.934894393	1.260789573	2.19675739
2024	1.931395172	1.252381247	2.104052732	1.267440633	1.993314425

Years	C6	C7	C8	C9	C10
2015	1.23659917	1.557607979	1.01472922	1.260801037	0.982519395
2016	1.083978525	1.673831661	0.993471433	1.333828129	0.982824111
2017	1.169833363	1.715564561	0.994589233	1.325734356	0.982599608
2018	1.235303471	1.846964335	0.997831929	0.980937714	0.981349968
2019	1.317924412	1.86552035	1.000277426	1.378946143	0.981133832
2020	1.217277907	2.139631156	0.982771575	1.344744085	0.981237168
2021	1.4519694	1.857229038	0.987922208	1.272637872	0.981261337
2022	1.303441412	1.460570255	0.99677782	1.252169085	0.981129608
2023	1.297835092	1.530604844	0.999824722	1.294614445	0.981354482
2024	1.313125001	1.488487288	0.997510797	1.359216698	0.981372105

In the last step of the MPSI method, at first the sum of preference variation values is calculated. Then, the weights of the decision criteria are determined using Equation 5. The total of preference variation values are shown in Table 7, and the criterion weights are shown in Table 8.

Table 7. Total preference variation value

Years	*Values*
2015	15.17643412
2016	14.99756182
2017	15.68882216
2018	15.18218783
2019	15.00697052
2020	14.09789587
2021	14.20386539
2022	14.36682446
2023	14.52637034
2024	14.68829610

Table 8. Criterion weights

Years	*C1*	*C2*	*C3*	*C4*	*C5*
2015	0.147145176	0.07636336	0.151388849	0.07507466	0.151234883
2016	0.152129431	0.071690343	0.147917427	0.071033225	0.152634884
2017	0.15614141	0.071768337	0.156538484	0.071237788	0.149872572
2018	0.154153279	0.078262085	0.148156008	0.077688867	0.143747886
2019	0.141552634	0.082233402	0.130943604	0.081880179	0.127339336
2020	0.140828634	0.078149588	0.118215347	0.078533516	0.11146038
2021	0.137083095	0.086192653	0.117032997	0.086870999	0.111606377
2022	0.12580033	0.087562519	0.134581448	0.088612247	0.146226123
2023	0.12268746	0.085877744	0.133198751	0.086793159	0.151225484
2024	0.131492119	0.085263889	0.14324689	0.086289153	0.135707669

Years	*C6*	*C7*	*C8*	*C9*	*C10*
2015	0.081481536	0.102633331	0.066862164	0.083076237	0.064739806
2016	0.072276983	0.111606919	0.066242196	0.088936332	0.065532259
2017	0.074564767	0.109349481	0.063394768	0.084501841	0.062630553
2018	0.081365313	0.121653371	0.065723856	0.064611091	0.064638244
2019	0.087820817	0.124310256	0.066654187	0.091887043	0.065378541
2020	0.086344652	0.151769539	0.069710515	0.095386155	0.069601675
2021	0.10222354	0.130755184	0.069553053	0.089597996	0.069084106
2022	0.090725784	0.101662706	0.069380525	0.087156984	0.068291334
2023	0.089343385	0.105367329	0.068828255	0.089121674	0.067556758
2024	0.08939941	0.101338323	0.067911948	0.092537398	0.066813203

4.2. MABAC Method Application

In this part of the study, the MABAC method was applied to evaluate the performances of airports in Türkiye both by years and according to the performances of other airports. In the first step of the application, the decision matrix is created. Since the decision matrix is given in the application part of the MPSI method, it will not be shown again here. In the second step of the MABAC method, the normalized decision matrix was prepared. The normalized decision matrix prepared with the values related to the calculations made using Equation 6 is included in Table 9.

Table 9. Normalized decision matrix

Airports	*C1*	*C2*	*C3*	*C4*	*C5*
LTFM	1.000000000	1.000000000	1.000000000	1.000000000	1.000000000
LTFJ	0.947406841	0.257980456	0.971731768	0.241067278	0.958195859
LTAC	0.575180756	0.049115534	0.570730789	0.038631515	0.54630297
LTBJ	0.459114294	0.064947088	0.454669978	0.060989588	0.493708539
LTAI	0.353385706	0.385783084	0.34296681	0.369618238	0.357206244
LTFG	0.022344271	0.011598585	0.022442989	0.010924316	0.020870726
LTBS	0.098672136	0.060290198	0.068533153	0.057156048	0.063569787
LTFE	0.149290879	0.039910852	0.123210657	0.031550291	0.119420623
LTAF	0.268597052	0.024578028	0.234688041	0.020762887	0.236991666
LTCG	0.159468854	0.007275221	0.166501091	0.002897443	0.168040933
LTCE	0.05855812	0.000691988	0.051599308	0.00028656	0.05528224
LTAJ	0.111811735	0.004410642	0.10874539	0.004078709	0.110472878
LTCP	0.010998331	3.11706E-05	0.011605329	0.000000000	0.00988906
LTCO	0.011916018	4.36389E-05	0.010514036	0.004454421	0.010936253
LTAP	0.007119021	9.35118E-05	0.008045458	7.32321E-05	0.00734949
LTBD	0.112604283	0.000000000	0.000158049	7.32321E-05	0.000183308
LTFD	0.054734427	0.000377164	0.022984872	0.000248352	0.016111806
LTBF	0.000264182	0.000483144	0.000000000	6.36801E-06	0.000000000
LTCJ	0.010344828	1.24682E-05	0.010182886	9.55201E-06	0.010179022
LTCU	0.007633482	5.61071E-05	0.008045458	0.003410068	0.007012563
LTBR	0.044417408	0.001084737	0.01011515	0.000592225	0.008207013
LTBH	0.030617353	0.000224428	0.011921427	6.36801E-06	0.008655507
LTFK	0.000000000	0.000364696	0.000000000	6.36801E-06	1.04999E-05
LTAY	0.042206618	0.000249365	0.029088583	0.000152832	0.026202898
LTCC	0.09762931	0.000458208	0.10107624	0.000289744	0.107834516
LTCA	0.046704672	0.000801085	0.046496576	0.000690929	0.048053318
LTCD	0.01749861	4.67559E-05	0.016233913	9.55201E-06	0.015256352
LTBY	0.030937152	0.00158035	0.000188154	0.001327729	0.000108774
LTCW	0.000542269	0.000607827	0.001354708	0.000579489	0.001064986
LTDA	0.04858871	0.007786419	0.048001806	0.007635241	0.046009155
LTCT	0.009948554	3.74047E-05	0.010401144	0.004406661	0.01095596
LTFC	0.154213014	0.003338373	0.005072627	0.002795555	0.003975103
LTCN	0.015600667	3.11706E-06	0.014359901	0.006081447	0.011817879
LTAZ	0.024339544	0.000330408	0.020990442	7.96001E-05	0.018559412
LTCF	0.021461346	4.36389E-05	0.02029051	0.008590442	0.022126003
LTAL	0.004970801	0.000000000	0.00557688	0.002365715	0.004276185
LTAU	0.089502225	0.006405561	0.092752314	0.005833095	0.090852308
LTBQ	0.005040323	0.000102863	0.00264168	0.000000000	0.002138196
LTAN	0.054247775	0.002509234	0.054376458	0.002005922	0.050538113
LTAT	0.047643215	0.000330408	0.037261985	0.000219696	0.039125797
LTCR	0.029692714	3.74047E-05	0.029209001	3.184E-06	0.029382132
LTCK	0.016393215	4.67559E-05	0.016489802	2.2288E-05	0.017607545
LTCB	0.011735261	2.18194E-05	0.011898848	2.2288E-05	0.011435333
LTFH	0.112367909	0.002540405	0.085263792	0.00159837	0.084771646
LTCL	0.006868743	0.003444353	0.006841273	0.002900627	0.003437903
LTCM	0.006562848	2.18194E-05	0.005366147	6.36801E-06	0.004738283
LTAR	0.028337041	0.000199492	0.028027395	0.000120992	0.027122748
LTCS	0.037972747	0.000539252	0.036148115	0.000404368	0.035007627
LTCV	0.017241379	3.42877E-05	0.013667495	0.000000000	0.014126194
LTBU	0.172323415	0.006246591	0.007548732	0.001633394	0.005039106
LTAW	0.007362347	0.003665664	0.006073606	0.002575859	0.002890255
LTBQ	0.011644883	1.87024E-05	0.001121397	0.000480785	0.000555044
LTCI	0.076508621	0.000417686	0.064228193	7.32321E-05	0.071490562
LTBZ	0.004762236	0.000654583	0.005162941	0.000566753	0.003635332
LTAS	0.00041713	0.000695105	0.001324603	0.000665457	0.001190571

Table 9. (*Continued*)

Airports	*C6*	*C7*	*C8*	*C9*	*C10*
LTFM	1.000000000	1.0000000	1.000000000	1.000000000	1.000000000
LTFJ	0.228176983	0.6091898	0.126476995	0.140583887	0.059861985
LTAC	0.036932219	0.370749769	0.019891194	0.256897257	0.005931569
LTBJ	0.062683335	0.390035481	0.031182287	0.490790176	0.004232135
LTAI	0.496758883	0.288387045	0.185162857	0.121361905	0.003309321
LTFG	0.01214705	0.016255111	0.004631009	2.60041E-05	1.91393E-06
LTBS	0.075067396	0.05125392	0.02781296	0.001589607	4.61413E-06
LTFE	0.037351309	0.089858204	0.014130561	0.003471679	0.000203781
LTAF	0.017320989	0.173049656	0.007604908	0.118855027	0.000988026
LTCG	0.00270507	0.127354506	0.001587601	0.042353712	5.64205E-06
LTCE	0.000284489	0.039923231	0.000198449	0.008485892	4.14516E-05
LTAJ	0.004643844	0.085008708	0.002286458	0.036650254	1.18098E-06
LTCP	1.95247E-06	0.007302484	1.05543E-06	0.001324813	6.49024E-06
LTCO	0.005039552	0.009336329	0.00135753	0.000496385	2.44573E-06
LTAP	8.95039E-05	0.005142736	5.41162E-05	0.000220052	1.09664E-06
LTBD	8.95039E-05	0.000367312	5.41162E-05	0.000220052	1.09664E-06
LTFD	0.000230105	0.009523225	0.000141662	6.35249E-06	5.33257E-08
LTBF	5.11927E-06	0.000000000	7.36909E-07	6.35248E-06	5.33257E-08
LTCJ	6.64315E-06	0.008219445	5.45535E-06	0.003484864	1.70359E-05
LTCU	0.003233307	0.006103358	0.000887702	0.000319589	1.58259E-06
LTBR	0.000678339	0.006699404	0.000453481	5.89776E-05	9.02522E-06
LTBH	9.95281E-06	0.004084681	5.09505E-06	5.56642E-05	2.94072E-07
LTFK	9.95281E-06	2.99891E-05	5.09505E-06	5.56642E-05	2.94072E-07
LTAY	0.000178722	0.017732506	0.000105469	0.007738881	1.86194E-07
LTCC	0.000357539	0.07425626	0.000248497	0.016427162	8.0222E-05
LTCA	0.000685006	0.036044189	0.000471935	0.002784491	1.36166E-05
LTCD	1.24529E-05	0.012532999	7.54924E-06	0.000993501	4.87272E-06
LTBY	0.001177789	0.000101106	0.000756363	0.000993501	4.44121E-07
LTCW	0.000495379	0.000973446	0.000142202	3.7178E-05	2.0382E-07
LTDA	0.006711529	0.037740046	0.003099665	0.001688024	4.46241E-08
LTCT	0.005048624	0.010870792	0.001580525	0.000628942	3.09289E-06
LTFC	0.003908669	0.002840017	0.00155726	0.000163771	8.21864E-07
LTCN	0.005445403	0.009048829	0.001315749	0.001516462	7.42589E-06
LTAZ	8.28131E-05	0.016305761	4.23654E-05	0.000296716	1.47092E-06
LTCF	0.01019068	0.019251398	0.002798426	0.001109834	5.44068E-06
LTAL	0.001973633	0.002653502	0.000386355	0.000141788	7.14543E-07
LTAU	0.005126175	0.075419463	0.003376098	0.01398534	1.26364E-06
LTBQ	7.61938E-07	0.00152504	7.83905E-07	4.37362E-05	2.35838E-07
LTAN	0.002195405	0.035555344	0.00138462	0.005560847	0.000000000
LTAT	0.000253678	0.030172812	0.00017858	0.008711383	4.25525E-05
LTCR	6.92887E-06	0.023610769	5.60939E-06	0.001689761	8.27196E-06
LTCK	2.60011E-05	0.014587671	1.68393E-05	0.001054421	5.17014E-06
LTCB	3.55492E-05	0.008178326	1.95506E-05	2.90889E-05	1.64328E-07
LTFH	0.001760791	0.061450686	0.001229911	0.014861526	1.49691E-05
LTCL	0.001587735	0.00274205	0.000399223	0.000248844	1.49691E-05
LTCM	1.06195E-05	0.004008938	5.91682E-06	0.000159406	9.72938E-06
LTAR	0.000147721	0.019752733	9.47474E-05	0.001765283	0.000103811
LTCS	0.000491617	0.022917439	0.000315139	0.001760872	0.000103552
LTCV	0.000000000	0.012610849	0.000000000	0.000690593	4.08493E-05
LTBU	0.001251459	0.00276342	0.001564409	3.50986E-05	0.00085773
LTAW	0.001335629	0.001869006	0.000272348	0.000000000	0.000857729
LTBQ	0.00026063	0.000336928	4.97006E-05	0.014633929	0.000857729
LTCI	9.03611E-05	0.055278519	5.63622E-05	0.006820124	0.000399952
LTBZ	0.000553191	0.002482272	0.000370551	8.45475E-05	5.34373E-06
LTAS	0.000656219	0.002544756	0.000393377	8.45475E-05	5.34373E-06

In the third step of the MABAC method, the weighted normalized decision matrix is prepared. In the calculations made using Equation 8, the weights obtained by applying the MPSI method were used. The weighted normalized decision matrix is shown in Table 10.

Table 10. Weighted normalized decision matrix

Airports	*C1*	*C2*	*C3*	*C4*	*C5*
LTFM	0.294290351	0.152726720	0.302777697	0.150149320	0.302469765
LTFJ	0.286551522	0.096063614	0.298498202	0.093172704	0.296147521
LTAC	0.231780249	0.080113987	0.237791126	0.077974908	0.233854948
LTBJ	0.214701629	0.081322938	0.220220813	0.079653433	0.225900836
LTAI	0.199144178	0.105823052	0.203310199	0.102823623	0.205256927
LTFG	0.150433027	0.077249067	0.154786467	0.075894799	0.154391265
LTBS	0.161664304	0.080967322	0.161764004	0.079365631	0.160848852
LTFE	0.169112608	0.079411087	0.170041568	0.077443287	0.169295447
LTAF	0.186667936	0.078240221	0.186918001	0.076633427	0.18707629
LTCG	0.170610248	0.07691892	0.176595257	0.075292185	0.176648533
LTCE	0.155761721	0.076416202	0.159200408	0.075096173	0.159595486
LTAJ	0.163597733	0.076700171	0.167851688	0.075380868	0.167942235
LTCP	0.148763527	0.07636574	0.153145766	0.07507466	0.152730454
LTCO	0.14889856	0.076366692	0.152980556	0.075409074	0.152888826
LTAP	0.148192705	0.076370501	0.152606841	0.075080158	0.152346382
LTBD	0.163714353	0.07636336	0.151412775	0.075080158	0.151262605
LTFD	0.155199083	0.076392161	0.154868502	0.075093305	0.15367155
LTBF	0.147184049	0.076400254	0.151388849	0.075075138	0.151234883
LTCJ	0.148667367	0.076364312	0.152930424	0.075075377	0.152774306
LTCU	0.148268406	0.076367644	0.152606841	0.07533067	0.152295427
LTBR	0.153680983	0.076446194	0.15292017	0.075119121	0.152476069
LTBH	0.151650371	0.076380498	0.15319362	0.075075138	0.152543897
LTFK	0.147145176	0.076391209	0.151388849	0.075075138	0.151236471
LTAY	0.153355676	0.076382402	0.155792536	0.075086134	0.155197675
LTCC	0.161510858	0.07639835	0.166690664	0.075096412	0.167543223
LTCA	0.154017543	0.076424533	0.158427912	0.075126531	0.158502221
LTCD	0.149720012	0.07636693	0.153846482	0.075075377	0.153542175
LTBY	0.151697428	0.076484041	0.151417333	0.075174339	0.151251333
LTCW	0.147224968	0.076409775	0.151593936	0.075118165	0.151395946
LTDA	0.15429477	0.076957957	0.158655787	0.075647873	0.158193072
LTCT	0.148609057	0.076366216	0.152963466	0.075405489	0.152891806
LTFC	0.169836877	0.076618289	0.152156788	0.075284535	0.151836057
LTCN	0.149440739	0.076363598	0.153562777	0.075531223	0.153022158
LTAZ	0.150726622	0.076388591	0.154566567	0.075080636	0.154041713
LTCF	0.150303109	0.076366692	0.154460605	0.075719584	0.154581106
LTAL	0.147876605	0.07636336	0.152233126	0.075252265	0.151881591
LTAU	0.160314996	0.07685251	0.165430515	0.075512578	0.164974921
LTBQ	0.147886835	0.076371215	0.151788769	0.075074660	0.151558253
LTAN	0.155127474	0.076554973	0.159620838	0.075225254	0.158878008
LTAT	0.154155645	0.076388591	0.157029898	0.075091154	0.157152068
LTCR	0.151514315	0.076366216	0.155810766	0.075074899	0.155678486
LTCK	0.149557358	0.07636693	0.153885221	0.075076333	0.153897758
LTCB	0.148871963	0.076365026	0.153190202	0.075076333	0.152964304
LTFH	0.163679571	0.076557354	0.164296836	0.075194657	0.164055313
LTCL	0.148155878	0.076626382	0.152424541	0.075292424	0.151754814
LTCM	0.148110867	0.076365026	0.152201223	0.075075138	0.151951476
LTAR	0.151314835	0.076378594	0.155631884	0.075083743	0.155336788
LTCS	0.152732682	0.076404539	0.156861270	0.075105018	0.156529257
LTCV	0.149682162	0.076365978	0.153457955	0.075074660	0.153371256
LTBU	0.172501735	0.076840370	0.152531642	0.075197286	0.151996971
LTAW	0.148228510	0.076643282	0.152308325	0.075268042	0.151671990
LTBQ	0.148858664	0.076364788	0.151558616	0.075110755	0.151318825
LTCI	0.158403050	0.076395256	0.161112281	0.075080158	0.162046749
LTBZ	0.147845916	0.076413346	0.152170460	0.075117209	0.151784672
LTAS	0.147206554	0.076416440	0.151589379	0.075124619	0.151414938

Table 10. (*Continued*)

Airports	*C6*	*C7*	*C8*	*C9*	*C10*
LTFM	0.162963073	0.205266661	0.133724327	0.166152474	0.129479611
LTFJ	0.100073748	0.165156509	0.075318689	0.094755417	0.068615259
LTAC	0.084490830	0.140684614	0.068192132	0.104418294	0.065123814
LTBJ	0.086589071	0.142663971	0.068947079	0.123849238	0.065013793
LTAI	0.121958214	0.132231453	0.079242553	0.093158527	0.064954050
LTFG	0.082471297	0.104301647	0.067171803	0.083078397	0.064739930
LTBS	0.087598143	0.107893691	0.068721798	0.083208296	0.064740104
LTFE	0.084524979	0.111855777	0.067806963	0.083364651	0.064752998
LTAF	0.082892877	0.120393993	0.067370644	0.092950265	0.064803770
LTCG	0.081701950	0.115704148	0.066968314	0.086594824	0.064740171
LTCE	0.081504717	0.106730785	0.066875432	0.083781213	0.064742489
LTAJ	0.081859924	0.111358057	0.067015041	0.086121002	0.064739882
LTCP	0.081481696	0.103382809	0.066862234	0.083186297	0.064740226
LTCO	0.081892167	0.103591549	0.066952931	0.083117475	0.064739964
LTAP	0.081488829	0.103161147	0.066865782	0.083094518	0.064739877
LTBD	0.081488829	0.102671029	0.066865782	0.083094518	0.064739877
LTFD	0.081500286	0.103610731	0.066871635	0.083076765	0.064739809
LTBF	0.081481954	0.102633331	0.066862213	0.083076765	0.064739809
LTCJ	0.081482078	0.103476920	0.066862528	0.083365746	0.064740909
LTCU	0.081744991	0.103259739	0.066921517	0.083102787	0.064739908
LTBR	0.081536809	0.103320913	0.066892484	0.083081137	0.064740390
LTBH	0.081482347	0.103052555	0.066862504	0.083080861	0.064739825
LTFK	0.081482347	0.102636408	0.066862504	0.083080861	0.064739825
LTAY	0.081496099	0.104453277	0.066869215	0.083719154	0.064739818
LTCC	0.081510669	0.110254498	0.066878779	0.084440944	0.064744999
LTCA	0.081537352	0.106332666	0.066893718	0.083307562	0.064740687
LTCD	0.081482551	0.103919634	0.066862668	0.083158773	0.064740121
LTBY	0.081577505	0.102643707	0.066912736	0.083158773	0.064739834
LTCW	0.081521901	0.102733239	0.066871671	0.083079326	0.064739819
LTDA	0.082028402	0.106506717	0.067069414	0.083216472	0.064739809
LTCT	0.081892906	0.103749036	0.066967841	0.083128487	0.064740006
LTFC	0.081800021	0.102924811	0.066966285	0.083089842	0.064739859
LTCN	0.081925236	0.103562042	0.066950137	0.083202219	0.064740286
LTAZ	0.081488284	0.104306845	0.066864996	0.083100887	0.064739901
LTCF	0.082311889	0.104609166	0.067049272	0.083168438	0.064740158
LTAL	0.081642351	0.102905668	0.066887996	0.083088016	0.064739852
LTAU	0.081899225	0.110373881	0.067087897	0.084238086	0.064739887
LTBQ	0.081481599	0.10278985	0.066862216	0.08307987	0.064739821
LTAN	0.081660421	0.106282494	0.066954742	0.083538211	0.064739806
LTAT	0.081502207	0.105730067	0.066874104	0.083799946	0.064742561
LTCR	0.081482101	0.105056582	0.066862539	0.083216616	0.064740341
LTCK	0.081483655	0.104130512	0.066863289	0.083163834	0.064740140
LTCB	0.081484433	0.103472699	0.066863471	0.083078654	0.064739816
LTFH	0.081625008	0.108940219	0.066944398	0.084310877	0.064740775
LTCL	0.081610908	0.102914756	0.066888856	0.083096910	0.064740775
LTCM	0.081482402	0.103044781	0.066862559	0.083089480	0.064740436
LTAR	0.081493573	0.104660619	0.066868499	0.083222890	0.064746526
LTCS	0.081521594	0.104985424	0.066883234	0.083222524	0.064746510
LTCV	0.081481536	0.103927624	0.066862164	0.083133609	0.064742450
LTBU	0.081583507	0.102916950	0.066966763	0.083079153	0.064795335
LTAW	0.081590366	0.102825153	0.066880373	0.083076237	0.064795335
LTBQ	0.081502773	0.102667911	0.066865487	0.084291969	0.064795335
LTCI	0.081488899	0.108306749	0.066865932	0.083642827	0.064765698
LTBZ	0.081526611	0.102888094	0.066886939	0.083083261	0.064740152
LTAS	0.081535006	0.102894507	0.066888466	0.083083261	0.064740152

In this step, boundary proximity values for the criteria are determined using Equation 9. Table 11 shows the border closeness values of the criteria calculated over the years.

Table 11. Border proximity values

Years	*C1*	*C2*	*C3*	*C4*	*C5*
2015	0.160509926	0.07854819	0.163141872	0.077162865	0.16293023
2016	0.166578186	0.073589613	0.159345805	0.072806194	0.164593485
2017	0.171807453	0.073713469	0.169328049	0.073103156	0.161892203
2018	0.169136781	0.080527599	0.159836438	0.079871246	0.154931438
2019	0.155649551	0.084710743	0.140589888	0.08429633	0.136585852
2020	0.156505954	0.080251356	0.126471885	0.080579557	0.118992937
2021	0.151838591	0.088773942	0.12517074	0.089424633	0.119136556
2022	0.138523735	0.090305216	0.14443799	0.091369889	0.15734006
2023	0.134774984	0.088508243	0.143070141	0.08943122	0.163080253
2024	0.145572966	0.087907062	0.154373941	0.088948166	0.14600062
Years	*C6*	*C7*	*C8*	*C9*	*C10*
2015	0.08389628	0.108943058	0.068232025	0.085969575	0.065651892
2016	0.074130653	0.11892992	0.067448809	0.092317377	0.066458505
2017	0.076594183	0.116760472	0.064546444	0.087844129	0.063513493
2018	0.083702532	0.13034863	0.066939107	0.065462953	0.065493526
2019	0.090501377	0.13311602	0.067905834	0.095616254	0.066263317
2020	0.088854863	0.163379396	0.07081233	0.098973005	0.070530337
2021	0.10551914	0.139738608	0.070727996	0.09250751	0.070004344
2022	0.093528541	0.107737908	0.070657921	0.090092205	0.069203962
2023	0.092082706	0.111957322	0.070116651	0.092220381	0.068458486
2024	0.092194692	0.107784876	0.069172361	0.095735106	0.067698283

In the fifth step of the MABAC method, the distance of the alternatives to the border proximity area is calculated. Equation 10 is applied to calculate the distances of the values in the weighted normalized decision matrix from the border proximity field matrix values.

In the last step of the MABAC method, the sum of the distances of the alternatives from the border proximity area is calculated by applying Equation 11. According to the calculation results, a ranking of the alternatives is obtained from the largest value to the smallest value. The alternative with the largest value represents the best alternative in the decision problem. The ranking of the alternatives according to their distance from the border proximity area is shown in table 13.

Table 12. Distance of alternatives to the border proximity area

Airports	*C1*	*C2*	*C3*	*C4*	*C5*
LTFM	0.133780425	0.074178530	0.139635825	0.072986455	0.139539535
LTFJ	0.126041596	0.017515425	0.135356330	0.016009839	0.133217291
LTAC	0.071270323	0.001565797	0.074649254	0.000812043	0.070924718
LTBJ	0.054191703	0.002774748	0.057078941	0.002490567	0.062970606
LTAI	0.038634252	0.027274863	0.040168327	0.025660758	0.042326697
LTFG	-0.010076899	-0.001299123	-0.008355405	-0.001268066	-0.008538966
LTBS	0.001154378	0.002419132	-0.001377868	0.002202766	-0.002081378
LTFE	0.008602682	0.000862897	0.006899696	0.000280422	0.006365216
LTAF	0.026158010	-0.000307969	0.023776129	-0.000529439	0.024146059
LTCG	0.010100322	-0.001629269	0.013453385	-0.001870681	0.013718303
LTCE	-0.004748205	-0.002131987	-0.003941464	-0.002066692	-0.003334744
LTAJ	0.003087807	-0.001848018	0.004709816	-0.001781998	0.005012005
LTCP	-0.011746399	-0.002182449	-0.009996106	-0.002088205	-0.010199777
LTCO	-0.011611366	-0.002181497	-0.010161315	-0.001753791	-0.010041404
LTAP	-0.012317221	-0.002177689	-0.010535031	-0.002082707	-0.010583848
LTBD	0.003204427	-0.002184830	-0.011729096	-0.002082707	-0.011667625
LTFD	-0.005310843	-0.002156028	-0.008273370	-0.002069560	-0.009258680
LTBF	-0.013325877	-0.002147935	-0.011753023	-0.002087727	-0.011695347
LTCJ	-0.011842559	-0.002183878	-0.010211448	-0.002087488	-0.010155924
LTCU	-0.012241520	-0.002180545	-0.010535031	-0.001832196	-0.010634803
LTBR	-0.006828943	-0.002101996	-0.010221702	-0.002043744	-0.010454161
LTBH	-0.008859555	-0.002167692	-0.009948252	-0.002087727	-0.010386333
LTFK	-0.013364750	-0.002156980	-0.011753023	-0.002087727	-0.011693759
LTAY	-0.007154250	-0.002165787	-0.007349336	-0.002076731	-0.007732555
LTCC	0.001000932	-0.002149839	0.003548792	-0.002066453	0.004612993
LTCA	-0.006492383	-0.002123656	-0.004713960	-0.002036334	-0.004428010
LTCD	-0.010789914	-0.002181259	-0.009295390	-0.002087488	-0.009388055
LTBY	-0.008812498	-0.002064149	-0.011724539	-0.001988526	-0.011678897
LTCW	-0.013284958	-0.002138414	-0.011547936	-0.002044700	-0.011534284
LTDA	-0.006215156	-0.001590233	-0.004486085	-0.001514992	-0.004737158
LTCT	-0.011900869	-0.002181973	-0.010178406	-0.001757377	-0.010038424
LTFC	0.009326951	-0.001929900	-0.010985084	-0.001878330	-0.011094173
LTCN	-0.011069187	-0.002184592	-0.009579094	-0.001631643	-0.009908072
LTAZ	-0.009783304	-0.002159599	-0.008575304	-0.002082229	-0.008888517
LTCF	-0.010206817	-0.002181497	-0.008681266	-0.001443281	-0.008349124
LTAL	-0.012633321	-0.002184830	-0.010908746	-0.001910600	-0.011048639
LTAU	-0.000194930	-0.001695680	0.002288643	-0.001650288	0.002044691
LTBQ	-0.012623091	-0.002176975	-0.011353102	-0.002088205	-0.011371978
LTAN	-0.005382452	-0.001993216	-0.003521034	-0.001937611	-0.004052222
LTAT	-0.006354281	-0.002159599	-0.006111974	-0.002071712	-0.005778162
LTCR	-0.008995611	-0.002181973	-0.007331106	-0.002087966	-0.007251744
LTCK	-0.010952568	-0.002181259	-0.009256651	-0.002086532	-0.009032472
LTCB	-0.011637963	-0.002183164	-0.009951670	-0.002086532	-0.009965926
LTFH	0.003169645	-0.001990836	0.001154964	-0.001968208	0.001125083
LTCL	-0.012354048	-0.001921807	-0.010717331	-0.001870442	-0.011175417
LTCM	-0.012399059	-0.002183164	-0.010940648	-0.002087727	-0.010978754
LTAR	-0.009195091	-0.002169596	-0.007509988	-0.002079122	-0.007593442
LTCS	-0.007777244	-0.002143651	-0.006280602	-0.002057847	-0.006400973
LTCV	-0.010827764	-0.002182211	-0.009683917	-0.002088205	-0.009558974
LTBU	0.011991809	-0.001707819	-0.010610229	-0.001965579	-0.010933259
LTAW	-0.012281416	-0.001904907	-0.010833547	-0.001894824	-0.011258240
LTBQ	-0.011651262	-0.002183402	-0.011583256	-0.002052111	-0.011611405
LTCI	-0.002106876	-0.002152934	-0.002029591	-0.002082707	-0.000883481
LTBZ	-0.012664010	-0.002134844	-0.010971412	-0.002045657	-0.011145558
LTAS	-0.013303372	-0.002131749	-0.011552493	-0.002038246	-0.011515292

Table 12. (Continued)

Airports	*C6*	*C7*	*C8*	*C9*	*C10*
LTFM	0.079066793	0.096323603	0.065492302	0.080182899	0.063827720
LTFJ	0.016177468	0.056213451	0.007086664	0.008785842	0.002963367
LTAC	0.000594551	0.031741556	-3.98933E-05	0.018448719	-0.000528077
LTBJ	0.002692791	0.033720913	0.000715054	0.037879663	-0.000638098
LTAI	0.038061934	0.023288396	0.011010528	0.007188952	-0.000697841
LTFG	-0.001424983	-0.004641411	-0.001060222	-0.002891178	-0.000911962
LTBS	0.003701864	-0.001049367	0.000489773	-0.002761280	-0.000911787
LTFE	0.000628699	0.002912719	-0.000425062	-0.002604924	-0.000898893
LTAF	-0.001003402	0.011450935	-0.000861381	0.006980690	-0.000848121
LTCG	-0.002194330	0.006761090	-0.001263711	0.000625249	-0.000911721
LTCE	-0.002391563	-0.002212273	-0.001356593	-0.002188362	-0.000909402
LTAJ	-0.002036356	0.002415000	-0.001216984	0.000151427	-0.000912010
LTCP	-0.002414584	-0.005560249	-0.001369791	-0.002783278	-0.000911666
LTCO	-0.002004113	-0.005351509	-0.001279094	-0.002852101	-0.000911928
LTAP	-0.002407450	-0.005781911	-0.001366243	-0.002875057	-0.000912015
LTBD	-0.002407450	-0.006272029	-0.001366243	-0.002875057	-0.000912015
LTFD	-0.002395994	-0.005332327	-0.001360390	-0.002892811	-0.000912083
LTBF	-0.002414326	-0.006309727	-0.001369812	-0.002892811	-0.000912083
LTCJ	-0.002414202	-0.005466138	-0.001369497	-0.002603829	-0.000910983
LTCU	-0.002151288	-0.005683319	-0.001310508	-0.002866788	-0.000911984
LTBR	-0.002359471	-0.005622145	-0.001339541	-0.002888439	-0.000911502
LTBH	-0.002413932	-0.005890503	-0.001369521	-0.002888714	-0.000912067
LTFK	-0.002413932	-0.006306649	-0.001369521	-0.002888714	-0.000912067
LTAY	-0.002400181	-0.004489781	-0.001362810	-0.002250421	-0.000912074
LTCC	-0.002385610	0.001311440	-0.001353247	-0.001528632	-0.000906892
LTCA	-0.002358928	-0.002610392	-0.001338307	-0.002662013	-0.000911205
LTCD	-0.002413728	-0.005023424	-0.001369357	-0.002810802	-0.000911771
LTBY	-0.002318775	-0.006299350	-0.001319290	-0.002810802	-0.000912057
LTCW	-0.002374379	-0.006209819	-0.001360354	-0.002890250	-0.000912073
LTDA	-0.001867877	-0.002436341	-0.001162611	-0.002753104	-0.000912083
LTCT	-0.002003374	-0.005194022	-0.001264184	-0.002841088	-0.000911886
LTFC	-0.002096259	-0.006018247	-0.001265740	-0.002879733	-0.000912033
LTCN	-0.001971043	-0.005381016	-0.001281888	-0.002767356	-0.000911605
LTAZ	-0.002407995	-0.004636213	-0.001367029	-0.002868688	-0.000911991
LTCF	-0.001584391	-0.004333892	-0.001182753	-0.002801138	-0.000911734
LTAL	-0.002253928	-0.006037389	-0.001344029	-0.002881559	-0.000912040
LTAU	-0.001997055	0.001430823	-0.001144128	-0.001731489	-0.000912004
LTBQ	-0.002414681	-0.006153207	-0.001369809	-0.002889705	-0.000912071
LTAN	-0.002235858	-0.002660564	-0.001277283	-0.002431364	-0.000912086
LTAT	-0.002394073	-0.003212991	-0.001357921	-0.002169629	-0.000909331
LTCR	-0.002414179	-0.003886475	-0.001369487	-0.002752959	-0.000911551
LTCK	-0.002412625	-0.004812546	-0.001368736	-0.002805741	-0.000911751
LTCB	-0.002411847	-0.005470358	-0.001368554	-0.002890922	-0.000912075
LTFH	-0.002271271	-2.83867E-06	-0.001287627	-0.001658699	-0.000911117
LTCL	-0.002285372	-0.006028301	-0.001343169	-0.002872665	-0.000911117
LTCM	-0.002413878	-0.005898277	-0.001369466	-0.002880096	-0.000911456
LTAR	-0.002402707	-0.004282438	-0.001363527	-0.002746685	-0.000905365
LTCS	-0.002374685	-0.003957634	-0.001348791	-0.002747052	-0.000905382
LTCV	-0.002414743	-0.005015434	-0.001369862	-0.002835967	-0.000909441
LTBU	-0.002312772	-0.006026108	-0.001265262	-0.002890423	-0.000856557
LTAW	-0.002305914	-0.006117905	-0.001351652	-0.002893338	-0.000856557
LTBQ	-0.002393507	-0.006275147	-0.001366539	-0.001677607	-0.000856557
LTCI	-0.002407380	-0.000636309	-0.001366093	-0.002326748	-0.000886193
LTBZ	-0.002369668	-0.006054963	-0.001345086	-0.002886315	-0.000911740
LTAS	-0.002361273	-0.006048550	-0.001343560	-0.002886315	-0.000911740

Table 13. Ranking of alternatives according to their distance from the border proximity area

Airports	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*
LTFM	1	1	1	1	1	1	1	1	1	1
LTFJ	2	2	2	2	2	2	2	2	2	2
LTAC	3	3	3	3	4	4	5	5	4	4
LTBJ	4	4	4	5	5	3	4	4	5	5
LTAI	5	5	5	4	3	5	3	3	3	3
LTFG	28	31	28	26	28	35	30	29	29	29
LTBS	10	13	10	9	9	9	9	9	9	9
LTFE	8	8	8	8	8	10	8	8	8	7
LTAF	6	6	6	6	6	6	6	6	6	6
LTCG	7	7	7	7	7	7	7	7	7	8
LTCE	15	15	15	15	20	21	21	19	17	17
LTAJ	9	9	9	10	10	8	10	10	10	10
LTCP	41	43	39	41	42	43	44	42	35	39
LTCO	37	39	38	39	38	39	38	39	40	41
LTAP	44	49	41	46	47	47	48	47	48	48
LTBD	24	24	25	24	24	17	16	15	15	14
LTFD	26	18	17	16	16	19	17	17	18	16
LTBF	54	54	55	53	54	55	55	54	55	54
LTCJ	40	33	31	28	30	30	29	31	28	28
LTCU	43	44	44	42	45	44	43	45	45	46
LTBR	31	32	32	36	33	27	25	24	27	24
LTBH	36	36	35	37	37	38	37	36	39	40
LTFK	55	55	54	54	55	54	54	55	54	55
LTAY	23	27	24	29	27	29	34	30	32	33
LTCC	11	11	12	12	12	13	13	13	12	13
LTCA	19	20	22	22	22	20	27	25	20	23
LTCD	33	35	33	33	34	37	36	37	36	36
LTBY	42	42	43	45	43	42	42	43	46	45
LTCW	53	52	45	43	44	45	45	44	43	44
LTDA	18	19	20	17	19	18	19	18	41	43
LTCT	38	40	40	40	41	41	40	38	37	35
LTFC	20	21	21	20	18	15	15	16	21	20
LTCN	34	38	37	38	40	40	39	40	38	42
LTAZ	30	30	42	30	23	25	20	21	23	18
LTCF	29	28	29	31	31	31	32	32	30	32
LTAL	49	45	47	48	51	50	49	50	50	51
LTAU	12	12	11	11	11	12	11	11	11	11
LTBQ	51	51	49	47	49	48	47	52	53	53
LTAN	16	17	18	18	21	23	23	23	24	25
LTAT	21	22	23	23	25	24	24	26	25	26
LTCR	25	26	27	27	29	28	28	28	26	27
LTCK	32	34	34	34	35	34	35	35	33	34
LTCB	39	23	19	19	17	22	22	22	16	19
LTFH	13	10	16	13	14	14	14	14	14	15
LTCL	45	41	50	55	53	49	50	51	51	50
LTCM	48	48	46	44	46	46	46	48	49	49
LTAR	27	29	30	32	32	32	31	34	34	37
LTCS	22	25	26	25	26	26	26	27	22	22
LTCV	35	37	36	35	36	33	33	33	31	30
LTBU	17	16	14	21	15	16	18	20	19	21
LTAW	47	46	52	52	48	51	53	46	47	47
LTBQ	46	47	51	50	39	36	41	41	44	31
LTCI	14	14	13	14	13	11	12	12	13	12
LTBZ	50	50	48	49	50	52	51	49	42	38
LTAS	52	53	53	51	52	53	52	53	52	52

5. CONCLUSION and EVALUATION

In this study, the MPSI based MABAC method was used to evaluate the air transportation performances of airports in Türkiye. Data from 55 airports were analyzed covering the years 2015-2024. In order to carry out the analysis, a total of ten decision criteria were determined by considering total movements traffic, commercial movements traffic, passenger traffic, freight traffic and cargo traffic at both domestic and international. The weights of the decision criteria were determined objectively using the MPSI method. Accordingly, the most important criteria are domestic commercial aircraft traffic in 2015, 2017 and 2024; domestic passenger traffic in 2016, 2022 and 2023; total aircraft traffic on domestic lines in 2018, 2019 and 2021; in 2020, it was determined as domestic freight traffic. In all years, least important criterion is seen as international cargo traffic. Afterwards, the air transportation performance analysis of the airports was made by using the criterion weights in the MABAC method and the airports were ranked according to their performance.

According to the findings obtained as a result of the study, Istanbul Airport is the airport with the highest performance in the period covered by the study. The airport with the second highest performance is Istanbul Sabiha Gökçen Airport. While Ankara Esenboğa Airport was the third airport with the highest performance in the 2015-2018 period, it was replaced by Antalya Airport in the 2021-2024 period. The airports with the lowest performance are Balıkesir Merkez Airport and Çanakkale Gökçeada Airport.

While Aydın Çıldır Airport was ranked 24th in 2015, it rose to 14th place by 2024. Similarly, while Balıkesir Koca Seyit Airport ranked 26th in 2015, its performance increased and it ranked 16th in 2024; while Batman Airport ranked 40th in 2015, it ranked 28th in 2024; while Kapadokya Airport ranked 30th in 2015, it ranked 18th in 2024; while Ordu-Giresun Airport ranked 39th in 2015, it ranked 19th in 2024. Uşak Airport ranked 46th in 2015 and ranked 31st in 2024. Information about airports whose performance has decreased over the years is as follows: While Denizli Çardak Airport was ranked 23rd in 2015, it will rank 33rd in 2024; while Kahramanmaraş Airport was ranked 34th in 2015, it will rank 42nd in 2024. and while Konya Airport was ranked 16th in 2015, it fell to 25th place in 2024. It can be said that there are no significant differences in the rankings of other airports according to their performance over the years.

In the study, unlike other studies in the literature, the air transportation performance of airports in Türkiye was evaluated. For this reason, it differs from studies conducted with the DEA method. In studies using the DEA method, the amount of output that airports can produce with their inputs, that is, their efficiency, is analyzed. This situation requires airports to be classified according to their scale in order to make an accurate comparison, based on the assumption that airports using similar inputs should produce similar outputs. On the other hand, the importance levels of the decision criteria used are not taken into account. In this study, air transportation varieties were taken as decision criteria and objective weights were determined for each criterion using ten-year data. Using the weights obtained, airports were ranked according to their performance. In almost all of the studies in the literature and in this study, Istanbul Airport ranks first.

It can be said that this study is similar to the study conducted by Mercan and Atalay (2021) in terms of application. Mercan and Atalay analyzed the airports, which have very different characteristics in terms of location and function and have different capacities, by clustering them with the hierarchical clustering method. Expert opinion was sought to determine the criterion weights. Afterwards, researchers ranked the airports using the TOPSIS method. As a result of the study, the airport with the highest performance was determined as Istanbul Airport, and the airport with the lowest performance was determined as Çanakkale Gökçeada Airport. In this study, largely the same results were obtained as in the study of Mercan and Atalay.

Interest in air transportation is increasing day by day because it is fast and safe. The findings obtained as a result of the study can be used for passenger, freight and cargo transportation planning at existing airports. It can ensure a balanced distribution at regionally located airports. It can also be an indicator for the location selection of new airports.

In future studies, the results obtained can be compared with the results of this study by using different decision criteria (paid passenger, offered seat - kilometer, paid passenger - kilometer, passenger occupancy rate, number of landings, supplied cargo ton - kilometer, paid cargo ton - kilometer, cargo occupancy rate, supplied ton - kilometer, paid ton - kilometer, general occupancy rate, block hour, aircraft usage, traffic revenue, operating expenses, non-operational expenses), weight determination and ranking methods.

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It was declared by the author(s) that scientific and ethical principles have been followed in this study and all the sources used have been properly cited.

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