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Evaluation of the Airline Business Strategic Marketing Performance: The Asia-Pacific Region Case

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Abstract

Businesses provide various marketing strategies in order to gain a competitive advantage and achieve sustainable profitability in today's globally competitive environment. While some of these strategies are realized through traditional marketing methods, some of them are implemented through digital marketing applications. The continuous and rapid change in information and communication technologies has made it obligatory for businesses to reconsider their marketing strategies and activities. In the literature, there are various studies conducted with multi-criteria decision-making methods in order to measure the marketing performance of businesses. However, there is no study conducted with these criteria specific to airline companies' marketing performance. The criteria determined as a result of the literature review were analyzed using the fuzzy-AHP and Fuzzy-BWM methods for weight determination, and the TOPSIS method for alternative selection which are among the multi-criteria decision-making techniques. As a result of the study, net profitability, load rate, and total passenger number criteria came to the fore among other criteria, evaluations were made for the 6 airline companies examined, and the best and the worst alternative airline companies were determined, and evaluations were made in terms of marketing strategies. As a result, an exemplary application was introduced to airline companies in order to improve their marketing strategies and performances, and inferences that could contribute to future studies were made in the literature.

1. Introduction

Marketing, which is one of the most important functions of businesses in today's globally competitive environment, has a very important place in gaining a competitive advantage in the market and ensuring the sustainability of businesses (Thomas and Gupta, 2005). Since it is an important function, the evaluation of the performances of enterprises and their interpretation by digitizing play an important role in terms of competition (Brookes, et al., 2004).

It ensures that the marketing activities planned to be measured, controlled, evaluated, and reviewed on the marketing performance reach the desired results. Continuous monitoring of marketing performance is important for businesses to achieve their goals. Today, measuring marketing performance attracts the attention of both the industry and researchers. There are several studies in the literature on determining and measuring criteria that can be used in marketing performance and performance measurement and related studies mostly focused on conceptual content and analysis (Ambler, 2000; Ambler, Kokkinaki, and Puntoni, 2004; Patterson, 2007; Bruni, Cassia, and Magno, 2017; Liang and Gao, 2020).

The airline industry is one of the sectors where fierce competition is experienced. This is true for both mature and emerging markets. Airline operators who want to gain a competitive advantage by differentiating the same service should closely follow the strategies of their competitors and can improve these strategies by comparing them or offering a superior service. Using multi-criteria decision-making (MCDM) techniques to analyze the competitors of airline operators serving in the same market can be useful in developing response strategies.

In this study, in order to evaluate the strategic marketing performance of airline companies, weight determination with fuzzy AHP (Analytic Hierarchy Process) method and evaluation of the best airline among the alternatives with TOPSIS method, which is one of the multi-criteria decision-making techniques, was applied on 6 airline companies operating in the Asia-Pacific region. The airlines considered are full-service providers and offer similar services. First, the conceptual framework was created by examining the strategic marketing literature, and then literature on multi-criteria decision making (MCDM) methods applied to airline companies were reviewed. After that, the criteria to be examined in the study were determined, and a proposed multi-criteria decision-making hybrid model was created. The reflection of the priorities of the criteria evaluated in the model to the application was provided with the help of fuzzy logic, therefore the sensitivity of the decisions made was increased and the effect of the uncertainty of human evaluations was thus tried to be reduced. With the FAHP and fuzzy BWM method, the weights of the criteria that are effective in evaluating the marketing performance of the airline business were calculated as fuzzy and then defuzzified. After that, comparisons and detailed analyzes were made with the data of 6 airline companies operating in the Asia-Pacific market using TOPSIS method. The consistency ratios of both weighting methods were compared. Finally, the outputs of the application were made in the literature, and suggestions for future studies were made.

2. Conceptual Framework

In the literature, the starting point of performance measurement in marketing is based on control theory. Control theory assumes that management has a strategy and a series of intermediate stages (plans) against which actual performance can be compared (Ambler, Kokkinaki, and Puntoni, 2004). The marketing unit should set the right strategic goals, measure, and control them continuously. In the airline industry, where competition is increasing day by day, managers constantly observe the performance of their business, especially in finance, marketing, and operational areas (Lu, Wang, Hung, and Lu, 2012).

The criteria used in marketing performance research; financial measures such as market share, profitability, cash flow, and non-financial criteria such as quality, customer satisfaction, and innovation (Ambler, 2000; Patterson, 2007). The studies of Schefczyk (1993) and Liedtka (2002) also show that non-financial performance data of airline companies are related to financial performance. In addition, airline companies mainly use financial and operational performance indicators in performance measurement (Schefczyk, 1993; Francis et al., 2005).

Francis et al. (2005) mentioned that the most widely used operational performance indicator for airlines is "cost per empty seat". This is also seen by airline managers as the most important indicator reflecting full operational performance.

Several studies show that success in non-financial performance affects financial performance in the airline industry. Khim et al. (2010) stated that performance indicators regarding customer satisfaction in airline operations are a leading indicator of the company's future performance. The results of the same study show that the efforts of airlines to correct mistakes (e.g. reducing the number of damaged baggage pieces) positively affect both short and long-term financial performance.

In a competitive market situation, an airline's activities can be viewed as a sequential and cyclical process, and operators decide on the most appropriate factor input for the current period (e.g. labor, assets, capital, etc.) based on customer consumption in the previous period (Feng and Wang, 2000).

At the same time, under a certain factor input, more product output at the production stage (e.g. seat-km, total debt, interest expense, etc.) and likewise, given product price and factor cost, more consumer consumption can be studied at the marketing stage (e.g. passenger-km, operating income, net income, etc.) (Feng and Wang, 2000).

Clark (1999) demonstrated that traditional accounting measures (profit, sales, cash flow) have expanded to include non-accounting measures (market share, quality, customer satisfaction, loyalty, brand equity), as well as marketing control, enforcement orientation, and wider issues.

Riley et al. (2003) stated that the load factor of airline companies and the current ton-kilometer amount are directly proportional to the equity share values, and the performance indicators regarding their market shares and the ton-kilometers offered are related to their financial performance.

3. MCDM Methods Applied to Airline Businesses Literature Review

Tsaur et al. (2002) proposed a fuzzy MCDM model to evaluate airline service quality. First, they used AHP to find the weight of the criteria, and then they defuzzied the weights. They used the TOPSIS method for the final evaluation. They collected the data by conducting a survey. As a result of the study, it was determined that airline customers are affected by the physical and empathy of the service and that the airline company, which is in the first place in the evaluation, also has the highest share in the market.

Chuang et al. (2007) argued that the corporate image and reputation of airline companies are very important in seeing their position in the market and in developing marketing strategies, and they tried to measure these two phenomena with the hybrid multi-criteria decision making (MCDM) methods they developed. They determined the safety and service criteria of Taiwan Airlines and made a comparison using fuzzy AHP, one of the fuzzy MCDM methods, to measure corporate image and reputation. Similar to that study in 2007, Liou and Chuang (2008) created a hierarchy network to measure the corporate image of airline operators and separated them into factors that determine the corporate image of the enterprise and its components. Based on the factors of the corporate image such as communication, incentives, customer relations, service and planning and communication, safety records, publications, management style, and other factors, firstly fuzzy integral, then based on the factors AHP finally Simple Additive Weight (SAW) methods used and evaluated the corporate image and reputation of airlines.

Kuo (2011) tried to evaluate the service quality of airline companies for a market where China and Taiwan Airlines are competing, using the hybrid fuzzy MCDM methods they developed, and obtained the data by surveying the passengers. In the model he developed, range values are fuzzified and that is based on gray relational analysis (GRA) and VIKOR. It is stated that with the presented model, he emphasizes the strengths and weaknesses of the airline by identifying the points they lack in service quality.

Pineda et al. (2018) developed a hybrid MCDM model to evaluate airline financial and operational efficiency. In the study, first, the DRSA method to determine the most effective criteria among the criteria determined from the database, then the DEMANTEL method to determine the relationship between the airline operational performance criteria, the DANP method to determine the relational weights after determining the relationship between the criteria, and finally they used the VIKOR method to analyze difference with the desired ideal level. As a result of the study, airlines will be able to see their strengths and weaknesses, so that they will prioritize their benchmarking reference and improvement aspects for improvement.

Bakır et al. (2019) used MCDM methods to evaluate the service quality performance of main airlines that adopt the LCC business model in Europe. They analyzed airline passenger criticism based on seven evaluation criteria and used the entropy method to determine the weights of the criteria and the WASPAS method to rank them.

Dožić (2019) reviewed the studies written using MCDM methods in the field of aviation between 2000-2018. According to the results of his study, a) MCDM methods were mostly used in airline studies. b) The main theme in most of the studies has been measurement. c) fuzziness is included in 50% of the articles. d) Analytical Hierarchy Process-AHP (including Fuzzy AHP) was applied in 40% of the reviewed articles. e) Taiwan ranked first in the list of academicians who wrote articles and case studies in which countries were presented. The theme of the articles on airlines, in which the MCDV method was applied, was given as service quality, partnership, fleet, competition, financial performance, safety, and others, respectively.

4. Marketing Performance Indicator Set

Common mistakes in determining criteria to measure marketing performance; the tendency to use easily measured and known criteria, to use criteria that do not reflect real marketing results, to prefer only quantitative data, to focus on activities and activities rather than results, and lastly, the overuse of indicators for efficiency rather than efficiency (Torlak Altunışık, 2018).

The list of criteria selected in the study and the literature review is given in Table-1 respectively;

Table 1. Literature Review of Criteria

	Criteria	Literature Review
C1	Net Profitability	(Francis et al., 2005)
C2	Net Profit/Revenue Passenger Kilometers (Profit/RPK)	(Francis et al., 2005; Feng and Weng, 2000)
C3	Total Number of Passengers	(Erdoğan and Kaya, 2014)
C4	Load Factor	(Schefczyk, 1993; Francis et a 2005; Erdoğan and Kaya, 2014)
C5	Market Share	(Leong, 2008; Surovitskikh and Berendien, 2008; Khim, 2010)
C6	The ratio of operational expense to operation kilometer (Expense/RPK)	(Erdoğan and Kaya, 2014; Sarangaand Nagpal, 2016)
C7	Marketing Expenditures	(Keh, vd. 2006; Doganis, R. 2009)

Grønholdt and Martensen (2006) reviewed the marketing performance criteria examined in the literature and combined them into four groups. These groups are; mental consumer indicators (brand awareness, customer interest, perceived differentiation, perceived quality, etc.), behavioral customer indicators (customer loyalty, churn rate, number of customer complaints, number of transactions per customer, share of wallet), market-related indicators (sales, new customer sales, sales trends, market share, number of customers, number of new customers, penetration, customer conversion rate, etc.) and financial indicators (profitability, gross margin, customer profitability, customer gross margin, cash flow, return on investment, customer lifetime value).

Airlines use some criteria in strategic marketing performance measurement. As a result of the literature review criteria like net profitability, the ratio of net profitability to paid passenger kilometers (Profit/RPK), the total number of passengers, load factor, market share, ratio of operational expense to operation kilometer (Expense/RPK), and marketing expenditures were mentioned in the results and definitions of studies.

Airline companies mainly use financial and operational performance indicators in performance measurement (Schefczyk, 1993; Francis et al., 2005). From the airline companies' internal business perspective, the first efficiency performance indicator is the load factor. In some airlines, load factor measurement is made for each flight, while others are made for each flight line (Erdoğan and Kaya, 2014). Load factor is an indicator used by most companies.

On the other hand, while indicators such as the number of customers, customer complaint rates, and market share are similar to performance indicators in other sectors, additional indicators based on different characteristics of the airline sector are used by airline companies. Some of these additional indicators are check-in service efficiency, the quality of cabin services, the quality of in-flight catering, and the effectiveness of customer loyalty programs (Leong, 2008; Surovitskikh and Berendien, 2008).

From the point of view of the customer, the mentioned indicators are accepted as supportive. In addition, studies show that customer satisfaction increases market share and profitability. Moreover, indicators related to customer complaints are considered as leading indicators for long-term financial profitability projections (Khim, 2010).

Another criteria profitability is financial indicator followed by all airlines and is closely related to the total number of passengers and the load factor. There are revenue management departments that determine different seat prices in order to increase profitability on the basis of flight lines and to ensure maximum profitability for airline companies. Since some airlines operate by chartering aircraft, these airlines monitor profitability by excluding aircraft rental costs.

With a strong emphasis on marketing spending, Kotler (2015) lists four types of marketing controls: annual plan, profitability, efficiency, and strategy. These factors enable the company to distinguish whether it has chosen the right goals (strategy), whether the goals have been achieved (efficiency or annual plan), whether the company has earned or lost money (profitability), and the return (efficiency) of each marketing expenditure. Therefore, marketing expenditures must be in line with the annual plan, profitable, efficient, and strategy.

The number and variety of measures offered to firms have increased significantly in recent years (Meyer 1998). Francis et al., (2005), the most frequently used financial performance indicators in airline performance measurement are operational cost, cash flow rate, operational income, profitability, return on capital invested, debt/equity ratio, income/expense ratio, price/earnings, ratio. They mentioned that it could consist of share price and earnings per share ratio.

While most financial performance indicators used by airlines are similar to those in other industries, there are a number of financial performance indicators specific to the airline industry. These indicators are RPK (revenue passenger kilometer), ASK (available seat kilometers), and WLU (income per workload unit).

In a competitive market, an airline's activities can be viewed as a sequential and cyclical process, and operators decide on the most appropriate factor input (eg labor, assets, capital, etc.) for the current period. At the same time, according to the customer consumption in the previous period, more product output under a certain factor input (eg seat-km, total debt, interest expense, etc.) can be planned as input for the next period (Feng and Weng, 2000).

Given the product price and factor cost, more consumption in the marketing phase (for example, passenger-km, operating income, net income, etc.) as a result of sales in this period, at the implementation stage, it can be used to calculate the price of factor input for this period and decide on the amount of factor (Feng and Weng, 2000).

Another criterion used in airlines is the ratio of operational expense to revenue passenger kilometers (expense/RPK). Airlines increase their operating kilometer by expanding and diversifying the network structure they offer to the market and try to reduce their per-operation costs by distributing them on top of the expanded network structure (Erdogan and Kaya, 2014; Saranga and Nagpal, 2016).

The ratio of operational expenses to the number of seats shows how much operational expenses they spend per seat for airlines. It aims to reduce operational expenses by applying different strategies given the cost structure of airlines (Erdoğan and Kaya, 2014; Saranga and Nagpal, 2016).

The marketing expense / operational income ratio shows the distribution of marketing expenses on operational income. Airlines aim to reduce marketing expenses and increase their operational revenues. But this ratio should follow a balanced distribution (Keh, et al. 2006; Doganis, 2009).

5. Proposed Hybrid Multi-Criteria Decision-Making Model

In a decision-making process, it is possible to determine the best alternative within the framework of the determining criteria by considering the interaction of many elements with each other in logical order. In this study, the first weights of determined airline marketing performance criteria were appointed using the Fuzzy AHP method. The criteria comparisons of the decision-makers were made according to linguistic evaluations and fuzzified. The fuzzified values were weighted using the F-AHP and F-BWM methods. Therefore, consistent results were obtained by removing the uncertainty factor in the discourses of decision-makers. After determining the weights of the criteria with fuzzy AHP and fuzzy BWM, the marketing performances of the airlines determined using the TOPSIS method will be evaluated, and the best will be selected within the framework of the criteria determined. Depending on the results obtained, weight determination methods were compared.

Figure-1 shows the procedure for selecting an airline based on marketing performance. In the literature, it has been seen that the combined use of fuzzy AHP and TOPSIS has been applied to different areas. Mahmoodzadeh et al. (2007) were used in project selection Balli et al. (2009) in selecting the appropriate operating system for computers, Gumus (2009) in evaluating hazardous waste transport companies, Mandic et al. (2014) evaluation of Serbian banks, Ertugrul and Karakasoglu (2009) evaluating the performance of Turkish cement firms and Kumar and Singh (2012) Supply Chain Management third party logistics service provider assessments. It has been observed that the use of the fuzzy BWM method and TOPSIS together has increased in recent years. Omrani et al. (2018) to determine the optimum mix among power plant facilities, Norouzu and Namin (2019) to evaluate the risk analysis of the railway construction project, Tian et al. (2018) in the selection of green suppliers in the agri-food industry, again Yücesan et al. (2019) in green supplier selection, Sagnak et al. (2021), Samanlıoğlu et al. (2020) used the fuzzy BWM and TOPSIS method together to evaluate the potential website and digital solution providers and Gupta (2018) to evaluate the green human resources performance of enterprises. Neither the fuzzy AHP nor the fuzzy BWM method has been used together in the literature in evaluating the performance of aviation or airline companies.

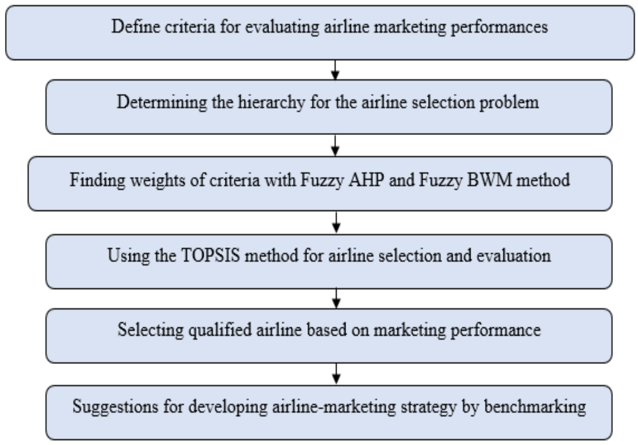

Figure 1. Airline Selection Procedure Based on Marketing Performance

6. Fuzzy Set Theory in Multi-Criteria Decision Making

There is always uncertainty in the decisions people make when describing or evaluating situations, events, substances or their environment while maintaining their lives. Since people's assessments include subjectivity, imprecision, and uncertainty. It is impossible to predict with precise numbers based on human evaluations when real-life problems are modeled to solve them (Mehrjerdi, 2012). Zadeh (1965,1976), based on this view, revealed fuzzy sets, and argued that traditional quantification is insufficient to explain complex situations, and therefore it is necessary to use linguistic variables whose values can be expressed in words or sentences. He noted that there are potential advantages to being able to work with linguistic variables, such as low computational cost and ease of understanding. Fuzzy set algebra developed by Zadeh (1965) is a theoretical whole that allows the handling of imprecise predictions in uncertain environments (Emrouznejad and Ho, 2017).

The application of fuzzy set theory to MCDM techniques started with the applications of Belman and Zadeh (1970) and Zimmermann (1978). Thus, they paved the way for a new family of methods that could not be solved with standard techniques.

Fuzzy sets, unlike standard sets, do not have crisp members and allow partial membership. The mathematical definition of the fuzzy set is given below.

If X is generally obtained by the collection of objects x, and fuzzy set a is a set of ordered pairs in X, and thus the fuzzy set is obtained as Equation 5.1.

$$\tilde{A} = \{ (X, \ \mu_{\tilde{A}}(x)) | x \epsilon X \} \qquad (5.1)$$

$\mu_{\tilde{A}}(x)$ is a membership function and shows the degree to which elements in any range of values belong to a fuzzy set (Zimmermen,1996, p.12). The most common membership functions are triangle, trapezoid, bell curve, exponential, Gaussian, pi (π) shaped and S shaped (Ali et al., 2015).

All of the fuzzy AHP methods developed used triangle membership functions (Pehlivan et al., 2017). It has been preferred in the fuzzy AHP method since triangle membership functions are easy to use and easy to calculate by decision makers (Kannan et al. 2013). Let $\tilde{A}$; (a, b, c) be a triangle consisting of fuzzy numbers and given as $a \leq b \leq c$. parameters a, b, and c represent the smallest possible value, the most promising value, and the largest possible value, respectively. Let X be a set representing the universe and containing a set of elements, and let its elements be denoted by x.

Let $\tilde{A}$, which is a fuzzy set in X, be represented by $\mu_{\tilde{A}}(x)$, which is a membership function, and let every element of x in $\tilde{A}$ give a real number between 0 and 1. The fuzzy set triangle membership function is defined as in Equation 5.2 (Zadeh, 1965, 1976) and given in Figure-2.

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & x < a, x > c \\ \dfrac{x-a}{b-a}, & a \leq x \leq b \\ \dfrac{c-x}{c-b}, & b \leq x \leq c \end{cases} \qquad (5.2)$$

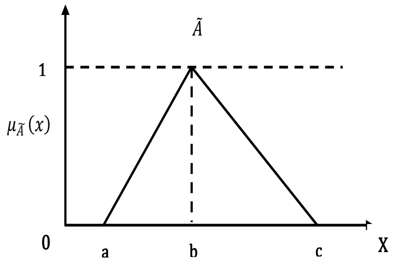

Figure 2. The triangular membership function of the fuzzy set A

7. The Methodology of Fuzzy AHP Used to Determine the Weights of Criteria

The analytical hierarchy process (AHP) was developed by Saaty (1980) and has become one of the most frequently used MCDM techniques in the literature. The AHP method is a technique used to select one of the finite multiple preferences, and three basic principles are proposed for the solution process. These are, respectively, the development of hierarchical structure, the binary comparison of alternatives and criteria, and finally synthesis (Saaty, 1986). If we obtain a matrix by comparing the decision-making criteria in binary and give an example of the most extreme points in the evaluation scale; it will give the equivalent of equally important criteria "1" and "9" when there are criteria that are very strongly important than the other, thus quantifying their views between "1-9". The decision maker may feel uncertain in his assessments of the criteria. For this reason, the criteria of the decision maker were studied as fuzzy to comparison values, and various fuzzy AHP methods were developed at different times. Pehlivan et al. (2017) considered the basic fuzzy AHP methods developed as methods proposed by Van Laarhoven and Pedrycz (1983), Buckley (1985), Chang (1996), and Mikhailov (2002, 2003).

In this study, the F-AHP method developed by Buckley (1985) with the geometric mean calculation will be used to determine the weights of the criteria that will be evaluated as criteria. The use of the F-AHP method developed by Buckley has advantages that it is easy to put it into a fuzzy state compared to other methods, ease of calculation, and guarantee a single solution (Pehlivan et al., 2017).

The degrees of binary comparison of linguistic variables can be expressed using fuzzy numbers, as shown in Table 2.

Table 2. Fuzzy Values Scale (Kannan vd., 2013)

Linguistic Variables	Fuzzy Triangle Scale	Fuzzy Triangle Opposite Scale
Equally Importance (EI)	(1,1,1)	(1,1,1)
Moderately Importance (MI)	(2,3,4)	(1/4,1/3,1/2)
Strong Importance (SI)	(4,5,6)	(1/6,1/5,1/4)
Very Strong Importance (VS)	(6,7,8)	(1/8,1/7,1/6)
Extremely Strong Importance (ES)	(9,9,9)	(1/9,1/9,1/9)
Intermediate Values	(1,2,3)	(1/3,1/2,1)
	(3,4,5)	(1/5,1/4,1/3)
	(5,6,7)	(1/7,1/6,1/5)
	(7,8,9)	(1/9,1/8,1/7)

The degrees of binary comparison of linguistic variables can be expressed using fuzzy numbers, as shown in Figure 3 (Tzeng and Huang, 2011:20).

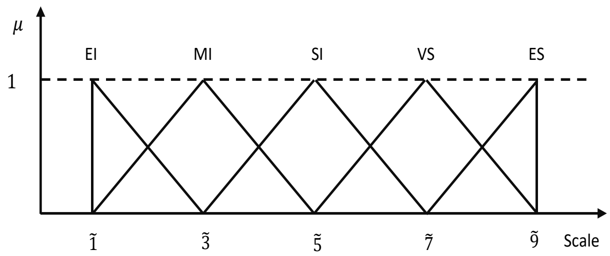

Figure 3. The Degrees of Binary Comparison of Linguistic Variables

The steps of Buckley's (1985) geometric mean method are shown below;

Step 1: Fuzzy binary comparison matrix $\tilde{D} = [\tilde{a}_{ij}]$ is created as in Equation 5.3;

$$\tilde{D} = \begin{bmatrix} (1,1,1) & \tilde{a}_{12} & \cdots & \tilde{a}_{1n} \\ \tilde{a}_{21} & (1,1,1) & \cdots & \tilde{a}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{a}_{n1} & \tilde{a}_{n2} & \cdots & (1,1,1) \end{bmatrix} \qquad (5.3)$$

Here $\tilde{a}_{ij} \times \tilde{a}_{ji} \approx 1$ and $\tilde{a}_{ij} \cong w_i / w_j$, $i, j = 1, 2, \ldots, n$.

Step 2: The Fuzzy geometric mean value $\tilde{r}_i$ is calculated as in Equation 5.4 for each i criterion.

$$\tilde{r}_i = (\tilde{a}_{i1} \times \tilde{a}_{i2} \times \ldots \times \tilde{a}_{in})^{1/n} \qquad (5.4)$$

Step 3: The calculated fuzzy weight value for each i criterion is shown in $\tilde{w}_i$ Equation 5.5.

$$\tilde{w}_i = \tilde{r}_i \times (\tilde{r}_1 + \tilde{r}_2 + \cdots + \tilde{r}_3)^{-1} \quad (5.5)$$

Here $\tilde{r}_k = (l_k, m_k, u_k)$ and $(\tilde{r}_k)^{-1} = \left(1/u_k, 1/m_k, 1/l_k\right)$.

Step 4: Fuzzy weight $\tilde{w}_i = (l_i, m_i, u_i)$ can be defuzzified using any defuzzification method. Center of Area (CoA) method (Equation 5.6) was used here.

$$\tilde{w}_i = \frac{l_i + m_i + u_i}{3} \quad (5.6)$$

8. The Methodology of Fuzzy BWM Used to Determine the Weights of Criteria

The BWM method was developed by Rezaei (2015) based on the creation of decision vectors by comparing the best and worst among criteria or alternatives by reducing the number of comparisons in the AHP method. Guo and Zhao (2017) developed the BWM method with fuzzy logic.

The steps of this method that will be used in determining the weights of the criteria in this study are given below.

Step 1: Determination of n decision criteria $\{c_1, c_2, \ldots, c_n\}$ that will affect the decision to be made.

Step 2: Determining the best (most important) c_B criterion and the worst (least unimportant) criterion c_W.

Step 3: By comparing the best criterion with the other criteria, how well it is from each of them is determined and the vector in Equation 5.7 is obtained. The fuzzy numbers obtained as a result of the comparison are obtained by using Table 3.

$$\tilde{A}_B = (\tilde{a}_{B1}, \tilde{a}_{B2}, \ldots \tilde{a}_{Bn}) \quad (5.7)$$

By comparing the best criterion with itself, $\tilde{a}_{BB} = (1, 1, 1)$ is obtained.

Step 4: The worst criterion is compared with other criteria. How much better the other criteria are than the worst criterion is determined with the help of Table 2 and the vector in Equation 5.8 is obtained.

$$\tilde{A}_W = (\tilde{a}_{1W}, \tilde{a}_{2W}, \ldots \tilde{a}_{nW}) \quad (5.8)$$

As a result of comparing the worst criterion with itself, $\tilde{a}_{WW} = (1, 1, 1)$is obtained.

Step 5: Determination of optimum fuzzy weights,

To reach optimum weights absolute difference $\left|\frac{\tilde{w}_B}{\tilde{w}_j} - \tilde{a}_{Bj}\right|$ must be greatest and $\left|\frac{\tilde{w}_j}{\tilde{w}_W} - \tilde{a}_{jW}\right|$ must be the smallest. After solving the nonlinear optimization problem given in Equation 5.9, the optimum weights of the criteria are obtained.

$$\min \max_j \left\{\left|\frac{\tilde{w}_B}{\tilde{w}_j} - \tilde{a}_{Bj}\right|, \left|\frac{\tilde{w}_j}{\tilde{w}_W} - \tilde{a}_{jW}\right|\right\}$$

$$s.t. \begin{cases} \sum_{j=1}^{n} R(\tilde{w}_j) = 1 \\ l_j^w \le m_j^w \le u_j^w \\ l_j^w \ge 0 \\ j = 1,2,\ldots,n \end{cases} \quad (5.9)$$

Where $\tilde{w}_B = (l_B^w, m_B^w, u_B^w)$, $\tilde{w}_j = (l_j^w, m_j^w, u_j^w)$, $\tilde{w}_W = (l_W^w, m_W^w, u_W^w)$, $\tilde{a}_{Bj} = (l_{Bj}, m_{Bj}, u_{Bj})$, $\tilde{a}_{jW} = (l_{jW}, m_{jW}, u_{jW})$.

The nonlinear constrained optimization problem in Equation 5.10 can be transformed as follows.

$$\min \xi \quad (5.10)$$

$$s.t. \begin{cases} \left|\frac{\tilde{w}_B}{\tilde{w}_j} - \tilde{a}_{Bj}\right| \le \xi \\ \left|\frac{\tilde{w}_j}{\tilde{w}_W} - \tilde{a}_{jW}\right| \le \xi \\ \sum_{j=1}^{n} R(\tilde{w}_j) = 1 \\ l_j^w \le m_j^w \le u_j^w \\ l_j^w \ge 0 \\ j = 1,2,\ldots,n \end{cases}$$

The weights found as a result of the solution of the problem are fuzzy values. Equation 5.11 was used to defuzzificate the fuzzy values.

$$R(\tilde{a}_i) = \frac{l_i + 4m_i + u_i}{6} \quad (5.11)$$

For the fuzzy BWM method, the consistency index has been proposed to control the comparison data. In Table 4, consistency indexes were calculated as shown by Guo and Zhao (2017).

Table 3. Consistency Index (CI) for Linguistic Assessments

Linguistic Variables	Fuzzy Triangular Scale	CI
Equally Importance (EI)	(1,1,1)	3
Intermediate Value	(1,2,3)	6
Moderately Importance (MI)	(2,3,4)	7,37
Intermediate Value	(3,4,5)	8,7
Strong Importance (SI)	(4,5,6)	10
Intermediate Value	(5,6,7)	11,275
Very Strong Importance (VS)	(6,7,8)	12,53
Intermediate Value	(7,8,9)	13,77
Extremely Strong Importance (ES)	(9,9,9)	13,77

9. TOPSIS Method for Sorting Airlines

The TOPSIS (Technique for Order preference by Similarity to Ideal Solution) method is one of the methods used in Multi-Criteria Decision-Making problems developed by Hwang and Yoon (1981). In the TOPSIS method, it tries to determine the most appropriate alternative among the alternatives, the shortest distance to the positive ideal solution and the furthest distance from the negative ideal solution. The TOPSIS method is a technique that is easy to implement, the steps are clear, the best alternatives for each criterion are searched with its simple mathematical structure, priority values are included in the comparison processes, and it allows working with different verbal evaluations or experimental data (Gomez et al., 2009). In the TOPSIS method, the weights of the criteria are given by decision makers based on their personal opinions. The opinions of decision makers can be as fuzzy as they are important. For this reason, the weights of the criteria were determined using the fuzzy AHP and fuzzy BWM methods.

Below are the implementation steps of the TOPSIS method.

Step 1: Creating the Decision Matrix

The rows of the decision matrix are created as Equation 5.12 in size mXn, so that the rows are an alternative to m and the columns are an evaluation factor of n.

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix} \begin{matrix} i = 1,2,\dots,m \\ j = 1,2,\dots,n \end{matrix} \quad (5.12)$$

Step 2: Creating the Normalized Decision Matrix

To facilitate cross-criteria comparison, the TOPSIS method normalizes the values in the decision matrix, resulting in a normalized decision matrix. Vector normalization (dividing each row vector by the norm of that Vector) is used to normalize Matrix values. Notation is given in Equation 5.13 and 5.14.

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_i{}^2}} \quad i = 1,2,\dots,m;\ j = 1,2,\dots,n \quad (5.13)$$

Thus, the generated normalized decision matrix is obtained as follows.

$$R_{ij} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix}_{m\times n} \quad (5.14)$$

Step 3: Creating the Weighted Normalized Decision Matrix

The weighting process is the only subjective part of the TOPSIS method. Each value in the normalized matrix is weighted, depending on the degree of importance determined ($w_j = w_1, w_2, \dots w_n$) by the decision makers. But it should be noted that the sum of the w_j value must be equal to 1 ($\sum_{j=1}^{n} w_j = 1$). Thus, the weighted normalized matrix Equation is found as in 5.15.

$$V_{ij} = \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \cdots & w_n r_{1n} \\ w_1 r_{21} & w_2 r_{22} & \cdots & w_n r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ w_1 r_{m1} & w_2 r_{m2} & \cdots & w_n r_{mn} \end{bmatrix}_{m\times n} \quad (5.15)$$

Step 4: Determination of Ideal and Negative Ideal Solutions

After obtaining a weighted normalized matrix, the goal may be maximization or minimization, depending on the nature of the evaluation element. If the goal in each column is maximization, the largest value is the ideal solution, and the smallest value is the negative ideal solution value. On the contrary, if the goal is minimization, the smallest value in the column can be the ideal solution, and the largest value can be the negative ideal solution value.

The Ideal solution value (when the evaluation factor is maximization) is calculated as in Equation 5.16.

$$A^+ = \left\{ \underset{i}{mak}\ v_{ij} \middle| i = 1,\dots,m\,; j = 1,\dots,n \right\} \quad (5.16)$$

$A^+ = \{v_1^+, v_2^+, \dots v_j^+, \dots v_n^+\}$ consists of evaluations of alternatives that get the best value in each criterion.

Negative ideal solution values;

$$A^- = \left\{ \underset{i}{min}\ v_{ij} \middle| i = 1,\dots,m\,; j = 1,\dots,n \right\} \quad (5.17)$$

$A^- = \{v_1^-, v_2^-, \dots v_j^-, \dots v_n^-\}$ consists of evaluations of alternatives that get the best value in each criterion.

Step 5: Obtaining Distance Values to Ideal and Negative Ideal Points

In this step, the evaluation of each decision point is calculated from the Euclidean distance approximation of the distances to the ideal and negative ideal solution. The resulting distance values (deviation values) are called distance to the positive solution (S_i^+) and distance to the negative solution (S_i^-) In calculating these offsets, Equation 5.18 and Equation 5.19 are used, respectively;

$$S_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+\right)^2}, i = 1,2,\dots,m \quad (5.18)$$

$$S_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2}, i = 1,2,\dots,m \quad (5.19)$$

Step 6: Calculation of Relative Proximity to The Ideal Solution

When calculating the relative proximity values of each point to the ideal solution, the distance values to the ideal and negative ideal points are used. The relative proximity to the ideal solution is represented by C_i^* and takes value in the range $0 \le C_i^* \le 1$. $C_i^* = 1$ indicates the absolute proximity of the relevant decision point to the ideal solution, and $C_i^* = 0$ indicates the absolute proximity of the relevant decision point to the negative ideal solution. In Equation 5.20, the calculation of relative proximity to the ideal solution is given.

$$C_i^* = \frac{S_i^-}{S_i^- - S_i^+} \quad (5.20)$$

10. Application

The aim of the study is to evaluate the marketing performance of airlines and to find the best one. For this reason, marketing performance criteria which determines marketing performance have been determined by scanning the literature and developed in order to make more precise evaluation. Two different methods have been proposed to evaluate the marketing performance of airlines. The first one is two-step Fuzzy AHP and TOPSIS and the other one is using Fuzzy BWM as the weighting method and then sorting with TOPSIS. MS Excel was used to implement the study. Firstly, the decision matrix was filled to determine the weights of the criteria with Fuzzy AHP and Fuzzy BWM, referencing the literature and the opinions of the decision makers. Three decision makers were consulted during the determination of the weights of the criteria. Two of the aforementioned decision makers are researchers studying in the field of aviation marketing and strategy, and the other one is an expert with seven years of airline industry experience. The weights of the obtained criteria were used as input in the TOPSIS method, and a systematic sorting of the airlines was carried out. The marketing strategies of the best airline companies based on the results were examined.

Figure-4 shows the model used in the study of the hierarchical structure of airline selection based on marketing performance;

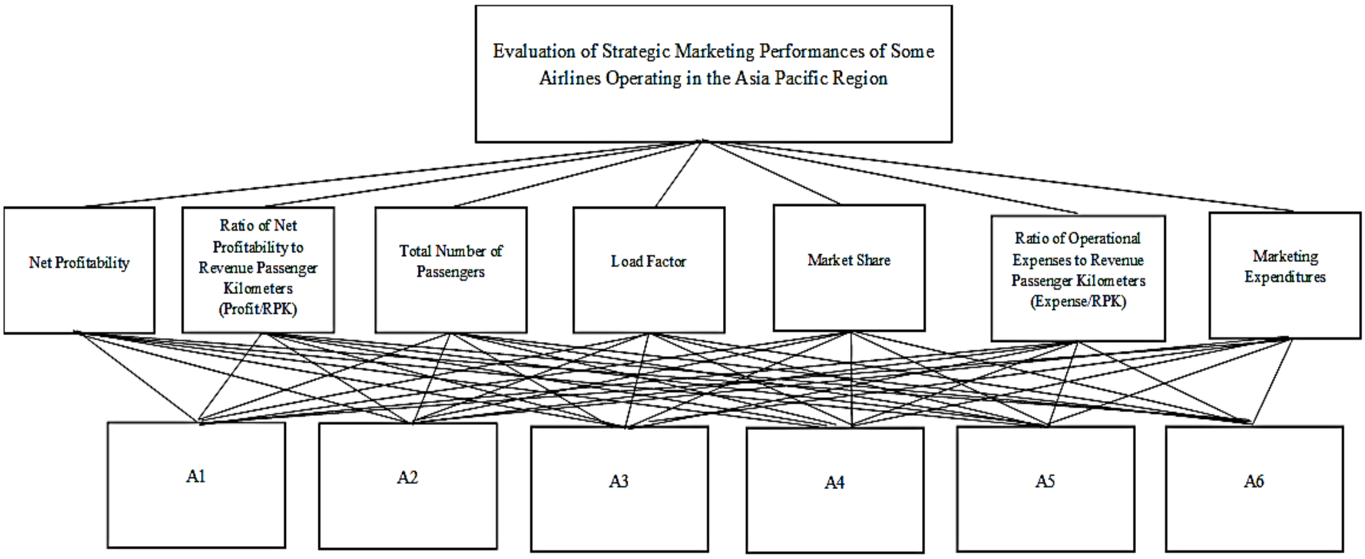

Figure 4. Hierarchical Structure of Airline Selection Based on Marketing Performance

In this study by examining the marketing performance of airlines operating in the Asia - Pacific market with multi-criteria decision-making methods, the data were obtained the 2019 annual reports of airlines, the articles studied in the relevant literature, the websites of airlines, and the examination of theses. As a result of the Covid-19 pandemic that emerged towards the end of 2019, the total seat capacity of airlines operating in Asia Pacific decreased by approximately 35% at the end of 2020 compared to 2019 (ICAO, 2021). The reason for using the data of 2019 in the study is that airline marketing activities are intended to be freed from the effects of the Covid-19 pandemic process. Thus, it is aimed to save the study from the effects of artificial results that will arise due to the pandemic. Data from a total of 6 airlines operating in the Asia - Pacific market was available. The reason for choosing full-service carriers operating in the Asia-Pacific region in the study is that the mentioned airlines are competitive in the region and their marketing strategies can be determined more accurately in terms of the market they focus on.

First, the weights of 7 criteria determined by applying the fuzzy AHP method. For the determination of weights, the criteria were compared in binary terms from 1-9, taking into account the linguistic values in Table 2. Then, using this Equation 5.15, the decision maker's level of inconsistency in the binary comparison was determined. If the discrepancy rate is below 10%, the decision maker is asked to review the binary comparison judgments if it exceeds this rate while being accepted (Saaty, 1996). CI used in equation; Consistency Index, RI; it represents the Random Consistency Index and the CR; consistency ratio.

$$CR = \mathrm{CI/RI} \qquad (5.21)$$

For matrices of different sizes, the random consistency index value is obtained by using Table-4.

The CI contained in Equation 5.21 is calculated as in Equation 5.22.

$$CI = \frac{\lambda_{max} - n}{n-1} \qquad (5.22)$$

the λ_{max} is calculated as in Equation 5.23.

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n} \frac{\sum_{j=1}^{n} a_{ij} w_j}{w_j} \qquad (5.23)$$

The consistency ratio of the binary comparison matrix of the determined criteria was found to be 0.092, and from here it seems that the comparison of the criteria is consistent.

Table 4. Random Consistency Index

Size (n)	*RI*
1	0
2	0
3	0,58
4	0,90
5	1,12
6	1,25
7	1,32
8	1,41
9	1,45
10	1,49

The resulting matrix was created using the fuzzy values scale given in Table 2. Table-5 contains a fuzzified comparison criteria matrix.

Table 5. Fuzzy Criteria Comparison Matrix with F-AHP

	C1	C2	C3	C4	C5	C6	C7
C1	(1,1,1)	(2,3,4)	(3,4,5)	(2,3,4)	(1,2,3)	(1,2,3)	(5,6,7)
C2	(1/5, 1/4, 1/3)	(1,1,1)	(2,3,4)	(1,2,3)	(2,3,4)	(1,1,1)	(2,3,4)
C3	(1/5, 1/4, 1/3)	(1/4, 1/3, 1/2)	(1,1,1)	(1/4, 1/3, 1/2)	(1/6, 1/5, 1/4)	(1/3, 1/2, 1)	(1,2,3)
C4	(1/4, 1/3, 1/2)	(1/3, 1/2, 1)	(2,3,4)	(1,1,1)	(4,5,6)	(1,2,3)	(3,4,5)
C5	(1/3, 1/2, 1)	(1/4, 1/3, 1/2)	(4,5,6)	(1/6, 1/5, 1/4)	(1,1,1)	(1,2,3)	(3,4,5)
C6	(1/4, 1/3, 1/2)	(1,1,1)	(1,2,3)	(1/3, 1/2, 1)	(1/3, 1/2, 1)	(1,1,1)	(2,3,4)
C7	(1/7, 1/6, 1/5)	(1/4, 1/3, 1/2)	(1/3, 1/2, 1)	(1/5, 1/4, 1/3)	(1/5, 1/4, 1/3)	(1/4, 1/3, 1/2)	(1,1,1)

The geometric mean method proposed by Berkeley (1985) was used to calculate the weight of criteria. The fuzzy geometric mean value for each i criteria was calculated as shown in Equation 5.4, and the fuzzy weights of the criteria were calculated as follows by applying Equation 5.5.

$$\begin{aligned}\tilde{w}_1 &= (0.187, 0.337, 0.596)\\ \tilde{w}_2 &= (0.100, 0.176, 0.299)\\ \tilde{w}_3 &= (0.028, 0.048\ 0.089)\\ \tilde{w}_4 &= (0.104, 0.184, 0.336)\\ \tilde{w}_5 &= (0.069, 0.120, 0.219)\\ \tilde{w}_6 &= (0.057, 0.101, 0.195)\\ \tilde{w}_7 &= (0.021, 0.034, 0.061)\end{aligned} \tag{5.24}$$

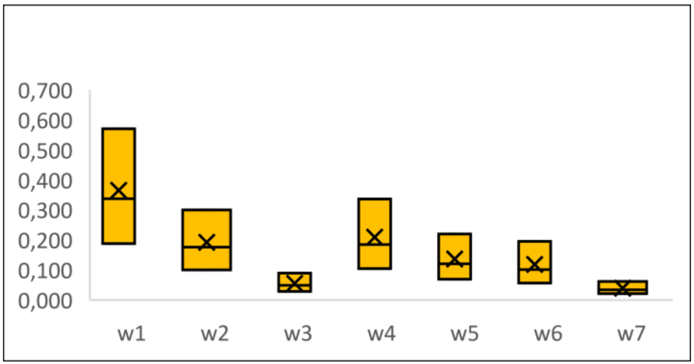

Figure 5. Weights Obtained by Fuzzy AHP

The weights of the criteria determined in Figure 5 are shown in the graph. It is seen that the difference between the lower and upper limits of the criteria with high weights is larger.

The weight of each criterion in problem solving was determined by using the center of area method in Equation 5.6. The weights of the criteria are indicated in the vector given in Equation 5.25.

$$W = (0.327, 0.173, 0.045, 0.187, 0.122, 0.106, 0.035) \tag{5.25}$$

Table 6. Best Criteria Comparison with Others

Criteria	C1	C2	C3	C4	C5	C6	C7
Best Criteria = C1	(1,1,1)	(2,3,4)	(5,6,7)	(2,3,4)	(1,2,3)	(2,3,4)	(6,7,8)

Table 7- Worst Criteria Comparison with Others

Criteria	Worst Criteria= C7
C1	(6,7,8)
C2	(3,4,5)
C3	(1,2,3)
C4	(4,5,6)
C5	(4,5,6)
C6	(2,3,4)
C7	(1,1,1)

The method suggested by Guo and Zhao (2017) was applied to determine the weights with the fuzzy BWM method. It has been determined that "Net Profitability" (C1) criterion is more important than others by decision makers in order to evaluate the marketing performance of airlines, and "Marketing Expenditures" (C7) is the least important criterion compared to the others. Table 6 shows the comparison of the best criterion with the others, and Table 7 shows the comparison of the least important criterion with the others based on linguistic values.

As a result of the obtained comparisons, the following nonlinear programming model was obtained and solved with MS Excel solver.

$$\min\ k^*$$

$$s.t.\begin{cases}\left|\dfrac{(l_1^w, m_1^w, u_1^w)}{(l_1^w, m_1^w, u_1^w)} - (l_{11}, m_{11}, u_{11})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_1^w, m_1^w, u_1^w)}{(l_2^w, m_2^w, u_2^w)} - (l_{12}, m_{12}, u_{12})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_1^w, m_1^w, u_1^w)}{(l_3^w, m_3^w, u_3^w)} - (l_{13}, m_{13}, u_{13})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_1^w, m_1^w, u_1^w)}{(l_4^w, m_4^w, u_4^w)} - (l_{14}, m_{14}, u_{14})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_1^w, m_1^w, u_1^w)}{(l_5^w, m_5^w, u_5^w)} - (l_{15}, m_{15}, u_{15})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_1^w, m_1^w, u_1^w)}{(l_6^w, m_6^w, u_6^w)} - (l_{16}, m_{16}, u_{16})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_1^w, m_1^w, u_1^w)}{(l_7^w, m_7^w, u_7^w)} - (l_{17}, m_{17}, u_{17})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_2^w, m_2^w, u_2^w)}{(l_7^w, m_7^w, u_7^w)} - (l_{27}, m_{27}, u_{27})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_3^w, m_3^w, u_3^w)}{(l_7^w, m_7^w, u_7^w)} - (l_{37}, m_{37}, u_{37})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_4^w, m_4^w, u_4^w)}{(l_7^w, m_7^w, u_7^w)} - (l_{47}, m_{47}, u_{47})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_5^w, m_5^w, u_5^w)}{(l_7^w, m_7^w, u_7^w)} - (l_{57}, m_{57}, u_{57})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_6^w, m_6^w, u_6^w)}{(l_7^w, m_7^w, u_7^w)} - (l_{67}, m_{67}, u_{67})\right| \le (k^*, k^*, k^*)\\ \left|\dfrac{(l_7^w, m_7^w, u_7^w)}{(l_7^w, m_7^w, u_7^w)} - (l_{77}, m_{77}, u_{77})\right| \le (k^*, k^*, k^*)\\ \displaystyle\sum_{j=1}^{7} R(\tilde{w}_j) = 1\\ l_j^w \le m_j^w \le u_j^w\\ l_j^w \ge 0\\ j = 1,2,3,4,5,6,7\end{cases} \tag{5.26}$$

The optimum solution of the problem has been reached. The optimum fuzzy weights of the criteria are given in Equation 5.27. The graphic representation of the weights is given in Figure 6.

$$\begin{aligned}\tilde{w}_1 &= (0.243, 0.278, 0.293)\\ \tilde{w}_2 &= (0.100, 0.144, 0.196)\\ \tilde{w}_3 &= (0.050, 0.056\ 0.062)\\ \tilde{w}_4 &= (0.100, 0.144, 0.228)\\ \tilde{w}_5 &= (0.152, 0.208, 0.228)\\ \tilde{w}_6 &= (0.100, 0.139, 0.164)\\ \tilde{w}_7 &= (0.032, 0.034, 0.034)\end{aligned} \tag{5.27}$$

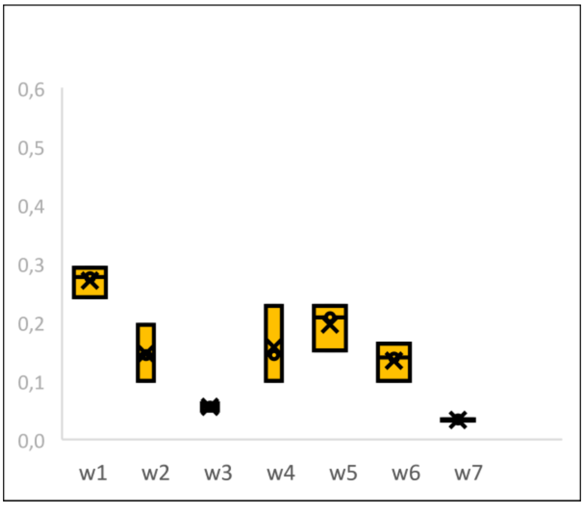

Figure 6. Weights Obtained by Fuzzy BWM

Since $C_{BW} = C_{17} = (6,7,8)$, using the consistency index in Table 3, the consistency ratio is found by dividing it by $k^* = 1{,}079$. The consistency ratio is found to be 1.079/12.53=0.086. The consistency ratio is an acceptable value.

The fuzzy weights were defuzzificate using Equation 5.11 and the weights in Equation 5.28 is obtained.

$$W = (0.274, 0.145, 0.056, 0.151, 0.202, 0.137, 0.034) \quad (5.28)$$

Marketing performance evaluation of airline companies was performed using the TOPSIS method of data related to criteria determined by weights. First, The Decision Matrix given in Table-8 was obtained. TOPSIS allows each criteria to serve its purpose. This aspect is also taken into account when calculating.

Table 8. Airline Selection Decision Matrix

	C1	C2	C3	C4	C5	C6	C7
A1	508.067.350	0,036	32.400.000	71%	3,60%	0,045	102.000.000
A2	477.000.000	0,046	20.906.000	81,90%	3,10%	0,055	48.000.000
A3	205.777.687	0,018	27.408.300	82,30%	2,60%	0,041	31.000.000
A4	456.000.000	0,024	56.000.000	78,80%	5,40%	0,033	69.900.878
A5	671.000.000	0,047	40.480.000	84,20%	3,20%	0,047	57.560.000
A6	266.186.784	0,021	29.800.000	78,70%	2,70%	0,029	25.500.000
Weights	32,77%	17,25%	4,96%	18,73%	12,24%	10,58%	3,48%
Goal	max	max	max	max	max	min	min

After the creation of the decision matrix, which is the first step in TOPSIS, the normalized decision matrix was calculated and then each element in the matrix was multiplied by the weight of the relevant criterion and then weighted normalized. Table 9 was obtained by following the relevant steps.

Table 9. Ideal (S^+) ve Negative Ideal (S^-) Distances to the Solution and Relative Closeness to the Ideal Solution (M^*) with F-AHP

	A1	A2	A3	A4	A5	A6
S^+	0,094	0,085	0,159	0,107	0,038	0,148
S^-	0,080	0,088	0,026	0,074	0,156	0,039
M^*	0,540	0,493	0,862	0,591	0,196	0,792

When the weights determined by F-AHP and the relative closeness values of the airlines to the ideal solution are taken into account, the ranking of the airline companies is $A_3 > A_6 > A_4 > A_2 > A_1 > A_5$

On the other hand, when the weights obtained by fuzzy BWM were applied to TOPSIS, the final Table 10 was obtained.

Table 10. Ideal (S^+) ve Negative Ideal (S^-)Distances to the Solution and Relative Closeness to the Ideal Solution (M^*) with F-BWM

	A1	A2	A3	A4	A5	A6
S^+	0,066	0,073	0,155	0,080	0,037	0,136
S^-	0,098	0,100	0,024	0,090	0,150	0,038
M^*	0,401	0,424	0,864	0,471	0,199	0,783

When the weights determined by F-BWM and the relative closeness values of the airlines to the ideal solution are taken into account, the ranking of the airline companies is $A_3 > A_6 > A_2 > A_1 > A_4 > A_5$

11.Conclusion

In the study, 6 airlines operating in the Asia-Pacific region were applied with multi-criteria decision-making techniques such as fuzzy logic, weight determination with F-AHP and F-BWM and choice between alternatives with TOPSIS in order to evaluate strategic marketing performances.

Firstly, the conceptual framework was created by examining the strategic marketing literature in the study. Secondly, Multi-Criteria Decision-Making (MCDM) methods applied to airlines were scanned in literature. Then, the criteria to be examined in the study were determined and the proposed multi-criteria decision-making hybrid model was created. In addition, comparisons and detailed analyses were made with the data of 6 airlines operating in the Asia-Pacific market.

The weights of the criteria were determined by fuzzy-AHP and fuzzy-BWM methods. Considering the consistency ratios, it was seen that the consistency ratio of fuzzy-BWM was higher. In the F-AHP method, it was observed that the gap widened as the weight increased. TOPSIS application was made with both weights and rankings were obtained depending on the marketing performance of alternative airlines. With the use of different weight determination methods, the third, fourth and fifth rankings differed, but the place of the others did not change.

As a result of the analysis, A3 airline took the first place when evaluated in terms of selected marketing performance evaluation criteria. It has been determined that the A3 airline performs above the average in terms of load rate, market share and total number of passengers, although it spends less on marketing compared to other airlines.

On the other hand, the airline with the lowest marketing performance according to the selected criteria is the A5 airline. Among the reasons for this situation, marketing expenses of the relevant airline are almost twice as much as those of the A3 airline, although there are no major differences in load factor and are close to each other in terms of the ratio of operational expenses to operational mileage.

In addition, when the marketing strategies of the A3 airline were examined, the fact that it uses digital marketing activities more actively than traditional marketing activities was reflected in marketing expenditures and came to the fore as an important factor affecting the ranking.

The contribution of the study to the literature is that multi-criteria decision-making techniques were used for the first time in the aviation sector in determining the marketing performance in the literature. The relevant study was carried out on 6 airline companies operating in the Asia-Pacific market, using annual reports and criteria selected as a result of literature review.

The fact that measuring the efficiency of marketing activities is quite complex and varies depending on many different variables is the biggest obstacle for marketing strategists to determine the appropriate strategy. In this study, it has been tried to evaluate the efficiency of marketing activities through the indicators such as "Profitability in airline marketing", "Net Profit/RPK", "Load Factor", "Market Share", "Expense/RPK". It has been observed that the leading airline companies support their marketing strategies with activities that are closely related to digitalization and technology, such as technology investment, search engine marketing, e-mail marketing, social media marketing. At the end of the study, it is important to make the necessary investments for the airlines that aim to compete with the airline companies that are the subject of the study, to gain a competitive advantage and to make this competitive advantage sustainable. At the same time, it is vital to align the marketing indicators related to these investments.

In future studies, studies that cover the whole market can be carried out and the study can be updated by changing the criteria according to the decision makers.

Ethical approval

Not applicable.

Conflicts of Interest

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

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