



Analyzing business competition by using fuzzy TOPSIS method: An example of Turkish domestic airline industry

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ABSTRACT

The article uses fuzzy TOPSIS multi-methodological approach in the Turkish domestic airline industry. It starts by describing exceedingly complex nature of competition in the sector. Then, it deals with the constituent parts of the research methodology and the eclectic approach itself. The implementation of fuzzy TOPSIS method in the Turkish domestic airline industry reveals the ranking of major air carriers in light of key success variables in the sector. The article also provides an evaluation of empirical findings of fuzzy TOPSIS method from a managerial perspective.

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1. Introduction

The purpose of this article is to apply fuzzy TOPSIS approach to the Turkish domestic airline sector in order to rank air carriers according to their relative closeness coefficient on the basis of criteria that are most critical to success and prosperity in the industry. This analysis provides useful information for airline companies about evaluating their objectives and strategies. To reach this end, in the first section the article initially describes the nature of rising competition in the Turkish domestic airline industry that became a menace to the survival of firms during the period 2003–2007, as well as provides brief information about the chief characteristics of major domestic air carriers in the sector. The next section, called background information about research methodology, explains the building blocks of fuzzy TOPSIS method, namely linguistic variables and fuzzy sets, and the traditional TOPSIS method, and then proposed fuzzy TOPSIS method. The fuzzy TOPSIS approach has been applied to various problems ranging from facility location selection (Chu, 2002), robot selection (Chu & Lin, 2003), selection of system analysis engineer for a software company and choosing optimal initial training aircraft in Air Force Academy in Taiwan (Wang & Chang, 2007) to service quality in hotel industry (Benitez, Martin, & Roman, 2007), plant layout design problem (Yang & Hung, 2007), transshipment site selection (Önüt & Soner, 2008), evaluation of the competitive advantage of shopping web-sites (Sun & Lin, 2009), and machine tool selection problem (Yurdakul & Ic, 2008). We assume that this multi-methodological fuzzy TOPSIS approach with its wide-ranging applications is a

unique and more useful tool than its constituent parts to comply with the rules and requirements of survival in chaotic and ambiguous environments like airline industry where combative rivals strive to continue to exist and prosper. Then the following section, called the application of the fuzzy TOPSIS method to the Turkish domestic airline industry, undertakes a real industry case from a comparative perspective that provides full and invaluable data for airline companies in the sector so that they should review their judgments and goals, strategies, plans and programmes, and actions. The final section, called an analysis of outcomes of fuzzy TOPSIS method from the managerial standpoint, provides a managerial evaluation of the meanings of quantitative values obtained in the use of fuzzy TOPSIS method. The purpose is to justify our analysis by exemplifying the activities of airline companies within the category of critical success factors of the airline industry respectively. Conclusion is provided in the final section.

2. The nature of Turkish domestic airline industry

Although the Turkish airline sector has been negatively affected by the political and financial crises, it has continued its progress in the long term with the growth of economy, liberalisation, globalisation, developing international trade, lowering prices, and expanding service net. This sector's climax was the terrorist attack in 9/11 2001 in the U.S. The airline sector was globally harmed due to this attack that gave rise to the bankruptcy of some prominent airline companies. While the airline sector was trying to recover itself, it was damaged again by Gulf War and SARS illness in the Far East Asia in 2003. But, Iraqi War was shorter than expected and SARS was taken under control, so airline sector got into growing trend in 2004.

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The high performance of the Turkish economy in recent years, the rising numbers of tourists coming to Turkey, the lower prices of the private airline companies after the tax cut on flight prices in 2004 accelerated the Turkish airline transportation to the sector. Though the domestic passenger number was 8.7 million in 2002, it rose to nearly 20 million in 2005. This number was 38% more than the number in 2004.

By 2006, the Turkish airline sector had 204 passenger planes, 24 cargo planes and capacity of 38,000 passengers. Although the Turkish Airlines had domestic flights from two airports to 25 scheduled domestic points in 2003, the flights today are from seven airports by five airline companies to 38 points. If we bear in mind the Turkey's advantageous geographical condition, interregional trade development, and the improvement efforts in tourism, the Turkish airline sector which has a current growing trend is expected to continue its expansion process.

Furthermore, cargo transportation had a great deal of improvements. There was 74% increase in domestic cargo flights between 2002 and 2005. Totally 27,182 tons of cargo capacity was reached by September 2006.

Turkey due to its geographical location acts like a point of passing between Europe, Middle East, and Asia. Improvements in recent years as well as Turkey's liberal policies and bilateral agreements have turned this hectic geographical area to a special centre for passenger and cargo transportation.

However, there are still 70 idle airports nationwide that can be opened to air traffic in Turkey. In particular, in the East part of Turkey the number of unused airports is high due to the topographic structure of this region. In a short time, the increasing need for air transportation would bring these airports in use and provide important benefits for Turkey.

In terms of fuel prices in the Turkish airline industry, the most important reason for preferring air transportation to other means is ticket fares. Fuel cost really acts as a significant determinant for ticket fares. Rising fuel prices negatively affects air transportation. The fuel price in Turkey is usually higher than fuel price in other countries because of high tax charge, so this naturally inhibits to lower the flight price and results in diminishing the competitive power of the Turkish air transportation firms.

In terms of competition in the Turkish Domestic Air Transportation after the privatisation of Turkish Airlines in 2003 the number of passengers in Domestic Air Transportation was noticeably increased. This led to new air carriers enter the aviation sector and the competition became severe. The slogan of "Every Turk will try plane at least once" became popular in the Domestic Air Transportation. In relation with the incentive policy to make the domestic flights attractive and to bring activity to regional airports there has been a reduction in DHMI (Government Airport Service) tariffs, and a cut in private communication tax. Furthermore, the Ministry of Transport abolished the education contribution pay in 2003 and gave authorisation of domestic flights to the private airline companies. With this practice a couple of new carriers such as Fly Air, Onur Air, Pegasus Airlines, and Atlas Jet entered the market. As a consequence, a sudden change and a cutthroat competition developed in the sector. This increased the number of domestic passengers (Table 1). Private firms increased domestic flights by taking their licenses. Onur Air, Pegasus Airlines, and Atlas Jet became initial firms that took their licenses.

Table 1
Number of domestic passenger carried in 2008.

Rank	Airline companies	Number of passenger
1	Turkish Airlines	8,857,000
2	Onur Air	4,400,267
3	Atlas Jet	2,982,712
4	Pegasus	1,818,989

Onur Air is a low-cost airline company based in İstanbul. It arranges package flights between Turkey and a number of Western European Countries as well as operates a no-frills scheduled service between İstanbul and 12 other Turkish cities by using a flat fare structure. Its main base is Atatürk International Airport in İstanbul. The airline company was founded in 1992 and started its operations in May, 1992. It began with two leased Airbus A320 aircrafts. In 2003, it launched its low-fare domestic services. It approximately carries 1.4 million passengers in a year. It is owned by Cankut Bagona (33.3%), the Chairman and the Chief Executive, Hayri İçli (33.3%), and Unsal Tulbentci (33.3%). Onur Air's average fleet age was 11.8 years in July, 2006.

Pegasus Airlines is an airline company based in İstanbul. It arranges holiday charter flights to the Turkish resorts from North and West Europe and leases aircraft and crew to the other operators on demand. Its main base is Sabiha Gökçen International Airport (SAW), İstanbul, with a second hub at Antalya International Airport (AYT). The airline company was established in December, 1989 and started its operations in April, 1990. It was owned by Aer Lingus, but was sold to Yapi Kredi Bank in 1994. It is currently owned by Esas Holdings (85%) and Silkar (15%). Pegasus Airlines is one of the biggest charter companies in Turkey with a passenger capacity of more than 4 million passengers per year.

Atlasjet is an airline company based in İstanbul, Turkey. It arranges domestic scheduled passenger services and regular charter flights to Europe, Kazakhstan, and the United Arab Emirates. It serves to Germany on behalf of Öger Tours. Its main base is Atatürk International Airport, İstanbul, with hubs at Adnan Menderes Airport, İzmir, and Antalya Airport. The airline company was established in March, 2001 and started its operations in June, 2001. The company was formerly known as Atlasjet International Airlines that was set up as a subsidiary of Öger Holdings. In 2004, ETS Group initially acquired a 45% stake in Atlasjet, and then increased its share to 90% in February, 2006 when it acquired 45% shares of Öger Holding. The 90% of company is now owned by ETS Group and the rest is owned by Tuncay Doganer who is Vice-President and Chief Executive. The company currently employs 730 managers and workers.

3. Background information about research methodology

This section briefly describes the linguistic variables and fuzzy sets, the TOPSIS method, and proposed fuzzy TOPSIS method.

3.1. Linguistic variables and fuzzy sets

A linguistic variable is a variable whose values are words or sentences in a natural or artificial language (Zadeh, 1975a). For instance, age is a linguistic variable if its values are assumed to be the fuzzy variables labeled as "not young", "young" and "very young" rather than the actual numbers (Delgado, Verdegay, & Vila, 1992). The concept of a linguistic variable provides a means of approximate characterisation of phenomena which are too complex or too ill-defined to be amenable to description in conventional quantitative terms. The main applications of the linguistic approach lie in the realm of humanistic systems especially in the fields of artificial intelligence, linguistics, human decision processes, pattern recognition, psychology, law, medical diagnosis, information retrieval, economics, and related areas (Bellman & Zadeh, 1970; Zadeh, 1975b).

Fuzzy sets and fuzzy logic are powerful mathematical tools for modeling uncertain systems in industry. A fuzzy set is an extension of a crisp set. Crisp sets only allow full membership or non-membership, whereas fuzzy sets allow partial memberships. A fuzzy number \tilde{M} is a convex normalised fuzzy set of the real line R such that (Chen, Lin, & Huang, 2006; Zimmermann, 1992):

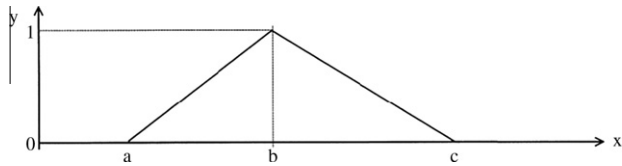


Fig. 1. An example of a triangular membership function.

- It exists such that one $x \in R$ with $\mu_{\tilde{M}}(x) = 1$
- $\mu_{\tilde{M}}(x)$ is piecewise continuous.

It is possible to use different fuzzy numbers depending on the situation. In applications it is often convenient to work with triangular fuzzy numbers (TFNs) because of their computational simplicity, and they are useful in promoting representation and information processing in a fuzzy environment. In this study TFNs are adopted in the fuzzy TOPSIS method. Triangular fuzzy numbers can be defined as a triplet (a, b, c) where the parameters of a, b , and c , respectively indicate the smallest possible value, the most promising value, and the largest possible value that describe a fuzzy event (Kaufmann & Gupta, 1991). A triangular fuzzy number \tilde{M} is shown in Fig. 1.

While there are various operations on triangular fuzzy numbers, only important operations used in this study are illustrated. If we define two positive triangular fuzzy numbers (a_1, b_1, c_1) and (a_2, b_2, c_2) then:

$$(a_1, b_1, c_1) + (a_2, b_2, c_2) = (a_1 + a_2, b_1 + b_2, c_1 + c_2) \quad (1)$$

$$(a_1, b_1, c_1) \times (a_2, b_2, c_2) = (a_1 \times a_2, b_1 \times b_2, c_1 \times c_2) \quad (2)$$

$$(a_1, b_1, c_1) \times k = (a_1 \times k, b_1 \times k, c_1 \times k) \quad \text{where } k > 0 \quad (3)$$

3.2. The TOPSIS method

TOPSIS method is a technique for order preference by similarity to ideal solution (Hwang & Yoon, 1981). The ideal solution (also called positive ideal solution) is a solution that maximises the benefit criteria/attributes and minimises the cost criteria/attributes, whereas the negative ideal solution (also called anti-ideal solution) maximises the cost criteria/attributes and minimises the benefit criteria/attributes (Chen, 2000). The so-called benefit criteria/attributes are those for maximisation, while the cost criteria/attributes are those for minimisation. The best alternative is the one, which is closest to the ideal solution and farthest from the negative ideal solution (Herrera, Herrera-Viedma, & Verdegay, 1996; Herrera & Herrera-Viedma, 2000).

Suppose a MCDM problem has m alternatives (A_1, A_2, \dots, A_m) , and n decision criteria/attributes (C_1, C_2, \dots, C_n) . Each alternative is evaluated with respect to the n criteria/attributes. All the values/ratings assigned to the alternatives with respect to each criterion form a decision matrix denoted by $X = (x_{ij})_{m \times n}$. Let $W = (w_1, w_2, \dots, w_n)$ be the relative weight vector about the criteria, satisfying $\sum_{j=1}^n w_j = 1$. Then the TOPSIS method can be summarised as follows:

- Normalise the decision matrix $X = (x_{ij})_{m \times n}$ by calculating r_{ij} which represents the normalised criteria/attribute value/rating.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m \frac{1}{x_{ij}^2}}} \quad \text{for minimisation objective,} \\ \text{where } i = 1, 2, \dots, m \quad \text{and } j = 1, 2, \dots, n \quad (4)$$

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}} \quad \text{for maximisation objective,} \\ \text{where } i = 1, 2, \dots, m \quad \text{and } j = 1, 2, \dots, n \quad (5)$$

- Calculate the weighted normalised decision matrix $V = (v_{ij})_{m \times n}$

$$v_{ij} = r_{ij} \cdot w_j \quad \text{where } i = 1, 2, \dots, m \quad \text{and } j = 1, 2, \dots, n \quad (6)$$

where w_j is the relative weight of the j th criterion or attribute, and $\sum_{j=1}^n w_j = 1$

- Determine the ideal (A^*) and negative ideal (A^-) solutions:

$$A^* = \{v_1^*, v_2^*, \dots, v_n^*\} \quad \text{where } v_j^* = \max_i(v_{ij}) \quad (7)$$

$$A^- = \{v_1^-, v_2^-, \dots, v_n^-\} \quad \text{where } v_j^- = \min_i(v_{ij}) \quad (8)$$

- Calculate the Euclidean distances of each alternative from the positive ideal solution and the negative ideal solution, respectively:

$$d_i^+ = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^*)^2} \quad i = 1, 2, \dots, m \quad (9)$$

$$d_i^- = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^-)^2} \quad i = 1, 2, \dots, m \quad (10)$$

- Calculate the relative closeness of each alternative to the ideal solution. The relative closeness of the alternative A_i with respect to A^* is defined as CC_i

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-} \quad i = 1, 2, \dots, m \quad (11)$$

- Rank the alternatives according to the relative closeness to the ideal solution. The bigger the CC_i , the better the alternative A_i . The best alternative is the one with the greatest relative closeness to the ideal solution.

4. The proposed fuzzy TOPSIS method

The basic steps of proposed fuzzy TOPSIS method can be described as follows:

- Step 1.** In the first step, a panel of decision-makers (DMs) who are knowledgeable about airline selection and evaluation process is established. In a group that has K decision-makers (i.e. D_1, D_2, \dots, D_k) are responsible for ranking (y_{jk}) of each criterion (i.e. C_1, C_2, \dots, C_n) in increasing order. Then, the aggregated fuzzy importance weight for each criterion can be described as fuzzy triangular numbers $\tilde{w}_j = (a_j, b_j, c_j)$ for $k = 1, 2, \dots, K$ and $j = 1, 2, \dots, n$. The aggregated fuzzy importance weight can be determined as follows:

$$a_j = \min_k \{y_{jk}\}, \quad b_j = \frac{1}{K} \sum_{k=1}^K y_{jk}, \quad c_j = \max_k \{y_{jk}\} \quad (12)$$

Then, the aggregated fuzzy importance weight for each criterion is normalised as follows:

$$\tilde{w}_j = (w_{j1}, w_{j2}, w_{j3})$$

where

$$w_{j1} = \frac{\frac{1}{a_j}}{\sum_{j=1}^n \frac{1}{a_j}}, \quad w_{j2} = \frac{\frac{1}{b_j}}{\sum_{j=1}^n \frac{1}{b_j}}, \quad w_{j3} = \frac{\frac{1}{c_j}}{\sum_{j=1}^n \frac{1}{c_j}} \quad (13)$$

Then the normalised aggregated fuzzy importance weight matrix is constructed as $\tilde{W} = [\tilde{w}_1, \tilde{w}_2, \dots, \tilde{w}_n]$.

- Step 2.** A decision matrix is formed.

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad (14)$$

Step 3. After forming the decision matrix, normalisation is applied. The calculation is done using formulas 4 and 5. Then, normalised decision matrix is obtained as:

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \dots & \dots & \dots & \dots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix} \quad (15)$$

Step 4. Considering the different weights of each criterion, the weighted normalised decision matrix is computed by multiplying the importance weight of evaluation criteria and the values in the normalised decision matrix. The weighted normalised decision matrix \tilde{V} for each criterion is defined as:

$$\tilde{V} = [\tilde{v}_{ij}]_{m \times n} \text{ for } i = 1, 2, \dots, m \text{ and } j = 1, 2, \dots, n \quad (16)$$

where $\tilde{v}_{ij} = r_{ij} \times \tilde{w}_j$. Here \tilde{v}_{ij} denotes normalised positive triangular fuzzy numbers.

Step 5. Then fuzzy positive (\tilde{A}^+) and fuzzy negative (\tilde{A}^-) ideal solutions are determined as follows:

$$\tilde{A}^+ = (\tilde{v}_1^+, \tilde{v}_2^+, \dots, \tilde{v}_n^+) \text{ where } \tilde{v}_j^+ = (\max_i(v_{ij1}), \max_i(v_{ij2}), \max_i(v_{ij3})) \text{ and}$$

$$\tilde{A}^- = (\tilde{v}_1^-, \tilde{v}_2^-, \dots, \tilde{v}_n^-) \text{ where } \tilde{v}_j^- = (\min_i(v_{ij1}), \min_i(v_{ij2}), \min_i(v_{ij3}))$$

$$\text{For } i = 1, 2, \dots, m \text{ and } j = 1, 2, \dots, n \quad (17)$$

Step 6. Then the fuzzy distance of each alternative from fuzzy positive and fuzzy negative ideal solutions are calculated as:

$$\tilde{d}_i^+ = \sqrt{\sum_{j=1}^n (\tilde{v}_j^+ - \tilde{v}_{ij}^+)^2} \text{ and}$$

$$\tilde{d}_i^- = \sqrt{\sum_{j=1}^n (\tilde{v}_j^- - \tilde{v}_{ij}^-)^2} \text{ } i = 1, 2, \dots, m \quad (18)$$

Step 7. Then the fuzzy closeness coefficient \tilde{CC}_i is determined as:

$$\tilde{CC}_i = \frac{\tilde{d}_i^-}{\tilde{d}_i^+ + \tilde{d}_i^-} \text{ } i = 1, 2, \dots, m \quad (19)$$

The fuzzy closeness represents the distances to the fuzzy positive ideal solution and the fuzzy negative ideal solution simultaneously.

Step 8. The fuzzy closeness coefficient defuzzified as follows:

$$CC_i = \sqrt[3]{CC_{i1} \cdot CC_{i2} \cdot CC_{i3}} \quad (20)$$

This formula can be considered as defuzzification procedure. A closeness coefficient (CC_i) is defined to rank all possible alternatives. According to the closeness coefficient, the ranking of the alternatives can be determined.

General steps of fuzzy TOPSIS approach can be summarised as in Fig. 2.

5. The application of fuzzy TOPSIS method to the Turkish domestic airline industry

The proposed algorithm in the application of fuzzy TOPSIS method to the Turkish domestic airline industry is explained in the following steps.

Step 1: In the first stage, a panel of ten DMs from various departments including purchasing, quality, and production and planning who were involved in strategy process was formed. Based on semi-structured interviews with DMs, a list of nine *Strategy Process* criteria was generated. These criteria are related to various aspects of strategy ranging from advertising, product quality, price competitiveness, customer loyalty, market share, customer service, e-commerce, management experience, and branding. These criteria have the following major characteristics in the airline sector of Turkey.

5.1. Advertising

Advertising in the airline business is a tool that stimulates customers to purchase the airline company's products and services or to prefer its brand and to ensure the continuity of the marketing mix efforts. In the airline business the existence of many airline companies with a wide range of ticket price offers indicate that the advertising activities of air carriers become essential and important. By and large, they ensure the airline company's publicity campaigns as well as increase their sales and market shares.

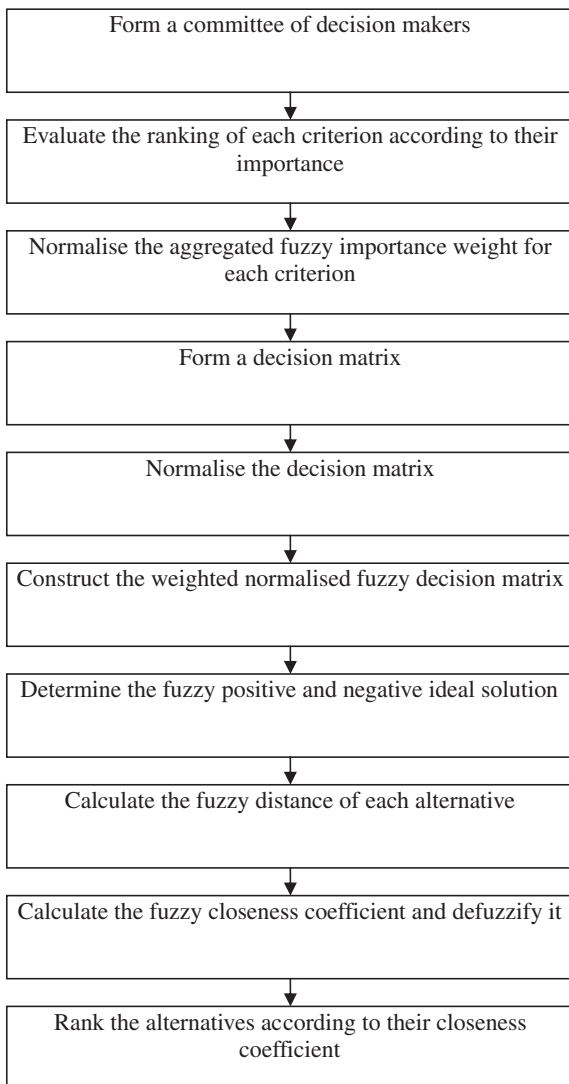


Fig. 2. The steps of fuzzy TOPSIS method.

Advertising in the airline business is a way to generate a company image, to sell products and services and to motivate personnel (Alkoç, 2004).

5.2. Product quality

The quality of service in the airline business ranges from the ticket purchase process to the behaviours and attitudes of cabin crew to the passengers. The quality of services given in the airline business may be exemplified as the waiting time for buying the ticket in the counter, the whole time spent for buying the ticket, the ticket fares, the waiting time for the check-in and boarding, the delay time before take off, the distance between the seats in the aircraft, the number of times the air hostess serves, the service quality, the emergency material and equipment, on time landing, the waiting time for collecting luggage, and the number of damaged or lost luggage (Gurses, 2006).

5.3. Price competitiveness

The proper cost calculation of services in the airline business plays a vital role in the determination of ticket fares. Airline companies have to minimise costs and to remove activities that do not add value to the end service. The fixed and variable costs that directly affect pricing in the aviation sector are as follows: (1) fixed costs: amortisation, depreciation, insurance expenses, engineering expenses, administrative expenses, and infrastructure expenses, (2) variable costs: fuel expenses, maintenance/overhauling expenses, personnel expenses, and passenger and food expenses.

5.4. Customer loyalty

Airline companies continuously develop and improve their products and services in order to meet customer needs. Companies employ fidelity programmes in order to ensure customer loyalty. In such programmes customer information are stored in databases whereby direct promotions may be sent to the groups of targeted customers. Such explicitly planned marketing strategy ensures both low-cost and high income for the airline companies (Yildirim, 2007).

The domestic airline companies that are in cutthroat competition in terms of quality of service with each other have similar or identical products and services. Customers are unable to perceive the significant discrepancies of products and services of airline companies that are in competition. This is why today's customers do not value the behaviour of brand loyalty in the airline business. Customers can easily shift brands until they get satisfaction with the product and service they choose (Kavas, 2004).

5.5. Market share

Market share is the percentage of the total market that a company controls for a particular product or product category. Market share is often broken down by geographic area (state, country, etc.), gender, ethnicity, and other demographics. Companies strive to increase market share to achieve economies of scale in production, distribution, advertising, and other functional areas, thereby widening profit margins and increasing earnings. (Karasu, 2007).

5.6. Customer service

The airline companies have to know targeted customers' needs while they plan their products and services for customers. The services given in the airline business can be classified as follows: cabin order, the type of aircraft, the frequency of flight, flight

network, reservation and ticket booking points, punctuality, and the services on board (Shaw, 1986).

5.7. E-commerce

Even though the air transportation is the fastest and safest means of carrying, it is usually considered as a costly option by people. Thus, the airline companies should invest in e-commerce infrastructure and expand e-commerce activities in order to make best use of e-commerce applications and increase their profit margins through satisfying their customers. E-commerce provides to the airline companies an appropriate environment where they reach their customers timely and reliably (Kaya & Kuyucak, 2004).

The air transportation with its features of high technology, swiftness, service quality, safety, and security as well as with its infinite, ongoing and low-cost e-commerce applications becomes a main building block of civil and contemporary life. Airline companies with their e-commerce activities may minimise their feature of being costly or even getting rid of it (Kaya & Kuyucak, 2004). According to IATA, while the cost of conventional ticket for the airline company is about \$10, the cost of online ticket is approximately \$1. This is why e-commerce brings to the airline companies the benefits of savings in distribution costs, increasing competitiveness, providing dynamic and market oriented pricing and of directly reaching the service for customers (Doganis, 2001; Şengür, 2004).

5.8. Management experience

The management in the airline company is important due to keeping costs low. The management should motivate employees to work efficient and make appropriate strategies to decrease costs. Especially, the employee motivation is a key to provide work efficiency that may help bring costs down.

5.9. Branding

In generating brand in the airline business such factors as advertisement and promotion activities, the company logos and colours, the internal design of the aircraft, ticket sales points, waiting rooms at the airport, and the variety and quality of services given on board and at the airport play a critical role for airline companies.

Reservation and ticket purchase are transactions that make the customer first time contact the airline company. Therefore, the design of the ticket booking point is an important milestone to create brand for the airline company. If the first impression is bad for the customer, this will directly harm the brand. Especially, the staffs who work in the ticket booking points should be skilled, trained, and qualified. The transactions regarding reservation and ticket purchase on the phone or online should be comprehensible, simple, and swift.

Table 2
Normalised aggregate fuzzy importance weights.

Criteria	w_{j1}	w_{j2}	w_{j3}
Advertising (\bar{w}_1)	0.0345	0.0614	0.0718
Product quality (\bar{w}_2)	0.2068	0.1267	0.1256
Price competitiveness (\bar{w}_3)	0.2068	0.1842	0.1675
Customer loyalty (\bar{w}_4)	0.2068	0.1351	0.1256
Market share (\bar{w}_5)	0.0414	0.0654	0.0628
Customer service (\bar{w}_6)	0.2068	0.2533	0.2512
E-commerce (\bar{w}_7)	0.0259	0.0482	0.0558
Management experience (\bar{w}_8)	0.0295	0.0507	0.0558
Branding (\bar{w}_8)	0.0414	0.0751	0.0837
Total	1.0000	1.0000	1.0000

After having grasped the brief definitions of criteria from the managerial outlook, the DMs were then asked to rank order selection criteria in terms of their relative importance. Next, using Eq. (12) aggregate fuzzy importance weights were calculated and their normalised aggregate fuzzy importance weights were computed using Eq. (13). These values are shown in Table 2.

Step 2: In this step, we measure the performance of firms with respect to each strategy criterion. Delivery performance was measured by lead time in days as an elapsed time between ordering and receiving of forging parts for propeller shaft, while quality performance was determined by the percentage of defective items. Supplier selection criterion of price/cost was measured by the purchasing cost of the items in terms of USD. Financial strength of the supplier firm was assessed by debt ratio which was computed by the proportion of total assets financed by outside creditors. Finally, managerial and organisational strength of the supplier firm was

identified based on an index value which considers the perceptual assessment of DMs with regard to a number of management and organisation related variables, i.e. the clarity of employee job definitions, mission and goals, the extent of autonomy and also the efficiency of human resources management practices.

Table 3 shows the decision matrix of selection criteria. While Supplier A was found to have a relatively better performance in terms of delivery performance and financial strength, Supplier B had a better performance in terms of delivery performance and price/cost. Supplier C, however, outperformed the other two suppliers in terms of quality performance and managerial and organisational strength.

Step 3: Using either Eqs. (4) or (5), normalised decision matrix is obtained depending on whether the objective of selection criterion is that of minimisation or maximisation. Table 4 shows the normalised decision matrix.

Table 3
Decision matrix.

	Advertising	Product quality	Price competitiveness	Customer loyalty	Market share	Customer service	E-commerce	Management experience	Branding
Turkish Airlines	5	5	3	4	5	5	5	5	5
Onur Air	2	2	4	2	3	1	3	2	1
Pegasus	3	3	5	3	4	3	4	4	3
Atlas Jet	3	3	4	2	3	2	3	2	1

Table 4
Normalised decision matrix.

Firms	Advertising	Product quality	Price competitiveness	Customer loyalty	Market share	Customer service	E-commerce	Management experience	Branding
Turkish Airlines	0.7293	0.7293	0.3693	0.6963	0.6509	0.8006	0.6509	0.7143	0.8333
Onur Air	0.2917	0.2917	0.4924	0.3482	0.3906	0.1601	0.3906	0.2857	0.1667
Pegasus	0.4376	0.4376	0.6155	0.5222	0.5208	0.4804	0.5208	0.5714	0.5000
Atlas Jet	0.4376	0.4376	0.4924	0.3482	0.3906	0.3203	0.3906	0.2857	0.1667

Table 5
Weighted normalised decision matrix.

	Advertising	Product quality	Price competitiveness	Customer loyalty	Market share	Customer service	E-commerce	Management experience	Branding	
V ₁	TA	0.0251	0.1509	0.0764	0.1440	0.0269	0.1656	0.0168	0.0211	0.0345
	Onur Air	0.0101	0.0603	0.1018	0.0720	0.0162	0.0331	0.0101	0.0084	0.0069
	Pegasus	0.0151	0.0905	0.1273	0.1080	0.0215	0.0994	0.0135	0.0169	0.0207
	Atlas Jet	0.0151	0.0905	0.1018	0.0720	0.0162	0.0662	0.0101	0.0084	0.0069
V ₂	THY	0.0448	0.0924	0.0680	0.0941	0.0426	0.2028	0.0314	0.0362	0.0625
	Onur Air	0.0179	0.0369	0.0907	0.0470	0.0255	0.0406	0.0188	0.0145	0.0125
	Pegasus	0.0269	0.0554	0.1134	0.0706	0.0340	0.1217	0.0251	0.0289	0.0375
	Atlas Jet	0.0269	0.0554	0.0907	0.0470	0.0255	0.0811	0.0188	0.0145	0.0125
V ₃	THY	0.0524	0.0916	0.0619	0.0875	0.0409	0.2012	0.0363	0.0399	0.0698
	Onur Air	0.0209	0.0366	0.0825	0.0437	0.0245	0.0402	0.0218	0.0160	0.0140
	Pegasus	0.0314	0.0550	0.1031	0.0656	0.0327	0.1207	0.0291	0.0319	0.0419
	Atlas Jet	0.0314	0.0550	0.0825	0.0437	0.0245	0.0805	0.0218	0.0160	0.0140

Table 6
Fuzzy positive ideal solution and its fuzzy distance for each alternative.

		Advertising	Product quality	Price competitiveness	Customer loyalty	Market share	Customer service	E-commerce	Management experience	Branding
\tilde{v}_{j1}^+	TA	0.0000	0.0000	-0.0509	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Onur Air	-0.0151	-0.0905	-0.0255	-0.0720	-0.0108	-0.1325	-0.0067	-0.0127	-0.0276
	Pegasus	-0.0101	-0.0603	0.0000	-0.0360	-0.0054	-0.0662	-0.0034	-0.0042	-0.0138
	Atlas Jet	-0.0101	-0.0603	-0.0255	-0.0720	-0.0108	-0.0994	-0.0067	-0.0127	-0.0276
	Jet									
\tilde{v}_{j2}^+	THY	0.0000	0.0000	-0.0454	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Onur Air	-0.0269	-0.0554	-0.0227	-0.0470	-0.0170	-0.1622	-0.0126	-0.0217	-0.0500
	Pegasus	-0.0179	-0.0369	0.0000	-0.0235	-0.0085	-0.0811	-0.0063	-0.0072	-0.0250
	Atlas Jet	-0.0179	-0.0369	-0.0227	-0.0470	-0.0170	-0.1217	-0.0126	-0.0217	-0.0500
	Jet									
\tilde{v}_{j3}^+	THY	0.0000	0.0000	-0.0412	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Onur Air	-0.0314	-0.0550	-0.0206	-0.0437	-0.0164	-0.1609	-0.0145	-0.0239	-0.0558
	Pegasus	-0.0209	-0.0366	0.0000	-0.0219	-0.0082	-0.0805	-0.0073	-0.0080	-0.0279
	Atlas Jet	-0.0209	-0.0366	-0.0206	-0.0437	-0.0164	-0.1207	-0.0145	-0.0239	-0.0558
	Jet									

Table 7
Fuzzy Negative ideal solution and its fuzzy distance for each alternative.

		Advertising	Product quality price competitiveness	Customer loyalty	Market share	Customer service	E-commerce	Management experience	Branding
\tilde{v}_{j1}^-	TA	0.0151	0.0905	0.0000	0.0720	0.1325	0.0067	0.0127	0.0276
	Onur Air	0.0000	0.0000	0.0255	0.0000	0.0000	0.0000	0.0000	0.0000
	Pegasus	0.0050	0.0302	0.0509	0.0360	0.0054	0.0662	0.0034	0.0084
	Atlas Jet	0.0050	0.0302	0.0255	0.0000	0.0000	0.0331	0.0000	0.0000
	Jet								
\tilde{v}_{j2}^-	THY	0.0269	0.0554	0.0000	0.0470	0.0170	0.1622	0.0126	0.0217
	Onur Air	0.0000	0.0000	0.0227	0.0000	0.0000	0.0000	0.0000	0.0000
	Pegasus	0.0090	0.0185	0.0454	0.0235	0.0085	0.0811	0.0063	0.0145
	Atlas Jet	0.0090	0.0185	0.0227	0.0000	0.0000	0.0406	0.0000	0.0000
	Jet								
\tilde{v}_{j3}^-	THY	0.0314	0.0550	0.0000	0.0437	0.0164	0.1609	0.0145	0.0239
	Onur Air	0.0000	0.0000	0.0206	0.0000	0.0000	0.0000	0.0000	0.0000
	Pegasus	0.0105	0.0183	0.0412	0.0219	0.0082	0.0805	0.0073	0.0160
	Atlas Jet	0.0105	0.0183	0.0206	0.0000	0.0000	0.0402	0.0000	0.0000
	Jet								

Step 4: Then weighted normalised decision matrix is calculated using Eq. (6). The weighted normalised decision matrix for each selection criterion is shown in Table 5.

Step 5 and Step 6: The fuzzy positive (\tilde{A}^+) and negative (\tilde{A}^-) ideal solutions are determined using Eq. (17). Next, the fuzzy distance of each alternative is calculated using Eq. (18). These values are shown in Tables 6 and 7.

Step 7 and Step 8: The fuzzy closeness coefficient \tilde{CC}_i is determined using Eq. (19) while defuzzified CC_i is obtained using Eq. (20). The values of both fuzzified and defuzzified closeness coefficients are shown in Table 8. As initial average weights were used in the TOPSIS calculations, the values of CC_{i2} in Table 8 are considered as crisp TOPSIS results. Fuzzy TOPSIS results, however, are shown in the last column of

Table 8 (CC_i).

When fuzzy TOPSIS approach was employed, the Turkish Airlines has been identified as the most appropriate company. This finding is not particularly surprising, as most airline evaluation decisions are currently being made in increasingly complex environments where the theory of fuzzy decision-making can be of significant use. In this study, the fuzzy TOPSIS methodology has been employed as an alternative to the conventional TOPSIS approach.

6. An analysis of outcomes of fuzzy TOPSIS method from the managerial standpoint

The implementation of fuzzy TOPSIS method revealed the ranking of major air carriers in light of key success variables in the sector (Table 8). These findings can be justified from the managerial perspective in terms of activities of airline companies respectively in the following way.

The Turkish Airlines performed the following activities in terms of key success factors of the Turkish airline industry.

In order to adapt to globalisation and increasing competition, the company gave much importance to the advertisement and promotion campaigns. The Turkish Airlines took steps in order to increase its sales and built up a company image through

Table 8
Computations of CC_i .

Airline companies	CC_{i1}	CC_{i2}	CC_{i3}	CC_i
Turkish Airlines	0.7791	0.8065	0.8214	0.8022
Onur Air	0.1231	0.1064	0.0975	0.1085
Pegasus	0.4979	0.5118	0.5070	0.5055
Atlas Jet	0.2654	0.2524	0.2481	0.2552

participating in different national and international exhibitions and trade fairs. Besides, it undertook cultural and sports sponsorship agreements in order to generate an awareness of its identity in the airline business.

On the one hand, the airline carrier firms plan to offer service to their customers through a wider, comfortable, secure flight network, and try to discard old planes. On the other hand, they try to add new planes to their fleets. In this regard, the Turkish Airlines makes the most effective study. The firm continuously increases the number of planes in its fleet. The company had domestic flights to 37 destinations with 127 planes in 2008. It has reduced its fleet's age to 6 and aims to increase its fleet's plane number to 232 by purchasing another 105 planes until 2023 within the long range plans of the firm.

The Turkish Airlines greatly differs from other private airline firms in terms of catering services during the trip. The company established Do & Co Catering Services after getting into a partnership with the Austrian Do & Co Restaurants & Catering firm in 2006. In this way, the company began to offer foods and beverages appealing to their customers.

The Turkish Airlines began to approach most of its units as a separate business in order to use them effectively and efficiently in 2006. The company firstly initiated this process in its technical department. Then, it added financial and efficiency dimension to its maintenance, repair, and overhaul services (Yildirim, 2007). The company's Technical Unit today offers services to many national and international firms. This service enabled Turkish Airlines to become one of the most important maintenance stations in the region.

The Turkish Airlines also offers training that contains many subjects in the airline business. The training unit became independent business like technical unit as a result of the company's top management decision and it started to give training to its customers throughout the world with the aim of catching the world standards in the airline business (Yildirim, 2007). The training unit offers services both for the company's own pilots and those of regional airlines through "flight training academy".

The airline companies quickly increased their market shares after having initiated their privatisation policies in 2003. The shares of airline companies in domestic flights reached to 30% in terms of passenger traffic in 2004, as a consequence, the Turkish Airlines' share grew by 15%. The firms just entered the sector preferred passengers who have not yet met with the flight experience to those of Turkish Airlines. In this way, the Turkish Airlines protected its current customers and improved its share in the market. However, the private airline carriers in the sector have recently gained competitive advantage through low cost policies against the Turkish Airlines.

As a result, the Turkish Airlines founded Anadolujet in 2008 after having realised that it could not respond to this competition with its current organisational structure. Anadolujet as a domestic brand of Turkish Airlines began to its flights based in Ankara. Anadolujet went out of current Turkish Airlines' concept and decreased prices by cutting down many services such as catering, seat size and comfort, and then has become a rival against other airline carriers in terms of price.

By becoming the first national airline company of Turkey, the Turkish Airlines has made a different image on passengers for years. Therefore, the customers became loyal to the company. The other reasons for customers being loyal to the Turkish Airlines can be classified in terms of quality of service, frequency of flights, behaviours of the staff, and safety and security provided (Aslan, 2007).

The Turkish Airlines offered Miles & Miles membership service which has Constant Flight Program in order to increase customer attachment. This membership leads to the benefits for customers: reservation priority, check-in facility at a separate counter, CIP (Special Departure Lounges), special seat in the aircraft, hotel and

car rental services, and emergency and legal services. In addition, it enables customers to win complimentary tickets by mile points accumulated in shopping through Shop & Miles cards.

The Turkish Airlines grew at a rate of 15% in 2008 while this figure in the European Airlines Association was 1.7%. The price increases in fuel gave rise to negative effects in the aviation sector. However, the Turkish Airlines took part among the leading airlines of Europe and the World. As a result of this growth, the company carried 22,597 million passengers in domestic flights in 2008. In the same year Anadolujet became a part of this activity in the domestic routes and the flight network of Turkish Airlines expanded nationwide and this positively affected the domestic flights' passengers. The number of passengers in the domestic routes reached to 11.1 million that meant 10.8% increase with respect to previous year.¹

The Turkish Airlines has recently added First Class flight mode to the Coach and Business Class flights and so it enabled more comfortable and delighted flight for its passengers. As a result of these services, the Turkish Airlines has been in the third place in rating in terms of inter-plane entertainment services by Skytrax and World Airline Entertainment Association (WAEA) which are the most esteemed inspection and consultancy institutions of the world.²

It raised its take-off speed to 83% which was one of the service quality evaluation criteria of the Association of European Airlines (AEA) in 2007. It has also reached to 4th place in Europe in terms of departure rate on time affecting customer satisfaction.

A Project named 'Back Manager' was used in 2006 in order to remove time loss due to luggage control in the domestic flights of Turkish Airlines. Through this system the passenger information that is given in his/her boarding card comes to the officer with a signal and the luggage is loaded onto the plane. The passenger, thus, should not wait in the queue for submitting his/her luggage before embarking.³

The Turkish Airlines was in the first place in terms of the number of lost luggage per 1000 passengers. This is one of the quality evaluation criteria of the AEA's.

All airline companies offer products to their customers on payment during flights except Turkish Airlines. This is a distinguishing feature of company.

The Turkish Airlines also carries out many projects which are concerned with both keeping the available customers and reaching to new customers within the scope of CRM studies. Some of these studies are called as 'Hidden Client Project,' 'Voluntary Observer Project,' 'Overseas Observer Application,' and 'Internal Customer-Foreign Customer Satisfaction.'⁴

The Turkish Airlines is a model in terms of e-commerce for other airline carriers in the sector. It enables their customers to receive fast and more reliable service with many projects applied. The Turkish Airlines increasingly expands its e-ticket application in order to prevent passengers from being victimised due to ticket loss like the case in all other airlines in the world. E-ticket application has been used in all stations since the late of 2007 and increased to 67%.⁵

Another service of the firm is 'online check-in system.' This enables customers to do their check-in process through internet before 90 minutes to take-off. The number of passengers who do online check-in has greatly increased.⁶

Sales over the internet site of the Turkish Airlines also increased to 70% in 2007. The Turkish Airlines' web-site has been deemed

¹ www.thy.com.tr, 22.06.2009.

² www.thy.com.tr, 22.06.2009.

³ www.gokyuzuhaberci.com, 10.02.2006.

⁴ www.thy.com.tr, Annual Report, p: 21, 02.03.2009.

⁵ www.thy.com.tr, Annual Report, p: 43, 03.04.2009.

⁶ www.thy.com.tr, Annual Report, p: 43, 03.04.2009.

worthy of championship award in e-commerce category according to 'Fifth Golden Spider Web Awards' competition.⁷

The Turkish Airlines has strengthened its position with its strategic plans that are prepared by its skilled and experienced staff during the reconfiguration process after the privatisation. The Turkish Airlines appears to be far better in terms of management competence and experienced staff than other firms.

The Turkish Airlines has made a decision to cooperate with airline alliances in order to respond their customers' increasing demands as a result of number of passenger increase. The Turkish Airlines attended to "Star Alliance" groups in which Lufthansa took the lead in 2006. The business expects benefits from this cooperation such as flight facility to more destinations worldwide, income increment, cost decrement, information, technology and experience sharing, common brand utilisation, opportunity to win mile points and spend it in other airlines that are the members of the alliance, connecting flight by ticket from only one airline, and transfer of the luggage to the destination point. All these benefits have strengthened the trust of customers who travels in domestic flights through the Turkish Airlines brand.

As a result, customer-oriented business policy, service-friendliness feature, comfort and reliability features, steady growing flight network, and structure sensitive to market conditions are factors that have an important role on customers' choice.

In light of above ideas, the Turkish Airlines has taken first place in eight factors out of nine critical success factors determined in the analysis (Table 4). It has only fallen behind of other firms in price competition. This is normal when it is considered that the main strategy of other airline carriers is low-cost. In this respect, the Turkish Airlines competes with Atlas Jet.

Pegasus performed the following activities in terms of key success factors of the Turkish airline industry.

Another firm planning to support its fleet with young planes is Pegasus. Pegasus was purchased by Esas Holding in 2005 took important steps towards the development of its fleet. The firm which performed flights to 18 destinations with 15 planes in 2008 aimed to raise its fleet to 43 by 2015.⁸

Pegasus' departure rate on time between March 2006 and March 2007 is 93%. This rate is above 80.9% rate of Association of European Airlines. The firm aims to be the number one in Turkey in terms of departure performance on time.

Training is one of the primary subjects for Pegasus. In addition to its maintenance services, Pegasus provides training services about cabin crew, pilot, and technical personnel to the other airline businesses in the sector (Dikyol, 2007).

Pegasus' low-cost policy and very strict financial policy, which are its major strengths, allow the firm to sell cheaper tickets to its customers. In this aspect, Pegasus takes example of Southwest Airlines which is one of the leading low-cost carriers in the world. With the supply and demand equilibrium of the fare, on the one hand, the customer who gets their tickets earlier or make an early booking finds cheaper tickets, on the other hand, fares gradually increases when flight day and time get closer. The highest fare is at the competitors' fare level. The passengers who get their tickets in domestic flights earlier than 60 days, they will have a right to fly with 25, 35, 45 TL according to the graded fare system of the firm named 'Peganomi.'

Below is the formula of cheap flight by Pegasus (Dikyol, 2007).

- It uses Sabiha Gökçen Airport as its main basis. Therefore, it finds opportunity to make fast and multi-frequency operations.
- It has uniform and young fleet.
- VIP and Business Class applications are not available.
- Electronic ticket is applied. Passengers receive flight and reservation information as an e-mail or sms message to their cellular phones.
- Sales offices are only found at airports, there are no high cost sales offices in the inner-city.
- Extra income sources are generated with alternative product and services (e.g., hotel, rent a car services, inner-plane bulletin advertisement spaces, etc.).
- Inner-plane caterings are priced.

Customers can have advantages of Advantage Card of HSBC Bank with Pegasus Card that Pegasus firm provides.

Pegasus gives its passengers opportunity of making insurance against many probable risks in travels intended for business, trip, visit or holiday. Within this service scope of Pegasus Airlines, passengers over 1500 were insured through approximately 60 travel agencies in 2007 (Dikyol, 2007).

Pegasus carried 4 million and 400,000 passengers in 2008. The firm achieved to raise its 110,000 passengers in 2005 to 3 million and 221,000 in 2008. In this way, the firm's sales increased from 14.9% in 2006 to 18.1% in 2007.

In Fast Fish competition where Reference Newspaper selects the fastest expanding-profitable businesses of Turkey each year with its slogan of "Paradigm of the economy changed; big fish does not devour small fish anymore, fast one devours slow one," Pegasus Airlines has been selected as the fastest fish of Turkey in 'Transportation' branch for the year 2008. Underlying factors for this award are explained as follows⁹:

- It became the first low-cost representative of airline model in Turkey.
- While the sector has grown at the ratio of 20%, Pegasus has grown at the ratio of 57% between 2005 and 2008.
- It has brought a new viewpoint to the air carriage with inter-plane catering sales.
- It has applied advertisement spaces over & inter-plane and ticket indexed travel insurance first time.
- It offered car rental, hotel, and travel insurance with reasonable cost over the web-site.
- It provided a chance of win points while shopping, cut-rate or free flight to its passengers via Pegasus Card in cooperation with HSBC.
- It has become a firm that has most timely departure rate in Turkey.
- When fuel prices increased in 2005, it reduced its costs \$2.2 million by applying the project named "War on Fuel."

All scheduled domestic flights of Pegasus are made over Istanbul Sabiha Gokcen Airport. This airport is considered as a new globalising face of Turkey with its strategic location, functional architecture, and transportation and all other facilities. This is why Pegasus explicitly differs from other domestic airline firms in terms of its service scope.

Pegasus offers car rental service in cooperation with Hertz-rent-a-car with the most convenient fare via a call centre and web-site.

⁷ www.thy.com.tr, Annual Report, p: 43, 03.04.2009.

⁸ www.referansgazetesi.com/haber.aspx?HBR_KOD=122089& HTP_KOD= 9, 05.05.2009.

⁹ www.referansgazetesi.com/haber.aspx?HBR_KOD=122089& HTP_KOD= 9, 05.05.2009.

Pegasus also offers an opportunity to make booking in the cheapest hotels over 180,000 worldwide through the web-site with the aid of Hotel Reservation Service.

The passengers traveling by Pegasus can use the parking area exclusively allotted for them within the first 72 h at the Istanbul Sabiha Gokcen Airport.

In case of a 3 h delay Pegasus returns the ticket; and in case of a 5 h delay it both returns the ticket and gives free ticket to its passengers.

It may be seen disadvantageous that Pegasus passengers can select their seats by paying.

ESAS Holding that was founded by Sabancı family members supported Pegasus to become a well-established private airline business in Turkey. ESAS Holding bought Pegasus Airlines in 2005 and launched a reorganisation project that complies with the customers' expectations along with the dynamism that the new administration originated.

ESAS Holding operates in health and food sector along with aviation. Ali Sabancı who chairs the Board of Directors of Pegasus Airlines injected managerial values and skills of Sabancı Holding to the firm.

The name of Sabancı provides a trust-incentive and stimulating factor for potential customers towards Pegasus brand. Pegasus Airlines received many awards in 2006 and the company was selected as "The Best Airline Business" and Ali Sabancı was chosen as "The Best Businessman" by Galatasaray University. He was also selected as "The Most Popular Businessman" by Yıldız Technical University.

Furthermore, Pegasus has received Effie bronze award as a result of its strategic approach in its advertisements and also "Think Marketing" revolutionary marketing award due to its marketing idea which is different and innovative. Besides, it has become "The Most Searched Airline Business" in Google Turkey.

In light of above ideas, the firm has become first in price competition which is one of the critical success factors. It has become second in all other factors after the Turkish Airlines (Table 4). According to these values, it has been observed that Pegasus is a firm that strongly competes with the Turkish Airlines in the domestic flights in Turkey. Thus, Pegasus could be considered as the closest airline company that can play a key role in the domestic flights through its potential partnerships in the airline business in the medium or long term.

Atlas Jet performed the following activities in terms of key success factors of the Turkish airline industry.

Atlas Jet emphasises attractive ticket fares and comfortable flight through television and newspaper ads.

Atlas Jet with its fleet of 11 air planes had scheduled domestic flights to 6 destinations in 2008.¹⁰ Atlas Jet sells its older air planes whose contracts were due in 2006 and in 2007 and were used for charter flights in its fleet. Atlas Jet began to use one type of aircraft in its fleet in order to reduce costs and made a contract with the American financial leasing company Aerocap and purchased 12 air planes with the capacity of 180 seats each. In this way, Atlas Jet's fleet included 22 air planes and the average age of aircraft for the year of 2007 became 3 (Dikyol, 2007).

Atlas Jet uses low-cost strategy in order to gain competitive advantage in the market.

The company gives privileges of making use of airport and transportation services to passengers who hold Akbank's Wing credit card. Furthermore, the company gives priority to the passengers who continuously fly with Atlas Jet through Jetmil Fidelity Programme and hold Jetmil card. Atlas Jet also opened rooms called Commercially Important People—CIP at Istanbul, Ankara, İzmir, Bodrum, and Dalaman Airports for the passengers who regularly fly with business class and Club Class. In these rooms ser-

vices such as television, Internet and special treatments are given to those passengers.¹¹

Atlas Jet's occupancy rate was 75% in 2005 and it became 86% in 2006. While Atlas Jet's revenue was \$265 million, it became \$340 million in 2006. However, the aircraft of Istanbul–Isparta route crashed on 30 November, 2007 and then the company faced a big trouble. This concern still continues today.

Atlas Jet differentiates its services from other air line companies by providing the leather seats and extending distances between seats around 77 cm in its aircraft. It also gives video-audio information and entertainment services to its customers.

Atlas Jet provides easy boarding system as well as self check-in service through kiosks to its passengers who have no luggage at some airports' domestic flights terminals (Dikyol, 2007). This greatly saves time for such passengers. The company also informs passengers about flight cancellation and delays due to bad weather conditions through sms messages to the passengers' cellular phones. Atlas Jet also provides Fly & Car service to the business people in some cities who are very busy and are supposed to be in different places in the city because of their business programmes. They are welcome in the luggage counter and seen off with a private car at the destination in return of a 150 TL fee.¹²

The passengers who fly with Atlas Jet can purchase their tickets through e-ticket that enables customers to buy ticket through phoning a call centre 24 h and 7 days service and receiving a sms message to their cellular phones.

Atlas Jet was founded by Öger Holding in 2001. In 2004 Atlas Jet and ETS Tour merged and Atlas Jet entered a new process of structuring. Atlas Jet as a newly founded firm compared with the Turkish Airlines and Pegasus confronted with managerial difficulties in terms of lacking administrative skills.

Atlas Jet with its wide-ranging activities and services such as Jetmil Fidelity Programme, Wings Credit Card, Club Class system, wide leather seats, and Easy Boarding system succeeded to build up a positive company image in the eyes of its passengers. However, the air crash in 2007 damaged the company's good image and made its reliability attribute questionable.

In light of above ideas, Atlas Jet became the runner-up in terms of advertising, service quality, and price competitiveness and the third in terms of customer loyalty, market share, e-commerce, managerial skill, and branding in the airline business. In spite of diversity of services, Atlas Jet remained behind the Turkish Airlines and Pegasus in the domestic airline sector (Table 4).

Onur Air performed the following activities in terms of key success factors of the Turkish airline industry.

Onur Air first initiated a project that gave special importance to the value of their services perceived by customers. Onur Air used an implicit control mechanism in which private controllers perform undercover activities in the response number of call centre per minute, the quality of service of cabin crew, etc.¹³

Onur Air chose to target customers who have never tried air ways as a means of transportation before or did seldom try it. In this way, the company expanded the market of airline business (Şengür, 2004).

Onur Air's call centre provides the services of information request, reservation, and ticket booking 2 h and 7 days. On line ticket selling on its web-site that sends the PNR number of the passenger to his/her cellular phone continuously increased. This service eliminated the need of having the ticket physically during the check-in process.¹⁴

¹¹ www.airporthaber.com, 01.02.2007.

¹² www.gokyuzuhaber.com, 10.02.2006.

¹³ www.gokyuzuhaber.com, 10.02.2006.

¹⁴ www.onurairmerkez.com/tarihce.aspx, 18.06.2009.

¹⁰ www.cmss.atlasjet.com/tr/kurumsal/filomuz, 03.06.2009.

In light of above ideas, although Onur Air became the runner-up in the price competitiveness, it was in the last position in all other critical success factors in the airline business (Table 4). On the basis of our analysis the company was far behind of its competitors in terms of value creating activities for its customers in the sector. The company was much weakened in the domestic airline business due to its incapability of furnishing brand loyalty. The company can save itself and have a reasonable share in the market as long as it engages in acquisitions with other airline companies in the industry.

7. Conclusion

In this study, fuzzy TOPSIS methodology has been employed as an alternative to the conventional TOPSIS approach. In light of critical success factors of the Turkish domestic airline sector we have made a comparative evaluation among air carriers. In terms of advertising and product quality the Turkish Airlines has outstandingly performed and achieved competitive advantage over other air carriers. Both Pegasus and Atlas Jet have moderately performed. Onur Air's performance has not been as good as other air carriers; therefore it should give a special attention to this issue. In terms of price competitiveness Pegasus has been the leading company. Both Onur Air and Atlas Jet have been in the runner-up position in the sector. The Turkish Airlines has poorly performed. In terms of customer loyalty and market share the Turkish Airlines has been the most competitive company and Pegasus has been competitive. Both Onur Air and Atlas Jet's performances have not been good enough, thus they should consider these issues in their strategic planning processes. In terms of customer service the Turkish Airlines has showed a remarkable performance. Pegasus has done all right. Atlas Jet has moderately performed. Onur Air has been disastrous. In terms of e-commerce and management experience the Turkish Airlines has been best. Pegasus has performed above average. Both Onur Air and Atlas Jet have not done well, thus they should review these issues cautiously. In terms of branding the Turkish Airlines has been dominant. Pegasus has showed a moderate performance. Both Onur Air and Atlas Jet have been weak, therefore they need to evaluate this issue in their long range plannings (Table 4).

When all these critical success factors are regarded, the Turkish Airlines has been identified as the most competitive company, Pegasus the runner-up, Atlas Jet the third, and Onur Air the fourth in the airline sector (Table 8). This research finding indicated that the Turkish Airlines preserved its dominant role even after its privatisation and entrance of newcomers into the domestic airline industry. It is worthy of noting that Pegasus though newly founded air carrier could intensify the competition in the sector and become a serious rival for the Turkish Airlines in the coming years. Both Onur Air and Atlas Jet should pay private attention to the critical success factors of the industry and prepare their long range plans accordingly if they want to survive.

References

Alkoç, H. (2004). Havayolu İşletmelerinin Hizmet Kalitesi Açısından Değerlendirilmesi Üzerine Bir Plot Araştırma: Türk Hava Yolları Uygulaması, (Yüksek Lisans Tezi), İstanbul University.

- Aslan, M. (2007). Havayolu İşletmelerinde Müşteri Değeri ve İç Hatlarda Hizmet Sunan Havayolu İşletmelerinde Müşteri Değerinin Belirlenmesi Üzerine Bir Araştırma, (Yüksek Lisans Tezi), Anadolu University.
- Bellman, B. E., & Zadeh, L. A. (1970). Decision-making in a fuzzy environment. *Management Science*, 17(4), 141–164.
- Benitez, J. M., Martin, J. C., & Roman, C. (2007). Using fuzzy number for measuring quality of service in the hotel industry. *Tourism Management*, 28, 544–555.
- Chen, C. T., Lin, C. T., & Huang, S. F. (2006). A fuzzy approach for supplier evaluation and selection in supply chain management. *International Journal of Production Economics*, 102, 289–301.
- Chen, C. T. (2000). Extensions of the TOPSIS for group decision making under fuzzy environment. *Fuzzy Sets Systems*, 114, 1–9.
- Chu, T. C., & Lin, Y. C. (2003). A fuzzy TOPSIS method for robot selection. *The International Journal of Advanced Manufacturing Technology*, 21, 284–290.
- Chu, T. C. (2002). Selecting plant location via a fuzzy TOPSIS approach. *International Journal of Advanced Manufacturing Technology*, 20, 859–864.
- Delgado, M., Verdegay, J. L., & Vila, M. A. (1992). Linguistic decision-making models. *International Journal of Intelligent Systems*, 7, 479–492.
- Dikyo, S. (2007). Sivil Hava Taşımacılığı Sektöründe Michael Porter'in Rekabet Stratejisi Faktörlerinin Analizi: Atlasjet ve Pegasus Havayolları Kıyaslaması, (Yüksek Lisans Tezi), Marmara University.
- Doganis, R. (2001). *The Airline Business in the Twenty-First Century*. London: Routledge.
- Gurses, F. (2006). Havayolu İşletmeciliğinde Müşteri Tercihlerini Etkileyen Faktörler ve Yerli Yolculara Yönelik Bir Araştırma, (Yüksek Lisans Tezi), Balıkesir University.
- Herrera, F., & Herrera-Viedma, E. (2000). Linguistic decision analysis: Steps for solving decision problems under linguistic information. *Fuzzy Sets and Systems*, 115, 67–82.
- Herrera, F., Herrera-Viedma, E., & Verdegay, J. L. (1996). A model of consensus in group decision making under linguistic assessments. *Fuzzy Sets and Systems*, 78, 73–87.
- Hwang, C. L., & Yoon, K. (1981). *Multiple Attribute Decision Making: Methods and Applications*. Berlin: Springer.
- Karasu, E. (2007). Havayolu Ulaşımında Düşük Maliyetli Taşıyıcılar ve Uzun Mesafeli Hatlarda Rekabet Olanakları, (Yüksek Lisans Tezi), İstanbul, Halic University.
- Kavas, Alican. (2004) "Marka Değeri Yaratma", Pazarlama ve İletişim Kültürü Dergisi (Pi), 3:8.
- Kaya, E., Kuyucak, F. (2004). "Havayollarında E-Ticaret İşlemleri ve Muhasebeleştirilmesi", Kayseri V. Havaçılık Sempozyumu, Kayseri: Erciyes University.
- Kaufmann, A., & Gupta, M. M. (1991). *Introduction to Fuzzy Arithmetic: Theory and Applications*. New York: Van Nostrand Reinhold.
- Önüt, S., & Soner, S. (2008). Transshipment site selection using the AHP and TOPSIS approaches under fuzzy environment. *Waste Management*, 28(9), 1552–1559.
- Şengür, Y. (2004). Havayolu Taşımacılığında Düşük Maliyetli Taşıyıcılar ve Türkiye'deki Uygulamalarının Araştırılması, (Yüksek Lisans Tezi), Eskişehir, Anadolu University.
- Shaw, S. (1986). *Airline Marketing and Management*. London: Pitman Publishing, Ltd.,
- Sun, C., & Lin, G. T. R. (2009). Using fuzzy TOPSIS method for evaluating the competitive advantages of shopping websites. *Expert Systems with Applications*, 36(9), 11764–11771.
- Wang, T. C., & Chang, T. H. (2007). Application of TOPSIS in evaluating initial training aircraft under fuzzy environment. *Expert Systems with Applications*, 33(4), 870–880.
- Yang, T., & Hung, C. C. (2007). Multiple-attribute decision making methods for plant layout design problem. *Robotics and Computer-Integrated Manufacturing*, 23, 126–137.
- Yıldırım, B.A. (2007). Küreselleşme Sürecinin Havayolu İşletmelerine Olan Etkiler: THY A.O.'da Toplam Kalite Yönetimi Üzerine Bir Uygulama, (Yüksek Lisans Tezi), Marmara University.
- Yurdakul, M. and İc, Y.T. (2008). Analysis of the benefit generated by using fuzzy numbers in a TOPSIS model developed for machine tool selection problems. *Journal of Materials Processing Technology*. doi:10.1016/j.jmatprotec.2008.02.006.
- Zadeh, L. A. (1975a). The concepts of a linguistic variable and its applications to approximate reasoning (I). *Information Science*, 8, 199–249.
- Zadeh, L. A. (1975b). The concepts of a linguistic variable and its applications to approximate reasoning (II). *Information Science*, 8, 301–357.
- Zimmermann, H. J. (1992). *Fuzzy Set Theory and Its Applications*. Boston: Kluwer.