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STRATEGIES FOR AIRLINE COMPETITIVENESS: ANALYZING KEY PRODUCT FEATURES AND DECISION-MAKER PRIORITIES USING SPHERICAL FUZZY AHP

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Abstract
The airline transportation industry is one of the most fiercely competitive sectors. To survive and gain competitive advantage, airlines may need to not only design new products but also redesign existing products to meet passengers' wants, desires and expectations. Therefore, in this study, we focus on airlines' key product futures. The aim of this study is to reveal the airline key product features that are important to the decision makers in airlines. In the study, we created a key product features pool, which is critical for airlines, through studies in the literature. We reached out to airline managers to reveal the importance of airline key product features, which consist of 6 main criteria and 30 sub-criteria. We used the Spherical Fuzzy (SF) Analytic Hierarchy Process (AHP) as the method in the study. The findings of the study show that some product components are more critical than others in the airline transportation industry. In addition, the results of the study demonstrate that the main price-related dimensions are critical for airline decision makers. In the sub-dimensions, airline ticket price, reputation of safety, ticket flexibility and seat cost for previous flight are the sub-criteria that airline managers focus on.
Keywords: Airlines, product features, Spherical Fuzzy, Analytic Hierarchy Process

1. INTRODUCTION

Airline transportation is carried out in a service process. In contrast to some tangible and/or intangible product characteristics of goods, the airline product also has some intangible components that cannot be touched (Shaw, 2007). Airline companies should design their service offerings (products with all their components) to meet and exceed customers' wants and needs (Pine & Gilmore, 2000). Conversely, perceived service quality, demand and revenues may decrease. Therefore, it is important to know what the airline product components are and what they mean to the customer.

Increasing liberalization has transformed the airline industry into a more competitive form (Dobruszkes, 2009). Airlines focused on the products they offered as they competed with their rivals. Liberalized markets have brought with them a wider choice of products (Gayle, 2004). When airlines offer these products to the market, they decide which features of this product they will offer by making product planning. The features of the airline product constitute the components of the product. Airlines have motivations such as managing supply-demand matching and controlling costs while product planning (Doganis, 2005). The process, which we can also call service delivery, has different components. Airline product or service offering components provide important clues on how to present the product to passengers. These components are schedule, price, comfort, convenience of service delivery and image. These components are the factors that make air travel a great experience. From the latest aircraft technology that improves safety and efficiency, to cabin interior design elements that enhance passenger comfort, each component plays a vital role in the decision to travel by air.

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When airlines put these together and offer the product, they try to influence their customers' preferences and make them choose according to their market segments and/or passenger profiles (Gillen & Morrison, 2003).

As product components meet customer wants and needs, the demand for the airline product will increase. If the product features do not match the wants and needs of the customers, some of the passengers may shift to other transportation options, reducing the total airline demand (Gkritza et al., 2006). Or, on the contrary, a more qualified airline product will capture the demand of other transportation options. On the other hand, in a competitive environment, the demand and market share of an airline that meets customer wants and needs better than its competitors may increase. Therefore, in the dynamic and highly competitive environment of the airline industry, the components of an airline's product are of vital importance (Law, 2011; Robledo, 2001). In other words, the characteristics of product components affect both the demand for airline transportation in general and the market share of airline companies. These components have different weights in the product creation process. For example, an airline that emphasizes a comfort-based component and in-flight service reflects this in its prices and offers higher ticket prices compared to its competitors planning (Doganis, 2005). However, the opposite is also possible. Today, increasingly globalized, and deepening competition is based on the airline product (Mazzeo, 2003). In this case, the characteristics of the product will play an important role in competition. The components of the service offered by the airline (airline product) and their characteristics are an important means of influencing demand. In other words, the components of the product will affect the revenue of the airline. On the other hand, the characteristics of the product offered to the market affect the operating costs of the airline due to the sacrifices to be made for its production (Doganis, 2005). These components affect everything from operational efficiency and environmental sustainability to passenger satisfaction and loyalty. When analyzing the research, there are studies that discuss the components of the airline product, such as schedule (Gil & Kim, 2021; Huang et al., 2020), price (Rouncivell et al., 2018; Teichert et al., 2008), comfort (De Jager et al., 2012; Helander, 2003; Nicolini & Salini, 2006; Wensveen, 2007) (Helander, 2003; Nicolini and Salini, 2006; De Jager et al. 2012; La et al., 2021), image (Gilbert & Wong, 2003; Linguistics & 2013, 2013; Wang & Ngamsiriudom, 2015) and convenience (Alamdari & Mason, 2006; Gudmundsson et al., 2002; Suzuki, 2003) but there is no research that systematically discusses all the components and ranks their importance within a model. Therefore, we started to think about which one or which of these components decision makers should pay more attention to. In the light of this information, we organized the questions of this research as follows:

(RQ1) Which product components are more critical in the airline industry?

(RQ2) What is the order of importance of product components and subcomponents in the airline industry?

(RQ3) What are the main and sub-product components that airlines should focus on to gain competitive advantage in the airline industry.

In this study, we aimed to reveal the importance levels of airline product components from the managers' perspective. In this context, we applied the Spherical Fuzzy Analytic Hierarchy Process, which is one of the multi-criteria decision-making methods, and in line with the data we received from industry experts and the interviews we conducted, we tried to reveal which components and subcomponents airline companies consider more important when creating an airline product. Then we ranked these components according to each other.

2. LITERATURE REVIEW

Airline product is a crucial instrument facilitating the fulfillment of desires and necessities of passengers with distinct expectations and demands. Satisfying the anticipations of passengers with varying segments is achievable solely through a well-crafted airline product design. Alamdari (1999) underscores that airlines, as a general practice, embark upon product development with the objectives of meeting customer needs and requisites, fulfilling corporate ambitions, enhancing the company's market value to gratify stakeholders, and outpacing competitors through product differentiation.

The primary dimensions of the airline product encompass schedule, price, comfort, image, and convenience. In the literature, these core dimensions of the airline product have been elaborated through associated sub-dimensions, enabling a comprehensive analysis of the airline product from various perspectives. In this context, a close relationship has been observed between in-flight entertainment and the enhancement of passenger satisfaction (La et al., 2021b) Consequently, passenger contentment plays a pivotal role in augmenting airline revenues and fostering passenger loyalty (Alamdari, 1999). Similarly, to attain a sustainable competitive advantage, the attainment of high service quality can potentially impact passenger satisfaction (Shah et al., 2020). One significant dimension of airlines' product is punctuality policy. Huang et al., (2020) emphasize the potential for airlines to enhance productivity by implementing a high punctuality policy, which in turn reduces flight delays. Generally, leisure passengers tend to prioritize price, whereas business passengers prioritize punctuality. Nevertheless, it has been revealed that improving flight punctuality contributes to enhancing customer satisfaction, attracting passengers, increasing demand, and reducing airline resource wastage in the long run (Choi et al., 2013). Recent studies further underscore the critical importance of punctuality for sustainable financial performance and the reduction of carbon emissions (Huang et al., 2020).

Flight frequency is considered a pivotal determinant of demand for airlines. Within airline transportation, this metric is acknowledged as a primary indicator of service quality (Calzada et al., 2022). Additionally, intensifying competition drives an escalation in flight frequency (Gil & Kim, 2021). Consequently, it has been established that flight frequency exerts a linear impact on airline revenue (Ng et al., 2023). Airlines endeavor to augment their market shares by developing new routes and initiating flights to new destinations, thereby expanding their flight networks. Furthermore, the expansion of airline flight networks facilitates the maximization of expected profits (Şafak et al., 2022). Hence, introducing flights to new routes and enhancing flight networks serves to amplify the operational revenue of airlines. In this context, recent research has been oriented towards addressing challenges such as the hub location problem (Atay et al., 2023), hub-and-spoke network design (J. Wu et al., 2022), and the modeling of flight delays and flight networks (C. L. Wu & Law, 2019). Total travel time stands as a crucial component of service quality in aviation. When compared with alternative modes of transportation, the reduction of overall travel time enables airlines to enhance demand and expand their market shares (Manaka et al., 2022). According to Capozza (2016), in the realm of aviation transportation, a decrease in total travel time correlates with an increase in airline market share relative to other transportation alternatives, such as rail. This increase is particularly pronounced within the business segment. Consequently, in the design of operational processes, airlines should focus on methodologies that optimize total travel time, as this is of paramount importance for gaining a competitive advantage and ensuring efficiency (Chang & Yeh, 2001).

The airline service process consists of a series of processes with distinct components, each of which may entail varying customer desires and expectations (F. Y. Chen & Chang, 2005). Generally, service quality pertains to an individual's overall judgment regarding the relative efficiency of the services received throughout the passenger service process (Park et al., 2004). Within the literature, diverse studies have delved into the components of service quality. Accordingly, factors such as cabin crew staffing, professional knowledge, and demeanor have been identified to influence service quality (F. Y. Chen & Chang, 2005; De Jager et al., 2012; Park et al., 2004). Additionally, elements like executive lounge amenities, baggage delivery time, ancillary product pricing, and the ability to perform early online check-in have become highly critical factors in terms of service quality (Garrow et al., 2012; Warnock-Smith et al., 2017; Wittmer & Rowley, 2014). One of the pivotal determinants of demand for airlines revolves around ticket prices and flexibility. Lower ticket prices relative to other transportation alternatives and competing airlines stimulate an increase in demand. Although existing demand and consumer attitudes play a role in ticket price determination, one of the most significant variables shaping airline revenue is the ticket price (Abdella et al., 2021). When establishing ticket prices, airlines consider factors such as customer price sensitivity, seasonality, and destination through dynamic pricing methods (Thirumuruganathan et al., 2023).

Economic regulations within the airline transportation industry have led to intense market competition. These regulations have not only spurred new market entries and fostered price and capacity competition but have also prompted a redefinition of airline products (Barrett, 2006) Within the dynamically evolving structure of the airline transportation industry, it is pertinent to examine how product features and their various factors influence the industry. Consequently, there have been studies on the impact of certain dimensions of the airline product on demand, revenue, competition, and perceived service quality. However, there exists a limited number of studies focusing on airline product attributes (Alamdari, 1999; H. Han et al., 2019; Ke, 2009; Post, 2010; Westwood et al., 2000).

In this study, in addition to the existing literature, we focused on determining the relative importance of airline product attributes within 5 main dimensions and 30 sub-dimensions associated with them. During the identification of these main and sub-dimensions, reputable sources from the literature were consulted. The motivation behind this study was the limited number of existing research works on airline product attributes, as well as the absence of academic studies based on expert opinions regarding the main and sub-dimensions of airline products. Furthermore, the novelty of this study lies in the application of recently developed Multi-Criteria Decision Making (MCDM) methods, particularly the Spherical Fuzzy, Analytic Hierarchy Process method, to assess airline product attributes, adding an innovative dimension to the research.

3. METHODOLOGY

This section provides knowledge on Spherical Fuzzy Sets and the Spherical Fuzzy Analytic Hierarchy Process.

3.1. Spherical Fuzzy Sets

Spherical fuzzy sets (SFS) base on the idea that a decision maker's hesitancy can naturally be defined independent from his/her membership and non-membership degrees. In SF, all of the membership, non-membership, and hesitancy parameters can be chosen independently as long as they are between 0 and 1 individually, and their squared sum is at most equal to 1 (Gündoğdu & Kahraman, 2019) in Figure 1.

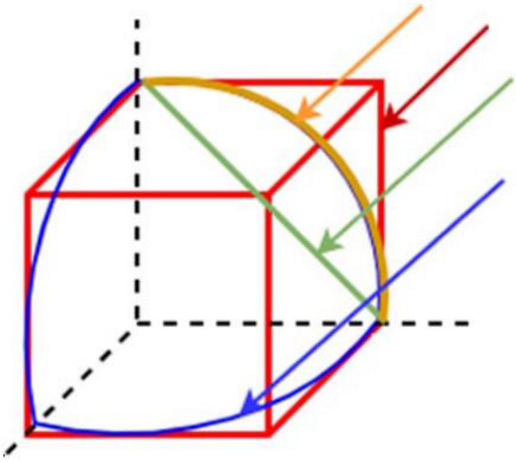

FIGURE 1 – GEOMETRIC REPRESENTATIONS OF IFS, PFS, NS, AND SFS

Definition 1. Assuming that $\tilde{A}_S$ and $\tilde{B}_S$ are two spherical numbers, and *x* and *y* are defined in two universes, U_1 and U_2 respectively as follows in Eq. (1-4).

$$\tilde{A}_S = \left\{ x, \left(\mu_{\tilde{A}_S}(x), \nu_{\tilde{A}_S}(x), \pi_{\tilde{A}_S}(x) \right) \middle| x \in U_1 \right\}, \ \forall x \in X \quad (1)$$

Where $\mu_{\tilde{A}_S}(x): U_1 \to [0,1]$, $\nu_{\tilde{A}_S}(x): U_1 \to [0,1]$, $\pi_{\tilde{A}_S}(x): U_1 \to [0,1]$, and

$$0 \le \mu^2_{\tilde{A}_S}(x) + \nu^2_{\tilde{A}_S}(x) + \pi^2_{\tilde{A}_S}(x) \le 1, \ \forall x \in X \quad (2)$$

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For each *x*, the $\mu_{\tilde{A}_S}(x)$, $\nu_{\tilde{A}_S}(x)$ and $\pi_{\tilde{A}_S}(x)$ represent membership, non-membership, and hesitancy degrees, respectively, of each *x* to $\tilde{A}_S$.

$$\tilde{B}_S = \left\{ y, \left(\mu_{\tilde{A}_S}(x), \nu_{\tilde{A}_S}(x), \pi_{\tilde{A}_S}(x) \right) \middle| y \in U_1 \right\}, \ \forall y \in X \tag{3}$$

Where $\mu_{\tilde{B}_S}(x): U_1 \rightarrow [0,1]$, $\nu_{\tilde{B}_S}(x): U_1 \rightarrow [0,1]$, $\pi_{\tilde{B}_S}(x): U_1 \rightarrow [0,1]$, and

$$0 \leq \mu^2_{\tilde{B}_S}(x) + \nu^2_{\tilde{B}_S}(x) + \pi^2_{\tilde{B}_S}(x) \leq 1, \ \forall y \in X \tag{4}$$

For each x, the $\mu_{\tilde{B}_S}(x)$, $\nu_{\tilde{B}_S}(x)$ and $\pi_{\tilde{B}_S}(x)$ represent membership, non-membership, and hesitancy degrees, respectively, of each x to $\tilde{B}_S$.

Definition 2. In the following, primarily spherical fuzzy sets operators are defined as in Eq. (5-16).

Union

$$\begin{aligned} \tilde{A}_S \cup \tilde{B}_S = \Big\{ & \max\left\{ \mu_{\tilde{A}_S}, \mu_{\tilde{B}_S} \right\}, \min\left\{ \nu_{\tilde{A}_S}, \nu_{\tilde{B}_S} \right\}, \\ & \min\left\{ 1 - \left(\left(\max\left\{ \mu_{\tilde{A}_S}, \mu_{\tilde{B}_S} \right\} \right)^2 + \left(\min\left\{ \nu_{\tilde{A}_S}, \nu_{\tilde{B}_S} \right\} \right)^2 \right), \max\left\{ \pi_{\tilde{A}_S}, \pi_{\tilde{B}_S} \right\} \right\} \Big\} \end{aligned} \tag{5}$$

Intersection

$$\begin{aligned} \tilde{A}_S \cap \tilde{B}_S = \Big\{ & \min\left\{ \mu_{\tilde{A}_S}, \mu_{\tilde{B}_S} \right\}, \max\left\{ \nu_{\tilde{A}_S}, \nu_{\tilde{B}_S} \right\}, \\ & \min\left\{ 1 - \left(\left(\min\left\{ \mu_{\tilde{A}_S}, \mu_{\tilde{B}_S} \right\} \right)^2 + \left(\max\left\{ \nu_{\tilde{A}_S}, \nu_{\tilde{B}_S} \right\} \right)^2 \right), \min\left\{ \pi_{\tilde{A}_S}, \pi_{\tilde{B}_S} \right\} \right\} \Big\} \end{aligned} \tag{6}$$

Addition

$$\tilde{A}_S \oplus \tilde{B}_S = \left\{ \left(\mu^2_{\tilde{A}_S} + \mu^2_{\tilde{B}_S} - \mu^2_{\tilde{A}_S}\mu^2_{\tilde{B}_S} \right)^{1/2}, \ \nu_{\tilde{A}_S}\nu_{\tilde{B}_S}, \ \left(\left(1 - \mu^2_{\tilde{B}_S} \right)\pi^2_{\tilde{A}_S} + \left(1 - \mu^2_{\tilde{A}_S} \right)\pi^2_{\tilde{B}_S} - \pi^2_{\tilde{A}_S}\pi^2_{\tilde{B}_S} \right)^{1/2} \right\} \tag{7}$$

Multiplication

$$\tilde{A}_S \otimes \tilde{B}_S = \left\{ \mu_{\tilde{A}_S}\mu_{\tilde{B}_S},\ \left(v^2_{\tilde{A}_S} + v^2_{\tilde{B}_S} - v^2_{\tilde{A}_S}v^2_{\tilde{B}_S}\right)^{1/2},\ \left(\left(1-v^2_{\tilde{B}_S}\right)\pi^2_{\tilde{A}_S} + \left(1-v^2_{\tilde{A}_S}\right)\pi^2_{\tilde{B}_S} - \pi^2_{\tilde{A}_S}\pi^2_{\tilde{B}_S}\right)^{1/2} \right\} \quad (8)$$

Multiplication by scalar λ (for λ)

$$\lambda \tilde{A}_S = \left\{ \left(1-\left(1-\mu^2_{\tilde{A}_S}\right)^{\lambda}\right)^{1/2},\ v^{\lambda}_{\tilde{A}_S},\ \left(\left(1-\mu^2_{\tilde{A}_S}\right)^{\lambda} - \left(1-\mu^2_{\tilde{A}_S} - \pi^2_{\tilde{A}_S}\right)^{\lambda}\right)^{1/2} \right\} \quad (9)$$

$\tilde{A}_S$ to the power of λ (for λ)

$$\tilde{A}^{\lambda}_S = \left\{ \mu^{\lambda}_{\tilde{A}_S},\ \left(1-\left(1-v^2_{\tilde{A}_S}\right)^{\lambda}\right)^{1/2},\ \left(\left(1-v^2_{\tilde{A}_S}\right)^{\lambda} - \left(1-\mu^2_{\tilde{A}_S} - \pi^2_{\tilde{A}_S}\right)^{\lambda}\right)^{1/2} \right\} \quad (10)$$

Definition 3. For these SFS $\tilde{A}_S$ and $\tilde{B}_S$ the followings are valid under the condition $\lambda,\ \lambda_1,\ \lambda_2 > 0$.

$$\tilde{A}_S \oplus \tilde{B}_S = \tilde{B}_S \oplus \tilde{A}_S \quad (11)$$

$$\tilde{A}_S \otimes \tilde{B}_S = \tilde{B}_S \otimes \tilde{A}_S \quad (12)$$

$$\lambda\left(\tilde{A}_S \oplus \tilde{B}_S\right) = \lambda \tilde{B}_S \oplus \lambda \tilde{A}_S \quad (13)$$

$$\lambda_1 \tilde{A}_S \oplus \lambda_2 \tilde{A}_S = (\lambda_1 + \lambda_2)\tilde{A}_S \quad (14)$$

$$\left(\tilde{A}_S \otimes \tilde{B}_S\right)^{\lambda} = \tilde{A}^{\lambda}_S \otimes \tilde{B}^{\lambda}_S \quad (15)$$

$$\tilde{A}^{\lambda_1}_S \otimes \tilde{B}^{\lambda_1}_S = \tilde{A}^{\lambda_1+\lambda_{12}}_S \quad (16)$$

Definition 4. Spherical weighted arithmetic mean (SWAM) with respect to, $w=(w_1,\ w_2,\ \dots,\ w_n)$; $w_i \in [0,1]$; $\sum_{i=1}^{n} w_i = 1$; SWAM is defined as in Eq. (17).

$$SWAM_w\left(\tilde{A}_{S_1},\ \dots,\ \tilde{A}_{S_n}\right) = w_1 \tilde{A}_{S_1} + w_2 \tilde{A}_{S_2} + \cdots + w_n \tilde{A}_{S_n}$$
$$= \left\{ \left[1-\prod_{i=1}^{n}\left(1-\mu^2_{\tilde{A}_{S_1}}\right)^{w_i}\right]^{1/2},\ \prod_{i=1}^{n} \nu^{w_i}_{\tilde{A}_{S_1}},\ \left[\prod_{i=1}^{n}\left(1-\mu^2_{\tilde{A}_{S_1}}\right)^{w_i} - \prod_{i=1}^{n}\left(1-\mu^2_{\tilde{A}_{S_1}} - \pi^2_{\tilde{A}_{S_1}}\right)^{w_i}\right]^{1/2} \right\} \tag{17}$$

Definition 5. Spherical weighted geometric mean (SWGM) with respect to, $w=(w_1,\ w_2,\ \dots,\ w_n)$; $w_i \in [0,1]$; $\sum_{i=1}^{n} w_i = 1$; SWGM is defined as in Eq. (18).

$$SWGM_w\left(\tilde{A}_{S_1},\ \dots,\ \tilde{A}_{S_n}\right) = \tilde{A}^{w_1}_{S_1} + \tilde{A}^{w_2}_{S_2} + \cdots + \tilde{A}^{w_n}_{S_n}$$
$$= \left\{ \prod_{i=1}^{n} \mu^{w_i}_{\tilde{A}_{S_1}},\ \left[1-\prod_{i=1}^{n}\left(1-\nu^2_{\tilde{A}_{S_1}}\right)^{w_i}\right]^{1/2},\ \left[\prod_{i=1}^{n}\left(1-\nu^2_{\tilde{A}_{S_1}}\right)^{w_i} - \prod_{i=1}^{n}\left(1-\nu^2_{\tilde{A}_{S_1}} - \pi^2_{\tilde{A}_{S_1}}\right)^{w_i}\right]^{1/2} \right\} \tag{18}$$

Definition 6. Score function and Accuracy function of sorting SFS are defined as in Eq. (19-20).

$$Score\left(\tilde{A}_S\right) = \left(\mu_{\tilde{A}_S} - \pi_{\tilde{A}_S}\right)^2 - \left(\nu_{\tilde{A}_S} - \pi_{\tilde{A}_S}\right)^2 \tag{19}$$

$$Accuracy\left(\tilde{A}_S\right) = \mu^2_{\tilde{A}_S} + \nu^2_{\tilde{A}_S} + \pi^2_{\tilde{A}_S} \tag{20}$$

Note that: $\tilde{A}_S < \tilde{B}_S$ if and only if

$Score\left(\tilde{A}_S\right) < Score\left(\tilde{B}_S\right)$ or

$Score\left(\tilde{A}_S\right) = Score\left(\tilde{B}_S\right)$ and $Accuracy\left(\tilde{A}_S\right) < Accuracy\left(\tilde{B}_S\right)$

3.2. Spherical Fuzzy Analytic Hierarchy Process

The proposed spherical fuzzy AHP method is composed of several steps as given in this section (Kutlu Gündoğdu & Kahraman, 2020a, 2020b).

Step 1. Construct the hierarchical structure. In this step, a hierarchical structure consisting of at least three levels is developed. Level 1 represents a goal or an objective (selecting the best alternative) based on score index. The score index is estimated based on a finite set of criteria , which are demonstrated at Level 2. There are many sub-criteria defined for any criterion C in this hierarchical structure. Therefore, at Level 3, a discrete set of m feasible alternative is defined.

Step 2. Constitute pairwise comparisons using spherical fuzzy judgment matrices based on the linguistic terms given in Table 1. Eq. (21-22) are used to obtain the score indices (SI).

TABLE 1 – LINGUISTIC MEASURES OF IMPORTANCE USED FOR PAIRWISE COMPARISONS

Linguistic Variables	(μ, v, π)	Score Index (SI)
Absolutely More Importance (AMI)	(0.9, 0.1, 0.0)	9
Very High Importance (VHI)	(0.8, 0.2, 0.1)	7
High Importance (HI)	(0.7, 0.3, 0.2)	5
Slightly More Importance (SMI)	(0.6, 0.4, 0.3)	3
Equally Importance (EI)	(0.5, 0.4, 0.4)	1
Slightly Lower Importance (SLI)	(0.4, 0.6, 0.3)	1/3
Low Importance (LI)	(0.3, 0.7, 0.2)	1/5
Very Low Importance (VLI)	(0.2, 0.8, 0.1)	1/7
Absolutely Low Importance (ALI)	(0.1, 0.9, 0.0)	1/9

$$SI=\sqrt{\left|100x\left[\left(\mu_{\tilde{A}_S}-\pi_{\tilde{A}_S}\right)^2-\left(\nu_{\tilde{A}_S}-\pi_{\tilde{A}_S}\right)^2\right]\right|} \quad \text{for AMI, VHI, HI, SMI and EI} \qquad (21)$$

$$\frac{1}{SI}=\frac{1}{\sqrt{\left|100x\left[\left(\mu_{\tilde{A}_S}-\pi_{\tilde{A}_S}\right)^2-\left(\nu_{\tilde{A}_S}-\pi_{\tilde{A}_S}\right)^2\right]\right|}} \quad \text{for EI, SLI, LI, VLI and ALI} \qquad (22)$$

Step 3. Check for the consistency of each pairwise comparison matrix. To do that, convert the linguistic terms in the pairwise comparison matrix to their corresponding score indices. Then, apply the classical consistency check. The threshold of the CR is 10%.

Step 4. Calculate the spherical fuzzy local weights of criteria and alternatives. Determine the weight of each alternative using SWAM operator given in Eq. (23) with respect to each criterion. The weighted arithmetic mean is used to compute the spherical fuzzy weights.

$$SWAM_w\left(\tilde{A}_{S_1},\ \ldots,\ \tilde{A}_{S_n}\right)=w_1\tilde{A}_{S_1}+w_2\tilde{A}_{S_2}+\cdots+w_n\tilde{A}_{S_n}$$

$$=\left\langle\left[1-\prod_{i=1}^{n}\left(1-\mu_{\tilde{A}_{S_1}}^2\right)^{w_i}\right]^{1/2},\ \prod_{i=1}^{n}\nu_{\tilde{A}_{S_1}}^{w_i},\ \left[\prod_{i=1}^{n}\left(1-\mu_{\tilde{A}_{S_1}}^2\right)^{w_i}-\prod_{i=1}^{n}\left(1-\mu_{\tilde{A}_{S_1}}^2-\pi_{\tilde{A}_{S_1}}^2\right)^{w_i}\right]^{1/2}\right\rangle \qquad (23)$$

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where $w = 1/n$

Step 5. Establish the hierarchical layer sequencing to obtain global weights The spherical fuzzy weights at each level are aggregated to estimate final ranking orders for the alternatives.

At this point, there are two possible ways to follow. The first one is to defuzzify the criteria weights by using the score function in Eq. (24) and then normalize them by Eq. (25) and apply spherical fuzzy multiplication given in Eq. (26).

$$S\left(\tilde{w}_j^S\right) = \sqrt{\left|100x\left[\left(3\mu_{\tilde{A}_S} - \frac{\pi_{\tilde{A}_S}}{2}\right)^2 - \left(\frac{\nu_{\tilde{A}_S}}{2} - \pi_{\tilde{A}_S}\right)^2\right]\right|} \tag{24}$$

Normalize the criteria weighted by using Eq. (24).

$$\tilde{w}_j^S = \frac{S\left(\tilde{w}_j^S\right)}{\sum_{j=1}^{n} S\left(\tilde{w}_j^S\right)} \tag{25}$$

$$\tilde{A}_S = \tilde{w}_j^S \tilde{A}_S = \left\langle \left(1-\left(1-\mu^2_{\tilde{A}_S}\right)^{\tilde{w}_j^S}\right)^{1/2}, \nu_{\tilde{A}_S}^{\tilde{w}_j^S}, \left(\left(1-\mu^2_{\tilde{A}_S}\right)^{\tilde{w}_j^S} - \left(1-\mu^2_{\tilde{A}_S}-\pi^2_{\tilde{A}_S}\right)^{\tilde{w}_j^S}\right)^{1/2} \right\rangle, \forall i \tag{26}$$

The final spherical fuzzy AHP score $\left(\tilde{F}\right)$ for each alternative A_i, is obtained by carrying out the spherical fuzzy arithmetic addition over each global preference weights as given in Eq. (27).

$$\tilde{F} = \sum_{j=1}^{n} \tilde{A}_{S_{ij}} = \tilde{A}_{S_{i1}} \oplus \tilde{A}_{S_{i2}} \cdots \oplus \tilde{A}_{S_{in}}, \forall i$$

$$i.e.\ \tilde{A}_{S_{11}} \oplus \tilde{A}_{S_{12}} = \left\langle \left(\mu^2_{\tilde{A}_{S_{11}}} + \mu^2_{\tilde{A}_{S_{12}}} - \mu^2_{\tilde{A}_{S_{11}}}\mu^2_{\tilde{A}_{S_{12}}}\right)^{1/2}, \nu_{\tilde{A}_{S_{11}}}\nu_{\tilde{A}_{S_{12}}}, \left(\left(1-\mu^2_{\tilde{A}_{S_{12}}}\right)\pi^2_{\tilde{A}_{S_{11}}} + \left(1-\mu^2_{\tilde{A}_{S_{11}}}\right)\pi^2_{\tilde{A}_{S_{12}}} - \pi^2_{\tilde{A}_{S_{11}}}\pi^2_{\tilde{A}_{S_{12}}}\right)^{1/2} \right\rangle \tag{27}$$

The second way to follow is to continue without defuzzification. In this case, spherical fuzzy global preference weights are computed by using Eq. (28).

$$\prod_{j=1}^{n} \tilde{A}_{S_{ij}} = \tilde{A}_{S_{i1}} \otimes \tilde{A}_{S_{i2}} \cdots \otimes \tilde{A}_{S_{in}}, \forall i$$

$$i.e.\ \tilde{A}_{S_{11}} \otimes \tilde{A}_{S_{12}} = \Big\langle \mu_{\tilde{A}_{S_{11}}} \mu_{\tilde{A}_{S_{12}}}, \left(\nu^2_{\tilde{A}_{S_{11}}} + \nu^2_{\tilde{A}_{S_{12}}} - \nu^2_{\tilde{A}_{S_{11}}} \nu^2_{\tilde{A}_{S_{12}}} \right)^{1/2}, \left(\left(1-\nu^2_{\tilde{A}_{S_{12}}}\right)\pi^2_{\tilde{A}_{S_{11}}} + \left(1-\nu^2_{\tilde{A}_{S_{11}}}\right)\pi^2_{\tilde{A}_{S_{12}}} - \pi^2_{\tilde{A}_{S_{11}}} \pi^2_{\tilde{A}_{S_{12}}} \right)^{1/2} \Big\rangle \quad (28)$$

The final score $\left(\tilde{F}\right)$ is calculated by using Eq. (27).

Step 6. Defuzzify the final score of each alternative by using the score function given in Eq. (24).

Step 7. Rank the alternatives with respect to the defuzzified final scores. The largest value indicates the best alternative.

The proposed approach tends to select the best alternative whose membership degree is the largest and the nonmembership degree is the smallest. A large hesitancy degree is better than a large non-membership degree with equal membership degrees in terms of a better alternative.

4. APPLICATION

Price is one of the most important key product features in the airline industry. The globalization of the air transport industry, the problem of excess supply over time and the fierce competition necessitates the correct operation of the price mechanism. In addition, the fact that passengers decide on their travels by examining the components in the ticket price and being sensitive to prices caused the decision makers in airlines to focus on price. Vasigh et al., (2013) revealed that the ticket price is inelastic in airline transportation and airline travel, long-run has an elasticity coefficient of 2.40. Passenger preferences react quickly to changes in airline ticket prices. Therefore, in the airline industry, price is of critical importance for both airline decision makers and passengers.

The proposed methodology is presented in Figure 2.

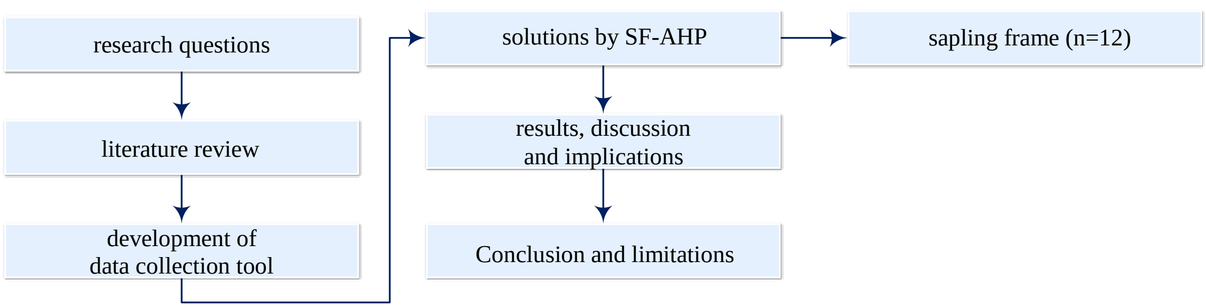

FIGURE 2 – PROPOSED RESEARCH DESIGN

In this study, the preparation process of this study was carried out in three stages. In the first stage, a criteria pool containing 30 criteria from 5 different dimensions was created by utilizing the relevant literature and experts through an online form. The main dimensions of the criteria were based on the study of (Doganis, 2005). The experts whose opinions were consulted on the selection of key product features of airlines consisted of academia (2 experts) and industry (3 experts). The titles and experience of the academic experts are associated professor (11 years), assistant professor (7 years). In addition, the positions and experience of the industry experts are a manager (22 years), a cost control and agreements manager (10 years), a regional manager (27 years) of an airline, a manager who previously worked as a manager in tariff and marketing and trade departments of an airline.

In the second stage, two experts from industry and academia checked the suitability of the criteria pool for the study. These experts are also among the practitioners mentioned below. As a result of the second stage check, the items in the criteria pool were agreed upon. The multi-criteria decision-making questionnaire created and used to collect data in the third stage consisted of 5 main criteria and 30 sub-criteria. The criteria used in the study, together with their definitions and references, are as shown in Table 2. The research data was collected from twelve experts. The practitioners in the final stage consisted of experts from industry and academia. The experts in academia are academics with expertise in management and strategy and research in the field of airline transportation. Industry experts included managers in the negotiations department, trade department, tariff planning and marketing departments.

TABLE 2 – DIMENSIONS OF AIRLINES KEY PRODUCT FEATURES

Criteria		Sub-Criteria		Definition	References
C_1	Schedule	C_{11}	Total travel time	It is the time that passengers spend between origin and destination.	(Doganis, 2005)
		C_{12}	Flight frequency	It is the daily or weekly delivery amount of the airline product. It indicates the number of flights per day or a week that the airline company has to the points within the flight network.	(Wensveen, 2007)
		C_{13}	Day of the flight	It is stated on which day or days of the week the airline operates flights.	(Doganis, 2005)
		C_{14}	Departure and arrival time	These are the departure and arrival times of the flights of the airline company from the starting point to the arrival.	(Şafak et al., 2018)
		C_{15}	Size of the flight network	It is expressed by the number of flight points to which the airline operates.	(Brueckner, 2004; Burghouwt et al., 2003)
		C_{16}	Direct flight	It means making a flight to the flight point specified by the airline operator in its schedule, without stopping at any intermediate point.	(Belobaba et al., 2009; Rubin & Joy, 2005)
		C_{17}	Punctuality	It is the parameter that measures the success of taking off at the time specified in the schedule of the airline operator. It can also be expressed as on-time performance.	(Burghouwt & de Wit, 2005; Suzuki, 2000)
		C_{18}	Connection quality	It is expressed by the duration and number of connections offered by the airline on connecting flights. The longer the time between connections and the lower the number of connections, the lower the quality.	(Burghouwt & de Wit, 2005; Rietveld & Brons, 2001)
C_2	Price	C_{21}	Ticket price	It is the fee charged by the airline company for the transportation service it offers between two points.	(Doganis, 2005)
		C_{22}	Ancillary product price	It is the price of services such as internet access requested in addition to the basic services offered by the airline company between two points.	(Rouncivell et al., 2018)
		C_{23}	Last flight price	It is the average ticket price of the previous flight of the airline operator on a certain route.	(Rouncivell et al., 2018)
		C_{24}	Ticket elasticity	Indicates whether the airline has the opportunity to return, change, postpone, change the route of the ticket purchased for a certain flight route.	(Teichert et al., 2008)
C_3	Comfort	C_{31}	Seat comfort	It refers to the seat design of the passenger seats that allows the passengers to travel comfortably from an ergonomic point of view. It includes the seat back, leg room, lumbar support, etc.	(Helander, 2003)
		C_{32}	Catering quality	It indicates the variety and taste of food and beverages offered to passengers.	(Law, 2011)

Criteria		Sub-Criteria		Definition	References
		C_{33}	Number of cabin crew	It is the number of cabin attendants who will serve the passengers. The higher the number of cabin attendants, the more efficient service is provided to the passengers.	(Nicolini & Salini, 2006)
		C_{34}	In-flight entertainment	It includes services such as seat-back TV and Internet, which help passengers to have a more enjoyable time during their journey.	(C. F. Chen & Wu, 2009; Desmet, 2012)
		C_{35}	Appearance of the cabin	It consists of elements such as the colors used in the aircraft cabin, the cleanliness of the floor coverings, the quality and smell of the air inside.	(Nicolini & Salini, 2006)
		C_{36}	Executive lounges	These are the lounges that allow passengers to receive premium services in privileged lounges at airports before the flight.	(S. Han et al., 2012)
		C_{37}	Baggage delivery quality	The quality of the baggage delivery is determined by the timely and undamaged pick up of the baggage by the passengers after the flight.	(De Jager et al., 2012)
		C_{38}	Internet check-in	Passengers can check-in through online channels without waiting in queue at airports.	(Lin & Filieri, 2015)
C_4	Image	C_{41}	Airline slogan	Slogans are used to promote the product or service to their customers through their brand's message.	(Kuswoyo et al., 2013)
		C_{42}	Advertising	Advertising includes the promotional activities of the airline to increase its profit and / or sales, to increase its market share and to keep it.	(Shi, 2012)
		C_{43}	Aircraft livery	Aircraft livery is a type of unique motif painted on the tails and/or any part of the fuselage of the aircraft to allow people to distinguish one airline's aircraft from others.	(Wang & Ngamsiriudom, 2015)
		C_{44}	Safety reputation	It expresses the degree of trust of the society about the airline company based on the past accidents and incidents of the airline company.	(Gilbert & Wong, 2003)
C_5	Convenience	C_{51}	Locations of ticket offices	Location, ease of transportation, and number of physical ticket sales points in the city.	(Doganis, 2005)
		C_{52}	Service quality of the call center	The time to reach the operator in the call center includes the solution of the problem and the operator's attitude towards the passenger.	(Shaw, 2007)
		C_{53}	Ease of online sales and reservation	It refers to situations such as website experiences that allow users to buy tickets comfortably on the internet and those websites have user-friendly interfaces.	(Alamdari & Mason, 2006; Ruiz-Mafé et al., 2009)
		C_{54}	Secure payment platform	It includes the presence of a 3d security system in payments made on the Internet, the presence of a firewall of the website, and the absence of security vulnerability on the site.	(Featherman & Pavlou, 2003)
		C_{55}	Frequent Flyer Programmes	Frequent flyer programs are loyalty programs aimed at accumulating miles for frequent flyers and enabling them to benefit from advantages such as reward tickets and class upgrades with the miles they have accumulated.	(Gudmundsson et al., 2002; Suzuki, 2003)
		C_{56}	Finding a seat for the flight at the desired time	It means that any passenger can find a ticket to the point they want to go whenever they want.	(Doganis, 2005)

The calculated results of the study using the SF-AHP method are presented in Table . According to the obtained results, the primary criterion with the highest weight among the key criteria is the criterion *Price* (C_2) with a weight of 0.245. After this criterion, the order is as follows: *Schedule (C_1)* with a weight of 0.217, *Comfort (C_3)* with a weight of 0.202, *Image (C_4)* with a weight of 0.176, and finally *Convenience (C_5)* with a weight of 0.159.

TABLE 3 – CRITERIA WEIGHTS OF AIRLINES KEY PRODUCT FEATURES

Main Criteria		Weight	Rank	Sub-Criteria		Local Weight	Global Weights	Rank
C_1	Schedule	0.217	2	C_{11}	Total travel time	0.110	0.024	26
				C_{12}	Flight frequency	0.120	0.026	20
				C_{13}	Day of the flight	0.114	0.025	24
				C_{14}	Departure and arrival time	0.126	0.027	17
				C_{15}	Size of the flight network	0.118	0.026	22
				C_{16}	Direct flight	0.152	0.033	9
				C_{17}	Punctuality	0.126	0.027	16
				C_{18}	Connection quality	0.133	0.029	14
C_2	Price	0.245	1	C_{21}	Ticket price	0.360	0.088	1
				C_{22}	Ancillary product price	0.203	0.050	5
				C_{23}	Last flight price	0.214	0.052	4
				C_{24}	Ticket elasticity	0.223	0.055	3
C_3	Comfort	0.202	3	C_{31}	Seat comfort	0.142	0.029	15
				C_{32}	Catering quality	0.147	0.030	11
				C_{33}	Number of cabin crew	0.101	0.020	29
				C_{34}	In-flight entertainment	0.119	0.024	25
				C_{35}	Appearance of the cabin	0.127	0.026	21
				C_{36}	Executive lounges	0.107	0.022	28
				C_{37}	Baggage delivery quality	0.123	0.025	23
				C_{38}	Internet check-in	0.134	0.027	18
C_4	Image	0.176	4	C_{41}	Airline slogan	0.225	0.040	7
				C_{42}	Advertising	0.246	0.043	6
				C_{43}	Aircraft livery	0.166	0.029	13
				C_{44}	Safety reputation	0.363	0.064	2
C_5	Convenience	0.159	5	C_{51}	Locations of ticket offices	0.092	0.015	30
				C_{52}	Service quality of the call center	0.142	0.023	27
				C_{53}	Ease of online sales and reservation	0.184	0.029	12
				C_{54}	Secure payment platform	0.203	0.032	10
				C_{55}	Frequent Flyer Programmes	0.165	0.026	19
				C_{56}	Finding a seat for the flight at the desired time	0.213	0.034	8

In addition, the analysis of the results of the sub-criteria in terms of local weights are as follows:

The results of the sub-criteria for the Schedule (C1) main criterion indicate that the most significant sub-criteria are Direct flight (C16), followed by Connection quality (C18), and Punctuality (C17). The least significant criterion is Total travel time (C11), followed by Day of the flight (C13) and Size of the flight network (C15), respectively.

The results of the sub-criteria for the Price (C2) main criterion indicate that the most significant criteria are, in order, Ticket price (C21), Ticket elasticity (C24), Last flight price (C23), and Ancillary product price (C22).

The results of the sub-criteria for the Comfort (C3) main criterion indicate that the most significant sub-criteria are Catering quality (C32), followed by Seat comfort (C31), and Internet check-in (C38). The least significant criterion is Number of cabin crew (C33), followed by Executive lounges (C36) and In-flight entertainment (C34), respectively.

The results of the sub-criteria for the Image (C4) main criterion indicate that the most significant criteria are, in order, Safety reputation (C44), Advertising (C42), Airline slogan (C41) and Aircraft livery (C43).

The results of the sub-criteria for the Convenience (C5) main criterion indicate that the most significant sub-criteria are Finding a seat for the flight at the desired time (C56), Secure payment platform (C54), Ease of online sales and reservation (C53), Frequent Flyer Programmes (C55), Service quality of the call center (C52) and lastly Locations of ticket offices (C51)

On the other hand, the analysis of the results of the sub-criteria in terms of global weights are as follows: The top five most significant criteria are as follows, with their respective weights: Ticket price (C21) with a weight of 0.088, Safety reputation (C44) with a weight of 0.064, Ticket elasticity (C24) with a weight of 0.055, Last flight price (C23) with a weight of 0.052, and Ancillary product price (C22) with a weight of 0.050. The last five least significant criteria are as follows, with their respective weights: Locations of ticket offices (C51) with a weight of 0.015, Number of cabin crew (C33) with a weight of 0.020, Executive lounges (C36) with a weight of 0.022, Service quality of the call center (C52) with a weight of 0.023 and Total travel time (C11) with a weight of 0.024.

5. RESULTS AND DISCUSSIONS

The findings of the study indicate that the most important main criterion is price. For the airline industry, which operates in an oligopoly market structure, ticket price is the most important determinant of demand. Airlines determine the ticket price by following the rival companies' moves regarding the ticket price and taking into account the operational costs. However, ticket price is the most obvious means of gaining competitive advantage. Companies that can keep their ticket prices lower than their competitors gain a serious advantage. In addition, the ticket price also allows airlines to gain market power (Silva et al., 2022).

There are many factors that affect the ticket price in airlines. Long-term policies regarding the ticket price, the date of ticket purchase and flight departure time, seasonality, holidays, supply, seat class, current market demand, competition and flight distance are among the most important factors that determine the ticket price. In addition, terrorist attacks, natural disasters, political instability, international organizations, weather conditions and economic activities are also factors that affect airline ticket price policies (Abdella et al., 2021). Therefore, ticket price is not only the most important indicator of demand, but also one of the critical indicators determined by evaluating many factors together. The results of our study revealed that the ticket price is the most important product component for airlines.

The safety reputation of airlines is one of the most important intangible resources of airlines (Low & Lee, 2014). Ensuring safety in airline operations is of vital importance for ensuring sustainable economic performance, as well as determining the demand for airlines. Therefore, safety performance is among the topics that researchers focus on in the airline industry. As safety performance is the most important quality factor in the aviation industry, it is expected that the financial conditions of the companies will also be affected (Stamolampros, 2022). The study's findings indicate that airlines' safety reputation is the second most important product feature. According to Liou & Chuang, (2010) safety reputation plays a key role in airlines' success and airlines must pursue better safety records to maintain their reputation. Therefore, safety reputation is critical for airlines to generate sustainable revenue, maintain product demand, and maintain a good safety image.

Ticket elasticity is used to explain whether the ticket sold by the airline for a particular flight route has the possibilities such as refund, change, delay, change of route. More recently, the importance of flight ticket flexibility has increased with the proliferation of online ticket sales. There is a correlation between prior knowledge and increased flexibility in the ticket purchasing process (Fournier et al., 2023) Nowadays, the increasing prevalence of online ticket sales and the fact that low-cost carriers do not have an option other than online ticket sales have made the quality of the purchased ticket critical. The results of the study reveal that one of the most important components of the airline product is ticket elasticity. Therefore, airlines must carefully design the ticket elasticity content when planning product specifications. Ticket elasticity's content and details can enable airlines to gain competitive advantage in the future.

The airline industry is one of the most advanced in using dynamic pricing practices and complex pricing strategies. There are different price applications for the same flight leg. While airline passengers are looking for ways to buy their tickets at the lowest possible price, airline companies apply methods and strategies to maximize total revenues. Airlines often have advanced tools and capabilities that allow them to control the ticket pricing process (Abdella et al., 2021). Therefore, the last flight price of the airline ticket is extremely important not only for the airline ticketing process, but also for the ticket price perceptions and purchasing behaviours of the passengers. In our study, we identified the last flight price as one of the most important product components of airlines. Last flight price is taken into account by airline decision makers in determining passenger demand and airline revenue management practices. Last flight price is also one of the critical indicators that determine the perceptions of the passengers about the airline ticket price and affect their purchasing behaviour.

The results of the study demonstrate that the prices of ancillary products offered in addition to the basic services offered by the airlines to the passengers (for example, internet access) are among the critical product components. Airline auxiliary product prices are one of the important variables that determine customer satisfaction (Warnock-Smith et al., 2017) and preferences, especially in long-haul transoceanic flights. In addition, components related to the image of the airline can be demonstrated among the important product features. In this context, the results of the study reveal that advertising and airline slogan are among the critical components. Therefore, when evaluated together with airline safety performance, airlines should focus on image-related product components in order to increase demand, meet customer expectations and demands, and ensure passenger satisfaction at the same time.

5.1. Managerial Implications

The airline industry is one of the most intensely competitive sectors. By designing new products over time, airlines have not only achieved customer satisfaction but also gained competitive advantage. Despite this, it is seen that newly developed products in the airline industry can be easily imitated. Since the 1950s, first technical innovations and then market-oriented innovations in the airline industry have made a significant contribution to the development of the airline industry.

The introduction of turbo propeller aircraft in the early 1950s, followed by the transatlantic jets in 1958 were critical for the industry. The introduction of wide-body aircraft in 1970 and later aircraft with advanced avionics were the main innovations. These innovations were important for the development of the sector, as they made possible higher speeds, more capacity, lower unit costs and lower fares and tariffs (IATA, 2023). Nowadays, the product structure of airlines has been redesigned according to customer demands and expectations. The new marketing approach has brought a new perspective to airlines' products such as ticketing, in-flight entertainment, product availability and tariffs. For example, in-flight entertainment systems have become an important component of the flight experience. In-flight entertainment applications have enhanced the range of services offered. Therefore, inflight entertainment systems and entertainment kiosks are among the latest innovations offering passengers more entertainment options than ever before (Einfochips, 2023).

Air Canada's airport lounges begin enhancements to its comprehensive product experience, from in-flight dining to entertainment (aircanada.com, 2023). Singapore Airlines has made it possible for passengers to access its digital content portal and use your own device before the flight. It makes it possible to stay online and control the system using a personal electronic device, which it calls “KrisWorld” in-flight (www.singaporeair.com, 2023). In the coming period, airlines are expected to design entertainment systems that allow passengers to be online throughout the flight experience and meet their personal desires. Therefore, airlines can develop new products by utilizing the critical importance and attractiveness of technological possibilities for passengers.

In this study, we focus on airlines' key product features, and airlines can diversify their products by leveraging the key components of these products. Airlines can develop new products or redesign existing products to meet passenger demands and expectations. Therefore, this study provides airlines with useful information on which products should be proportioned by knowing the characteristics and importance of the products.

5.2. Theoretical Implications

In this research, the airline product components were analysed using multi-criteria decision-making methods. In addition to numerous studies on airline product design, this research grouped the product components by identifying the main and sub-criteria, and identified the components that were considered more important than

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other components for the airline industry. Expanding the model created in future research will pave the way for more comprehensive research.

Competition in the airline industry is based on airline product components. Companies that want to gain a sustainable competitive advantage must make changes to their product components in order to gain a more advantageous position than their competitors. This research has identified which product component is most effective in achieving this advantage. For this reason, we believe that the research contributes to the field of strategic management by identifying the source of competitive advantage.

Product bundling allows airlines to price discriminate by offering different products to different customer segments. Theoretical models can guide airlines in determining optimal pricing strategies for different combinations of bundles to maximize revenue. The theoretical model presented in the study can help predict demand for bundled products based on market conditions, seasonality and customer requirements.

6. CONCLUSIONS

Airlines operate in a competitive market. In dynamic market conditions, in-depth analysis of the product and product components created is required to gain competitive advantage. In this study, airway product components were revealed by examining existing studies in the literature. A subjective judgment form was sent to a group of 12 airline industry experts to determine the importance levels of airline products and product components. By means of the comparative form sent, 5 main criteria and 30 sub-criteria were compared with each other. In this way, we identified the most important airline product components and sub-components. Our main motivation in this study is to determine which product components are the most important for airline professionals. In this way, the critical product components that airlines should focus on can be revealed. To gain competitive advantage, airlines can focus on these product components and pursue new strategies to further develop them.

6.1. Limitations and Future Research

The study has several limitations. First, in line with the proposed model, the evaluations regarding the selection of key product features for airlines are limited to the thoughts, experience and knowledge of the decision makers participating in the study. Another limitation is that this research on the selection of key product features was conducted in the context of the airline industry. Although the airline industry has come to the forefront with the product components it offers, the selection of key product features in other modes of transportation is also important in offering the appropriate product. Therefore, it is possible to use the proposed methodology for other modes of transportation, taking into account the contextual differences. Moreover, considering the contextual differences, the proposed model can be applied to different sectors as a "key product features selection model". In this context, it would be useful to test the robustness of the proposed model in future studies conducted in different sectors. Moreover, if the proposed model is applied to airline companies from different countries in future research, cross-cultural differences in the decision-making process can be evaluated by analyzing the selection processes of key product features. Another limitation of the study is related to the methodology used. Spherical Fuzzy Analytic Hierarchy Process method was used for key product features selection. In future research, various popular weighting methods (AHP, Entropy, CILOS, Critic, IDOCRIW, FUCOM, MEREC, SMART, etc.) and ranking methods (EDAS, PROMETHEE, MARCOS, TOPSIS, VIKOR, WASPAS, etc.) can be used, including classical form or different sets of fuzzy numbers and different levels (first type, second type).

In air transport, product features are important for airlines to achieve sustainable income in dynamic and fiercely competitive market conditions. When designing products, airlines must identify areas of focus and ensure customer loyalty by adding new features or attributes to existing products. Undoubtedly, new features and qualities will continue to be added to existing products in the airline industry. Gaining competitive advantage and customer loyalty for airlines can only be achieved through innovative product design and adding new features to existing products. In this study, we focused on airline product features. By examining 5 main criteria and 30 sub-components, we identified the product features that are critical for airlines. Future studies can focus on new product design. In this way, new product components can be added to this scale as well as improving the features of existing products. In addition, which strategies the airlines should implement in order to develop existing products are among the subjects worth researching. We suggest researchers to examine what innovations airlines need to make in existing products in order to gain competitive advantage.

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