Service quality of airports' food and beverage retailers. A fuzzy approach

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ABSTRACT

Nowadays the profitability of airports is largely based on non-aeronautical or commercial activities, and particularly on retail and food and beverage services. Further, researchers concur that shopping, eating and drinking in airports have to be considered an important part of tourists' experience and activities that can significantly enhance or damage the tourist destination image. Despite this, there is still little research that analyses how service quality (SQ) is perceived by passengers consuming food and beverages (F&B) in airport areas. This study aims to deepen the scientific debate on this topic. Specifically, this study applies fuzzy numbers with a sample of 551 passengers flying from Olbia-Costa Smeralda Airport (Sardinia Region, Italy) with the aim of determining how they perceive the SQ delivered by F&B retailers and whether age plays a determinant role in segmentation. Findings reveal which F&B features outperform others; furthermore, they show that age is a moderating factor in consumer satisfaction, with older passengers being less satisfied than their counterparts. This study adds knowledge to the literature devoted to SQ, applying a fuzzy number approach to the under-investigated research area related to F&B consumption in airport areas. Further, it provides information useful to airport managers on the features of F&B services that are most important in shaping consumer satisfaction, based also on their age. Limitations of the study are also discussed and suggestions for future research are given.

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1. Introduction

Forsyth (2006, p. 73) contends that the links between aviation and tourism are becoming recognized more explicitly and that these exert a considerable influence on the role of governments' aviation policies. This is particularly relevant to some islands within the European Union (EU), where bilateral agreements outside the EU unequivocally affect the nationalities of tourists that can be targeted in promotional activities by destination marketing organizations. Most of the islands in the EU do not have country sovereignty rights to negotiate aviation bilateral agreements freely and thus tourism development can be highly constrained. In islands, for obvious reasons, tourism development depends to a great extent on airport infrastructures and tourism policy makers and airport managers are very conscious that to be competitive in tourism,

aeronautical fares need to be low. The airline industry has exerted some pressure on airports to control the level of aeronautical charges, so airports have been obliged to find new ways of obtaining revenues through the development of new and more sophisticated commercial activities, with shopping and restaurant services being among the most important ones also in terms of their ability to affect airport operations (Rhoades et al., 2000).

Graham (2009) argues that there are some similarities and differences between high street and airport retailing that need to be analysed. Customers at airports tend to be more price-inelastic than high street customers because they are usually a captive market and belong to a high socio-economic group. The stress and shock customers experience at airports are not comparable. Another important difference is based on the primary function of airports as a modal interchange within the transport system that should not be compromised by the development of commercial activities. It is well known that many global brands with a good reputation operate in many of the airports around the world, e.g. Starbucks and McDonald's. However, airports have recently started to introduce a new revolutionary strategy, opening up to new local

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brands that are changing the uniformity observed in the past. Assies (2014) analyses these strategies in some European airports and finds that they are increasingly giving more relevance to local brands as a way of fulfilling the needs of consumers by providing an experience that reflects a sense of community and place.

Over the past few decades, globalization has played a major role in modifying habits of eating out (Warde and Martens, 2000). Eating out is an activity that has more than economic implications as it is influenced by consumers' social and cultural backgrounds and has become an important habit in the modern way of life. This trend is also relevant to companies managing food and beverage (F&B) services in airport areas, where eating and drinking has to be considered an important part of tourists' experience and thus can enhance or damage the tourist destination image. Every year, more than 900 million people, including businessmen, commuters, tradesmen, occasional travellers and tourists, use airports around the world. In 2010, non-aeronautical revenues worldwide made up 46.5% of industry revenue. Specifically, they accounted for USD 35 billion, with F&B having a market value of USD 10 billion (The Foodie Report, 2011), thus generating higher profit margins than aeronautical activities (ACI, 2012). It is estimated that the number of airport passengers may reach 7.3 billion by the year 2017, thus determining a significant increase in the F&B sector, which may be worth up to USD 18 billion in seven years' time (The Foodie Report, 2011). According to ACI (FAB, 2011), this market may even double in size by 2027, reaching up to 11 billion passengers with an annual revenue of USD 35 billion.

To date, there has been very little research examining the consumer F&B behaviour in airport areas (Geuens et al., 2004), which are often the main gate and the first service encounter for tourists visiting a tourism destination. Prior research has analysed the influence of emotions (Volkova, 2009; Martinelli, 2012), stress (Thomas, 1997), length of stay prior to embarkation (Torres et al., 2005) and type of flight (Appold and Kasarda, 2006). With regard to the latter, Graham (2009) claims that F&B services are more important in airports that have a very high number of low-cost carrier flights and that do not offer free in-flight catering. Finally, recent research has started to analyse consumers' valuations of their experience and perceptions of the service provided. For example, Han et al. (2012) examined the influence of service quality (SQ) on overall satisfaction and intentions to revisit airline lounges and discovered that the quality of F&B was the strongest predictor of satisfaction and revisit intention. However, it can be argued that the literature on SQ in F&B retailers is still scarce.

Knowing that airport passengers are in some sense a captive market, airport managers might be tempted to misrepresent the relative importance that SQ plays in maximizing the benefits of all the commercial activities, in particular, those of F&B retailers. To this end, the overall goals of this study were to: (1) analyse SQ in the F&B retailers in one Sardinian airport (Olbia Costa Smeralda Airport) by employing a method based on triangular fuzzy numbers and the similarity to ideal solutions; (2) examine the different department dimensions under analysis distinguishing the areas that require an immediate enhancing SQ program from those that are currently well managed; (3) analyse the dimensions whose SQ performance is more or less heterogeneous in order to develop possible contingency procedures; (4) study whether age acts as a moderating effect of the SQ experienced at the F&B retailers; (5) analyse the SQ elasticity over each of the dimensions included in the study obtaining this for each of the age-segments; (6) provide some policy recommendations to airport and F&B retail managers on the department dimensions that are critical in shaping consumer satisfaction where age has been used to segment the market.

As mentioned above, the research importance of the sector of F&B retailers in airports has been neglected and this paper fills somehow this evident gap. The originality of this paper resides in the application of a well-known methodology that is based on the fuzzy logic and the similarity to ideal solutions to analyse the SQ on the F&B retailers in airports, a sector that has been scarcely studied. Specifically, this paper contributes to the existing strand of literature on SQ applying fuzzy numbers with a sample of 551 passengers with the aim of determining how they perceive the SQ delivered by F&B retailers and whether age plays a determinant role in segmentation.

2. Literature review

As Graham (2008, p. 187) has pointed out, "there have been a number of factors which have contributed to the growth in dependence on non-aeronautical revenues". The main factors can be listed as follows: (1) paradigmatic moves towards commercialization and privatization within the industry have given airports greater freedom to develop their commercial policies and diversify into new areas; (2) competitive forces in the airline industry have led them to exert increasing pressure on the airport industry to control the level of aeronautical fees which are being levied; (3) passengers nowadays are more sophisticated and experienced airport shoppers, who demand not only good SQ, but also outstanding value for money with regard to the commercial facilities on offer; (4) a trend of increasing airport competition, especially between tourism and hub airports, has also played a determinant role in the development of non-aeronautical revenues.

Commercial revenues cannot be optimal if an offer is made without listening to the customers. Airport managers, as with other commercial and F&B retail managers, need to win the hearts and minds of particular segments of passengers at airports. As noted by Whiteley (1994), great companies do not just focus on the customers but develop a relationship with them. They listen to customers and customers become an integral part of all company processes and decisions. Every decision is driven by giving customers what they want. Wireback (2001) contends that the success of business today is heavily dependent on the adaptability and flexibility to adjust to the changing requirements of customers. The author concludes that good companies are customer-focused, but great companies are customer-driven. Shen et al. (2000) point out that dynamics are also important as listening to customers' needs and wants cannot be simply made with a static horizon, but rather there is a need to anticipate long-term customer needs and preferences in the future. Similarly, Shamma and Hassan (2013) contend that companies need to use more customer-driven benchmarking techniques as a way not only of providing a clear direction and methods for learning from customers by initiating value-added services that exceed their expectations, but moreover helping to sustain a company's performance and competitiveness in the long term. Thus, airports need to be engaged in research to analyse (i) the passenger profiles of those shopping at airports and where, when and what they buy, (ii) the profiles of those who do not shop and why and (iii) the SQ provided by different retailers with an analysis of the value for money of the products. This type of research needs to be updated on a regular basis to adapt offers dynamically to the passengers' changing preferences (Graham, 2008).

As airports have evolved far beyond the pure functional infrastructure facilities of earlier decades, the number and variety of retail businesses has increased substantially in venues such as shops, restaurants, convention centres and even entertainment facilities, for example museums or cinemas (Fuerst et al., 2011). This trend is part of a strategy to expand commercial services at airports that has been observed particularly in international departure terminals (Rowley and Slack, 1999). In line with this trend, the ratio

of revenues from non-aviation and commercial activities over total revenues has experienced parallel growth. Nevertheless, the current ratio can vary considerably across airports within the same region. In the EU, it is possible to find airports with a low ratio of about 20%, while for others this figure can be around 60%. According to Graham (2008), the most important income sources for commercial revenues are retail (22%), property (19%) and car parking (18%), with property including a wide range of types such as space rented to airlines for offices and passenger club lounges, as well as facilities rented to shippers, freight forwarders, etc (De Neufville and Odoni, 2003).

Different segments of passengers present different spending profiles and preferences. There is a considerable body of empirical evidence showing that leisure charter and low-cost carrier passengers have a positive impact on commercial revenues. They tend to be more evenly spread over time and are particularly good users of F&B retailers. They also tend to spend more time waiting in the departure terminal building. In addition, they tend to use the car parking facilities because of the relative remoteness of some secondary airports served by the low-cost carriers (Gillen and Lall, 2004; Papatheodorou and Lei, 2006; Echevarne, 2008). Business passengers usually spend less time at airports and they tend to wait for the departure of their flights in the designated airline lounges so they are very infrequent shoppers. The negative influence of business travellers on commercial revenues per passenger has been proven by some empirical research (Castillo-Manzano, 2010; Fuerst et al., 2011). Transfer passengers have quite different needs from those not connecting at the airport in terms of the terminal layout. They will not generally use rental cars or parking facilities. Regarding other commercial activities, like shopping, transfer passengers' behaviour is greatly constrained by the nature and characteristics of the connection. Good hub airports try to minimize the time between connecting flights and make the process as smooth and seamless as possible and for certain connections that take a considerable amount of time, some airports are developing imaginative solutions to minimize the passengers' disutility. For example, Singapore's Changi airport has a swimming pool, a sauna, a gym and a cinema, and for transfer passengers staying longer than 5 h, the airport can arrange a bus tour of Singapore (Graham, 2008).

There are certain socio-economic and demographic traits, such as nationality, age, occupation, income and gender, which can explain in part some spending and shopping behavioural patterns. Geuens et al. (2004) found that men are more likely to be "apathetic shoppers" or "mood shoppers", whereas women tend to be "shopping lovers". Other authors consider that it may be more important to analyse psychographic and consumption behaviour considering other factors such as attitudes, values, relationship with brands and reaction to media, rather than simply considering the demographic and travel-related characteristics of the passengers. Thus, for example, Rowley and Slack (1999) established a series of categories which were then used to characterize passengers' potential sense of timelessness and placelessness. They argue that a potential feeling of placelessness arises from a lack of opportunities for interaction within the airport environment, the restricted availability of time and the inherent sameness of airport terminal design. This sameness of design can be argued to be especially evident within the retail environment due to the standardization of retail operators within most international airport terminals. According to Rowley and Slack (1999), the design of airport terminals is responsible for the lack of interaction among passengers and that this encourages them to rush through the retail environment rather than lingering to browse or purchase.

However, Entwistle (2007) found that passengers are increasingly arriving earlier in order to have time to shop. Only a small proportion of passengers (5%) consider shops to be an inconvenience. Over 60% of passengers plan to use shops and/or cafes and 85% of passengers want shops easily accessible from the departure lounge. Graham (2008) reports on the segmentation of the passenger market undertaken by Manchester airport, categorizing passengers into six different types: (1) the airport shopaholic, who is typically a young, happy female on a charter holiday; (2) the agitated passenger, who is a young and frustrated middle-income traveller; (3) the unfulfilled shopper, who is a young professional on a business or leisure trip; (4) the value seeker, who is either a student or pensioner on an annual trip to Europe; (5) the unlikely shopper, who is a frequent business traveller; (6) the measured shopper, who is an older male traveller.

Commercial facilities have tended to be focused on passengers, but this trend is not universal as many other segments, such as employees, accompanying persons and local residents, can also be very profitable to some extent. Sevcik (2014) notes that the positive trend of growth in retail revenues could change dramatically in the near future as profound changes in certain variables, such as passengers' socio-demographic characteristics, as well as the rise of online retail are being observed. Nevertheless, other authors contend that the concept of the airport city will prevail, encompassing many different commercial activities developed in the surrounding area that are driven by the aviation industry (Kasarda and Appold, 2009). The increasing numbers of airport employees combined with hundreds of thousands of passengers passing through airports each year have facilitated the natural expansion of a variety of shopping and entertainment venues at passenger terminals. Thus, today's airport gateways can be considered authentic functional airport cities that have evolved from simple transport nodes to strategic national and regional economic poles (Charles et al., 2007).

3. Questionnaire and data

The study is based on a sample of 551 tourists, aged more than 18 years old. Data were collected with questionnaires administered face to face at Olbia Costa Smeralda Airport (Sardinia Region, Italy). The survey was administered by two trained interviewers directly supervised by one of the authors. People in the terminal building and especially in the boarding areas at the airport were approached for interview; the fact that respondents were interviewed while waiting for their departure increased their willingness to participate in the study. Airport staff members were deliberately excluded from the study as the nature of their daily food and drink consumption outside their homes clearly coincides with food and drink consumption at the airport. The data collection lasted from April to September 2011.

The questionnaire was built on the basis of an in-depth review of the literature and was divided into two sections. The first focused on respondents' socio-demographic information. In the second part, respondents were asked to assess the extent to which they were satisfied with a list of 13 SQ attributes. Specifically, the items were as follows: (1) price acceptability; (2) quality of products offered; (3) presentation of dishes; (4) originality of the food; (5) variety of food; (6) value/price; (7) location and proximity; (8) appearance; (9) internal atmosphere; (10) friendliness of staff; (11) speed of service; (12) cleanliness and comfort of the premises; (13) provision of entertainment. Respondents were asked to give their responses using a seven-point Likert scale (1 = completely dissatisfied; 7 = completely satisfied).

The questionnaire was pilot tested with a sample of 30 tourists to verify the validity of its content, the comprehensibility of the questions and the scale used to make the assessments. A battery of issues was first evaluated to ensure that: (1) the questions were clear and did not lead to possible misinterpretations; (2) SQ

dimensions accurately described all the existing F&B retailers in the airport; (3) passengers' response burden to complete the survey was reasonable. After this stage, a focus group was held by the researchers, the airport managers and the F&B retailers executive officers to discuss whether to employ self-administered questionnaires or interviews, and it was finally decided that in order to get more accurate data it was better to use well-trained students from the university to administer the survey.

Data were coded and analysed using SPSS (version 17.0). A series of descriptive statistics were developed to give an overview of the profile of the F&B users. Table 1 presents the general profile of the sample population. Interviewees were mainly women (64.2%), aged between 25 and 35 (36.1%) and 36 and 45 (17.1%), with a significant number of young travellers (16.3%). In terms of nationality, 72.6% of the people interviewed were Italian, of which number 46.5% were residents of Sardinia. Concerning the level of education, the majority of people interviewed (46.5%) reported having a high school diploma, with 28.9% holding a university degree and 5.1% a postgraduate degree; 19.6% of respondents reported holding a low/low-mid level of education (below secondary school). Occupations included administrative workers (32.1%), executive managers (4.7%), freelancers (12.3%), retired persons (12.2), unemployed persons (9.1%), students (15.1%) and other (14.5%).

Regarding the reasons for travelling, 69.3% of respondents were taking leisure trips, 14.3% were flying for business and 16.3% for other purposes. The sample includes people travelling by plane annually on average 1–4 times (64.9%), and the rest of the passengers (35.1%) travel on average more than five times per year.

Table 1
Socio-demographic characteristics of the interviewees.

Variables	%
Gender	
Male	35.8
Female	64.2
Age	
16–24 years	16.3
25–35 years	36.1
36–45 years	17.1
46–55 years	9.4
56–65 years	11.8
Over 65	9.3
Level of education	
Below secondary school	3.3
Secondary school	16.3
High school	46.5
University degree	28.9
Postgraduate degree (Master, PhD)	5.1
Occupation	
Administrative worker	32.1
Executive manager	4.7
Freelance	12.3
Retired	12.2
Unemployed	9.1
Student	15.1
Other	14.5
Resident in Sardinia	
Yes	46.5
No	53.5
Nationality	
Italian	72.6
Foreign	27.4
Reason for travelling	
Leisure	69.3
Work	14.3
Other	16.3
Journeys per year	
1–4 times	64.9
>5 times	35.1

4. Methodology

4.1. Fuzzy logic

Satisfaction and SQ are well-known marketing constructs that are difficult to measure due to lack of data and adequate quantitative approaches. This paper presents a hybrid approach based on the questionnaire explained above and a fuzzy technique for order performance by similarity to ideal solution (TOPSIS) for evaluating the satisfaction of customers who used a bar, cafeteria or restaurant at Olbia Airport. The method proposed consists of three different steps: (1) the development of a well-grounded questionnaire based on previous studies to collect data for measuring satisfaction with F&B retailers in airports; (2) a linguistic evaluation by customers to proxy their satisfaction regarding the services provided, with the information then treated using a fuzzy TOPSIS approach to calculate an overall satisfaction index or SQI for different segments of passengers; (3) further analysis to calculate the elasticity of the SQI over the different attributes included in the set of SQ key performance indicators.

As noted above, the responses to the questionnaire provide information on the SQ attributes in linguistic terms that result in uncertain and imprecise information. Aggregating this vague information into the multi-criteria decision-making (MCDM) process poses a real challenge. However, since the seminal work of Zadeh (1965), this challenge has usually been overcome with the help of fuzzy theory as fuzzy measures are perfectly able to handle imprecise information such as that provided in questionnaires based mainly on ratings using linguistic terms like "poor", "fair", "good" and "excellent" (Benítez et al., 2007). The vagueness of information arises because it is much easier to represent the quality of service in organizations or the satisfaction experienced with a service in linguistic terms rather than in numbers. In fuzzy set theory, linguistic terms are used to represent decision makers' preferences. Essentially, fuzzy logic handles the imprecise information adequately because intermediate values to be defined between exact and true conventional values can be formulated mathematically and processed by computers to apply a more human-like way of thinking in programming (Zadeh, 1984). Fuzzy sets are widely used to describe linguistic information because they can effectively blur this imprecise information. Methods based on fuzzy logic are becoming very popular in the field of SQ (e.g. Tsaur et al., 2002; Yeh and Kuo, 2003; Benítez et al., 2007; Lin, 2010; Kabir and Hasin, 2012; Bai et al., 2014; Saeida Ardakani et al., 2015).

4.2. Ideal solutions

One of the best known classic MCDM methods extensively applied in the literature on SQ and satisfaction is based on TOPSIS developed by Hwang and Yoon (1981). This is founded on the concept that the best performance should have the shortest distance from the positive ideal solution (PIS), i.e. the virtual alternative which maximizes all the SQ attributes, and the farthest from the negative ideal solution (NIS), i.e. the virtual alternative that minimizes all the SQ attributes (Wang and Elhag, 2006; Benítez et al., 2007). The term "virtual" is used because a single segment, in particular, presenting the best or the worst evaluation for all the SQ attributes is highly unrealistic.

4.3. Triangular fuzzy numbers

Following Zadeh (1975) and Mamdani and Assilian (1975), let the universe of discourse X be the subset of real numbers R, $X = \{x_1, x_2, x_3, \ldots, x_n\}$. A fuzzy set $\tilde{A} = \{(x, \mu_A(x)) | x \in X\}$ in X is a set of ordered pairs, where $\mu_A(x)$ is a membership function and

$\mu_A(x) : X \to [0,1]$. The membership function for fuzzy sets can take any value within the closed interval [0,1]. The greater $\mu_A(x)$ the greater the truth of the statement that element x belongs to set A.

This paper parameterizes a triangular fuzzy number $\tilde{A}$ using a triplet (a_1, a_2, a_3). The membership function $\mu_A(x)$ is defined as follows:

$$\mu_A(x) = \begin{cases} \dfrac{x - a_1}{a_2 - a_1}, & a_1 \leq x \leq a_2, \\[2mm] \dfrac{x - a_3}{a_2 - a_3}, & a_2 \leq x \leq a_3, \\[2mm] 0, & otherwise. \end{cases} \tag{1}$$

Each linguistic term is characterized by a triangular fuzzy number to represent its approximate value in a range between 0 and 100 (other ranges, such as (0–1), (0–7) or (0–10), would also be valid) and denoted as (a_1, a_2, a_3), where $0 \leq a_1 \leq a_2 \leq a_3 \leq 100$. a_2 is the most likely value of the linguistic term and a_1 and a_3 are the lower and upper bounds used respectively to reflect the fuzziness of the term. It is not possible to reflect the fact that respondents may have different perceptions of the representativeness of the Likert scale, but hopefully this caveat is not very important because some representative default values are used the robustness of which could be tested empirically. The default values of the linguistic terms are shown in Table 2 and the membership functions can be calculated according to equation (1). The asymmetry of these fuzzy numbers is explained well by the asymmetry of the linguistic terms.

The vagueness of linguistic terms evaluating degree of satisfaction degree has already been established. Thus, to provide more objective information for Olbia Airport managers, the study fuzzified degree of satisfaction as triangular fuzzy numbers and aggregated the group opinions of consumers according to the average fuzzy number of n triangular numbers $\tilde{A}_i = (a_1^{(i)}, a_2^{(i)}, a_3^{(i)})$, where $i = 1, 2, 3, \ldots, n$, as follows:

$$\tilde{A} = (a_1, a_2, a_3) = \left(\frac{1}{n}\right) \bullet \left(\tilde{A}_1 \oplus \tilde{A}_2 \oplus \cdots \tilde{A}_n\right)$$
$$= \left(\frac{\sum_{i=1}^{n} a_1^{(i)}, \sum_{i=1}^{n} a_2^{(i)}, \sum_{i=1}^{n} a_3^{(i)}}{n}\right), \tag{2}$$

where • denotes the multiplication of a scalar and a fuzzy number and ⊕ the addition of fuzzy numbers, so $\tilde{A}$ is the overall average performance valuation for each segment included in the analysis. Equation (2) shows that the average performance can be represented by a new triangular fuzzy number (Buckley, 1985).

4.4. Defuzzification

To determine whether the performance of a certain attribute is

Table 2
Triangular fuzzy numbers. Default values of linguistic terms.

Linguistic terms	Fuzzy number
Completely dissatisfied (1)	(0,0,30)
Mostly dissatisfied (2)	(3,18,33)
Somewhat dissatisfied (3)	(21,36,51)
Neither satisfied or dissatisfied (4)	(35,50,65)
Somewhat satisfied (5)	(53,68,73)
Mostly satisfied (6)	(61,76,91)
Completely satisfied (7)	(70,100,100)

weak or strong, the information obtained above must be defuzzified. The result of fuzzy synthetic information for each observation or segment is a fuzzy number. Therefore, it is necessary to employ some non-fuzzy ranking method for fuzzy numbers in comparing service quality for each observation. In other words, defuzzification is a technique to convert the fuzzy number into crisp real numbers. The procedure for defuzzification is to locate the best non-fuzzy performance (BNP) value. This can be attained by several available methods, some of the most common being the mean of maximum (MoM), centre of area (CoA) and a-cut approaches (Zhao and Govind, 1991). Liou and Wang (1992) proposed the total integral value method with an index of optimism.

This paper compares the performance of two triangular fuzzy numbers using $v_{\tilde{A}}$ defined as $v_{\tilde{A}} = (a_1 + 2a_2 + a_3)/4$ for the triplet (a_1, a_2, a_3) of a triangular fuzzy number $\tilde{A}$. This method (Chen, 1996) is chosen due to its simplicity and the lack of requirement for an analyst's personal judgement. It is based on Kaufmann and Gupta's (1988) method for comparing fuzzy numbers and its logic is underpinned by the definition of the removal of a fuzzy number. Thus, it is possible to obtain $v_{\tilde{A}}$ for each dimension to be used in the next step. It can be seen that this approach uses the total integral value method with a neutral optimism weight as alpha is equal to one half.

4.5. Similarity to ideal solutions and elasticity

To resolve the multi-attribute evaluation problem characterized by the crisp performance matrix, the study applies a method based on the concept of the degree of optimality rooted in a best virtual alternative formed by different alternatives where multiple attributes characterize their achievement and the notion of the best (Zeleny, 1982). As noted, a TOPSIS method is applied (Hwang and Yoon, 1981) in which the ideal solutions need to be obtained. Thus, ideal solutions are computed based on the following equations:

$$A^+ = \{(\max V_{ij} | j \in J), (\min V_{ij} | j \in J'), i = 1, 2, \ldots, m\} \tag{3}$$

$$A^- = \{(\min V_{ij} | j \in J), (\max V_{ij} | j \in J'), i = 1, 2, \ldots, m\} \tag{4}$$

where J and J' form a partition of the different criteria according to their benefit or cost characteristic. In this case, there are no dimensions with cost characteristics.

Having determined the ideal solutions, the Euclidean distance between the ideal solution and negative ideal solution for each observation is calculated as follows:

$$S_i^+ = dist\left(V_i, A^+\right) = \sqrt{\sum_{j=1}^{n} \left(V_{ij} - A_j^+\right)^2} \quad i = 1, 2, \ldots, m \tag{5}$$

$$S_i^- = dist\left(V_i, A^-\right) = \sqrt{\sum_{j=1}^{n} \left(V_{ij} - A_j^-\right)^2} \quad i = 1, 2, \ldots, m \tag{6}$$

Then, the relative closeness to the positive ideal solution for each observation can be calculated, such as:

$$SQI_i = \frac{S_i^-}{S_i^+ + S_i^-} \quad i = 1, 2, \ldots, m, \tag{7}$$

where $0 \leq SQI_i \leq 1$. An observation is closer to an ideal solution when SQI_i approaches 1. A set of alternatives can be sorted according to the descending order of SQI_i.

This approach has been used widely in different decision

contexts (e.g. Chen and Hwang, 1991; Athanassopoulos and Podinovski, 1997; Zeleny, 1998; Yeh et al., 2000; Chang and Yeh, 2001; Min and Peng, 2012; Bai and Sarkis, 2013). This is mainly due to its applicability in solving different scenarios of human decision problems and its mathematical simplicity in measuring the relative performance of the alternatives.

The rationale behind equation (7) is that better performance of a particular segment should be captured by a higher degree of similarity to the positive ideal solution and a lower degree of similarity to the negative ideal solution. The larger the performance index, the better the overall SQ performance for that particular segment. As such, the performance index calculated is a relative concept and it could be used to analyse the satisfaction experienced in F&B retailers at Olbia Airport.

Once SQI has been calculated, another remarkable variable of interest for airport managers that can be calculated is the elasticity of the overall SQ for each attribute and segment. Elasticity is a major economic concept and has its origin in physics. It serves to quantify the sensitivity (which may be positive or negative) that a variable experiences in changing another. In this case, it is assumed that there is a functional dependence between the SQI and the attributes that form it and therefore the elasticity measures the responsiveness of the overall quality to a small variation in the attribute for which the elasticity is being calculated. Thus, elasticity can be understood or defined as the percentage change in quality for each attribute. In mathematical notation, the elasticity can be calculated for each segment i and each SQ attribute j as follows:

$$\eta_{ij} = \frac{\Delta\%SQI_i}{\Delta\%V_{ij}} = \frac{dSQI_i}{dV_{ij}}\frac{V_{ij}}{SQI_i}. \tag{8}$$

Elasticity values can help airport managers to determine the critical success attributes (CSAs) that guarantee adequate passengers' experience at F&B retailers and these can be used to develop strategies to foster commercial revenues for F&B retailers in the airport. Knowing these attributes is paramount in developing such strategies and programmes.

5. Results

Table 3 shows the triangular fuzzy numbers and the crisp information (defuzzification) of the total segment included in the analysis. As can be seen, SQ performance looks uneven in terms of the crisp information. Two dimensions present good performance, namely "location and proximity" and "cleanliness and comfort of the premises". However, two other dimensions, "price acceptability" and "provision of entertainment" clearly fail. These results can be used by airport managers to establish adequate managerial programmes to correct the underperformance of some dimensions.

The last column of Table 3, the crisp vector for this segment is the basic information that is needed for each segment to complete the fuzzy performance matrix for all the segments under analysis.

Thus, the virtual PIS and NIS can be calculated according to equations (3) and (4) and Table 4 shows the virtual PIS and NIS taking into account the information provided for all the segments.

As explained above, a single segment is not responsible for being the PIS or NIS. Analysing both virtual vectors, some relevant information can be extracted. First, a very different pattern exists if one analyses the incremental variation between the crisp information obtained by each attribute. It can be seen that "provision of entertainment" and "internal atmosphere" show the highest and lowest heterogeneity. This is also very important information that airport managers need to scrutinize carefully, as in SQ the performance should not only be good but homogeneous. A corrective managerial process to standardize some dimensions to a greater extent should be introduced in the near future. Susskind (2010, p. 481) described how "in 1970, Michael Hurst wrote an article titled 'You Sell More than Food,' which resonated with him strongly over the years". Hurst (1970) talked about how a restaurant experience is created, and he highlighted all the details and factors that influence the guest's experience, using what have since been termed the "Big Three Ps": people, product and (operational) processes. He highlighted that the atmosphere is just as important as the food, arguing that the food will simply not taste as good as it could if the atmosphere is not seasoned with good, caring service providers. He further noted that management is principally responsible for setting the tone, hiring the people who interact with the guests at all levels. The stage is set by management and the show is created for the guests.

Finally, the SQI for each segment can be calculated according to the method used to synthesize the SQ performance for each of the segments under analysis. Fig. 1 shows how age affects the level of satisfaction experienced by passengers. It can be seen that older

Table 4
Service quality: virtual positive and negative ideal solution.

Attribute	Virtual PIS	Virtual NIS	Inc.
Price acceptability	51.63	33.57	53.79%
Quality of products offered	68.87	55.94	23.10%
Presentation of the dishes	65.10	51.72	25.88%
Originality of the food	68.80	45.77	50.32%
Variety of food	71.37	50.06	42.56%
Value/price	53.61	40.47	32.48%
Location and proximity	72.04	57.14	26.09%
Appearance	74.90	56.36	32.88%
Internal atmosphere	64.36	56.81	13.29%
Friendliness of staff	69.67	57.44	21.29%
Speed of service	72.57	57.91	25.30%
Cleanliness and comfort of the premises	76.50	59.55	28.47%
Provision of entertainment	54.10	28.50	89.82%

Table 3
SQ attributes, fuzzy numbers and defuzzification: total.

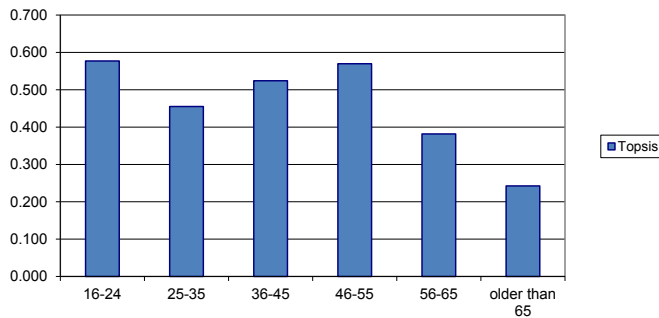| Attributes	Triangular fuzzy number	Crisp information
Price acceptability	(29.96, 42.96, 58.69)	43.64
Quality of products offered	(43.66, 59.89, 71.48)	58.73
Presentation of the dishes	(42.15, 57.99, 70.09)	57.05
Originality of the food	(39.97, 55.34, 67.97)	54.65
Variety of food	(42.01, 57.78, 69.81)	56.84
Value/price	(33.82, 48.06, 62.25)	48.05
Location and proximity	(50.30, 68.53, 78.45)	66.45
Appearance	(48.93, 66.33, 76.64)	64.56
Internal atmosphere	(46.37, 62.97, 73.95)	61.56
Friendliness of staff	(48.84, 66.01, 76.44)	64.33
Speed of service	(47.65, 64.58, 75.20)	63.00
Cleanliness and comfort of the premises	(51.13, 68.96, 78.86)	66.98
Provision of entertainment	(30.88, 42.98, 59.50)	44.08

Fig. 1. SQI — Passenger satisfaction by age.

passengers experience less satisfaction than the rest of the passengers.

These results are very important as forecasts estimate that the number of people over 65 is set to more than double, the elderly consisting of 26% of the world's population by 2050 (Haub, 2011). This means that this market segment will increase in the near future, affecting two basic characteristics: overall participation in numbers and revenues (Bai et al., 2001; Schröder and Widmann, 2007). The tourism industry has recognized the potential of this market for a number of years and it is therefore time that Olbia Airport made some effort to correct the underperformance observed in F&B retailers for this particular segment. The airport needs to focus on developing strategic plans to increase the competitiveness of this type of commercial activity and specifically to target elderly passengers.

Table 5 shows the value of the elasticity of SQI for the whole sample and each of the segments analysed by age. It can be seen that only three elasticity values show that the overall quality is elastic, namely: "friendliness of staff", "cleanliness and comfort of the premises" and "provision of entertainment". In all cases, it is also apparent that satisfaction is only elastic for the elderly passengers. On the other hand, one can see that satisfaction is more inelastic or rigid with respect to the following attributes: "price acceptability" (elderly passengers), "presentation of dishes" and "internal atmosphere" (all segments). These values can be used to extract the CSAs and those which are not so critical. It is evident that for elderly passengers, the friendliness of the staff, the cleanliness and comfort of the premises and the provision of entertainment are key performance attributes that need to be put in value. Uhrich et al. (2013) contend that service managers should hedonize their services in marketing communications, thus guaranteeing that the service consumption is a hedonic experience, because not delivering as promised can lead to customer dissatisfaction and defection. To hedonize their services, service managers should concentrate on three relevant aspects: people, processes and physical evidence (Bitner, 1993). The results of this study are in agreement with this argument and selecting the right employees who enjoy their jobs is fundamental to the transfer of enjoyment to passengers. Furthermore, training staff to deliver "service with a smile" can enhance passengers' moods and also lead them to perceive the service process as more hedonic (Pugh, 2001).

To finalize, it can be said that this proposal constitutes a valid tool that can help airport managers understand the relative overall SQ performance of F&B retailers. In relation to this, the scores obtained for different dimensions and for specific segments can also be seen as an adequate tool for involving staff in attaining better results in the future. Each operational area should develop a plan that visually depicts the key components necessary for the staff to succeed and obtain better results with respect to the scores for overall SQ performance. This plan should comprise certain measures that can be tested empirically over time according to SQ performance indicators, such as employee attitude and competencies and possibly other organizational factors that will directly or indirectly affect the future sustainability of commercial activities at the airport.

SQ questionnaires are a very important element of a comprehensive strategy to adjust and improve performance. However, to date, the practice of listening to consumers has not usually been accompanied by any further analysis to correct any malfunctioning of a service. There is a need to quickly redirect actions fitting the needs of passengers. Operational, service and support areas can then use this framework to analyse not only the overall SQI but also the partial SQ achieved by each dimension-segment pair. Once managers have analysed the results, they can provide guidelines on how to respond more effectively to passengers to increase their satisfaction. It will also be necessary to balance the trade-offs between different services effectively, to zero in on the measures that are most effective and to determine which services are working well or poorly, which processes need improvement and which skills need to be enhanced.

6. Conclusions

Although airports' profitability nowadays largely relies on non-aeronautical or commercial activities, research aimed at analysing perceived service quality (SQ) and the satisfaction of passengers consuming foods and beverages (F&B) in airport areas is still lacking. This study aimed to deepen the scientific debate around this topic. The findings are relevant for both researchers and practitioners and mainly contribute to the third of the research questions that need to be studied according to Graham (2008), namely, "to

Table 5
Elasticity of SQI over each attribute by age segmentation.

Attribute	Total	16—24	25—35	36—45	46—55	56—65	Older than 65
Price acceptability	0.445	0.372	0.471	0.384	0.361	0.522	0.167
Quality of products offered	0.389	0.399	0.335	0.380	0.398	0.396	0.448
Presentation of the dishes	0.412	0.353	0.380	0.371	0.374	0.452	0.171
Originality of the food	0.671	0.607	0.610	0.611	0.625	0.747	0.278
Variety of food	0.633	0.599	0.582	0.577	0.611	0.642	0.487
Value/price	0.360	0.296	0.355	0.302	0.282	0.455	0.464
Location and proximity	0.565	0.417	0.564	0.461	0.435	0.692	0.208
Appearance	0.648	0.586	0.656	0.572	0.563	0.688	0.263
Internal atmosphere	0.270	0.214	0.265	0.218	0.180	0.341	0.092
Friendliness of staff	0.443	0.382	0.437	0.371	0.359	0.551	1.191
Speed of service	0.489	0.465	0.483	0.451	0.466	0.337	0.480
Cleanliness and comfort of the premises	0.614	0.543	0.586	0.543	0.561	0.694	1.232
Provision of entertainment	0.642	0.501	0.644	0.520	0.506	0.835	1.695

analyse the SQ provided by the F&B retailers in airports".

From a theoretical point of view, this paper suggests that fuzzy numbers can be considered an appropriate methodology to measure SQ, reducing the uncertainty associated with linguistic information. Specifically, it proposes a fuzzy logic approach to compute a satisfaction index (SQI) for certain segments of passengers purchasing F&B at Olbia Airport using 13 attributes. To the best of authors' knowledge, this is the first time that fuzzy logic has been proposed to analyse SQ in this service sector context: F&B retailers in airports. Furthermore, it highlights that age is a moderating factor in consumers' satisfaction in this specific service setting, as in others; specifically, our findings show that older passengers are less satisfied than their counterparts, suggesting that they can be considered more critical and demanding when seeking, consuming and evaluating F&B retailers in airports. Assuming that passengers form an overall opinion of F&B retailers at the airport by weighing up the different dimensions that make up the overall SQ on an individual basis, the SQI constructed by the model in this study reflects the pattern quite well.

Measuring perceived SQ and satisfaction has been considered a milestone in marketing theory for all sectors and airports are certainly no exception. Hence, listening to the passengers' voices and opinions and measuring their satisfaction concerning F&B retailers in airports in a systematic way and over time is necessary to plan and implement all the corrective measures that are needed to meet passengers' needs and fulfil their expectations; organizations that fail to do so are doomed to failure. All departmental areas, regardless of whether they are operations or services, should use the measurements obtained from the questionnaires to promote best practice and institute corrective measures. Two dimensions showed good performance, namely "location and proximity" and "cleanliness and comfort of the premises". However, two other dimensions, "price acceptability" and "provision of entertainment" clearly needed corrective actions. It was also observed that "provision of entertainment" and "internal atmosphere" showed the highest and lowest heterogeneity. This information is crucial because airport managers not only need to scrutinize carefully whether SQ performance is good but homogeneous. In this regard, a further analysis should be done to see whether the results can be partly explained by very heterogeneous market segments or by the lack of managerial practices that help to obtain some standards in the different dimensions.

From a marketing perspective, these findings can be used worldwide by airport managers to strengthen the competitiveness of their F&B commercial activity. Specifically, they seem to suggest that satisfaction is more inelastic (or rigid) with respect to the following attributes: price acceptability (elderly passengers), presentation of dishes and internal atmosphere (all segments). Broadly, the results highlight the main strengths and weaknesses of F&B retailers for consumers of different ages, thus helping airport marketers to direct their resources to the service features which — according to their specific target market — leave consumers more satisfied. In this respect, it is clear, for example, that the attributes related to the friendliness of staff, cleanliness and comfort of the premises and provision of entertainment are crucial factors for elderly passengers at Olbia Airport. With the support of personnel at all hierarchical levels (executives, intermediate functional managers, front-line employees, etc.), the airport should undertake an analysis to decide what kinds of marketing operations could be implemented to improve these crucial factors dynamically. With the aim of developing a continuous process of SQ improvement, the skills of all employees should be enhanced through appropriate training courses as friendliness of staff is one of the crucial factors.

Although this study helps to fill a gap in existing knowledge as presented in the literature and proposes some implications for practitioners, limitations still remain. First, the study applied the methodology of fuzzy sets without first developing a passenger-derived typology for transferring linguistic information to the triangular fuzzy numbers used. In this respect, the study highlights that there are different segments of passengers and these can be characterized as more or less demanding regarding the different dimensions used in the article. Second, the study used a convenience sample and the data were collected from just one airport which has its own specific characteristics (dimensions, insularity and seasonality), making the findings hardly generalizable. In future, it would be useful to repeat the study in other locations to verify whether or not the findings can be generalized. Finally, the study considered only one factor (age) of the several that could moderate consumer satisfaction (e.g. gender, income, length of flight, national vs international tourists, etc.), so future research could also take into account a broader range of variables and extend the results of this study to other potential market segments.

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