



# A multiple criteria approach for airline passenger satisfaction measurement and service quality improvement



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## ABSTRACT

Measuring customer satisfaction is a key element for modern businesses as it can significantly contribute to a continuing effort of service quality improvement. In order to meet customer expectations and achieve higher quality levels, airlines need to develop a specific mechanism of passenger satisfaction measurement. In this paper we show how MUSA, a multicriteria satisfaction analysis method, can be utilized in order to measure passengers' satisfaction from a large set of services dimensions, as well as to indicate those dimensions that need to be improved. The effectiveness of the method as a passenger satisfaction measurement and analysis tool is illustrated through an application to Aegean Airlines. The results reveal useful findings with regard to the satisfaction criteria and subcriteria that passengers of a full service airline value most, while interesting patterns emerge in different segmentation schemes.

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## 1. Introduction

In a competitive industry such as the airline industry, it is important for firms not only to correctly perceive what their customers want and expect, but also to manage their own resources in meeting their customer expectations appropriately (Chow, 2015). There is no doubt that nowadays, global financial environment demands targeted and well estimated management of resources. Park et al. (2004) suggest that carriers which provide services meeting customer expectations enjoy a higher level of passenger satisfaction and value perception. Service quality and passenger satisfaction is increasingly recognized as a critical determinant of business performance and as a strategic tool for gaining competitive advantage (Li et al., 2017).

Measuring customer satisfaction in the airline industry is becoming ever more frequent and relevant due to the fact that the delivery of high-quality service is essential for airlines' survival and crucial to the competitiveness of the airline industry (Park et al., 2005). Recently, competition between airlines has become more intense and service quality of airlines is receiving more attention than ever before. High-quality service has become a requirement in the market among air carriers, and helps companies to gain and

maintain customer loyalty. It also leads to creating competitive pressure among air carriers (Chen et al., 2011). To achieve a high level of customer satisfaction, a high standard of service quality should be delivered by the service provider, since service quality is considered the basis for customer satisfaction (Clemes et al., 2008).

As Liou et al. (2011) state, there is no universal and exact definition of service quality. Instead, service quality may imply different things to different industries, suggesting that the concept of service quality is context-dependent and its measurements should reflect the operational environment being considered. Passenger satisfaction measurement is a key factor for improving service quality in airline companies, due to the intangible nature of the product, and the fact that customers perceive only two elements: the general outcome and the supplementary services. The general outcome is the transition from one location to another one, and this transition to the desired destination is combined with some essential or complimentary services. Whereas the traditional approach implies that the higher the perceived service quality, the higher the customer's satisfaction, recent studies indicate that the relationship between the dimensions of service quality and customer satisfaction may show a nonlinear pattern (Basfirinci and Mitra, 2015). Thus, determining the relative importance of service quality dimensions is also required.

In this paper we employ MUSA (MULTicriteria Satisfaction Analysis), an approach that combines MCDM analysis for assessing customer satisfaction and IPA for suggesting the critical service

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dimensions that need to be improved. The applicability of the method to airline passenger satisfaction is illustrated through the case of Aegean airlines, a Star Alliance member, which has received seven Skytrax awards within a period of eight years (2009–2016) as the Best Regional Airline in Europe.

## 2. Literature review

Different approaches have been applied in measuring the airline service quality and passenger satisfaction. One research stream concerns studies that use statistical techniques such as regression (logistic or ordinal) to test hypothesis related to the topic (Oyewole et al., 2007; Eboli and Mazzulla, 2009; Josephat and Ismail, 2012; Ali et al., 2016). Vink et al. (2005) studied service quality from the comfort perspective, dividing the comfort during flight experience into seven phases. Vink et al. (2012) found six descriptors strongly associated with comfort based on 10,032 passengers' trip reports. Nicolini and Salini (2006) used decision trees and the Rasch model, while other studies employ SERVQUAL (Chen and Chang, 2005; Pakdil and Aydin, 2007; Degirmenci et al., 2012). Another research stream is based on the application of Multiple Criteria Decision Making (MCDM) methods and tools in order to evaluate an airline's integrated service level and make suggestions for improvement. Most of them employ fuzzy multicriteria approaches (Tsaour et al., 2002; Chang and Yeh, 2002; Liou and Tzeng, 2007), while Liou et al. (2011) utilize SERVQUAL and Importance Performance Analysis (IPA).

Another MCDM method for customer satisfaction evaluation and service quality assessment is MUSA. The main advantage of MUSA is that it respects the qualitative form of customers' judgments and preferences as they are expressed in a customer satisfaction survey. The method avoids the arbitrary quantification of the collected information, since the coding of the qualitative scale is a result, not an input to the proposed methodology, as is the case with other statistical methods such as regression analysis. This capability of qualitatively representing the customer's judgments and preferences makes MUSA an appropriate tool for assessing customer satisfaction and service quality in a wide range of sectors such as banking (Mihelis et al., 2001; Grigoroudis et al., 2002), coastal shipping (Grigoroudis et al., 1999), publishing (Alexopoulos et al., 2006), and ecommerce (Kyriazopoulos et al., 2006; Grigoroudis et al., 2007a,b) among others.

MUSA constitutes an appropriate tool for assessing customer satisfaction and service quality in the civil aviation industry, as the latter exhibits all the typical characteristics of service industries: the intangibility and perishability of the product and the high importance of personal contact to the customer (Wittmer and Bieger, 2011). Furthermore, MUSA is based on the principles of ordinal regression, and thus can effectively handle qualitative assessment structures such as ordinal scales based on star ratings that are typical in customer review systems for service industries (e.g. Tripadvisor for hotels). Skytrax for example, the leading international Airline Rating system classifying airlines by the quality of front-line product and staff service standards, allows passengers to evaluate airlines on seven criteria using a 5-point ordinal scale based on star rating.

## 3. Customer satisfaction

Satisfaction has been defined as the feeling of pleasure or disappointment when a customer compares a product's perceived performance with his or her prior expectations (Oliver, 1981). In recent times, organizations of all types and sizes have increasingly come to understand the importance of customer satisfaction. It is widely understood that it is far less costly to keep existing

customers than it is to win new ones, and it is becoming accepted that there is a strong link between customer satisfaction, customer retention and profitability. (Hill and Alexander, 2006). O'Sullivan and McCallig (2012) showed that customer satisfaction has a positive impact on firm value. Critically, the authors found that this impact is over and above the impact that earnings has on firm value, and that customer satisfaction positively and significantly moderates the earnings-firm value relationship. According to Daub and Ergenzinger (2005) customer satisfaction must be seen in a more holistic, multidimensional perspective in future. Companies succeeding in taking this step towards sustainable management will raise their profile among customers, and differentiate themselves from the competition. Service quality and customer satisfaction are closely related but not interchangeable, although both concepts involve a comparison of expectations of quality and the actual service received (Jiang and Zhang, 2016). Szwarc (2005) notes that service quality increases customer satisfaction, which enforces customer loyalty and in turn leads to increased corporate profits.

The most frequently used customer satisfaction and service quality measurement approaches are (Grigoroudis and Siskos, 2010):

- Quantitative methods and data analysis techniques: descriptive statistics, multiple regression analysis, factor analysis, probit–logit analysis, discriminant analysis, conjoint analysis, and other statistical quantitative methods (DEA, cluster analysis, probability-plotting methods).
- Quality approaches: Malcolm Baldrige award, European quality model, ideal point approach, SERVQUAL.
- Consumer behavioral analysis: expectancy disconfirmation model, motivation theories, equity theory, regret theory.
- Other methodological approaches: customer loyalty, Kano's model, Fornell's model.

## 4. The MUSA method

Most of the aforementioned models do not consider the qualitative form of customers' judgments, although this information is the basic satisfaction input data. Furthermore, in several cases, the measurements are not sufficient enough to analyze in detail customer satisfaction because models' results are mainly focused on a simple descriptive analysis. The MUSA method (Grigoroudis and Siskos, 2002) fully considers the qualitative form of customers' satisfaction data in order to overcome the above limitations. The results of the model are not only focused on descriptive analysis of customer satisfaction data, but they are also able to assess an integrated benchmarking system. The model does not require strong assumptions regarding customer satisfaction or consumer behavior generally. Furthermore, input data can be easily collected using a very simple, comprehensive, and short questionnaire. The MUSA system is a survey-based software, which is able to provide complete and effective results to the user, through the evaluation of concrete and understandable indices of customer satisfaction.

MUSA is based on the principles of multicriteria analysis, and particularly on the aggregation–disaggregation approach and linear programming modeling. The preference disaggregation methodology is an ordinal regression based approach in the field of multicriteria analysis used for the assessment of a set of marginal satisfaction functions in such a way that the global satisfaction criterion becomes as consistent as possible with customer's judgments. The main objective of the MUSA model is the aggregation of individual judgments into a collective value function assuming that

customer's global satisfaction depends on a set of criteria or variables representing service dimensions (Fig. 1). Each customer is asked to express his/her judgments, namely his/her overall satisfaction and his/her satisfaction for a set of discrete criteria. These criteria are divided to certain subcriteria in order to formulate a more specific data output. MUSA provides quantitative measures of customer satisfaction, through the aggregation of individual customer judgments into a collective value function.

The method assumes that the customer's satisfaction from a product/service depends on a set of  $n$  criteria  $X=(X_1, X_2, \dots, X_n)$ , where  $X_i$  is a monotonic variable representing satisfaction dimension (criterion)  $i$ . Through a simple questionnaire respondents evaluate the considered product/service by expressing their "global" (overall) satisfaction  $Y$  from the product/service, as well as their "partial" satisfaction  $X_i$  from each criterion  $i$ . Both global and partial satisfaction are expressed in a predefined ordinal scale, e.g. *Very satisfied, Somehow satisfied, Neutral, Somehow unsatisfied, Very unsatisfied*. Based on the collected evaluations MUSA estimates partial satisfaction functions  $X_i^*$  and a global additive value function  $Y^*$ , given customers' judgments  $Y$  and  $X_i$ . The method follows the principles of ordinal regression analysis under constraints using linear programming techniques. The ordinal regression analysis equation has the following form:

$$Y^* = \sum_{i=1}^n b_i X_i^*, \text{ with } \sum_{i=1}^n b_i = 1$$

where  $b_i$  is the weight of criterion  $i$ , and  $Y^*$  and  $X_i^*$  are the monotonic value functions normalized in the interval  $[0, 100]$  in order to be easily and directly understood. The following variables are also used:

Variable	Description
$Y$	Customer's global satisfaction
$a$	Number of global satisfaction levels
$y^m$	The $m$ -th global satisfaction level ( $m = 1, 2, \dots, \alpha$ )
$n$	Number of criteria
$X_i$	Customer's satisfaction according to the $i$ -th criterion ( $i = 1, 2, \dots, n$ )
$\alpha_i$	Number of satisfaction levels for the $i$ -th criterion
$x_i^k$	The $k$ -th satisfaction level of the $i$ -th criterion ( $k = 1, 2, \dots, \alpha_i$ )
$Y^*$	Value function of $Y$
$y^{*m}$	Value of the $y^m$ satisfaction level
$X_i^*$	Value function of $X_i$
$x_i^{*k}$	Value of the $x_i^k$ satisfaction level

The normalization constraints for the value functions  $Y^*$  and  $X_i^*$  can be written as follows:

$$y^{*1} = 0, y^{*a} = 100$$

$$x_i^{*1} = 0, x_i^{*\alpha_i} = 100 \text{ for } i = 1, 2, \dots, n$$

The method aims to achieve maximum consistency between  $Y^*$  and  $Y$  through the use of two error terms in the ordinal regression equation:

$$Y^* = \sum_{i=1}^n b_i X_i^* - \sigma^+ + \sigma^-, \text{ with } \sum_{i=1}^n b_i = 1 \tag{1}$$

where  $\sigma^+ + \sigma^-$  are the overestimation and underestimation error respectively.

This equation holds for a customer who has expressed a set of satisfaction judgments. For this reason, a pair of error variables



Fig. 1. Aggregation of customer's preferences.

should be assessed for each customer separately (see Fig. 2).

According to the aforementioned definitions and assumptions, the customers' satisfaction evaluation problem may be formulated as the minimization of the sum of errors under the constraints:

- ordinal regression equation for each customer,
- normalization constraints for  $Y^*$  and  $X_i^*$  in the interval  $[0, 100]$ , and
- monotonicity constraints for  $Y^*$  and  $X_i^*$ .

To reduce the size of the problem, transformation variables  $z$  and  $w$ , are introduced which represent the successive steps of the functions  $Y^*$  and  $X_i^*$  respectively (see Fig. 3):

$$\begin{cases} z_m = y^{*m+1} - y^{*m} \text{ for } m = 1, 2, \dots, \alpha - 1 \\ w_{ik} = b_i x_i^{*k+1} - b_i x_i^{*k} \text{ for } k = 1, 2, \dots, \alpha_i - 1 \text{ and } i = 1, 2, \dots, n \end{cases} \tag{2}$$

These transformation variables enable the formulation of the initial non-linear problem (Eq. (1) includes the term  $b_i X_i^*$  where both variables should be estimated) as a linear model.

The initial variables can now be written as:

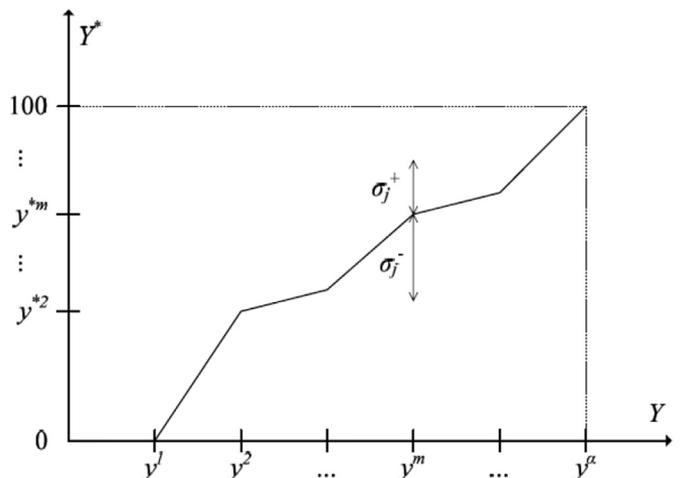


Fig. 2. Error variables for the  $j$ -th customer (source: Grigoroudis and Siskos, 2010).

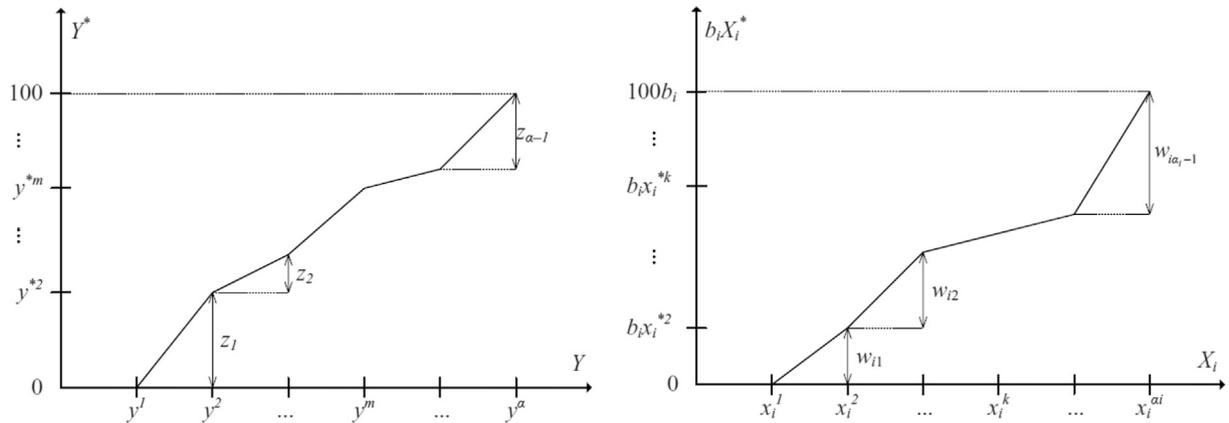


Fig. 3. Transformation variables  $z_m$  and  $w_{ik}$  in global and partial value functions (source: Grigoroudis and Siskos, 2010).

$$\begin{cases} y^{*m} = \sum_{t=1}^{m-1} z_t \text{ for } m = 2, 3, \dots, \alpha \\ b_i x_i^{*k} = \sum_{t=1}^{k-1} w_{it} \text{ for } k = 2, 3, \dots, \alpha_i \text{ and } i = 1, 2, \dots, n \end{cases} \quad (3)$$

Using equations (3) and assuming that customer  $j$  has expressed his/her global satisfaction  $y^{ij}$  and his/her partial satisfaction  $x^{ij}$  using the ordinal scales  $Y$  and  $X_i$ , the ordinal regression equation (1) can be written as:

$$\sum_{m=1}^{t_j-1} z_m = \sum_{i=1}^n \sum_{k=1}^{t_{ij}-1} w_{ik} - \sigma_j^+ + \sigma_j^-, \quad \forall j$$

Hence, the final form of the linear program is as follows:

$$[\min]F = \sum_{j=1}^M (\sigma_j^+ + \sigma_j^-) \quad (4)$$

subject to

$$\sum_{i=1}^n \sum_{k=1}^{t_{ij}-1} w_{ik} - \sum_{m=1}^{t_j-1} z_m - \sigma_j^+ + \sigma_j^- = 0 \quad \forall j$$

$$\sum_{m=1}^{a-1} z_m = 100$$

$$\sum_{i=1}^n \sum_{k=1}^{a_i-1} w_{ik} = 100$$

$$z_m \geq 0, w_{ik} \geq 0, \sigma_j^+ \geq 0, \sigma_j^- \geq 0. \quad \forall i, j, k, m$$

The method calculates  $a_i-1$  variables  $w$  for each criterion  $i$ , and  $a-1$  variables  $z$  for the global satisfaction value. Hence, if  $a_i$  is the same for all  $i$ , the method requires at least  $(a_i-1)n+a-1$  customer evaluations.

After the above problem is solved the initial variables can be calculated as follows:

$$b_i = \frac{1}{100} \sum_{t=1}^{a_i-1} w_{it} \text{ for } i = 1, 2, \dots, n$$

$$y^{*m} = \sum_{t=1}^{m-1} z_t \text{ for } m = 2, 3, \dots, a \quad (5)$$

$$x_i^{*k} = 100 \frac{\sum_{t=1}^{k-1} w_{it}}{\sum_{t=1}^{a_i-1} w_{it}} \text{ for } i = 1, 2, \dots, n \text{ and } k = 2, 3, \dots, a_i$$

The main results of the MUSA method are the value (satisfaction) functions as well as the criteria importance weights. The first indicate, in the interval  $[0, 100]$ , the real value that customers give to each level of the global ( $Y$ ) or marginal ( $X_i$ ) ordinal satisfaction scale. The form of those functions' curve shows the customers degree of demanding. Three examples are illustrated in Fig. 4.

A linear value function indicates *Neutral customers*, who the more satisfied they claim to be, the higher the percentage of their fulfilled expectations. A convex value function represents *Demanding customers*, who are not really satisfied, unless they receive a very high level of quality. A concave value function indicates *Non-demanding customers*, who express a high level of satisfaction, even when only a small portion of their expectations is fulfilled. The satisfaction criteria weights ( $b_i$ ) indicate the relative importance of the evaluated satisfaction dimensions. It should be stressed that importance weights are tradeoff values among the criteria, and should be used only for comparative analysis.

Combining weights and satisfaction indices, a series of "Performance/Importance" diagrams can be developed (Fig. 5). These diagrams are also mentioned as action, decision, and strategic or perceptual maps (Customers Satisfaction Council, 1995).

Each of these maps is divided into quadrants according to performance (high/low), and importance (high/low), that may be used to classify actions:

- Status quo (low performance/low importance): In this area, no action is required due to the low importance of satisfaction criteria
- Leverage opportunity (high performance/high importance): This area contains the company's service dimensions that can be used as an advantage against competition.
- Transfer resources (high performance/low importance): This indicates that the particular satisfaction dimensions are not important, and company's resources may be better used elsewhere.

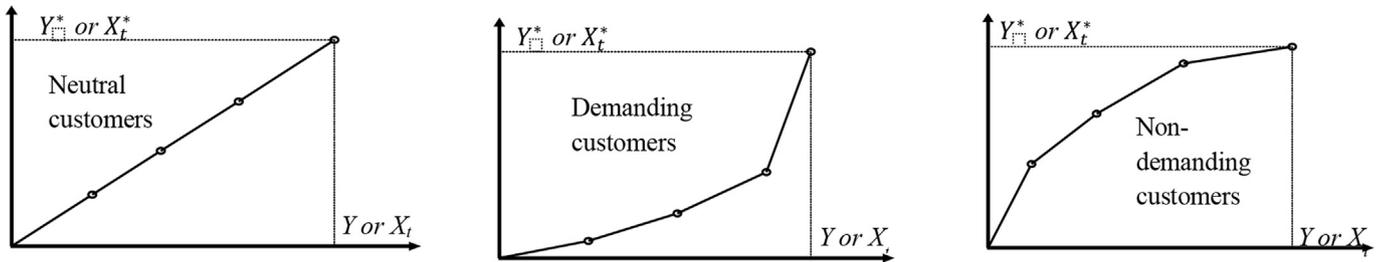


Fig. 4. Customer satisfaction curves with different demanding levels.

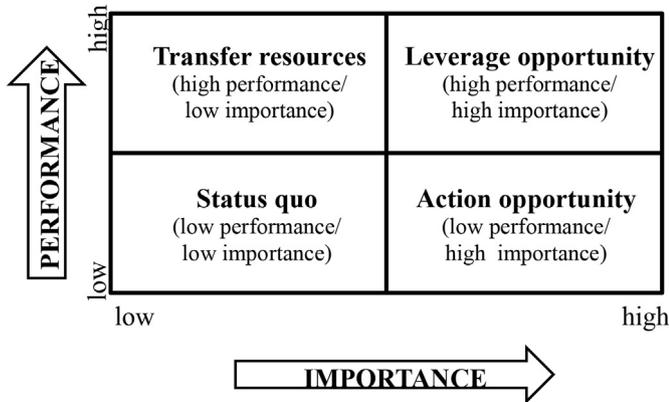


Fig. 5. Performance/Importance diagram.

- **Action opportunity (low performance/high importance):** These are the criteria/subcriteria that are important for customers but performance is low, so immediate action is required.

This diagram can help the identification of improvement actions for the company. The bottom right quadrant is obviously the first priority. The second priority may be given to the satisfaction criteria/subcriteria in the top right quadrant, especially if there is room for improvement. The third priority issues are indicated in the bottom left quadrant; although these issues are not important at the moment, they may be more important in the future, so company should pay attention since its performance is relatively low. Finally, last priority for improvement should be given to the criteria/subcriteria in the top left quadrant because this category is the least important and company's performance is relatively good. Here, reallocation of resources into more essential business functions is suggested. Apparently, priorities for improvement can vary among different companies, depending on the potential capabilities of improving the particular category.

### 5. The case of Aegean airlines

Airlines are part of a fast growing industry. IATA estimates revenues for the airline industry to USD717 billion in 2016, a 0.7% increase from 2015. Of this, USD 533 billion, or about 80% of the total revenues, is associated with passenger transport (3.8 billion passengers are estimated for 2016, an increase of 6.9% over 2015). This involves approximately 36.4 million commercial flights across about 50,000 routes. Over the past several years, North America and Asia Pacific regions have been the most profitable, as well as having the largest numbers of routes and passengers. The airline

industry can be characterized as a high-volume and low-profit service industry. It has its own vulnerabilities, such as the volatile price of fuel, and the ever-present risk of danger. It employs over 58 million people globally, and represents 3.4% of global GDP.

Tourism industry in Greece has been a key element of economic activity. There has been projections from the Association of Greek Tourism Enterprises (SETE) that tourists visited Greece in 2016 have reached the 27.5 million, and roughly the 20% of the Greek workers are employed in this sector. Tourism plays important role in the Greek economy, contributing 18% to the nation's GDP. According to SETE, from the cumulative arrivals of tourists in the country, 16.87 million of them travel with airplane, being transferred from one of the 14 existing commercial airports. These numbers indicate that air transport sector in Greece is in line with the tourism sector, and benefits significantly from this boost of arrivals. The satisfaction of these visitors is particularly important to the airline business and to the economic growth of the country as a whole.

Aegean Airlines SA, founded in 1999, operates in the sector of aviation transportation, providing services that concern the transportation of passengers and commodities in the sector of public aviation transportation in Greece and abroad, conducting scheduled and unscheduled flights. At the same time, it renders services of aviation applications, technical support and on ground handling aircraft services. It collaborates with Lufthansa, TAP Portugal, Brussels Airlines, British Midland International and US Airways. It also collaborates with Continental Airlines on flights between Greece and its New York hub, Newark Liberty International Airport, as well as on selected flights operated by Aegean Airlines in Europe. The company invests in strengthening its international presence and supporting the Greek tourism both in Athens and in regional airports. On October 23, 2013, it acquired 100% stake in Olympic Air, becoming the dominant player that holds the majority market share of air travels in Greece (51% in 2016 - Athens International Airport Annual Report). Data presented by SETE, indicate that 2016 was a record year for passenger transportation, with up to 54 million people traveling through Greek airports. This particular feature may lead to a development of a more aggressive commercial strategy devised by the Greek flag carrier, aiming to acquire larger market shares and boost revenues. In line with this, the 2017 timetable includes a network of 145 destinations, 112 international in 40 countries and 33 domestic, with 15 million available seats. The flights are performed with one of the youngest fleets in Europe, comprising 61 aircraft, after a recent investment in new additional Airbus A320neos.

As Aegean is listed on Athens Stock Exchange, it gives high importance to profitability, while air service, like in most airlines, is implemented subject to highly standardized processes, in order to reduce the quality variation. But Aegean is not focusing mainly to cost issues, as is the case with low cost carriers. In its mission statement it emphasizes "the continuous provision of high

standards services across all travel stages”, while its values include “Respond to our passenger’s needs”, “Put the passenger in focus”, “Pursue constant enhancement of the overall passenger experience in all travel stages”, and “Focus on the quality of the services and products offered” among others. Aegean is a Star Alliance member, it operates a “miles and bonus” frequent flyer program, and places great emphasis on the fact that in 2017 it has been honored with the Skytrax World Airline Award for the eighth time, as the Best Regional Airline in Europe. In a recent contest, the company asked passengers to vote for their favorite Greek traditional snack which will be offered in its domestic flights for the next year. Overall, Aegean’s market positioning as a high quality airline that listens to the voice of the passenger, justifies the need of procedure for measuring the provided service quality by customer’s subjective perception, as described in the following sections.

**6. Passenger satisfaction survey**

The assessment of a consistent family of criteria representing

customers' satisfaction dimensions is one of most important stages of the implemented methodology. This assessment can be achieved through an extensive interactive procedure between the analyst and the decision-maker (company). In any case, the reliability of the set of criteria/subcriteria has to be tested in a small indicative set of customers. A small pilot pre-survey took place among 20 passengers to assess the understanding and validity of the questionnaire and the set of criteria. In the main survey passengers were requested to evaluate their experience with Aegean airlines. The hierarchical structure of passenger's satisfaction dimensions is presented in Fig. 6, showing the set of criteria and subcriteria used in this survey. Criteria are listed in chronological order following the timeline of contacts between the passenger and each criterion involved with a particular service. For example, the customers initially perceive *price*, when they desire to buy a ticket. Afterwards, they seek air routes through the website, and the interaction experience between the customer and the company is concluded with the services obtained after the landing of the aircraft.

The main satisfaction criteria consist of:

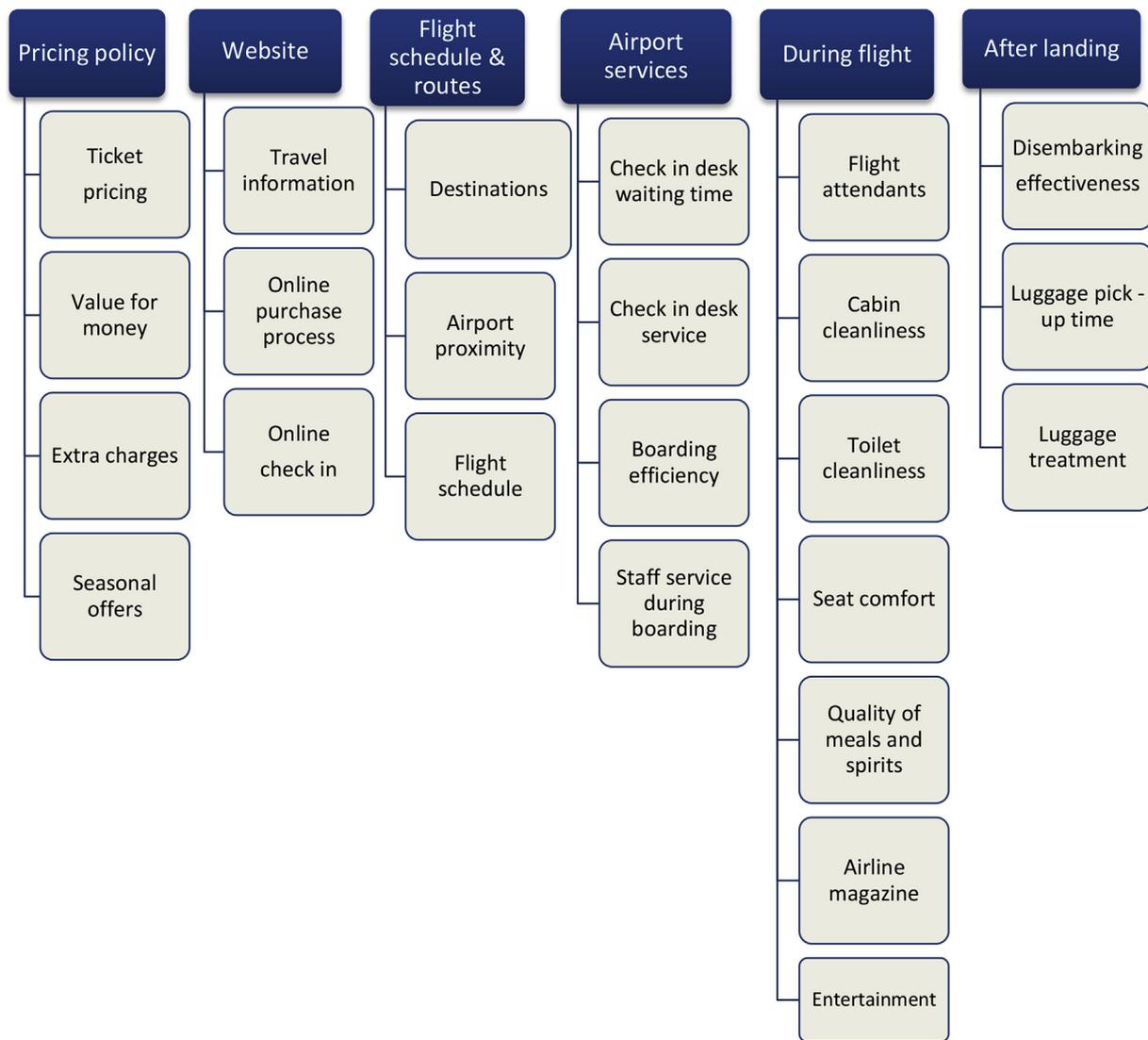


Fig. 6. Hierarchical structure of customers' satisfaction dimensions.

- Pricing policy: This criterion examines the satisfaction level of customers regarding the price of the ticket, value for money, extra charges and seasonal offers.
- Website: Characteristics concerning the IT processes are analyzed, such as the website travel information section, the online purchase process of the ticket and the online check-in process.
- Flight schedule and routes: This criterion includes characteristics with regard to the flight schedule and destinations, as well as the airports chosen, and their proximity to the city center.
- Airport services: All airport handling related issues are examined, such as check-in desk service and waiting time, boarding efficiency and staff service during boarding.
- Flight: This criterion examines all satisfaction factors concerning the flight experience: flight attendants, cleanliness of the cabin and toilet, seat comfort, meals and spirits, flight entertainment magazine.
- After landing: All the characteristics that occur after landing of the aircraft are included in this criterion, such as effectiveness of disembarking, luggage waiting time and luggage treatment.

The survey was conducted through the use of questionnaires (for a detailed questionnaire see [appendix](#)). The questionnaires were filled by customers in short scale interviews that took place in the departures main haul of the Athens International Airport “Eleftherios Venizelos”, within the period of March and April of 2016. Passengers were asked to evaluate a total trip experience from the near past, answering on an ordinal qualitative scale with five satisfaction levels for each criterion and subcriterion. Figs. 7–10 present the general profile of the sample. Since the survey included  $n = 6$  criteria with  $a_i = a = 5$  satisfaction levels the required sample size was at least  $(a_i - 1)n + a - 1 = 28$  respondents. A total of 241 passengers were interviewed, the majority of which were Greek. 128 respondents were men, and 113 were women, 93 of them were private employees, 56 were freelancers, 38 were students and 54 were state employees. 49 passengers were under 24 years old, 75 were 25–34 years old, 54 were 35–44 years old, and 63 passengers were 45 years old or older. Regarding the boarding method, 141 were transferred to the aircraft through bus and 100 embarked the aircraft through a jet bridge.

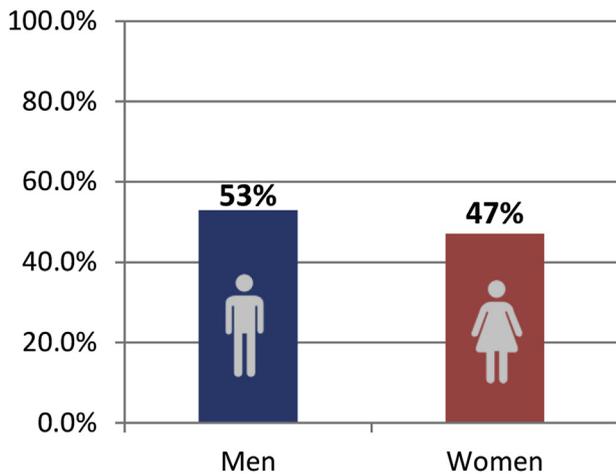


Fig. 7. Distribution of gender in our sample.

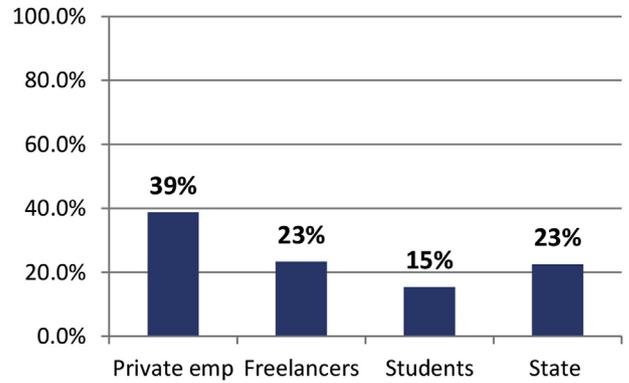


Fig. 8. Profession of passengers' sample.

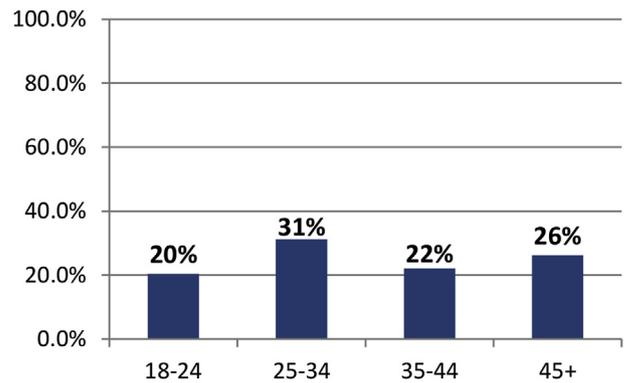


Fig. 9. Age range of passengers' sample.

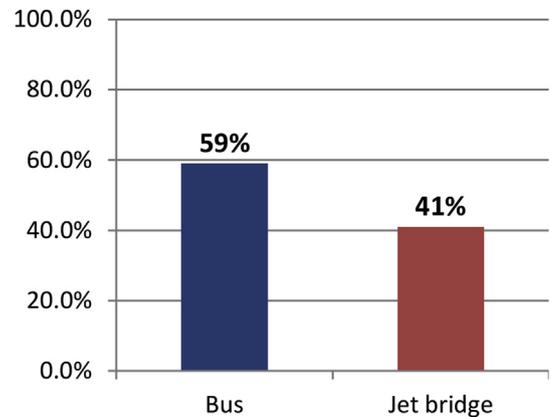


Fig. 10. Customer sample per boarding method.

### 6.1. MUSA results

Taking into consideration the global satisfaction index and curve (Fig. 11), it is obvious that passengers are very satisfied from the overall provided service, given that the average global satisfaction index is 89%.

The added value curve for the entire set of customers, presented in the same figure, indicates non demanding passengers, since the curve has a concave shape. Criteria satisfaction analysis (Fig. 12)

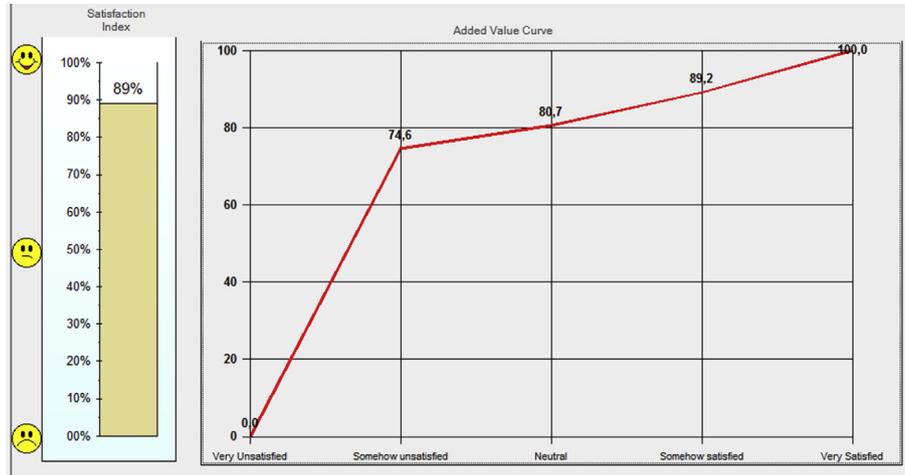


Fig. 11. Global satisfaction index and added value curve.

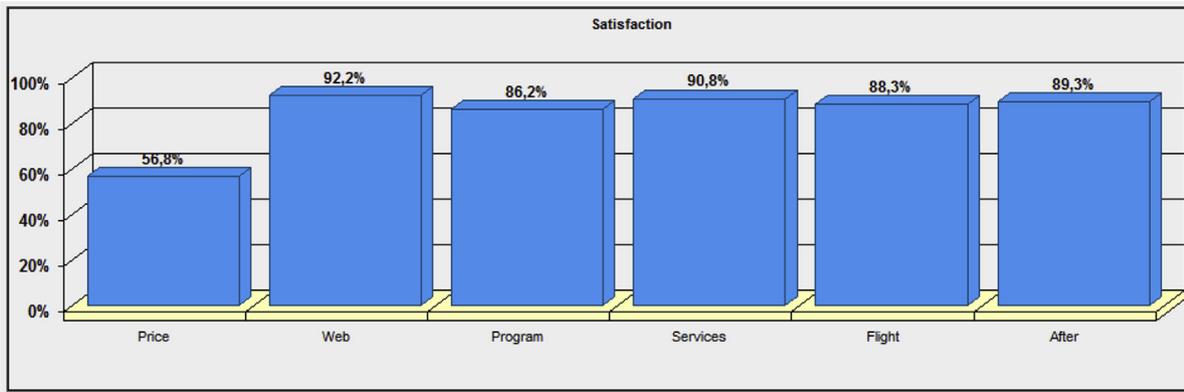


Fig. 12. Satisfaction levels for each criterion.

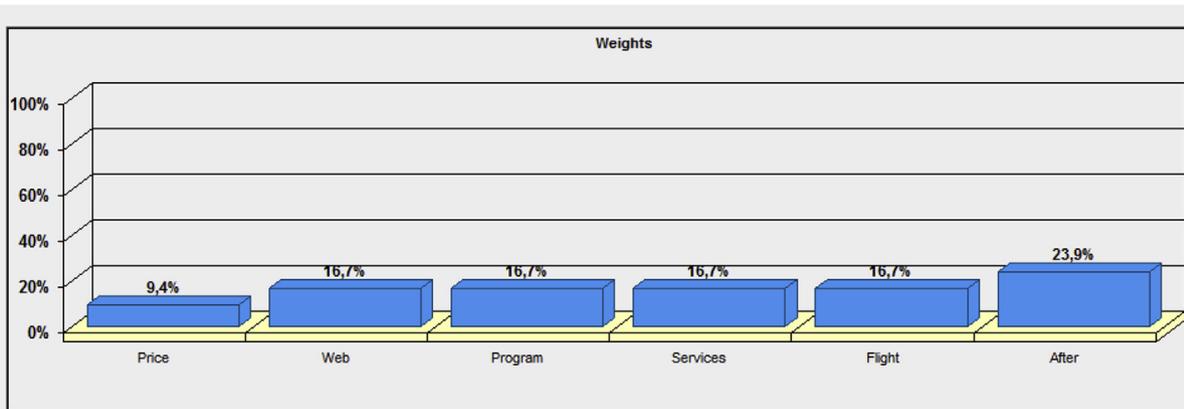


Fig. 13. Importance level for each criterion (weights).

shows that customers are very satisfied with all criteria except Pricing Policy, as Aegean is a full service airline that charges higher than its low cost competitors. The criterion that passengers are

satisfied the most is Website services, justifying the fact that the company has invested a lot of resources to this. Regarding criteria weights (Fig. 13), the most important criterion for passengers

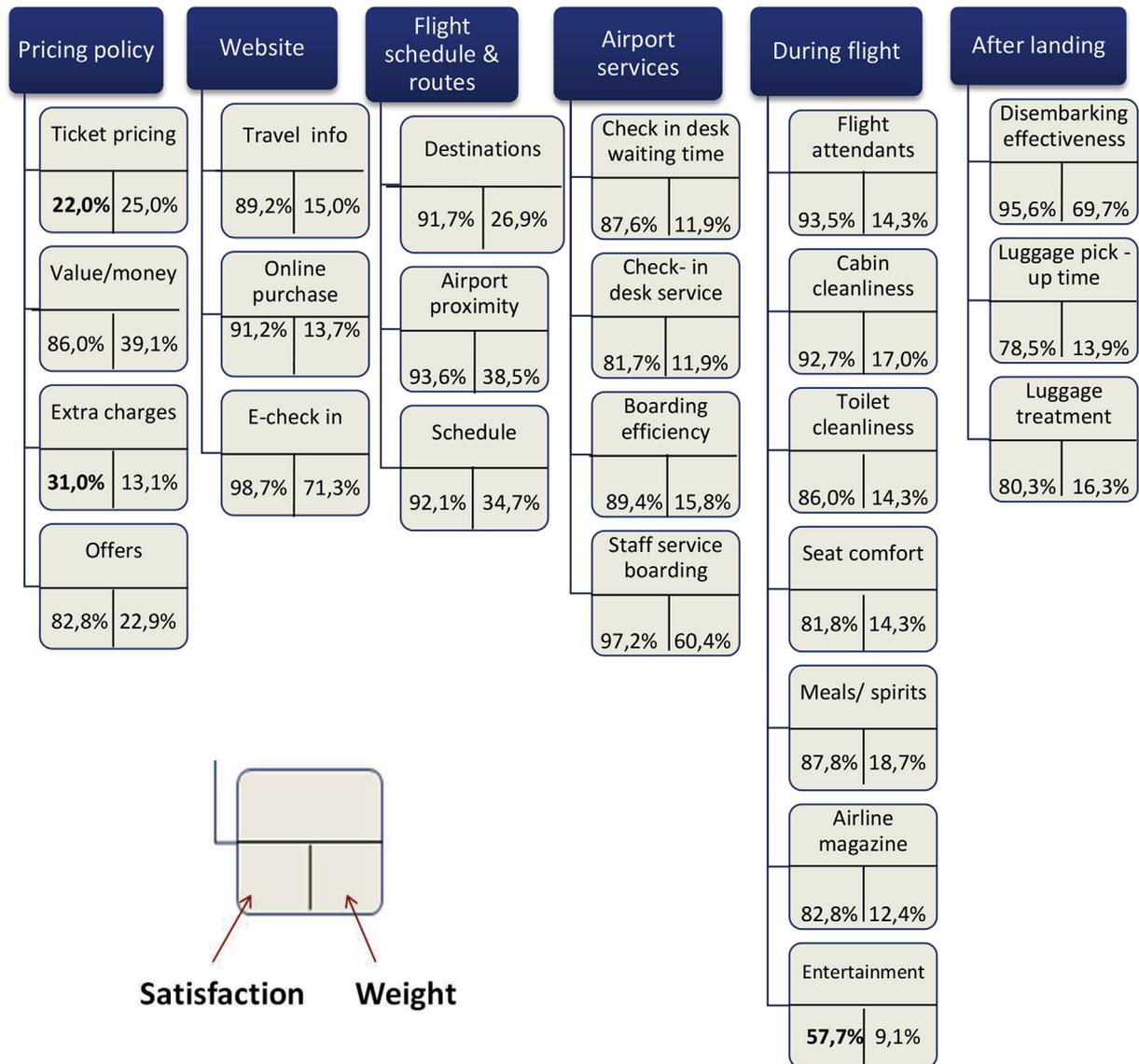


Fig. 14. Analytical results for the global set of customers.

seems to be After landing services, which shows that passengers want to disembark and receive their luggage on time, in order to leave the airport as soon as possible. The rest criteria have equal weights, except for Pricing policy that is considered as an unimportant criterion, although passengers are less satisfied from it. Obviously, the ones that consider Price as important prefer to travel with a low cost airline.

6.2. Partial satisfaction analysis

Fig. 14 presents the analytical results for the entire set of sub-criteria. The following conclusions are drawn:

- Pricing policy: Passengers are dissatisfied with the price of the tickets and additional service charges, but the weight appears to be in low levels because they have evaluated higher the value/money sub-criterion. In addition, their expectations are low

about the prices sub-criterion, knowing that the airline is a full service one, with normal charges, in contrast to its low cost competitors. However, value/money is evaluated high and passengers seem to seek quality in Aegean airlines flights.

- Website: Passengers evaluate highly the sub-criteria of website services. Aegean has invested a lot of resources in making a user friendly website, containing all the necessary information, a simplified online purchasing process, and a convenient application for making online check-in. The online check-in sub-criterion receives the highest importance as it constitutes a crucial process.
- Flight schedule & routes: Airport proximity receives the highest satisfaction level due to strategic choice of the airline to use main airports that are located near city centers. Destinations are also evaluated noticeably high because the company recently has expanded its destinations list, offering flights to 145 cities (2016 data).

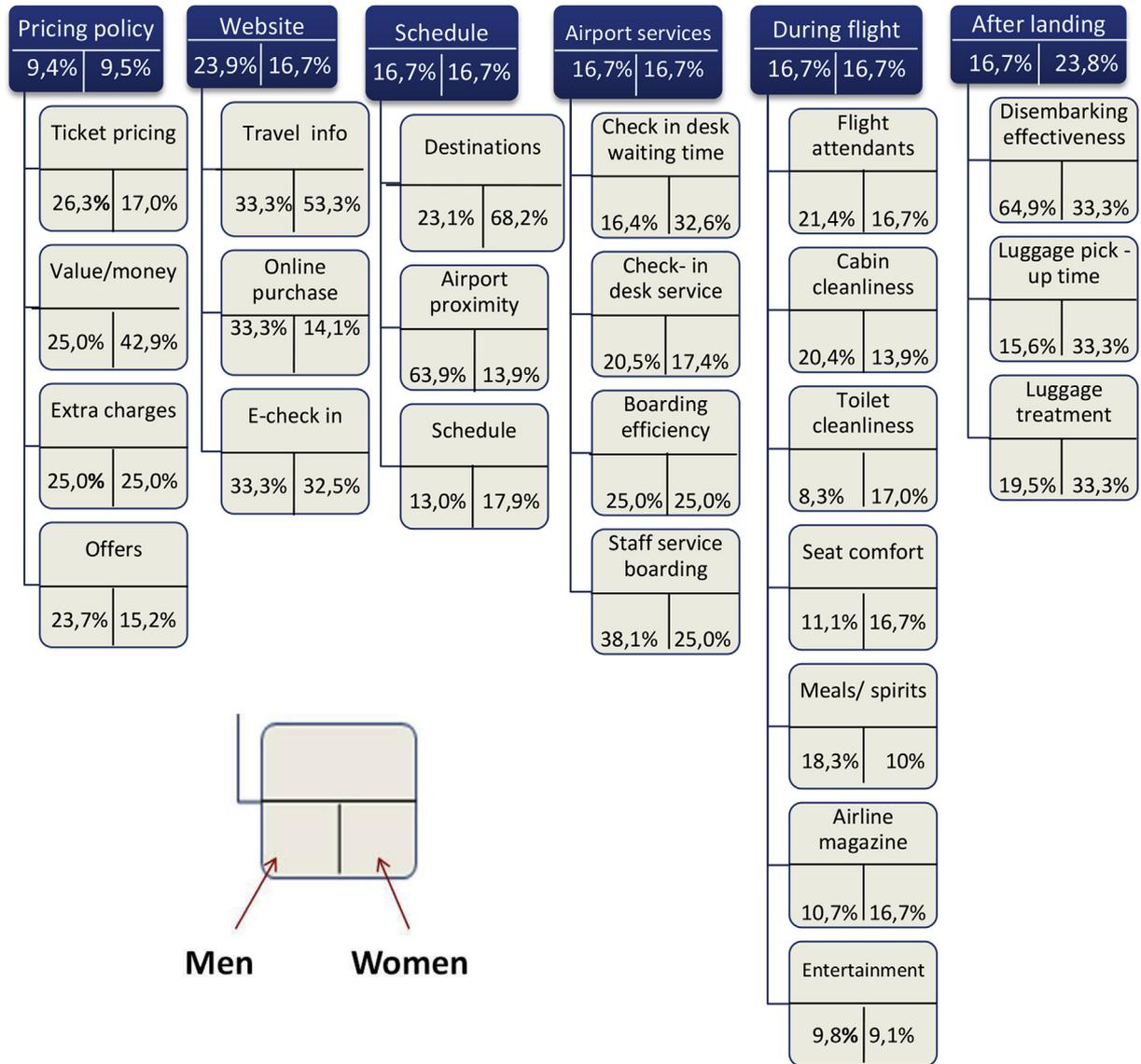


Fig. 15. Analytical results for the global set of customers: Weights of genders.

- During flight: Food and catering services is the most important subcriterion for Aegean passengers, and also has a high satisfaction level due to the fact that the airline has an award winning menu of meals, wine and spirits. On the other hand, entertainment has a low performance, since the only mean of entertainment is video projection in airplane screens (available in few flights).
- After landing: Disembarking effectiveness has the highest importance as well as the highest satisfaction level.

6.3. Segmentation satisfaction analysis

The main objective of segmentation analysis is to identify homogeneous groups of passengers with regard to demographics, usage, preferences etc. This type of analysis is considered necessary, given that the implemented preference disaggregation

methodology is based on a collective model. The segmentation variables that have been used for the formation of passenger groups are: Gender, Profession, Age, and Boarding method. The rest of the variables included in the study did not show significant variation, and thus were excluded from the analysis. Regarding Gender, only criteria weights have been utilized, in order to focus on how the two genders distribute their importance level. In boarding categorization there has been a special analysis, presenting satisfaction levels connected only with embarking the aircraft.

Fig. 15 presents the criteria weights for each gender.

- Pricing policy: Women give more importance to the quality that they obtain, related with a certain price, whereas men are more focused on good prices of tickets. Generally, women seek satisfaction from overall factors combined with a ticket

purchase, while men are more to the point, and they aim to a lower price.

- Website: Online purchase process has a higher weight for men, as women mostly focus on the travel information contained in the websites' special section. Women aim to obtain more information about their trip and traveling processes, such as boarding, special conditions, luggage.
- Schedule and routes: Men give a higher weight to the distance of the airport to the city center, while women give importance to airline's destinations. The majority of men use Aegean airlines for business trips, and they seek convenient and quick transfer to the city. Women seek for better connectivity of cities, probably because they want less transfer flights.
- During flight: Men give more value to satisfaction from flight attendants and meals/drinks whereas women give higher importance to cleanliness of the airplane and in-flight magazine.

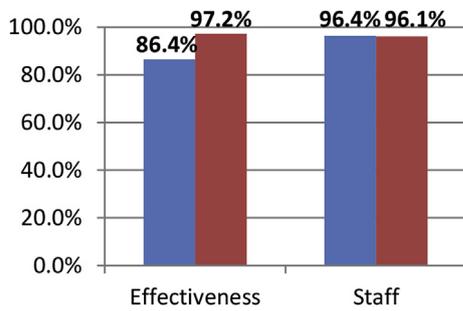


Fig. 16. Satisfaction level for subcriteria Boarding effectiveness and Embarkation personnel.

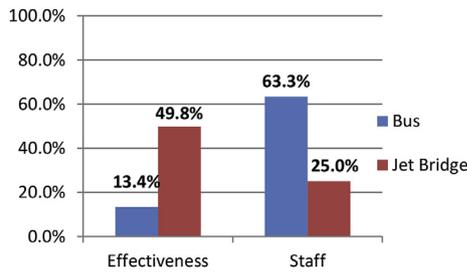


Fig. 17. Weights for subcriteria Boarding effectiveness and Embarkation personnel.

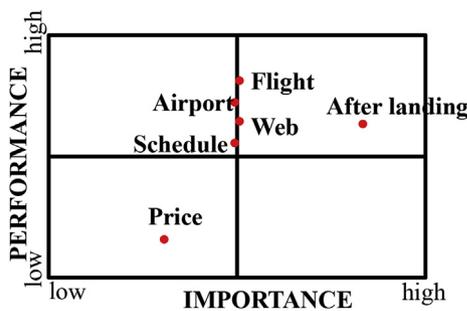


Fig. 18. Performance/Importance diagram on global set of criteria.

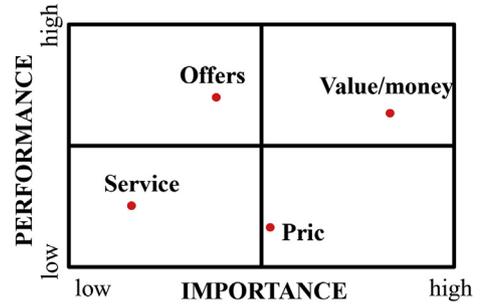


Fig. 19. Performance/Importance diagram for Pricing policy criterion.

- After landing: Considering the fact that men want to quickly transit to the city for business purposes, they desire fast and effective disembarkation process, while women give more importance to receive their luggage in a good shape, as it contains their clothes, jeweler and their cosmetics.

Figs. 16 and 17 present satisfaction and weight levels for the criterion of embarkation using bus or Jet Bridge, aiming to assess passengers' satisfaction from the boarding method. It derives that passengers consider Jet Bridge as a more effective boarding method, as it is more convenient and fast. Generally, boarding the aircraft with bus requires two additional queues, the one for entering the bus and the one for entering the aircraft, and it also takes time for the bus to transfer passengers from the gate till the parking lot of the airplanes. In a matter of fact, people that used bus to board the aircraft gave higher importance to the embarkation personnel. On the contrary, passengers that used the Jet Bridge gave higher importance to the effectiveness of embarkation.

6.4. Performance/importance diagrams

Performance/Importance diagrams indicate current and potentially critical satisfaction dimensions. Here, selected graphs are presented, based on the relevance with the previous data and notable results that need to be further analyzed. Concerning the global set of criteria, passengers are not satisfied from the Pricing policy of the company, although this criterion is not so important to them (Fig. 18).

Pricing policy could be a potential critical factor in the future, given the increasing competition from low cost carriers. After landing is in the leverage opportunity quadrant constituting the company's competitive advantage, as passengers consider it as very

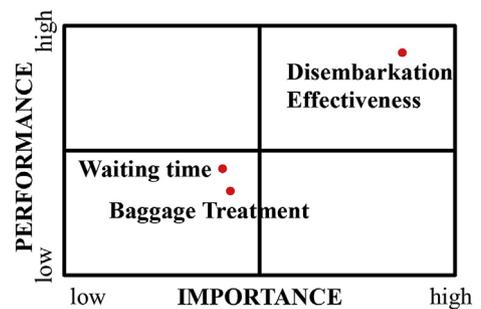


Fig. 20. Performance/Importance diagram for After landing criterion.

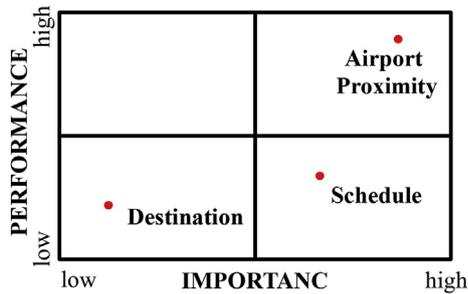


Fig. 21. Performance/Importance diagram for Flight schedule and routes criterion.

important, and at the same time they are satisfied with it.

Focusing on the Pricing policy criterion to investigate what is the source of the dissatisfaction, the Performance/Importance diagram of subcriteria shows that the nominal *Price of the ticket* in the low performance/high importance quadrant (Fig. 19).

However, *value for money* is balancing the issue, located in the leverage opportunity quadrant, as Aegean is giving great importance in providing quality services. This large variance in the satisfaction from the Nominal Ticket Price and Value for Money shows that passengers understood the difference and were able to discriminate between the two subcriteria. With the Nominal Ticket Price passengers evaluate the actual amount paid for the ticket, having in mind the prices of competitive airlines operating in the same routes. With Value for Money passengers evaluate the cost of the trip in relation to the entire offering of the airline. For example, Aegean offers free drinks and snacks as well as a free magazine during the flight (hence passengers consider them as included in the ticket price), whereas Ryanair charges for any drinks or food during the flight.

Focusing on the After landing criterion, we see that *Effectiveness of disembarkation* is in the leverage opportunity quadrant (Fig. 20). This subcriterion has high performance because Aegean is usually disembarking the passengers through Jet bridges, and the parking lot of the airline is near to the exit gates.

Performance/Importance diagram of *Schedule and routes* criterion is presented in Fig. 21. The *Airports* subcriterion is in the leverage opportunity quadrant, and *flight schedule* is in the action opportunity quadrant, meaning that the company needs to do certain moves in order to improve it. This positioning can be explained from the fact that during summer (which is the busiest season of the year) schedule of some certain routes might not be that convenient.

## 7. Concluding remarks and suggestions

We have shown how MUSA can be applied to measure passenger satisfaction and indicate the critical service dimensions that need to be improved. The implementation of the method in airline passenger satisfaction surveys is able to evaluate global and partial satisfaction levels and to determine the strong and the weak points of the particular airline. The provided results are focused not only on the descriptive analysis of customer satisfaction data but they are also able to assess an integrated benchmarking system. This way they offer a complete information set including value functions, criteria weights, average satisfaction, demanding, and improvement indices, as well as action diagrams.

The application of MUSA to the Greek flag carrier Aegean

airlines reveals several insights. Customers seem dissatisfied from the Nominal Ticket Price, as well as from the Extra Charges, but these two subcriteria have relatively low importance in the Pricing policy criterion. On the other hand, they are very satisfied from Value for money, which constitutes the most important subcriterion in Pricing policy. This contradiction may be explained by the fact that the main competitor of Aegean is Ryanair, thus passengers probably compare the nominal ticket price of Aegean with that of Ryanair, which is usually lower as it is a low cost airline. However, regarding Value for money Aegean is highly evaluated when passengers consider Ryanair as the main alternative. Satisfaction from Pricing policy can be raised by expanding offers through the Low fare calendar program, and by promoting cheap tickets through Social Media networks in order to attract largest market share in younger ages. Also, the airline could offer tickets at a fixed price to students that live or study in islands far from capital, negotiate with airports that have high handling fees and taxes for their reduction, and provide tickets at a fixed price for island residents who travel for an emergency situation. Concerning Flight schedule and routes, fleet expansion is proposed in order to have more convenient and frequent schedule of flights, leasing of aircraft from other airlines during summer months where demand raises significantly due to the tourists that visit Greece, and introduction of “Red eye flights”, flights operated during night hours, in order to expand the flight schedule and operational time of the aircraft. These actions of course are always subject to company’s network optimization targets and the related constraints.

Regarding the Airport services criterion, satisfaction from embarkation can be further improved, through the usage of the satellite terminal in Athens International Airport, which also charges lower fees. Furthermore, negotiations can be conducted with the Hellenic Civil Aviation Authority and Greek airports to create, where feasible, a pedestrian boarding walkway with the appropriate marking areas and security personnel. Satisfaction from the Flight criterion can be improved through the enrichment of the entertainment program “enterGreece” and the addition of series/films with subtitles and free Wi-Fi access to all flights of Aegean, in order to provide passengers with the ability to better entertain themselves, or exploit flight time for working.

It should also be noted that customer satisfaction is a dynamic parameter of the business organization. Future changes in the airline market, (e.g. due to socioeconomic reasons) can affect passengers’ preferences and expectations. For example, some satisfaction dimensions may become critical in the near future if passengers give more importance to them. Therefore, implementation of a permanent customer satisfaction system is considered necessary, given that this particular application was basically a pilot survey. This system can be related with an online survey sent to passengers’ email after flight, or satisfaction boxes with buttons, where passengers can express their opinion for certain parts of the flight experience. In this way the airline will be able to analyze behavioral trends for different groups of passengers and adjust accordingly the related services.

Future research may concern the conduction of a comparative passenger satisfaction survey that will include different airlines (especially low cost carriers such as Ryanair which operates in Greece), which will ultimately lead to a passenger satisfaction benchmarking system. Also, some recent extensions of MUSA can be tested, such as MUSA-INT (Angilella et al., 2014), which detects possible correlations among satisfaction criteria.

**Appendix. Survey questionnaire**

**Personal data**

**Age:** below 24  25-35  35-45  45-55  55-65  65 or older

**Gender:** Male  Female

**Purpose of trip:** Business  Visiting family or friends   
 Personal  Leisure  Other

**Profession:** Government employee  Private sector employee  Freelancer  Pensioner   
 Military officer  Student  Executive  Businessman  Unemployed  Other

**How often do you travel by airplane? :** Every week  Twice a month  Once a month   
 Every two months  Every six months  More rarely

**Satisfaction**

**Pricing Policy**

<b>How satisfied are you from:</b>	Very Unsatisfied	Somehow unsatisfied	Neutral	Somehow satisfied	Very satisfied
The price of the ticket					
The value for money					
The level of the extra charges (e.g. luggage)					
The seasonal offers of the airline					
<i>Overall, how satisfied are you from the company's <u>Pricing policy</u>?</i>					

**Website**

<b>How satisfied are you from:</b>	Very Unsatisfied	Somehow unsatisfied	Neutral	Somehow satisfied	Very satisfied
The travel information given in the website of the airline					
The online purchasing process					
The online check in process					
<i>Overall, how satisfied are you from the company's Website?</i>					

**Flight schedule and routes**

<b>How satisfied are you from:</b>	Very Unsatisfied	Somehow unsatisfied	Neutral	Somehow satisfied	Very satisfied
The destinations that the airline is flying to					
The proximity from the city					

of the airports that the airline operates					
The flight schedule of the airline					
Overall, how satisfied are you from the company's Flight & Routes?					

**Airport services**

How satisfied are you from:	Very Unsatisfied	Somehow unsatisfied	Neutral	Somehow satisfied	Very satisfied
The check in desk waiting time					
The service in the check in desks of the airline					
The staff service during boarding process					
The efficiency of boarding to the aircraft					
Overall, how satisfied are you from the Airport services?					

**The embarkation process took place through:** Shuttle bus      Air gate

**During flight**

How satisfied are you from:	Very Unsatisfied	Somehow unsatisfied	Neutral	Somehow satisfied	Very satisfied
The flight attendants					
The cabin cleanliness					
The cleanliness of the toilet					
How comfortable was your seat					
The quality of meals and spirits served on board					
The airline magazine					
The In-Flight entertainment					
Overall, how satisfied are you from the "During flight" Criterion?					

**After landing**

How satisfied are you from:	Very Unsatisfied	Somehow unsatisfied	Neutral	Somehow satisfied	Very satisfied
The effectiveness of the disembarkation process					
The luggage pick-up time					
The treatment of your luggage					
Overall, how satisfied are you from the After landing services?					

Overall how satisfied are you from the airline company?	Very Unsatisfied	Somehow unsatisfied	Neutral	Somehow satisfied	Very satisfied

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