UNIVERSITÀ DELLA CALABRIA

Dipartimento di Ingegneria Civile

Dottorato di Ricerca in Ingegneria Civile e Industriale

CICLO
XXXIII

THE QUALITY OF AIR TRANSPORT SERVICES
Evaluation techniques and models

Settore Scientifico Disciplinare

ICAR/05 – Trasporti

Coordinatore:
Ch.mo ~~Prof.~~ Enrico CONTE

Firma Firma oscurata in base alle linee guida del Garante della privacy

Supervisore:
Prof.ssa Laura EBOLI

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A nonna Maria

Declaration

I hereby declare that, except where specific reference is made to the work of others, the contents of this dissertation are original and have not been submitted in whole or in part for consideration for any other degree or qualification in this, or any other university. This dissertation is my own work and does not compromise in any way the rights of third parties, including those relating to the security of personal data.

Friday, 26 March 2021

Maria Grazia BELLIZZI

Acknowledgements

Quando ho iniziato questo percorso immaginavo la sua fine lontana, invece è arrivata più in fretta del previsto. Si dice che il tempo scorra più velocemente quando si sta bene, e ora posso davvero confermarlo. Sì, in questi anni sono stata bene, e non posso non ringraziare tutti coloro che mi hanno accompagnata e sostenuta.

Ringrazio la prof.ssa Laura Eboli per avermi seguita come supervisore della mia tesi di dottorato. La ringrazio per aver svolto il suo ruolo con dedizione senza mai sovrastarmi, ma lasciandomi lavorare al suo fianco. In questi anni da lei ho imparato tanto, e non solo dal punto di vista professionale. La ringrazio perché ha riposto in me tanta fiducia dal primo momento, e questo mi ha aiutata a credere di più in me stessa.

Ringrazio sinceramente la prof.ssa Rocio de Oña e la prof.ssa Maria Attard, le quali hanno pazientemente revisionato questo lavoro di tesi dispensandomi utili suggerimenti per migliorarlo.

Ringrazio la prof.ssa Gabriella Mazzulla, che ritengo punto di riferimento fondamentale e guida preziosa. La stima che nutro nei suoi confronti è frutto di tanti anni durante i quali ho ascoltato, ma soprattutto sono stata ascoltata. La ringrazio per avermi aiutata a scoprire i miei punti di forza e per avermi sempre incoraggiata a fare meglio.

Grazie di cuore a Carmen perché con lei anche il lavoro più difficile si è rivelato piacevole. La ringrazio per il suo aiuto incondizionato e per avermi insegnato ad essere un po' più paziente. Custodirò gelosamente il ricordo di ogni singolo momento trascorso insieme, le nostre risate rumorose e le nostre avventure dentro e fuori il dipartimento.

Ringrazio il prof. Demetrio Festa e l'ing. Antonino Marasco, entrambi fonti di saggezza. I loro suggerimenti e le loro riflessioni sono state fondamentali per accrescere la mia esperienza di vita e di studio all'interno del dipartimento.

Ringrazio il prof. Luigi dell'Olio per avermi accolta nel suo gruppo di ricerca dell'Università della Cantabria. Lo ringrazio per l'esperienza proficua e stimolante, e per il rapporto di stima reciproca che ancora oggi ci lega.

Grazie ad Jaime, che ho avuto il piacere di conoscere all'inizio del mio percorso di dottorato. Grazie perché, nonostante i tantissimi chilometri che ci separano, abbiamo continuato a collaborare senza sentirci mai distanti.

Ringrazio sinceramente Gianfranco Salfi per il prezioso aiuto che mi ha dato in una fase delicata della mia ricerca e per la sua pazienza. Grazie all'ing. Angelo Cardamone, all'ing. Alessandro Vitale e al sig. Franco Di Mauro. Sapendo di poter incontrare loro tra i corridoi del dipartimento, ho sempre avuto la certezza di poter ricevere e donare un sorriso.

Un ringraziamento sincero va all'Università della Calabria, ed in particolare al Dipartimento di Ingegneria Civile che per tanti anni è stato la mia seconda casa. È qui che ho incontrato tante persone speciali che sento di poter considerare ormai compagni di vita. In particolare, grazie a Sara e a Nicole. Grazie perché ci siamo sempre tenute per mano in questi anni, senza mai lasciarci, anche quando la nuova normalità ci ha imposto limiti e distanze. Ringrazio Francesco per esserci sempre e, soprattutto, per insegnarci ad essere più ottimiste. Ringrazio Lucia per l'affetto e la stima che ci unisce ormai da tanti anni, ringrazio Giusi per le risate che solo lei riesce a regalarci, e ringrazio Giuseppe per averci sempre preferite come compagne di mensa. Un grazie di cuore anche a tutti i colleghi del dottorato che hanno incrociato il mio cammino.

Grazie alla mia amica Giusi per aver condiviso tanta vita insieme a me. Grazie perché, qualsiasi cosa facciamo e ovunque ci troviamo, sappiamo di esserci l'una per l'altra.

Ringrazio tutta la mia famiglia per l'amore immenso che non mi ha mai fatto mancare. Grazie a mio padre e a mia madre per rendermi orgogliosa di avere due genitori come loro. Grazie a mia sorella, così tanto lontana ma così tanto presente. Grazie a mio fratello per credere in me più di chiunque altro.

Ringrazio Saverio per quello che siamo. Grazie per insegnarmi giorno dopo giorno a superare gli ostacoli con più pazienza e serenità. Grazie perché insieme a te tutto mi sembra più semplice da affrontare.

Abstract

The socioeconomic development of a country necessarily relies on the improvement of all transport services. With the introduction of new technologies, transport industry has developed considerably in recent years, and as a consequence people habits and travel choices changed as well. In this context, air transport has a significant role, and it could be considered one of the most significant contributors to the advancement of modern society.

Evaluating air transport service quality is important as it is for the other public transport systems. Airport facilities and services are the first experiences that a passenger receives upon arrival. For this reason, providing airport services characterized by high levels of quality is very important to make the travel more pleasant for the passengers, with the final objective to attract more users. Therefore, measuring the levels of airport services by evaluating passengers' satisfaction with them is essential to understand the needs of customers. In the same way, with the airlines' deregulation the number of airlines entered into the air transport industry significantly increased, causing a stronger competition. In this context, it is evident that provided service quality, as well as passengers' satisfaction, play an important role also in the airlines marketing strategies.

While literature regarding the evaluation of road and rail public transport service quality is well established from many years, literature concerning air transport service quality is relatively recent. A first substantial issue that emerges from the air transport related literature concerns the complexity of the various characteristics of the services, which can relate to the airport managing companies and to the airlines. For this reason, the major part of the studies treats separately these two groups of service. Specifically, the researchers analysed air transport services by distinguishing the factors

concerning the services offered in the airports from the ones provided by the airlines.

The aim of this thesis work is to give a contribution to the existing literature, by applying various techniques and models for analysing both airport and airlines' service quality. As suggested by the literature, also in this work the airport services have been treated separately by the airlines' services. In fact, two different data samples were analysed. Specifically, the International airport of Lamezia Terme (Italy) has been considered as case study for the airport services. Otherwise, data collected by an online survey conducted at the University of Calabria (Italy) became object of study for the airlines' services analyses. Several tools have been tested and proposed. The obtained results could be considered not only as a research contribution, but also as starting point to help air transport managers and providers in choosing the effective strategy for providing services characterized by adequate levels of quality.

Sommario

Lo sviluppo socioeconomico di un paese dipende necessariamente dal miglioramento di tutti i servizi di trasporto. Con l'introduzione delle nuove tecnologie, l'industria dei trasporti si è sviluppata notevolmente negli ultimi anni e, conseguentemente, sono cambiate anche le abitudini delle persone e le loro scelte di viaggio. In questo contesto, il trasporto aereo gioca un ruolo importante e può considerarsi uno dei contributori più significativi al progresso della società moderna.

La valutazione della qualità servizio per il trasporto aereo è importante come lo è per gli altri sistemi di trasporto pubblico. Le strutture aeroportuali e i relativi servizi offerti caratterizzano la prima fase del viaggio per un passeggero. Per questo motivo, fornire servizi aeroportuali di buona qualità è molto importante per far sì che l'intero viaggio risulti più piacevole per i passeggeri, e far in modo che si possa attrarre sempre più utenza. Pertanto, misurare i livelli dei servizi aeroportuali anche sulla base della soddisfazione dei passeggeri è essenziale per comprendere le esigenze dei clienti. Un discorso analogo può essere fatto per le compagnie aeree, le quali in seguito alla deregolamentazione hanno dovuto fronteggiare una crescente competizione dovuta al numero sempre più alto di compagnie entrate nel mercato. In questo contesto, è evidente che la qualità del servizio fornito, così come la soddisfazione dei passeggeri, giocano un ruolo importante anche nelle strategie di marketing delle compagnie aeree.

Mentre la letteratura sulla valutazione della qualità del servizio di trasporto pubblico stradale e ferroviario è ben consolidata da molti anni, la letteratura sulla qualità del servizio di trasporto aereo è relativamente recente. Una prima questione sostanziale che emerge dalla letteratura relativa al trasporto aereo riguarda la complessità delle diverse caratteristiche dei servizi, i quali possono riguardare o le società di gestione aeroportuale o le compagnie aeree. Per questo motivo, la maggior parte degli studi tratta

separatamente questi due gruppi di servizi. Nello specifico, i ricercatori hanno analizzato i servizi di trasporto aereo distinguendo i fattori riguardanti i servizi offerti negli aeroporti da quelli forniti dalle compagnie aeree.

Lo scopo di questo lavoro di tesi è quello di dare un contributo alla letteratura esistente, applicando varie tecniche e modelli per analizzare sia la qualità del servizio aeroportuale che delle compagnie aeree. Come suggerito dalla letteratura, anche in questo lavoro i servizi aeroportuali sono stati trattati separatamente dai servizi delle compagnie aeree. Sono stati infatti analizzati due diversi campioni di dati. In particolare, l'aeroporto internazionale di Lamezia Terme (Italia) è stato considerato come caso di studio per le analisi relative ai servizi aeroportuali. Invece, per le analisi dei servizi offerti dalle compagnie aeree, sono stati utilizzati dati raccolti da un sondaggio online condotto presso l'Università della Calabria (Italia). Diversi strumenti sono stati testati e proposti. I risultati ottenuti, oltre ad apportare un contributo alla ricerca, possono considerarsi utili per aiutare i gestori e fornitori dei servizi di trasporto aereo nella scelta di strategie efficaci volte ad offrire servizi caratterizzati da adeguati livelli di qualità.

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List of acronyms

ACI: Airport Council International
AGFI: Adjusted Goodness-of-Fit Index
ASQ: Airport Service Quality
CART: Classification and Regression Tree
CFA: Confirmatory Factor Analysis
CFI: Comparative Fit Index
CMIN: Chi-square Minimum
CSS: Customer Satisfaction Survey
DF: Degrees of Freedom
EFA: Exploratory Factor Analysis
ENAC: *Ente Nazionale per l'Aviazione Civile* (Italian Civil Aviation Authority)
GFI: Goodness-of-Fit Index
IATA: International Air Transport Association
IPA: Importance Performance Analysis
LC: Latent Class
MCDM: Multiple Criteria Decisions Making
ML: Mixed Logit
MNL: MultiNomial Logit
OL: Ordered Logit
OP: Ordinal Probit
P: Probability level
PCA: Principal Component Analysis
PS: Pilot Survey
RMSEA: Root Mean Square Error of Approximation
RP: Revealed Preferences
RPML: Random Parameters Mixed Logit
RW: Regression Weights

S.A.CAL.: *Società Aeroportuale Calabrese* (Calabrian Airport Company)
SE: Standard Error
SEM: Structural Equation Modelling
SEM-MIMIC: Multiple cause – Multiple indicator SEM
SP: Stated Preferences
SRMR: Standardized Root Mean Square Residual
st.RW: standardized Regression Weights
TLI: Tucker-Lewis Index
WRMR: Weighted Root Mean Square Residual

Introduction

Nowadays, air transport is fundamental not only because it facilitates and speeds up the movement of people, but also for the important role it plays in the countries' economy (Wu and Cheng, 2013). Just think, for example, to insular territories that live from tourism, the lack of adequate transport systems could reduce the opportunities of development of these regions (Espino et al., 2008). However, it is not uncommon that when people make use of the air transport system they discover some elements of discontent and inefficiency. People complain, for example, about delays, uncomfortable seats in the cabin, toxic air in the cabin, environmental pollution, long travelling times and costly ticket (Schmitt and Gollnick, 2016). For this reason, over the years, both the researchers and air transport providers have increasingly worked to analyse the problem and find tools for improving the service quality. The assessment of service quality plays an important role in all public transport systems because having high quality levels has been shown to have a positive effect on the demand for transport services (de Oña et al., 2016; Echaniz et al., 2018). In this perspective, knowing the users point-of-view is essential. The concept of users' satisfaction has been well-established in the literature and frequently discussed over time (van Lierop et al., 2018). In the field of road and rail public transport, many studies dealt with the assessment of service quality based on users' perceptions (see, for example, Allen et al., 2020; de Oña et al., 2013; de Oña and de Oña, 2015; Eboli et al., 2018; Echaniz et al., 2019a)

People choosing to travel by public transport modes make use of services provided during the time spent on board but also services offered at the public transport stops or stations where they take the transport mean. Air transport can be considered as quite different from public transport systems. People travelling by air are constrained to arrive at the airport at least 40 minutes before the flight for a series of reasons. In fact, within the terminal

area, services such as check-in, passport and security controls, baggage drop, customs and baggage claim are provided to departing and arriving travellers (Ashford et al., 1997). Therefore, an airport has a prominent role in the complete travel experience as compared to a railway station or a bus stop, which are places where people stay for a relatively short time. For this reason, providing airport services characterized by high levels of quality is very important to make the travel more pleasant for the passengers, with the final objective to attract more users. Only in recent years, this topic has become of interest also in the field of air transport, due also to the exponential increase in the number of passengers travelling by air (IATA, 2018)

Air transport industry consists of a wide variety of services, that can be differentiated into airport services and airlines' services. In the literature there is a relevant number of studies analysing the services provided in the airport, and as many studies analysing the services provided by the airlines. Because of the complexity and the numerousness of the service aspects that interest the users travelling by air, the major part of the studies analyses only one of this two categories of services. The aim of almost all the studies is to investigate on the various service attributes and to determine which are those mostly influencing the quality of the overall service. There is a large variety of methodologies proposed and/or adopted for analysing the services. The differences among the studies emerged also in terms of design and collection of the experimental data used for applying the various methods.

The aim of the present work of thesis is to give a contribution in terms of investigation on air transport service quality. More specifically, on the basis of studies already present in the literature, this work aims to test well-known techniques and models to specific case studies for identifying the service attributes that passengers consider as the most important, and propose practical implications of the obtained results as well.

By following the existing literature, this thesis treats separately the analyses conducted for the airport services and those conducted for the airlines' services. For the sake of clarity, the thesis has been organised in parts including the various chapters.

The first part "State of the art" includes two chapters. The first one provides a literature review related to the airport service quality by focusing on the several service attributes, the data collection, and the data techniques and models. The second chapter, following the same scheme of the first one, deals with the study of the literature concerning the airlines' service quality.

The second part, named "Analysis of airport services", also include two chapters. The first one provides a description of the airport services' study case: the international airport of Lamezia Terme. A detailed description of the airport has been provided, then the airport related data collection has been

described. The chapter ends with the preliminary statistics of the data, subject of the analysis of the next chapter. The second chapter of this part, in fact, reports all the results obtained by applying several techniques and models. Specifically, Ordered Logit (OL) models have been proposed for identifying the service attributes that passengers consider as the most important, and for identifying the differences in passengers' perceptions. A Latent Class (LC) modelling approach is performed in order to identify the latent classes representing air passengers' attitude towards the different provided service quality aspects, and detecting the sense of passengers well-being in the terminal. Then, the services provided by the airport became object of Structural Equation Modelling (SEM) and a Multiple cause – Multiple indicator SEM (SEM-MIMIC) approach for capturing the heterogeneity in perceptions of passengers and identify groups of passengers with similar assessments of the services. Finally, the Importance Performance Analysis (IPA) and the Gap-IPA are proposed as tools useful for airport managers.

The third part "Analysis of airlines' services" is organised by following the same criteria of the previous part. However, in this case the data object of analysis are those collected through an online survey conducted at the University of Calabria. Therefore, a first chapter describes the design of the survey in all its stages and ends with a brief preliminary analysis of the collected data. In the following chapter, the deeper data analysis is reported. Specifically, the CART (Classification and Regression Tree) approach is performed in order to analyse the data collected by the Revealed Preferences (RP) part of the survey. Otherwise, data related to the Stated Preferences (SP) part of the survey have been analysed by discrete choice models.

Finally, a concluding chapter provides final considerations and future developments of this thesis work.

Part 1 – State of the art

Chapter 1

The evaluation of airport service quality

1.1 Introduction

In the last two decades, there was a paradigm shift from seeing airports solely as huge public facilities towards the concept of multi-services business organizations. As a result, airport executives have become more concerned with their businesses performance, as well as understanding passenger experience at the airport, which has become crucial for airport management (Bezerra and Gomes, 2020). This issue together with the growth in air transport across the world has caused a considerable increase in studies on the service quality at airport terminals (Gitto and Mancuso, 2017; Rocha et al., 2016).

Assessing airport service quality is fundamental both for users and airport management companies. Specifically, a customer-driven service quality enhancements affect not only passengers' perceptions, but also the overall attractiveness of the airport relative to its competitors (Fodness and Murray, 2007). According to this, improving the level of quality of the provided service is essential because travellers would undoubtedly be delighted from a comfortable and well-functioning airport. In addition, airport service quality can have an indirect impact on tourism and related business activities, because travellers are more likely to use an airport again if they remain satisfied with its service quality and they are more likely to recommend the airport to other potential travellers (Park and Jung, 2011).

For these reasons, there is a growing competition among airports to attract business and get more airlines to choose them as their destination. The quality of customer service could be the determinant that attracts airlines to an airport (Arif et al., 2013). In fact, airports and airlines are of course closely

related, and passengers' loyalty to an airport may be influenced by their loyalty to the airlines serving this airport (Nesset and Helgesen, 2014).

In this chapter, a literature review about the evaluation of airport service quality is reported. Only studies published in the past 20 years (from 2000 to 2020) were analysed, this because it was observed that starting from 2000 there has been a growing interest in research on this topic. Only journals indexed on the best database, such as Scopus and Web of Science, were selected. Specific aspects of these studies were treated. As an example, one aspect selected for analysing literature review concerns the different service factors that an airport can provide; another aspect regards the ways adopted for collecting data. Concerning this last aspect, it was determined that many different methods for collecting data have been adopted in the literature: some researchers adopted the traditional face-to-face interviews, while others preferred or were forced to collect the data online. Many differences were registered also in the evaluation scales adopted for collecting passengers' opinions: Likert scale is one of the most used scale together with other verbal scales; someone used a numerical scale. Finally, there is a great variety also in terms of methodologies adopted for analysing the collected data. In the following, a focus on all these aspects is provided.

1.2 Airport services

When talking about evaluation of airport service quality, the choice of variables to be considered is a difficult task (Rocha et al., 2016). This is because the choice not only depends on the type of service analysed, but also because the variables have to reflect as best as possible the service environment being investigated. As it happens for all other transport environment, the variables are "context dependent" (Yeh and Kuo, 2003). The wide range of services and facilities provided at the airports makes them complicated systems (Liou et al., 2011b). In fact, in an airport there are many different activities dealing with several operations such as, for example, aviation, security controls, shopping, and so on.

Considering the wide range of terminal activities, it is not possible to find within the airport-related literature a single way to classify them. Generally, the passengers' air travel experience is composed by two major components: airport ground service and in-flight service (Bogicevic et al., 2013). The first ones are those closely linked to the airport management, and they are also called "landside operations". Specifically, in Liou et al. (2011a), the "landside operations" are defined as the airport service activities directly associated with passengers. In the "landside operations" context, the airport terminal may be divided in three major areas: access interface, processing

area, and flight interface (Horonjeff et al., 2010). In the same context, there are three different ways to classify the activities. The first one distinguish the process activities from the discretionary ones (Popovic et al., 2009). In the case of departing passengers, process activities comprise the passenger flow from check-in, security screening, passport control until boarding operations. Discretionary activities comprise what the passengers are able to do with their slack time in the terminal such as getting a coffee, shopping, exchanging money, or do any other activity provided by the airport (Bezerra and Gomes, 2016). The second one considers the service system of an airport company divided into two sub-processes: aeronautical service and commercial service (Liu, 2016). The last one has been reported in Gitto and Mancuso (2017), and according to them, the services provided by airports can be divided into aviation and non-aviation services. Belonging to the first group there are services such as the provision, maintenance and operation of the infrastructure required for the aircraft movements, the provision, maintenance and operation of the equipment and information technologies, and other ground handling services such as the aircraft for flight, luggage loading, passenger transport and so on. On the other hand, the non-aviation services include car parking, commercial activities at the airport, business lounges, rent, advertising and so on.

Anyway, despite these differences in activities' classification, the attributes used to evaluate airport service quality are similar among the authors (Pantouvakis and Renzi, 2016), and it is clear that many different and independent attributes have to be considered in order to measure its service quality. In this context, the selections of those to consider remained a difficult task for researchers over the years. Some authors, as Yeh and Kuo (2003), have decided to considers the major services that are under the control of airport management of their case study. Fodness and Murray (2007), through an in-depth interview and by a focus group, asked directly to participants about their expectations and experiences at airport in generals, then by a content analyses a master list of airport service quality themes were compiled. Furthermore, Liou et al. (2011a) drew up a list of airport service-related elements by consulting with airport management, directors, tour guides and through a literature review. The literature review is definitely the most adopted practice (Bezerra and Gomes, 2020, 2019, 2016, 2015; Del Chiappa et al., 2016; Hong et al., 2020; Jiang and Zhang, 2016a; Lubbe et al., 2011; Pandey, 2016; Prentice and Kadan, 2019). Some of them (Bezerra and Gomes, 2015; Hong et al., 2020; Jiang and Zhang, 2016a; Pandey, 2016) have also based the items' choose by considering the Airport Service Quality (ASQ) of the Airport Council International (ACI). Specifically, the ACI introduced the ASQ program in order to better understand passengers'

expectations from an airport's facilities and services and, eventually, to measure passenger' experience in different airports. ACI introduces eight different service quality indicators, which focus on how passengers perceive the level of service provided by the airport, and on objective measures of service delivery. They are: practical hourly capacity, gate departure delay, taxi departure delay, customer satisfaction, baggage delivery time, security clearing time, border control clearing time and check-in to gate time. In particular, customer satisfaction is defined as the overall level of satisfaction measured through questionnaire responses, and it depends on many factor. Some of them are within the airport's control (for example cleanliness, ease of wayfinding, variety of shops, comfort of departure areas, reliability of escalators and moving walkways); others may be or not within the airport's control, such as security controls and baggage delivery; and still others are not within the airport's control, such as speed of airline check-in, level of airfares, and range of flights offered (ACI, 2012).

For convenience, the main service aspects found in the analysed literature are reported in Table 1.1. As it emerges, most studies analysed almost all the service aspects. Only a few authors have decided to focus their attention on particular aspects. Geng et al. (2017) focused their study on the indoor environment quality factors such as thermal comfort, acoustic quality, air quality and lighting. Otherwise, Sricharoenpramong (2018) analysed only the quality of airport staff.

Table 1.1. Selected studies for airport services' literature review.

Service	Studies analysing the service
Airport accessibility	(Arif et al., 2013; Bogicevic et al., 2013)
Airport external signposting	(Fodness and Murray, 2007; Lubbe et al., 2011; Pantouvakis and Renzi, 2016)
Airport parking	(Bogicevic et al., 2013; Fodness and Murray, 2007; Hong et al., 2020; Jiang and Zhang, 2016a; Lee and Yu, 2018; Liou et al., 2011b; Pandey, 2016; Rhoades et al., 2000; Rocha et al., 2016)
Ground transportation connecting the airport	(Arif et al., 2013; de Barros et al., 2007; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Hong et al., 2020; Jiang and Zhang, 2016a; Liou et al., 2011b; Lubbe et al., 2011; Martin-Domingo et al., 2019; Pandey, 2016; Rhoades et al., 2000; Rocha et al., 2016)
Connecting flights	(Jiang and Zhang, 2016a; Nesset and Helgesen, 2014; Pandey, 2016; Rhoades et al., 2000)
Information displays	(Bezerra and Gomes, 2020, 2019, 2016, 2015; Brida et al., 2016; Ceccato and Masci, 2017; de Barros et al., 2007; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Hong et al., 2020; Jiang and Zhang, 2016a; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b; Lubbe et al., 2011; Martin-Domingo et al., 2019; Pandey, 2016; Park and Jung, 2011; Yeh and Kuo, 2003)

Information sound system	(Brida et al., 2016; Ceccato and Masci, 2017; Fodness and Murray, 2007)
Information facilities	(Arif et al., 2013; Brida et al., 2016; Ceccato and Masci, 2017; de Barros et al., 2007; Fodness and Murray, 2007; Kuo and Liang, 2011; Liou et al., 2011b; Lupo, 2015; Nesset and Helgesen, 2014; Pantouvakis and Renzi, 2016; Yeh and Kuo, 2003)
Signposting inside the airport/Wayfinding	(Arif et al., 2013; Bezerra and Gomes, 2020, 2019, 2016, 2015; Bogicevic et al., 2013; Brida et al., 2016; Ceccato and Masci, 2017; de Barros et al., 2007; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Hong et al., 2020; Jiang and Zhang, 2016a; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b; Lubbe et al., 2011; Pandey, 2016; Pantouvakis and Renzi, 2016; Rocha et al., 2016; Yeh and Kuo, 2003)
Walking distance and/or facilities (escalators, elevators, moving walkways)	(Bezerra and Gomes, 2020, 2019, 2016, 2015; Ceccato and Masci, 2017; Fodness and Murray, 2007; Hong et al., 2020; Jiang and Zhang, 2016a; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b; Martin-Domingo et al., 2019; Pandey, 2016; Park and Jung, 2011; Prentice and Kadan, 2019; Rocha et al., 2016)
Check-in procedure (Staff, waiting time, self-facilities)	(Bezerra and Gomes, 2020, 2019, 2016, 2015; Bogicevic et al., 2013; Fodness and Murray, 2007; Jiang and Zhang, 2016a; Kuo and Liang, 2011; Lee and Yu, 2018; Lubbe et al., 2011; Martin-Domingo et al., 2019; Pandey, 2016; Prentice and Kadan, 2019; Rhoades et al., 2000; Rocha et al., 2016)
Passport/Customs/Immigration procedure	(Arif et al., 2013; Hong et al., 2020; Jiang and Zhang, 2016a; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b; Lubbe et al., 2011; Lupo, 2015; Martin-Domingo et al., 2019; Pandey, 2016; Rhoades et al., 2000; Rocha et al., 2016; Yeh and Kuo, 2003)
Waiting areas/Lounges	(Arif et al., 2013; Bezerra and Gomes, 2020, 2019, 2016, 2015; Bogicevic et al., 2013; Fodness and Murray, 2007; Jiang and Zhang, 2016a; Lee and Yu, 2018; Lubbe et al., 2011; Martin-Domingo et al., 2019; Nesset and Helgesen, 2014; Pandey, 2016; Park and Jung, 2011; Rhoades et al., 2000)
Airport staff (Courtesy, Friendliness, Professionality)	(Arif et al., 2013; Bezerra and Gomes, 2020, 2019, 2016, 2015; Bogicevic et al., 2013; Brida et al., 2016; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Hong et al., 2020; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b; Lubbe et al., 2011; Lupo, 2015; Martin-Domingo et al., 2019; Nesset and Helgesen, 2014; Pantouvakis and Renzi, 2016; Park and Jung, 2011; Sricharoenpramong, 2018; Yeh and Kuo, 2003)
Cleanliness	(Bezerra and Gomes, 2020, 2019, 2016, 2015; Bogicevic et al., 2013; Brida et al., 2016; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b; Lupo, 2015; Pandey, 2016; Pantouvakis and Renzi, 2016; Park and Jung, 2011; Prentice and Kadan, 2019; Rocha et al., 2016; Yeh and Kuo, 2003)
Air conditioning/Thermal comfort	(Bezerra and Gomes, 2016, 2015; Brida et al., 2016; Ceccato and Masci, 2017; Eboli and Mazzulla, 2009; Geng et al., 2017; Hong et al., 2020; Jiang and Zhang, 2016a; Kuo and Liang,

	2011; Pantouvakis and Renzi, 2016; Prentice and Kadan, 2019; Rocha et al., 2016)
Noise/Acoustic comfort	(Bezerra and Gomes, 2016, 2015; Ceccato and Masci, 2017; Geng et al., 2017; Prentice and Kadan, 2019; Rocha et al., 2016)
Lighting	(Brida et al., 2016; Ceccato and Masci, 2017; Fodness and Murray, 2007; Hong et al., 2020; Jiang and Zhang, 2016a; Lupo, 2015; Pantouvakis and Renzi, 2016)
Ambience/Comfort/Atmosphere/ Decor	(Brida et al., 2016; Ceccato and Masci, 2017; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Geng et al., 2017; Hong et al., 2020; Jiang and Zhang, 2016a; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b; Lubbe et al., 2011; Pandey, 2016; Pantouvakis and Renzi, 2016; Park and Jung, 2011; Prentice and Kadan, 2019; Yeh and Kuo, 2003)
Toilets/Washrooms (Availability, Cleanliness)	(Arif et al., 2013; Bezerra and Gomes, 2020, 2019, 2016, 2015; Ceccato and Masci, 2017; de Barros et al., 2007; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Hong et al., 2020; Jiang and Zhang, 2016a; Lee and Yu, 2018; Liou et al., 2011b; Lupo, 2015; Martin-Domingo et al., 2019; Nesset and Helgesen, 2014; Pandey, 2016; Rocha et al., 2016; Yeh and Kuo, 2003)
Luggage carts	(Arif et al., 2013; Bezerra and Gomes, 2016, 2015; Bogicevic et al., 2013; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Hong et al., 2020; Jiang and Zhang, 2016a; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b; Lupo, 2015; Pandey, 2016; Rocha et al., 2016; Yeh and Kuo, 2003)
Baggage delivery procedure	(Fodness and Murray, 2007; Hong et al., 2020; Jiang and Zhang, 2016a; Lee and Yu, 2018; Lubbe et al., 2011; Lupo, 2015; Martin-Domingo et al., 2019; Nesset and Helgesen, 2014; Pandey, 2016; Rhoades et al., 2000; Rocha et al., 2016; Yeh and Kuo, 2003)
Safety	(Bezerra and Gomes, 2020, 2019, 2016, 2015; Brida et al., 2016; Ceccato and Masci, 2017; Hong et al., 2020; Lee and Yu, 2018; Lupo, 2015; Pandey, 2016; Pantouvakis and Renzi, 2016; Park and Jung, 2011; Prentice and Kadan, 2019; Yeh and Kuo, 2003)
Security procedure (Staff, Waiting time)	(Arif et al., 2013; Bezerra and Gomes, 2020, 2019, 2016, 2015; Bogicevic et al., 2013; Ceccato and Masci, 2017; de Barros et al., 2007; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Hong et al., 2020; Jiang and Zhang, 2016a; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b; Lupo, 2015; Martin-Domingo et al., 2019; Pandey, 2016; Pantouvakis and Renzi, 2016; Prentice and Kadan, 2019; Yeh and Kuo, 2003)
Shopping/Rental services (Availability, Staff, Prices)	(Arif et al., 2013; Bezerra and Gomes, 2020, 2019, 2016, 2015; Bogicevic et al., 2013; de Barros et al., 2007; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Hong et al., 2020; Jiang and Zhang, 2016a; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b; Lubbe et al., 2011; Lupo, 2015; Pandey, 2016; Park and Jung, 2011; Rhoades et al., 2000; Yeh and Kuo, 2003)
Restaurants/Bars (Availability, Staff, Prices)	(Arif et al., 2013; Bezerra and Gomes, 2020, 2019, 2016, 2015; Bogicevic et al., 2013; de Barros et al., 2007; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Hong et al., 2020; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b;

	Lubbe et al., 2011; Lupo, 2015; Martin-Domingo et al., 2019; Pandey, 2016; Park and Jung, 2011; Prentice and Kadan, 2019; Rhoades et al., 2000; Yeh and Kuo, 2003)
Money exchange/ Cash machines/ ATM	(Bezerra and Gomes, 2020, 2019, 2016, 2015; Hong et al., 2020; Jiang and Zhang, 2016a; Kuo and Liang, 2011; Lee and Yu, 2018; Liou et al., 2011b; Lupo, 2015; Martin-Domingo et al., 2019; Pandey, 2016; Rocha et al., 2016; Yeh and Kuo, 2003)
Telephone/Internet facilities/Business centers	(Bogicevic et al., 2013; de Barros et al., 2007; Eboli and Mazzulla, 2009; Fodness and Murray, 2007; Lee and Yu, 2018; Liou et al., 2011b; Lubbe et al., 2011; Pandey, 2016; Rocha et al., 2016)
Wi-Fi connection	(Bezerra and Gomes, 2020, 2019; Bogicevic et al., 2013; Hong et al., 2020; Jiang and Zhang, 2016a; Lee and Yu, 2018; Martin-Domingo et al., 2019; Pandey, 2016; Rocha et al., 2016)
Charging stations	(Bogicevic et al., 2013; Jiang and Zhang, 2016a)
Special services	(Arif et al., 2013; Brida et al., 2016; Rhoades et al., 2000)
Prayer rooms/chapel	(Arif et al., 2013; de Barros et al., 2007; Fodness and Murray, 2007)
Childrens' play areas	(Fodness and Murray, 2007; Jiang and Zhang, 2016a; Park and Jung, 2011)
Pharmacies	(de Barros et al., 2007; Park and Jung, 2011)
Smoking area	(Fodness and Murray, 2007; Jiang and Zhang, 2016a)

In general, through the analysis of the literature review the complexity and variety of airport services is confirmed. For this reason, it is extremely important to deepen the research towards those methodologies that try to identify the most relevant airport service aspects for passengers.

1.3 Data collection

When the interest is to analyze the services offered at the airport, a first difference emerged from the literature relates to the type of interviewee to whom the questionnaire is addressed. The data are generally collected at the airport by interviewing the passengers directly. The airport passengers can be divided into three different groups: departing, arriving and transfer passengers. Each of these groups will have a different set of needs and wishes when they use different facilities at the airport (Park and Jung, 2011).

Departing passengers are those who are waiting the flight departure at gates or lounges. They have the possibility to express their opinions about the services provided by the airport even if they did not travel yet, because they are staying in the airport and they have already had the opportunity to experience the services, processes, and facilities (Bezerra and Gomes, 2016; Correia et al., 2008). Similar to the departing passengers, the transfer ones

are generally interviewed at the flight departure at gates or lounges (de Barros et al., 2007; Park and Jung, 2011). On the contrary, when the survey is addressed to arriving passengers, they are interviewed in the public hall, just after leaving the baggage claim area (Brida et al., 2016) or at arrival lounge (Jiang and Zhang, 2016a; Tseng, 2020).

The major advantage to interview departing passengers is due to the possibility to exploit their availability because they are not in a hurry and their sole engagement is to wait the time of the flight departure (Liou et al., 2011b; Pantouvakis and Renzi, 2016). On the contrary, the arriving passengers or transfer passengers could be in a hurry to leave the airport or to reach the gate of the next flight respectively. Moreover, the needs of transfer passengers are generally quite different from those of departing and arriving passengers. For example, transfers passengers do not make use of airport access roads, and the use of other facilities depends on the type of transfer, the airport's operational configuration, and the services provided by the airline (de Barros et al., 2007).

In Del Chiappa et al. (2016) another type of passengers differentiation and the related spending profiles and preferences have been proposed. According to them, in an airport there are three different segments of passengers: leisure charter and low-cost carrier passengers, business passengers, and transfer passengers. The first ones have a positive impact on commercial revenues, they tend to be more evenly spread over time and are particularly good users of food and beverage retailers. 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. As regards transfer passengers, 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 (Del Chiappa et al., 2016).

Anyway, the choice of the passengers' type to whom submit the questionnaire is certainly based on the objectives of the analysis and on the airport services on which the study will be focus on. In the existing literature, most of the studies are based on data collected by interviewing departing passengers (Arif et al., 2013; Bezerra and Gomes, 2020, 2019, 2016, 2015; Ceccato and Masci, 2017; Del Chiappa et al., 2016; Eboli and Mazzulla, 2009; Geng et al., 2017; Liou et al., 2011b; Lubbe et al., 2011; Nesset and Helgesen, 2014; Pandey, 2016; Prentice and Kadan, 2019; Sricharoenpramong, 2018; Tsafarakis et al., 2018). Some researchers (Brida et al., 2016; Hong et al., 2020; Jiang and Zhang, 2016a; Rocha et al., 2016; Tseng, 2020) analysed data obtained by interviewing all airport passengers indifferently (departing, transfer and arriving passengers). Otherwise, de

Barros et al. (2007) and Park and Jung (2011) analysed the responses of transfer passengers only.

Generally, when the survey is addressed to departing, transfer and arriving passengers, the interviews take place directly in the airport through face-to-face (Arif et al., 2013; Brida et al., 2016; de Barros et al., 2007; Del Chiappa et al., 2016; Liou et al., 2011b; Nesset and Helgesen, 2014; Pantouvakis and Renzi, 2016; Rocha et al., 2016) or self-administered (Bezerra and Gomes, 2020, 2019, 2016, 2015; Hong et al., 2020; Jiang and Zhang, 2016a; Lubbe et al., 2011; Pandey, 2016; Park and Jung, 2011; Sricharoenpramong, 2018; Tseng, 2020) questionnaires. However, there are some researchers, such as Prentice and Kadan (2019), that due to security and geographic restrictions that prevent from accessing participants in airport terminals, had to conduct the survey through the online social networking platforms (e.g., Facebook; Linkedin). Otherwise, when the goal is to reach a large number of air travellers opinions, various data collection tools are adopted, such as: online questionnaires sent by email (Suárez-Alemán and Jiménez, 2016), or other platforms where users leave their airports' evaluations as Skytrax (Gitto and Mancuso, 2017), Twitter (Martin-Domingo et al., 2019), Google reviews (Lee and Yu, 2018) or in an airport review website (Bogicevic et al., 2013). Finally, in the reviewed literature there are some studies that do not analyse the opinions of airport passengers or air travellers, but the data collected through surveys submitted for example to airport directors and consultants (Rhoades et al., 2000), travel experts (Kuo and Liang, 2011; Lupo, 2015; Yeh and Kuo, 2003), or frequent flyers (Fodness and Murray, 2007).

Wanting to differentiate the studies in terms of kind of opinions collected through the questionnaire, it can be said that the types of data found in the literature are: (1) satisfaction/perceptions data; (2) importance/expectations data; (3) behavioural intentions. Specifically, there are studies investigating only on perceptions or satisfaction with the service. In other words, people provide their judgments on the used services indicating their level of satisfaction with the various service aspects (Bezerra and Gomes, 2016, 2015; Brida et al., 2016; Ceccato and Masci, 2017; Del Chiappa et al., 2016; Geng et al., 2017; Pantouvakis and Renzi, 2016), or providing a rate on the performance of the service aspects (Arif et al., 2013; de Barros et al., 2007; Eboli and Mazzulla, 2009; Hong et al., 2020; Kuo and Liang, 2011; Lupo, 2015; Park and Jung, 2011). Liou et al. (2011a) requested both the perceptions and satisfaction levels with the service. Therefore, it is evident that the major part of the reviewed studies analysed only this kind of opinions. However, a respectable number of studies investigated on both perceptions and expectations about the service (Jiang and Zhang, 2016a;

Lubbe et al., 2011; Pandey, 2016; Sricharoenpramong, 2018; Tseng, 2020; Yeh and Kuo, 2003), requested often in terms of satisfaction and importance rates. In these cases, in addition to the opinions about the performance of the various service aspects, passengers are requested to express also what they expect from the service and therefore to provide a rate of importance on each of the analysed service aspect. Instead, Fodness and Murray (2007) and Rhoades et al. (2000) investigated only on expectation of airport service quality. Finally, a restricted number of studies investigated on satisfaction and/or expectations together with the passengers' behavioural intentions (Bezerra and Gomes, 2020, 2019; Nesset and Helgesen, 2014; Prentice and Kadan, 2019), which represent their intentions to reuse the service or to recommend it to other people, and so on. The studies based on the collection of behavioural intentions are more complete and innovative and need more sophisticated approaches of analysis, and for this reason they are less than the others.

Another differentiation of the literature studies concerning the collection of the data regards the evaluation scales adopted for collecting passengers' opinions. The scales are very variegated, in terms of number of levels but also the kind of levels. The major part of the studies refers to evaluation scales on 5 levels (Arif et al., 2013; Bezerra and Gomes, 2016, 2015; Jiang and Zhang, 2016a; Liou et al., 2011b; Lubbe et al., 2011; Lupo, 2015; Pandey, 2016; Tseng, 2020; Yeh and Kuo, 2003), some on judgement from "very poor" (or "very bad") to "very good" (or "excellent"), and other on satisfaction levels from "strongly dissatisfied" to "strongly satisfied" or also from "very unsatisfied" to "very satisfied". Analogously, when also expectations or importance rates are requested, the scale varies from "very low" to "very high", or "not very important" to "very important"(Lubbe et al., 2011; Pandey, 2016; Tseng, 2020; Yeh and Kuo, 2003). A limited number of studies adopted service quality ratings scales (Bezerra and Gomes, 2020, 2019) and satisfaction levels scale (Brida et al., 2016; Del Chiappa et al., 2016; Nesset and Helgesen, 2014) on seven points. Among them, Geng et al. (2017) are the only ones who adopted a bipolar seven points scale ranging from -3 (corresponding to "strongly dissatisfied") to 3 (corresponding to "strongly satisfied"). Only three studies adopted scales on a number of points different from 5 or 7: the study by Ceccato and Masci (2017) using a scale on 10 levels, and the studies by de Barros et al. (2007) and by Eboli and Mazzulla (2009) adopting a 6-point scale. There are some studies adopting Likert scales (5-point, 6-point or 7-point) according to which a level of agreement or disagreement with some sentences is expressed (Fodness and Murray, 2007; Hong et al., 2020; Pantouvakis and Renzi, 2016; Park and Jung, 2011; Prentice and Kadan, 2019).

1.4 Data analysis techniques and models

In the literature concerning airport services, almost all the studies aim to determine the attributes that most influence the overall service quality, representing the aspects on which a company should focus the efforts for improving the service and satisfying the users. As stated above, there are several attributes to be taken into account for the analysis of the airport service quality. The variety of the services offered in the airport, and the multicultural nature of air transport industry in general, make assessing service quality quite complex. Due to the complexity of the airport services, an effective process for measuring and analysing relevant information regarding passenger perceptions of air transport service quality is not a simple task (Bezerra and Gomes, 2016). According to this, over the years, researchers have always tried to use methodologies capable of synthesizing the phenomenon as much as possible. Understanding which factors mainly affect overall passengers' satisfaction could help airport management companies to achieve better financial resource administration. Allocating an appropriate amount of resources to the key factors of airport service quality can increase the likelihood of being perceived by a passenger as the best choice, relative to the alternatives available (Fodness and Murray, 2007).

The methodologies adopted or proposed for analysing the data collected from the air passengers can be more or less sophisticated. From the analysis of the papers selected for the proposed literature review, it emerges that there are some authors proposing simple descriptive statistical analyses (Arif et al., 2013; Sricharoenpramong, 2018), or Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) (Bezerra and Gomes, 2016; Fodness and Murray, 2007; Rhoades et al., 2000), or regression model (Bezerra and Gomes, 2015; Brida et al., 2016; Ceccato and Masci, 2017; de Barros et al., 2007; Eboli and Mazzulla, 2009; Jiang and Zhang, 2016a; Suárez-Alemán and Jiménez, 2016), while a large number of researchers aim to more advanced approaches, such as SEM (Bezerra and Gomes, 2020, 2019; Hong et al., 2020; Nesset and Helgesen, 2014; Park and Jung, 2011; Prentice and Kadan, 2019), or Multiple Criteria Decisions Making (MCDM) (Kuo and Liang, 2011; Lupo, 2015; Pandey, 2016; Rocha et al., 2016; Yeh and Kuo, 2003), or Fuzzy theory (Del Chiappa et al., 2016; Kuo and Liang, 2011; Lupo, 2015; Pandey, 2016; Yeh and Kuo, 2003), or Sentiment Analysis (Gitto and Mancuso, 2017; Lee and Yu, 2018; Martin-Domingo et al., 2019), or Importance-Performance Analysis (IPA) (Jiang and Zhang, 2016a; Lubbe et al., 2011; Pandey, 2016; Tseng, 2020). There are some authors who adopted other kinds of methods not included in the above mentioned ones: one study adopted the Kano model (Geng et al., 2017), one paper proposed

a decision rules approach (Liou et al., 2011b), and one paper proposed a Rasch modelling technique (Pantouvakis and Renzi, 2016).

The authors that applied an EFA, or CFA, or a regression model, have as principal aim to identify the key facilities or service aspect related to airport service quality and air traveller satisfaction. From the EFA conducted by Bezerra and Gomes (2015), it emerged that the airport service quality can be explained by seven factors named as check-in, security, convenience, ambience, basic facilities, prices, earliness of arrival and travel frequency. Through a regression analysis, the authors found that the dimension with the highest effect on airport service quality are related to comfort and cleanliness inside the terminal (represented by the factor "ambience"), and to prices at food facilities and stores. Further analyses have been carried out in Bezerra and Gomes (2016) in order to test the differences on the perceptions of domestic and international passengers. By performing a Principal Component Analysis (PCA), Brida et al. 2016 obtained five different components (image perception, airport information, terminal servicescape, airport sound information system and flight information screen), and from the results of a Logit model, they concluded that airports should improve mainly the way of communicating flight information and the location of different airport's utilities. In Ceccato and Masci (2017) the focus is on passengers' satisfaction with safety inside the airport, and from the results of a binary logistic regression, it emerges that the airport's environment (e.g. cleanliness, maintenance, information facilities, signage, acoustic and thermal comfort) plays an important role on the perceived safety.

The aim of Pantouvakis and Renzi (2016) is similar, although they used a Rasch Modeling technique. They concluded that the service quality provided in an airport multi-national context can be better described by three distinct, independent and invariant dimensions, namely servicescape and image, signage and service. Moreover, according to them the presence of the dimension of servicescape and image seems to play the most decisive role in satisfying passengers. When the data object of the study are web reviews (Gitto and Mancuso, 2017; Lee and Yu, 2018; Martin-Domingo et al., 2019), the technique adopted is the sentiment analysis. The findings of Gitto and Mancuso (2017) suggest that passengers concentrate their valuations on a restricted set of services concerning food and beverage and the shopping area for the non-aviation services. The evaluations for the aviation services mostly concern check-in, baggage claim and security control procedures. Lee and Yu (2018) found that there is a different order of priority for each airport for improving its passengers' perception of service quality. Specifically, not all service attributes are equally important for airports of different sizes. According to them, for the small airports, good transportation to/from the

city and cleanness and kindness of airport staff are more prominent issues, whereas, for the larger airports, customs inspection and nice ambiance appear to be more important.

It can be observed that there is also a large number of studies oriented towards SEM, which can be seen as an advanced regression model where latent constructs can be considered. These kinds of techniques are very suitable for analysing customer satisfaction data expressed in terms of rates. Furthermore, in the reviewed studies, it has been proved that the SEM approach could adequately account for latent constructs affecting overall air service quality, and to explore observed indicators for measuring the introduced latent constructs themselves. It could be verified that the studies aiming at investigating also on the behavioural intentions adopted the SEM approach, because it permits to model well the relationship among different constructs, such as satisfaction, expectation, and behavioural intentions.

Specifically, in Park and Jung (2011) the SEM approach has been adopted to test the relationships between the airport service quality, value, satisfaction, airport image, and passenger behaviour, by taking into account the perception of only transfer passengers. From the results, it emerges that airport service quality has a significant positive effect on value, satisfaction, and airport image. Moreover, they concluded that the airport service quality influences transfer passengers' reuse intentions. The results of the study carried out by Nesset and Helgesen (2014) presented the airport service quality as the most important driver for the loyalty attitude, passengers' satisfaction creation and airport's image building. The study of Prentice and Kadan (2019) examines through a SEM the relationship between airport service quality, passengers' satisfaction, and behavioural intentions including airport reuse and destination revisit. Otherwise, Hong et al. (2020) proposed a SEM by comparing the results obtained for air travellers and service providers as two different groups od airport users. Finally, Bezerra and Gomes (2020) used the SEM for analysing the relationships between passenger expectations, airport service quality, switching costs for changing airports, and passenger loyalty towards the airport. From the obtained results, they concluded that service quality still influences passenger post-consumption attitudes, even when the effects of switching costs were considered.

All these methodologies, albeit useful for identifying the most influential service's aspects and their relationships, do not provide a practical information about which provided service require prompt action. A specific technique that represents a practical instrument for reaching such an objective is surely the Importance-Performance Analysis (IPA), proposed initially by Martilla and James (1977). In almost all the mentioned studies

that proposed this technique, performance and importance represented the ratings provided directly by the passengers. Specifically, Lubbe et al. (2011) report the importance and performance findings with respect to purpose of travel and to frequency of travel, in order to show the differences between business and leisure travellers and between frequent and infrequent travellers. In the work of Pandey (2016), a fuzzy analysis was performed for deriving both performance and importance ratings. A modified version of the traditional IPA was proposed by Tseng (2020) to classify and diagnose the service attributes of an airport: the IPA-Kano model. Both Jiang and Zhang (2016a) and Tseng (2020) added to their study also a GAP analysis.

Finally, as reported in Lupo (2015), in the field of airport service quality evaluation, differently from the studies investigating on service quality of other public transport modes, several studies have focused on the deterministic nature of the multi-criteria decision process. In all the reviewed studies, the MCDM approach was chosen to make a comparative analysis among airports belonging to the same region and for this reason they are in reciprocal competitiveness.

1.5 Summary

From the analysis of the airport related literature, it emerged a great variety both in terms of services to take into account and in terms of methodologies adopted for collecting and analysing data.

Regarding the collection of data, these are generally obtained through surveys that took place inside the airports. In fact, the interviewers have the possibility to ask passengers their opinions about the service before their departure, because they used or they are using the services when they are contacted by the interviewers. In these cases, the traditional face-to-face interview or the self-administer questionnaire are adopted. However, there are also studies analysing data collected online.

Many differences were registered also in the evaluation scales adopted for collecting passengers' opinions: Likert scale is one of the most adopted scale together with other verbal scales; someone used a numerical scale. It can be noted that the major part of the studies adopted scales are odd, and specifically 5-point scales. But some researchers believe a 5-point scale is totally inappropriate for customer satisfaction studies because scales with fewer points can be more susceptible to inflated results. In addition, by providing an even number of choices, neutrality is not allowed. It should be highlighted that probably for the major part of the studies reported in this literature review, the data were provided by the companies managing the

services that evidently do not consider the advantages of a scale as regards another scale.

Moreover, it can be observed that authors that analysed air service quality on the basis of only satisfaction or perceptions are more than the others. There are several reasons for this evidence. First of all, it is simpler to collect only one kind of opinions avoiding to fatigue the respondents with a large number of questions. In fact, asking passengers to express also importance rates increases the length of the questionnaire and could undermine the accuracy of the survey (Hernandez et al., 2016).

From the analysis of the literature review in terms of methodologies proposed for analysing the data, it can be highlighted that some authors aim to traditional methods as regression models, or more advanced such as SEM, which are suitable for analysing customer satisfaction data because the objective of the major part of the works is to identify the service aspects mostly influencing the overall service quality. On the other hand, some authors considered an important aspect of the customer satisfaction data, linked to their uncertainty. In fact, the linguistic assessment of human perception and expectation can be incomplete and vague, such that representing it by means of an exact numerical value may prove unrealistic. In addition, evaluation of service quality presents intrinsic complexity aspects related to the nature of services. Another research stream is based on the application of MCDM methods that permit to evaluate an integrated service level and make suggestions for improvement.

From our literature review study, it can be concluded that there is a large variety of methods both for collecting the data and for analysing them, and that it is difficult to understand if all the methods are suitable, or which are the best methods for analysing airport service quality. Moreover, one of the main gaps emerged from the literature review is the under-representation of small-medium sized airports as case studies. Therefore, it is important to investigate much more on the literature of the concerning air transportation, which is an emerging sector in the field of public transport service quality analysis. Nonetheless, it might be worth further investigating on small-medium sized airports, which often represent real opportunities for decentralised and developing regions.

Chapter 2

The evaluation of airlines' service quality

2.1 Introduction

Nowadays, in this borderless world and modern society, and also with the emergence of low cost airlines, air travelling has been a kind of necessity rather than a luxury activity (Leong et al., 2015). Over the years, the airlines have been experiencing great competition due to both the deregulation and the increasing of passenger's awareness of service quality (Chou et al., 2011). At the same time, in a such highly competitive environment, where all airlines have comparable fares and matching frequent flyer programs, airline's competitive advantages lie in the service quality perceived by customers (Chang and Yeh, 2002). It can be said that delivering high-quality service to passengers is essential for airlines survival (Park et al., 2006, 2004; Suki, 2014). An airline would lead the market if it offers superior quality services relative to its competitors. It is therefore of strategic importance for airlines to understand their relative competitive advantages on service quality (Chang and Yeh, 2002).

In this context, airlines need to emerge effective operating and marketing strategies that can meet the needs of passengers (Wen and Lai, 2010). In other words, to deliver better service to passengers, airlines needed to understand passengers' need and expectations (Aksoy et al., 2003). Understanding what customers expect is a crucial step in delivering high-quality service, but only customers, however, can truly define service quality (Liou et al., 2011c). According to this, the airlines regularly carry out Customer Satisfaction Surveys (CSSs), and the competition that has been established between the companies is certainly the reason behind this

practice. In fact, the airlines marketing strategies increasingly consider customer satisfaction as an opportunity to improve the service and attract new users (Park et al., 2006). Through CSS questionnaire, the airlines try to understand what users have appreciated (or not) about the service received during their travel experience. At the same time, since service quality has become an important factor for airlines, research related to service quality and customer satisfaction in the airline industry has been growing as well (Park et al., 2006; Tsafarakis et al., 2018).

In this chapter, a literature review about the evaluation of airlines' service quality is reported. Only studies published in the past 20 years (from 2000 to 2020) on journals indexed on the best database, such as Scopus and Web of Science, were considered. Specifically, the various airlines' service attributes and the different ways for collecting data were identified. Moreover, the evaluation scales adopted by the several authors are shown, as the great variety of methodologies used for analysing the collected data as well.

2.2 Airlines' services

As it happens for the airport service, the airlines' service quality attributes are context-dependent and should be selected to reflect the investigated service environment (Chang and Yeh, 2002). From the analysis of the literature, it emerges that over years the context-dependent service quality attributes have been identified by consulting airline managers, government officials, expert academics and travel agents (Atalay et al., 2019; Chang and Yeh, 2002; Chen and Chang, 2005; Liou et al., 2011a; Park et al., 2006), or by the existing literature (Atalay et al., 2019; Chen, 2008; Chen and Chang, 2005; Chou et al., 2011; Gilbert and Wong, 2003; Hu and Hsiao, 2016; Kuo and Jou, 2014; Leong et al., 2015; Li et al., 2017; Lim and Tkaczynski, 2017; Liou and Tzeng, 2007; Medina-Muñoz et al., 2018; Pakdil and Aydin, 2007; Tahanisaz and Shokuhyar, 2020; Tsaur et al., 2002; Wang et al., 2011; Wu and Cheng, 2013).

It can certainly be said that the attributes taken into consideration by the various authors to assess the airlines' service quality are numerous and variegated. According to this, the attributes for airlines' service quality are still a matter of debate (Liou and Tzeng, 2007). Furthermore, it must be said that often the researchers have to include in their studies also service attributes that do not compete with the airlines directly. This occurrence probably happens because the survey for collecting data are addressed to customers that do not always know who certain services are competing for. Therefore, it is still difficult for researchers to describe and assess airlines' service quality.

The airlines provide a range of services to customers including ticket reservation, purchase, airport ground service, on-board service and the service at the destination (Tsaur et al., 2002). According to this, the airlines' service attributes could be divided in aspects relating to the following phases: before the flight (e.g. flight booking and check-in procedure), during the flight (e.g. seat comfort and cabin cleanliness) and after the flight (e.g. landing procedures and luggage delivery) (Namukasa, 2013). Or, even more simply they could be considered divided into ground and in-flight service attributes (Chen and Chang, 2005).

From the literature, in the questionnaires the service attributes are often divided in the questionnaires into categories or dimensions. The number of these categories or dimensions is different among the authors. In Suki (2014) these airlines' service quality dimensions are only two: tangibles and empathy. According to the author, airline tangible-related quality traits include for example the cleanliness of airplane interior toilets, the quality of the catering and the comfort level of the plane seats. On the other hand, empathy is allied to all these attributes regarding how the company cares and provides individualized attention to their customers. Hu and Hsiao (2016) represented the airlines' service quality by three dimensions: interaction quality, physical environmental quality, and outcome quality. The first one regards the airlines staff in general. The second dimension is determined by factors related to cleanliness on board and other in-flight services. Finally, the outcome quality relates, for example, to the flight information, the flight punctuality but also to the check-in service.

For Wu and Cheng (2013), service quality is the overall dimension consisting of four primary dimensions: interaction quality (regarding, for example, expertise and problem solving), physical environment quality (e.g. cleanliness and comfort), outcome quality (focusing on the outcome of the service) and access quality (concerning information and convenience).

In Chang and Yeh (2002) the service attributes are embodied in five categories: on board comfort, airline employees, reliability of service, convenience of service, and handling of abnormal conditions. Other authors (Basfirinci and Mitra, 2015; Erdil and Yildiz, 2011; Leong et al., 2015; Tsaur et al., 2002) by adopting the SERVQUAL model (Parasuraman et al., 1988), represented the airlines' service quality with five dimensions, that are: tangibility (representing the physical service presentation such as on-board equipment, quality of the food and so on), reliability (standing for the how credible the airline is in terms of safety and pilot navigating skills), responsiveness (describing how ground or on-board crew interact with customers), assurance (representing the certainty that airlines provides for customers) and empathy (representing how airline deal with the customer

complaints and provide thoughtful services). A similar way of splitting service attributes was proposed by Chou et al. (2011), which considered five dimensions of airlines' service quality: tangibility, responsiveness, reliability and assurance, empathy and flight patterns. Also Hussain et al. (2015) modified a bit the SERVQUAL model and proposed the airlines service quality composed of six dimensions: reliability, responsiveness, assurance, tangibles, security and safety, and communications. Otherwise, in Li et al. (2017) the five airlines' service quality dimensions are: employees, facilities, flight schedule and information, supporting service, and physical environment.

In Park (2007) and in Park et al. (2006), the instrument for measuring airline service quality encompasses six dimensions named: in-flight service (e.g. seat comfort, meal service, etc.), reservation and ticketing, airport service (e.g. check-in and baggage delivery), reliability (e.g. punctuality and safety), employee service, and flight availability. Gilbert and Wong (2003) proposed seven dimensions based on the SERVQUAL to measure service quality: employees, facilities, responsiveness, reliability, flight patterns, assurance and customization. Shah et al. (2020) added to the SERVQUAL other two dimensions: passenger satisfaction and behavioural intentions. Otherwise, Pakdil and Aydin (2007) proposed eight dimensions that combined the SERVQUAL with Gilbert and Wong's study and by adding the image dimension. A larger number of airlines' service quality dimensions can be found also in Liou et al. (2011a) and Liou et al. (2011c). Specifically, in these studies the service attributes were divided by eight dimensions that are: booking service, ticketing service, check-in, baggage handling, boarding process, cabin service, baggage claim, and responsiveness.

Beyond the different ways to consider the dimensions of the airlines' service quality, the airlines service attributes found in the selected studies are reported in Table 2.1.

Table 2.1. Selected studies for airlines services' literature review.

Service	Studies analysing the service
Flight booking	(Aksoy et al., 2003; Atalay et al., 2019; Chen, 2008; Chou et al., 2011; De Jager et al., 2012; Farooq et al., 2018; Hu and Hsiao, 2016; Jiang and Zhang, 2016b; Keshavarz Ghorabaee et al., 2017; Kuo, 2011; Lim and Tkaczynski, 2017; Liou et al., 2011c, 2011a; Medina-Muñoz et al., 2018; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Tsafarakis et al., 2018; Tsaur et al., 2002; Wang et al., 2011; Wu and Cheng, 2013)
Seat choosing	(Chen, 2008; Chou et al., 2011; Farooq et al., 2018; Jiang and Zhang, 2016b; Keshavarz Ghorabaee et al., 2017; Lim and Tkaczynski, 2017; Pakdil and Aydin, 2007; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Wang et al., 2011; Wong and Chung, 2007)

Airlines web site	(Aksoy et al., 2003; Chen, 2008; De Jager et al., 2012; Namukasa, 2013)
Check-in	(Agarwal and Gowda, 2020; Chang and Yeh, 2002; Chen, 2008; Chou et al., 2011; Gilbert and Wong, 2003; Hu and Hsiao, 2016; Hussain et al., 2015; Jiang and Zhang, 2016b; Lim and Tkaczynski, 2017; Liou et al., 2011a, 2011c; Lucini et al., 2020; Medina-Muñoz et al., 2018; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Tsafarakis et al., 2018; Wang et al., 2011; Wen et al., 2014; Wen and Lai, 2010; Wu and Cheng, 2013)
Frequency and Scheduling	(Atalay et al., 2019; Basfirinci and Mitra, 2015; Chang and Yeh, 2002; Chen, 2008; Chou et al., 2011; De Jager et al., 2012; Espino et al., 2008; Farooq et al., 2018; Gilbert and Wong, 2003; Jiang and Zhang, 2016b; Keshavarz Ghorabaee et al., 2017; Leong et al., 2015; Lim and Tkaczynski, 2017; Liou and Tzeng, 2007; Martín et al., 2011; Medina-Muñoz et al., 2018; Pakdil and Aydin, 2007; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Tahanisaz and Shokuhyar, 2020; Tsafarakis et al., 2018; Tsaur et al., 2002; Wen et al., 2014; Wen and Lai, 2010; Wu and Cheng, 2013)
Waiting lounges	(Chou et al., 2011; Gilbert and Wong, 2003; Jiang and Zhang, 2016b; Keshavarz Ghorabaee et al., 2017; Lim and Tkaczynski, 2017; Lucini et al., 2020; Tahanisaz and Shokuhyar, 2020)
Boarding operations	(Jiang and Zhang, 2016b; Liou et al., 2011c, 2011a; Medina-Muñoz et al., 2018; Tsafarakis et al., 2018; Wong and Chung, 2007)
Punctuality	(Agarwal and Gowda, 2020; Aksoy et al., 2003; Atalay et al., 2019; Basfirinci and Mitra, 2015; Chang and Yeh, 2002; Chen, 2008; Chou et al., 2011; De Jager et al., 2012; Farooq et al., 2018; Gilbert and Wong, 2003; Hu and Hsiao, 2016; Hussain et al., 2015; Jiang and Zhang, 2016b; Keshavarz Ghorabaee et al., 2017; Kuo, 2011; Leong et al., 2015; Li et al., 2017; Lim and Tkaczynski, 2017; Liou and Tzeng, 2007; Lucini et al., 2020; Medina-Muñoz et al., 2018; Pakdil and Aydin, 2007; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Suki, 2014; Tahanisaz and Shokuhyar, 2020; Tsaur et al., 2002; Wang et al., 2011; Wen et al., 2014; Wen and Lai, 2010; Wu and Cheng, 2013)
Airline staff/Cabin crew	(Agarwal and Gowda, 2020; Aksoy et al., 2003; Atalay et al., 2019; Basfirinci and Mitra, 2015; Chang and Yeh, 2002; Chen, 2008; Chen and Chang, 2005; Chou et al., 2011; De Jager et al., 2012; Erdil and Yildiz, 2011; Farooq et al., 2018; Gilbert and Wong, 2003; Hu and Hsiao, 2016; Hussain et al., 2015; Jiang and Zhang, 2016b; Keshavarz Ghorabaee et al., 2017; Kos Koklic et al., 2017; Kuo, 2011; Leong et al., 2015; Li et al., 2017; Lim and Tkaczynski, 2017; Liou et al., 2011a, 2011c; Liou and Tzeng, 2007; Lu and Ling, 2008; Lucini et al., 2020; Medina-Muñoz et al., 2018; Namukasa, 2013; Pakdil and Aydin, 2007; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Tahanisaz and Shokuhyar, 2020; Tsafarakis et al., 2018; Tsaur et al., 2002; Wang et al., 2011; Wen et al., 2014; Wen and Lai, 2010; Wong and Chung, 2007; Wu and Cheng, 2013)

Cabin announcements	(Atalay et al., 2019; Chen, 2008; Chen and Chang, 2005; Hussain et al., 2015; Jiang and Zhang, 2016b; Li et al., 2017; Liou et al., 2011c, 2011a)
Seat comfort/Space available	(Agarwal and Gowda, 2020; Aksoy et al., 2003; Atalay et al., 2019; Balcombe et al., 2009; Chang and Yeh, 2002; Chen and Chang, 2005; Chou et al., 2011; De Jager et al., 2012; Espino et al., 2008; Farooq et al., 2018; Hu and Hsiao, 2016; Hussain et al., 2015; Keshavarz Ghorabaee et al., 2017; Kos Koklic et al., 2017; Kuo, 2011; Li et al., 2017; Lim and Tkaczynski, 2017; Liou et al., 2011c, 2011a; Lucini et al., 2020; Martín et al., 2011; Medina-Muñoz et al., 2018; Namukasa, 2013; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Tahanisaz and Shokuhyar, 2020; Tsafarakis et al., 2018; Tsaur et al., 2002; Wang et al., 2011; Wen et al., 2014; Wen and Lai, 2010; Wong and Chung, 2007; Wu and Cheng, 2013)
Acoustic comfort inside the cabin	(Agarwal and Gowda, 2020; Chang and Yeh, 2002; Li et al., 2017; Wu and Cheng, 2013)
Thermal comfort inside the cabin	(Agarwal and Gowda, 2020; Aksoy et al., 2003; Farooq et al., 2018; Li et al., 2017)
Air quality inside the cabin	(Agarwal and Gowda, 2020; Aksoy et al., 2003; Li et al., 2017) Aksoy et al. (2003), Li et al. (2017), Agarwal and Gowda (2020)
Cleanliness inside the cabin	(Agarwal and Gowda, 2020; Aksoy et al., 2003; Basfirinci and Mitra, 2015; Chang and Yeh, 2002; Chen, 2008; Chen and Chang, 2005; Chou et al., 2011; De Jager et al., 2012; Gilbert and Wong, 2003; Hu and Hsiao, 2016; Hussain et al., 2015; Keshavarz Ghorabaee et al., 2017; Kuo, 2011; Li et al., 2017; Liou et al., 2011a, 2011c; Liou and Tzeng, 2007; Namukasa, 2013; Pakdil and Aydin, 2007; Suki, 2014; Tahanisaz and Shokuhyar, 2020; Tsafarakis et al., 2018; Tsaur et al., 2002; Wang et al., 2011; Wong and Chung, 2007; Wu and Cheng, 2013)
Toilets	(Chou et al., 2011; Farooq et al., 2018; Keshavarz Ghorabaee et al., 2017; Suki, 2014; Tsafarakis et al., 2018; Wu and Cheng, 2013)
Safety and security	(Basfirinci and Mitra, 2015; Chang and Yeh, 2002; Chen and Chang, 2005; Chou et al., 2011; Erdil and Yildiz, 2011; Gilbert and Wong, 2003; Hussain et al., 2015; Jiang and Zhang, 2016b; Keshavarz Ghorabaee et al., 2017; Kuo, 2011; Leong et al., 2015; Li et al., 2017; Lim and Tkaczynski, 2017; Liou et al., 2011c, 2011a; Liou and Tzeng, 2007; Lu and Ling, 2008; Lucini et al., 2020; Medina-Muñoz et al., 2018; Namukasa, 2013; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Tahanisaz and Shokuhyar, 2020; Tsaur et al., 2002; Wang et al., 2011; Wu and Cheng, 2013)
Food and drinks	(Agarwal and Gowda, 2020; Aksoy et al., 2003; Atalay et al., 2019; Balcombe et al., 2009; Chang and Yeh, 2002; Chen, 2008; Chen and Chang, 2005; Chou et al., 2011; De Jager et al., 2012; Espino et al., 2008; Farooq et al., 2018; Gilbert and Wong, 2003; Hu and Hsiao, 2016; Hussain et al., 2015; Jiang and Zhang, 2016b; Leong et al., 2015; Li et al., 2017; Lim and Tkaczynski, 2017; Liou and Tzeng, 2007; Lucini et al., 2020; Martín et al., 2011; Medina-Muñoz et al., 2018; Namukasa,

	2013; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Suki, 2014; Tahanisaz and Shokuhyar, 2020; Tsafarakis et al., 2018; Tsaur et al., 2002; Wang et al., 2011; Wen et al., 2014; Wen and Lai, 2010; Wong and Chung, 2007)
Entertainment	(Aksoy et al., 2003; Balcombe et al., 2009; Chang and Yeh, 2002; Chen, 2008; Chou et al., 2011; De Jager et al., 2012; Gilbert and Wong, 2003; Hu and Hsiao, 2016; Hussain et al., 2015; Jiang and Zhang, 2016b; Keshavarz Ghorabaee et al., 2017; Kos Koklic et al., 2017; Leong et al., 2015; Li et al., 2017; Lim and Tkaczynski, 2017; Liou et al., 2011a, 2011c; Liou and Tzeng, 2007; Lucini et al., 2020; Medina-Muñoz et al., 2018; Namukasa, 2013; Pakdil and Aydin, 2007; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Tahanisaz and Shokuhyar, 2020; Tsafarakis et al., 2018; Tsaur et al., 2002)
In-flight internet/phone services	(Aksoy et al., 2003; Chen, 2008; Gilbert and Wong, 2003; Hussain et al., 2015; Li et al., 2017; Pakdil and Aydin, 2007; Tahanisaz and Shokuhyar, 2020)
Baggage delivery	(Aksoy et al., 2003; Atalay et al., 2019; Basfirinci and Mitra, 2015; De Jager et al., 2012; Jiang and Zhang, 2016b; Kuo, 2011; Leong et al., 2015; Lim and Tkaczynski, 2017; Liou et al., 2011a, 2011c; Liou and Tzeng, 2007; Medina-Muñoz et al., 2018; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Tsafarakis et al., 2018; Wong and Chung, 2007)
Handling services	(Agarwal and Gowda, 2020; Atalay et al., 2019; Basfirinci and Mitra, 2015; Chang and Yeh, 2002; Chen, 2008; Erdil and Yildiz, 2011; Espino et al., 2008; Gilbert and Wong, 2003; Hu and Hsiao, 2016; Hussain et al., 2015; Jiang and Zhang, 2016b; Keshavarz Ghorabaee et al., 2017; Kuo, 2011; Leong et al., 2015; Liou et al., 2011c, 2011a; Liou and Tzeng, 2007; Martín et al., 2011; Namukasa, 2013; Pakdil and Aydin, 2007; Park, 2007; Park et al., 2006, 2004; Shah et al., 2020; Suki, 2014; Tahanisaz and Shokuhyar, 2020; Tsaur et al., 2002; Wang et al., 2011; Wong and Chung, 2007)
Frequent flyer program	(Aksoy et al., 2003; Atalay et al., 2019; Basfirinci and Mitra, 2015; Chen, 2008; De Jager et al., 2012; Gilbert and Wong, 2003; Lim and Tkaczynski, 2017; Liou and Tzeng, 2007; Lu and Ling, 2008; Martín et al., 2011; Namukasa, 2013; Park et al., 2004; Shah et al., 2020)
Pricing	(Aksoy et al., 2003; Balcombe et al., 2009; Espino et al., 2008; Farooq et al., 2018; Kos Koklic et al., 2017; Lucini et al., 2020; Martín et al., 2011; Medina-Muñoz et al., 2018; Park, 2007; Park et al., 2006; Shah et al., 2020; Tsafarakis et al., 2018; Wang et al., 2011; Wen et al., 2014; Wen and Lai, 2010)

2.3 Data collection

As in the case of the airports' related studies, also in airlines' related literature, differences emerge in terms of type of survey, choice of respondents, methods of data collection and the type of data. In this case, it is even more complex to organize the data collection and choose the time

and place for collecting data as regards for the airports' related studies, because for investigating on airport services the interviews are generally carried out at airport at the departure gates, where passengers are waiting the flight and have an opinion of the airport services that they already received or experienced. On the contrary, airlines services cannot be judged before flying, and a particular attention have to be dedicated to this issue.

The major part of the studies focuses on data collected by RP surveys addressed to departing passengers. Among these studies analysing the services provided by the airlines, there is a greater variety in terms of data collection. Most of them analyse data collected at the airport (Atalay et al., 2019; Chang and Yeh, 2002; Chen and Chang, 2005; Erdil and Yildiz, 2011; Hu and Hsiao, 2016; Jiang and Zhang, 2016b; Kuo, 2011; Leong et al., 2015; Liou et al., 2011a, 2011c; Liou and Tzeng, 2007; Lu and Ling, 2008; Park, 2007; Park et al., 2006; Wu and Cheng, 2013). Some authors referred to departing passengers at the boarding gates or anyway in the departure area (Aksoy et al., 2003; Farooq et al., 2018; Gilbert and Wong, 2003; Han et al., 2012; Hussain et al., 2015; Kuo and Jou, 2014; Medina-Muñoz et al., 2018; Namukasa, 2013; Shah et al., 2020; Tahanisaz and Shokuhyar, 2020; Tsafarakis et al., 2018; Wang et al., 2011). In this case, the collected opinions have to necessarily refer to a previous flight, given that in the departure area passengers are waiting the flight and therefore they have not travelled yet. For this reason, the questionnaires can be addressed only to people who purchased a ticket of flight or either considered the analysed airline in the past; as an example, Wu and Cheng (2013) considered the passengers who had used the airline services during the past 12 months. Only a few studies analysed data collected during the flight (Chou et al., 2011; Li et al., 2017; Pakdil and Aydin, 2007). Instead, for the studies by Liou et al. (2011c, 2011a), the questionnaire was distributed at the boarding gate of several airports and collected at the exit doors after the baggage claim. In these specific cases, passengers could refer to the current flight. Generally, when the survey takes place in the airport or during the flight, the interviews are conducted face-to-face (Atalay et al., 2019; Chang and Yeh, 2002; Erdil and Yildiz, 2011; Kuo and Jou, 2014; Kuo, 2011; Namukasa, 2013; Shah et al., 2020; Tsafarakis et al., 2018), or by using a self-administered questionnaire (Chen and Chang, 2005; Chou et al., 2011; Farooq et al., 2018; Gilbert and Wong, 2003; Han et al., 2012; Hu and Hsiao, 2016; Hussain et al., 2015; Jiang and Zhang, 2016b; Leong et al., 2015; Liou et al., 2011c, 2011a; Liou and Tzeng, 2007; Lu and Ling, 2008; Medina-Muñoz et al., 2018; Pakdil and Aydin, 2007; Park et al., 2006; Tahanisaz and Shokuhyar, 2020; Wang et al., 2011; Wu and Cheng, 2013).

Other studies analysed data collected from self-administered questionnaires compiled neither in the airport nor during flight. Specifically, Tsaur et al. (2002) sent out the questionnaire to licensed tour guides in order to have a greater chance to reach respondents who had the experience of traveling with all airlines to be evaluated. Park (2007) and Park et al. (2004) distributed the questionnaire to Koreans who had undertaken at least one international flight in the previous 12 months. De Jager et al. (2012) collected data by South African and Italian tourists who have travelled by domestic airlines during the previous 12 months through face-to-face interviews. The study by Suki (2014) analysed data from residents who had flown regularly with a certain company in the preceding six months. Basfirinci and Mitra (2015) published the survey online, and in order to attract many participants, the links to the survey were sent by email to people (consisting of colleagues and the staff of national airline companies) requesting their participation. Also in the work by Kos Koklic et al. (2017) an online survey was adopted in which people reported the opinions about a specific airline for the most recent travel within the past 12 months. Whereas Keshavarz Ghorabaee et al. (2017) sent an email to tour leaders and requested them to cooperate with them in evaluation process if they have had some experience with the considered airlines. Lim and Tkaczynski (2017) requested to a sample of students only their expectations about the services provided by the airlines.

Wanting to differentiate the studies in terms of kind of opinions collected through the questionnaire, it can be said that the types of data found in the literature are: (1) satisfaction/perceptions data; (2) importance/expectations data; (3) behavioural intentions. Specifically, there are studies investigating only on perceptions or satisfaction with the service (Farooq et al., 2018; Jiang and Zhang, 2016b; Leong et al., 2015; Li et al., 2017; Liou and Tzeng, 2007; Park, 2007; Tsafarakis et al., 2018; Tsaur et al., 2002; Wu and Cheng, 2013). In other words, people provide their judgments on the used services indicating their level of satisfaction with the various service aspects, or providing a rate on the performance of the service aspects. In a respectable number of studies, in addition to the perceptions about service aspects, passengers are requested to express what they expect from the service and therefore to provide a rate of importance on each analysed service aspect (Aksoy et al., 2003; Atalay et al., 2019; Basfirinci and Mitra, 2015; Chang and Yeh, 2002; Chen and Chang, 2005; Chou et al., 2011; Erdil and Yildiz, 2011; Hu and Hsiao, 2016; Hussain et al., 2015; Keshavarz Ghorabaee et al., 2017; Kuo, 2011; Liou et al., 2011a; Pakdil and Aydin, 2007; Park et al., 2004; Tahanisaz and Shokuhyar, 2020; Wong and Chung, 2007). On the other hand, some studies investigated just the expectations/importance (De Jager et al., 2012; Gilbert and Wong, 2003; Lim and Tkaczynski, 2017;

Medina-Muñoz et al., 2018). A particular analysis was done by Lu and Ling (2008) and by Wang et al. (2011). The first ones asked to respondents to evaluate each service attribute by the gap between their experiences and expectations, using a five-point descending Likert scale staring with 'Much better than expected''. The second ones requested respondents to express the degree of influence of some criteria on the other criteria by using a five-point scale ranging from "no influence" to "direct influence". Whereas a restricted number of studies investigated on satisfaction and/or expectations together with the passengers' behavioural intentions (Agarwal and Gowda, 2020; Han et al., 2012; Kos Koklic et al., 2017; Kuo and Jou, 2014; Namukasa, 2013; Park et al., 2006; Shah et al., 2020), which represent their intentions to reuse the service or to recommend it to other people, and so on. The studies based on the collection of behavioural intentions are more complete and innovative and need more sophisticated approaches of analysis, and for this reason they are fewer than the others.

As regards the adopted scales, they are very variegated in terms of number of levels but also of the kind of levels. The major part of the studies refers to evaluation scales on 5 levels (Agarwal and Gowda, 2020; Atalay et al., 2019; Basfirinci and Mitra, 2015; Chen and Chang, 2005; Chou et al., 2011; Erdil and Yildiz, 2011; Han et al., 2012; Hu and Hsiao, 2016; Hussain et al., 2015; Jiang and Zhang, 2016b; Kos Koklic et al., 2017; Li et al., 2017; Liou et al., 2011a, 2011c; Namukasa, 2013; Pakdil and Aydin, 2007; Shah et al., 2020; Tsafarakis et al., 2018; Tsaur et al., 2002). In some studies, the evaluation scales go from "very poor" (or "very bad") to "very good" (or "excellent"). In other studies, the evaluation scales are based on satisfaction levels from "strongly dissatisfied" to "strongly satisfied" or also from "very unsatisfied" to "very satisfied". As an example, Tsafarakis et al. (2018) asked passengers to express a level of satisfaction with the total trip experience on an ordinal qualitative scale with five levels (very satisfied, somehow satisfied, neutral, somehow unsatisfied, very unsatisfied); on the other hand, Li et al. (2017) asked passengers to evaluate each item of in-flight services expressing a rate on a five-point scale anchored from 1 (very low) to 5 (very high). Regarding the importance scale, the proposed levels generally range from "least important" (or "not important at all") to "most important" (or "very important"). Finally, in a respectable number of studies the adopted evaluation scales are on 7 levels (Aksoy et al., 2003; De Jager et al., 2012; Farooq et al., 2018; Kuo, 2011; Leong et al., 2015; Medina-Muñoz et al., 2018; Park, 2007; Park et al., 2006, 2004; Wu and Cheng, 2013). A small number of studies adopted scales on a number of points different from 5 or 7: Chang and Yeh (2002), Liou and Tzeng (2007) and Tahanisaz and Shokuhyar (2020) adopted a numerical scale ranging from 0 to 10; Gilbert

and Wong (2003) choose a 8-point numerical scale; Keshavarz Ghorabaee et al. (2017) used a 9-point Likert scale;

Finally, a few studies address the investigation on service quality by analysing data collected through SP surveys. Specifically, in Espino et al. (2008) and in Martín et al. (2011) the individuals were asked to choose between two hypothetical airlines that differed in terms of services provided, by considering the Gran Canaria-Madrid route as specific case study. In both cases, the interviews took place at the Gran-Canaria Airport. Wen et al. (2014) and Wen and Lai (2010) asked air travellers to choose one of the airlines serving their most recent international trips. Also in these cases, the data were collected at the airport. Only Balcombe et al. (2009) delivered the survey instrument by internet for collecting travellers' preferences on the in-flight services provided by charter airlines on a flight of 4.5–5.5 h.

Only in recent years, traditional surveys seem to have been accompanied by more modern data collection. In fact, the most recent studies use the opinions of users left through reviews on online platforms such as social networks (Kumar and Zymbler, 2019; Lucini et al., 2020; Park et al., 2020).

2.4 Data analysis techniques and models

The airlines operate in a context of strong competition, which over the years has become increasingly intensified. For this reason, in the literature concerning airlines' services, the main focus is often helping airlines to better understand how the customer views their services relative to their competitors. The quality of airlines' service is difficult to describe and measure due to its heterogeneity, intangibility and inseparability (Chang and Yeh, 2002; Erdil and Yildiz, 2011). In fact, as shown above, airlines' service quality consists not only of tangible attributes, but also intangible and subjective attributes such as safety, comfort, which are difficult to measure and analyse accurately (Chou et al., 2011; Tsaur et al., 2002). There is a large variety of methodologies proposed and adopted for analysing the services, and these can be more or less complex. From the studies selected for the proposed literature review, the most common data analysis techniques and models are: regression models (Han et al., 2012; Jiang and Zhang, 2016b; Lu and Ling, 2008; Namukasa, 2013); EFA and/or CFA (Aksoy et al., 2003; De Jager et al., 2012; Erdil and Yildiz, 2011; Lim and Tkaczynski, 2017; Medina-Muñoz et al., 2018; Shah et al., 2020); SEM (Chen, 2008; Farooq et al., 2018; Hussain et al., 2015; Kos Koklic et al., 2017; Kuo and Jou, 2014; Leong et al., 2015; Park et al., 2006; Suki, 2014); MCDM (Chang and Yeh, 2002; Keshavarz Ghorabaee et al., 2017; Kuo and Liang, 2011; Li et al., 2017; Liou et al., 2011a, 2011c; Tsafarakis et al., 2018; Tsaur et al., 2002);

and Kano model (Basfirinci and Mitra, 2015; Hu and Hsiao, 2016; Tahanisaz and Shokuhyar, 2020).

Generally, when the authors have chosen a regression model for their analysis the aim is examining the influence of airline service quality on passenger satisfaction and loyalty. As an example, Han et al. (2012) focused their study on passengers' perceptions of airline lounges, and according to a multiple regression analysis, they found that food and beverage service was the strongest predictor of overall satisfaction and revisit intentions. Jiang and Zhang (2016b), through a probit model, found that ticket pricing had a positive and significant effect on passengers' overall satisfaction and in turn strengthened customer loyalty among leisure travellers, but achieved no impact on the satisfaction and loyalty of business passengers. According to this, they conclude that different marketing strategies may be used. Also Namukasa (2013) came to the same conclusion, and the author's findings indicated that pre-flight, in-flight and post-flight services had a significant effect on passenger satisfaction. As regards the EFA, this analysis is generally conducted in order to determine the service dimensions and eventually the relationships among them. Specifically, in the study of Aksoy et al. (2003) the key airline service dimensions were identified separately for foreign airline and domestic airlines passengers. Fundamental service dimensions based on the passengers' expectations varied between the two groups. Food and beverage services, personnel, cabin features, Internet services, in-flight activities, country of origin and promotion, punctuality, speed, and aircraft were found to be the nine underlying dimensions of airline services for foreign airline passengers. On the contrary, domestic airline passengers displayed a more loosely defined service package with a clear emphasis on the price factor. Another comparison has been made in the study of De Jager et al. (2012) whose results show that a very similar ranking structure of service dimensions emerges between the South African and Italian passengers. In both cases, timeliness of flights was rated as most important. Second most important are in-flight service elements. The third most important dimensions are convenience of booking and the offering of booking facilities via the internet. Less important is the country origin of the airline. Finally, the results obtained by Medina-Muñoz et al. (2018) revealed the existence of eight categories of attributes that are important for airline passengers. The most important categories were: "safety and punctuality", "ticket price", and "attention and service during the customer journey".

As it happens for the airport related literature, also for airlines' there is a large number of studies oriented toward SEM. Specifically, in the selected studies, the principal aim is the analysis of the relationships between airlines' service quality, passengers' satisfaction and other latent constructs.

In Park et al. (2006) significant relationships between in-flight service, employee service, passenger satisfaction, airline image, value, and behavioural intentions were found. In particular, in-flight service and employee service were found as significant drivers of passenger satisfaction, which was directly related to pricing (value), airline image, and passengers' future behavioural intentions. Also in Chen (2008) the direct influences of both perceived value and overall satisfactions on passengers behavioural intentions were found. Furthermore, the results of the study conducted by Suki (2014) revealed that the relationship between customer satisfaction with airline service quality and 'word-of-mouth' recommendations is a consistent one. Moreover, customer satisfaction is widely influenced by empathy. Finally, consistent results have been obtained by Hussain et al. (2015), Kos Koklic et al. (2017) and Farooq et al. (2018). According to them, service quality, perceived value, and brand image have a positive significant impact on customer satisfaction, which can in turn lead to brand loyalty.

When the objective is to help airlines better understand how the customer views their services relative to their competitors, the most adopted methodology is the MCDM analysis. In other words, through this technique the authors were not only able to compare several airlines with each other and determine a ranking of the alternatives, but they were also able to identify the most influential aspects that emerge from the comparison. Some of these studies (Chang and Yeh, 2002; Kuo, 2011; Li et al., 2017; Tsaur et al., 2002) combined the fuzzy theory with the most common MCDM techniques (e.g. AHP and TOPSIS). Other modified version of the classical MCDM analysis are proposed also by Keshavarz Ghorabaee et al. (2017) and Liou et al. (2011a, 2011c). Finally, Tsafarakis et al. (2018) employed MUSA, an approach that combines MCDM analysis for assessing customer satisfaction and IPA for suggesting the critical service that need an improvement.

Otherwise, when the data were collected through SP survey, the most common proposed models are the discrete choice models (Balcombe et al., 2009; Espino et al., 2008; Martín et al., 2011; Wen et al., 2014). As an example, Espino et al. (2008) and Martín et al. (2011) analysed users' preferences by estimating MultiNomial Logit (MNL) and Mixed Logit (ML) models. Wen et al. (2014) and Wen and Lai (2010) proposed a generalized logit model and a LC model respectively. Instead, Balcombe et al. (2009) use the Bayesian methods to estimate a ML specification.

A different kind of methodology has been proposed by the study concerning reviews taken from web. In these cases, a recurring technique is the sentiment analysis (Kumar and Zymbler, 2019; Lucini et al., 2020) applied for identifying and calculating the sentiment strengths of adjectives that are normally used by airlines' customers in their online reviews.

2.5 Summary

From the analysis of the literature review concerning the airlines' service quality, the first thing that emerges is definitely the great variety of services provided in all the phases characterizing a trip by air (before, during and after the flight), that makes difficult to summarize the phenomenon in a few dimensions.

The main important difference between the studies analysing airport services and those analysing airlines services regards data collection. Although in both cases most of the studies refer to data collected at the airport, in the case of airlines if the interviews are effected while passengers wait the flight departure, which is a good moment for collecting information, passengers have not used yet the services provided by the airlines during the flight. Therefore, in this case the major part of studies analyse data collected before the flight departure even if referred to a previous flight, or data collected online concerning a travel made recently. Generally, a period within the past six or twelve months is considered, because a larger time period would result too far for remembering well the flight and provide reliable information and opinions.

Among the selected studies, many differences were registered also in terms of evaluation scales adopted for collecting passengers' opinions. The major part of the studies adopted 5-point Likert or verbal scale, followed by those that used similar evaluation scale but on 7-points. As regards the kind of data collected, the authors that analysed airlines' service quality on the basis of both perception (or satisfaction) and expectations (or importance) are more than other.

Regarding the proposed methodologies for analysing the data, it can be highlighted that the most applied techniques are the SEM and MCDM analyses. These last, in particular, are often combined with other techniques.

From the analysis of the literature, it can be concluded that although in the last 20 years the researches in the field of airlines' service quality have become increasingly numerous, this topic needs further investigation and developments.

Part 2 – Analysis of Airport services

Chapter 3

The airport services' study case: the International Airport of Lamezia Terme

3.1 Introduction

The Lamezia Terme International airport has been considered as case study for analysing the airport services. The airport is the principal one of the Calabria region, and it is among the first twenty Italian airports. Due to its position, it can be considered one of the main reference point for traveling to and from the southern Italy.

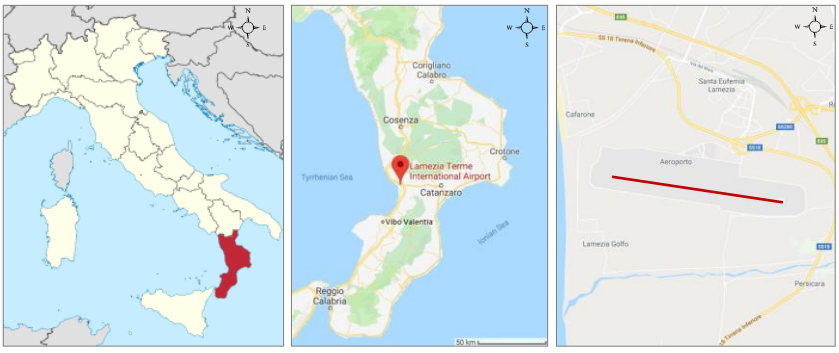
The Lamezia Terme International airport is managed by the S.A.CAL. S.p.a. (*Società Aeroportuale Calabrese* – Calabrian Airport Company), which also manages the other two regional airports: Reggio Calabria airport and Crotone airport. In order to promote the improvement and contrast the inefficiencies, the S.A.CAL. S.p.a. ensures a constant monitoring of services provided by taking into account indicators related to the actual events that occur inside the terminal and indicators based on users' perceptions. In order to make that, the S.A.CAL. S.p.a carried out CSSs every year inside the terminal.

Thanks to our cooperation with the managing company of the Lamezia Terme International airport, it was possible to get the data necessary for the development of this research. Specifically, data collected from 2012 to 2016 have been adopted for the subsequent analyses.

The following sections present a description of the airport services' study case and of its managing company, the CSS carried out inside the terminal annually, and to the collected data. The chapter ends with the discussion on the preliminary statistics of the datasets, which are object of the modelling described in the next chapter.

3.2 The International Airport of Lamezia Terme

The Lamezia Terme International airport is located in the middle of Calabria, a region of the southern Italy (Figure 3.1). It is connected to the main Calabrian cities by road links and railway. Specifically, it is easily reachable by the motorway A2, and by the highways SS280 and SS18. The nearest Calabrian cities are about 35 km away from the airport and can be reached by car in less than 30 minutes, whereas the most distant ones are more than 120 km away and can be reached in over an hour. The principal railway junction is the Lamezia Terme railway station that is connected to the airport by buses and taxies. Besides, several public transport companies provide scheduled services to link the airport with the main cities by bus. The Lamezia Terme airport has two road accesses: one access conducts to the passenger terminal, and the other one to the cargo terminal. Airport parking areas are located in front of both accesses and have over 1,600 parking spaces. The parking area in front of the passengers' terminal is perfect for short stopovers, while the area in front of the cargo terminal is cheaper and more convenient for long-term parking.



(a) (b) (c)

Figure 3.1. Lamezia Terme International airport location.

The airport runways develop from west to east, and they are located south of the terminal infrastructure (Figure 3.1(c), red line). The recently completed extension of the runway is now on use. With a length of over 3,000 meters, the runway allows non-stop routes to intercontinental destinations. Over the years, passengers' air traffic has considerably developed at the Lamezia Terme International airport. The graph reported in Figure 3.2 shows the air traffic trends over a ten-years period (2010-2019) expressed in millions of passenger movements (Assaeroporti, 2010-2019). By considering the period from 2010 to 2011, the passengers' movements

increased from 1,916,187 to 2,301,408 (+20%) and consequently, at the end of the year, the airport infrastructure was expanded. Due to the works, not all the airlines were able to operate, and as a result, the passengers' movements fell gradually until 2013. Further extensions of the airport's infrastructures were carried out after the peak of 2014, resulting as it is today. Later a slight decrease registered from 2014 to 2015 (-3%), the passengers' traffic at the Lamezia Terme International airport rose gradually until 2017. In the last two years, there has been a constant annual increase +8%. These extension works were accompanied by an increase in the number of operating airlines at the airport. Currently, about 40 different airlines operate at the Lamezia Terme International airport, and connect the region with several locations in Italy and abroad by both scheduled and charter flights. Among the operating airlines, the low cost carriers have played an important role above all in the increase of the number of direct connections to European destinations.

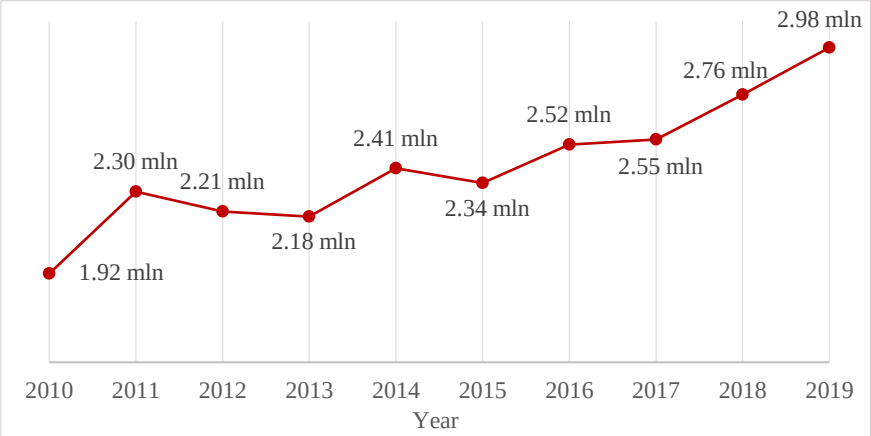


Figure 3.2. Air traffic in millions of passengers' movements at the Lamezia Terme International airport from 2010 to 2019.

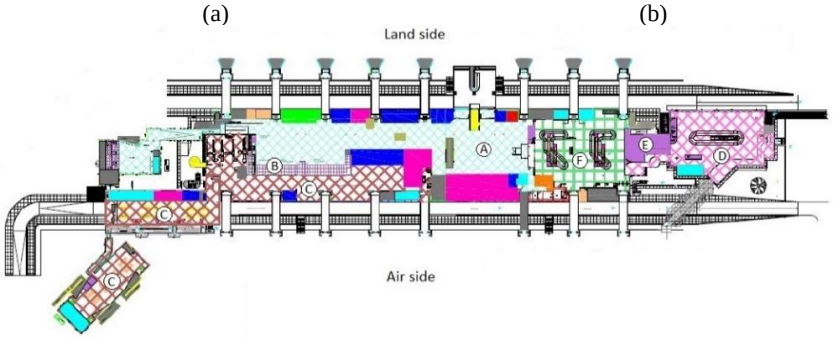
Scheduled domestic traffic has been centred on the airports of the main Italian cities (e.g. Rome, Milan, Turin, Verona and Treviso). International scheduled flights were primarily concentrated in the summer months with destination to many European cities, such as Athens, Berlin, Brussels, Copenhagen, Frankfurt, London, Madrid, Munich, Prague, Rotterdam, Stockholm, Vienna, Warsaw, Zurich, and the intercontinental link with Toronto (S.A.CAL., 2019).

Currently, the passenger terminal is spread over three floors and has six gates. At the ground floor and on the second level there are only offices, toilets and a restaurant. The first level (Figure 3.3(c)) is the most important because all the operations related to passenger movements take place there.

Departure area is located on the west side of the terminal, where an area for the security checks is placed before the gates. Check-in counters (Figure 3.3(b)) and ticket offices are located in the central part of the terminal, in front of the main entrance door of the airport. Also, shops, restaurants and toilets are positioned there. The arrivals are located on the east side of the terminal, with an area for domestic flights including two baggage delivery belts, and another for international flights including one baggage delivery belt and an area for customs checks.

The S.A.CAL. S.p.a. manages the airport's infrastructure under the control of ENAC (*Ente Nazionale per l'Aviazione Civile* – Italian Civil Aviation Authority). Its main tasks are to coordinate the several activities of working operators in the terminal, and to maintain adequate standards of service and airport safety.

(a) (b)



(c)

Figure 3.3. Passenger terminal of the Lamezia Terme International airport: (a) external view; (b) internal view; (c) first level layout (S.A.CAL., 2019).

S.A.CAL. performs several and diversified activities, ranging from economic aspects to engineering ones. Broadly, the S.A.CAL. has the main task of organizing the airport activities in such a way as to guarantee an efficient use of economic resources. Specifically, as regards the air side, it

plans and coordinates the development of airport infrastructures on the basis of the traffic. It assigns the apron stands to aircrafts and monitors the movement of other vehicles and personnel on the same apron. Moreover, it checks the flight infrastructures in order to guarantee safety, and to monitor the level of service and risk conditions. As regards the land side, the S.A.CAL. deals with the security check of departing passengers, baggage and freights, as well as the management of lost items. Finally, regarding the activities and the services provided inside the terminal, the company ensures that they are carried out by maintaining adequate levels of quality. On this matter, the S.A.CAL. must publish the "Service Charter" according to the directives given by the Ministry of Infrastructure and Transport and by ENAC (Dlgs 96/05 Art. 705, 2005). Specifically, in the document GEN 06 (ENAC, 2014), entitled "Quality of air transport services: the standard service charters for airport managers and airlines", ENAC establishes the criteria and procedures for implementing the service charters of the airport operators (for both passengers and cargo sectors) and of the airlines. The ENAC document GEN 06 is based on the directive of the president of the council of ministers dated 27 January 1994, also known as the "Ciampi-Cassese Directive" (D.P.C.M. 27.01.1994), and on the subsequent decree of the president of the council of ministers of 30 December 1998 that established the reference scheme for the Service Charter of public transport sector (D.P.C.M. 30.12.1998).

3.3 The collection of the data

Every year the S.A.CAL S.p.a carries out the CSSs in order to collect the passengers' perceptions about the quality of services provided by the terminal. The surveys are conducted by a dedicated staff through face-to-face interviews addressed to the departing passengers who are waiting for embark. The motivation behind the choice to interview the departing passengers is very simple. This kind of passengers are those who, being at the boarding gate, were able to test all the services provided by the terminal and at the same time have the possibility to take a few minutes to answer questions. The tool used by the staff for carrying out the survey is a paper questionnaire. Over the years the questionnaire has undergone changes; however, the structure has remained unchanged and characterized by two parts: the first part with the aim to collect some passengers' characteristics, the second part containing all the questions related to the evaluation of the service aspects. Specifically, passengers were asked to express a judgement on each service attribute and on the overall service. The adopted evaluation scale is an ordinal verbal scale, and it is composed of five judgements, from

"Very poor" to "Excellent", and of an additional response "Service not used". At the end of each year, the collected data are processed and analysed. The obtained results are published by the S.A.CAL S.p.a in its service charter, in accordance with the specifications of ENAC on the Charter of Airport Standard Services. Thanks to the cooperation with the S.A.CAL. S.p.a, it was possible to obtain the data collected from the CSS, useful for this research. The data collected from 2012 until the end of 2016 were analysed and are object of this work. Considering the changes made to the questionnaire over the years, the data were analysed separately by dividing them into two datasets. The first dataset for the 2012-2014 three-years period, and the second for the 2015-2016 two-years period.

In the first part of the questionnaire used until 2014, some passengers' and travel characteristics are requested. A first multiple choice question concerns the trip purpose, and the respondent can choose among five alternatives: (1) business; (2) leisure; (3) study; (4) medical care; (5) other. Subsequently the interviewee is asked if he/she is traveling alone or not. Then there is an open-ended question on the country of origin and a multiple choice one about the mode for reaching the airport: (1) car parked in the airport; (2) car dropping-off the passenger; (3) taxi/rental; (4) bus/shuttle. Finally, the time of arrival at the airport and that expected for the flight departure are required. This information allows to calculate the earliness of arrival before the departure and, therefore, the dwell time in the terminal.

In the revised version of the questionnaire (see Appendix A), the first part has been extended by adding further questions. Specifically, the gender, the sex and the level of education were added to the country of origin question, in order to collect further personal characteristics about the interviewee. All of them are multiple choice questions. As regards the age, five age group are provided: (1) less than 30; (2) between 31 and 40; (3) between 41 and 50; (4) between 51 and 60; (5) more than 60. For level of education, the interviewee can choose among three alternatives: (1) lower secondary; (2) upper secondary; (3) university. To better characterise the passenger's travel experience, questions concerning the flight destination and the flight type were added. Starting from 2016, S.A.CAL S.p.a decided to add a question about the flight type, and one related to the number of air travel made by the interviewee in the last 12 months. Both are multiple choice questions. For the first one there are three answers' alternatives: (1) low cost; (2) legacy; (3) charter. For the second one the alternatives are: (1) one time; (2) more than one time. In Table 3.1, a brief comparison of the first parts of both questionnaires is reported.

In both versions of the questionnaire, the second part begins with a brief description of the evaluation scale, and the questions related to the evaluation

of the service aspects are organized in groups including one or more attributes. The questionnaire used until the end of 2014 contains six groups named: modal integration, information, airport staff, security, cleanliness, and comfort. It ends with a question on the evaluation of the overall service. In the revised version of the questionnaire (see Appendix A) there are some differences in the existing group of service attributes. Specifically, three new groups of facilities were added: ticketing facilities; additional facilities and food facilities. The latter is preceded by a multiple choice question relating to the type of food facility used: (1) coffee bar; (2) restaurants; (3) none. In Table 3.2 the service attributes evaluated by each questionnaire are reported.

Table 3.1. Comparison of the first parts of the questionnaires.

	Questionnaire 2012-2014	Questionnaire 2015-2016
Personal informations	Country of origin	Country of origin
		Gender
		Age
		Level of education
Travel characteristics	Trip purpose	Trip purpose
	Mode for reaching the airport	Mode for reaching the airport
	Travelling alone	Travelling alone
	Time of arrival at the airport	Time of arrival at the airport
	Flight departure time	Flight departure time
		Flight destination
		Flight type*
		Flights in the last 12 months*

*Questions added from 2016

Table 3.2. Service attributes evaluated by the questionnaires.

	Questionnaire 2012-2014	Questionnaire 2015-2016
Modal integration	Road links	
		Road signposting
Information	Flight information display	Flight information display
	Terminal signposting	Terminal signposting
	Announcements	
		Information accessibility
		Airport website
Airport staff	Infopoint and security staff	Infopoint and security staff
Ticketing facilities		Waiting time at check-in
		Ticket office
Security	Baggage and passenger control	Baggage and passenger control
	Personal security	Personal security
Cleanliness	Cleanliness of terminal	Cleanliness of terminal

	Cleanliness of toilets	Cleanliness of toilets
Comfort	Terminal air conditioning Lighting inside the terminal Noise inside the terminal	Terminal air conditioning
		Luggage trolleys Escalators/lifts
Additional facilities		Charging stations Airport wi-fi Snack machines Shop products
Food facilities		Food choices Food prices Food staff
Overall service	Overall service	
		Terminal comfort Terminal reliability

3.4 Preliminary statistics

Even if for subsequent modelling the data will not be analysed by year, the preliminary statistics reported below are representative of each year in order to better characterize the case study and its evolution over the time. From 2012 to 2016, the number of collected completed questionnaires is about 1,100 per year. The frequencies of socio-economic and travel experience characteristics are reported in Table 3.3.

By considering the country of origin there has been a progressive increase of passengers from non-European countries and from Europe but not from Italy. As expected, also the number of passengers traveling for leisure has increased over the years, confirming more and more the strong tourist vocation of the airport. This could also be highlighted by observing that almost all passengers do not travel alone. Most of the passengers arrive at the airport by car and the highest percentage values relate to the option "Car dropping-off the passenger", that is, most of the passengers prefer to be driven by someone to the airport. By analysing the time of arrival before the flight, most of the passengers arrive in the airport from 1 to 2 hours before the flight, followed by a high percentage of those arriving more than 2 hours before.

As regards the information available only for the two-year period from 2015 to 2016, there are no relevant differences in the sample composition. Apart from gender, all the passengers' characteristics seem to have the same trend. In 2015 females (55%) were more than males (45%), instead in 2016, the sample is divided equally between the two genders. In both years, about

40% of users are aged from 30 to 50 and, and most of them (more than 60%) are from Italy. Since Lamezia Terme is not a hub airport, half of the trips have national destinations. However, thanks to the increase in direct connections with international destinations, in 2015, 38% of passengers flew to other European countries and in 2016 this percentage rose above 40%.

Table 3.3. Frequencies by year of sample socio-economic and travel characteristics.

Sample characteristics		2012	2013	2014	2015	2016
Gender	Male				44.8	50.9
	Female				55.2	49.1
Age	Less than 30				13.0	13.9
	between 31 and 40				24.2	22.1
	between 41 and 50				18.1	15.7
	between 51 and 60				12.1	12.7
	more than 60				9.7	9.1
	No response				22.9	26.5
Level of education	Lower-secondary				9.2	4.6
	Upper-secondary				31.9	24.9
	University				25.7	21.8
	No response				33.2	48.7
Country of origin	Italy	86.0	80.1	69.8	65.0	62.2
	European countries	8.9	14.7	18.2	24.9	29.6
	Other	5.1	5.2	12.0	10.1	8.2
Flight destination	Italy				50.6	49.1
	European countries				37.8	42.8
	Other				11.6	8.1
Trip purpose	Business	18.7	20.4	18.7	18.1	15.2
	Leisure	53.8	64.3	71.3	73.8	71.8
	Other	27.5	15.3	10.1	8.1	13.0
Travelling alone	Yes	21.2	10.5	4.4	4.1	9.1
	No	78.8	89.5	95.6	95.9	90.9
Mode for reaching	Car parked in the	20.9	17.8	19.5	15.6	16.5
	Car dropping-off the	53.5	53.1	49.9	48.9	45.7
	Taxi/rental	14.9	18.1	18.6	27.1	23.9
	Bus/shuttle	10.7	11.0	12.1	8.4	13.9
Time of arrival	Less than 1 hour before	9.9	13.3	6.7	7.1	11.0
	From 1 to 2 hours	58.1	51.6	50.0	53.2	46.5
	More than 2 hours	32.0	35.1	43.3	39.7	42.5
Flight type	Low cost					50.5
	Legacy/charter					38.2
	No response					11.3
Flights in the last 12 months	One flight					66.7
	More flights					29.6
	No response					3.7

The last two characteristics shown in Table 3.3 are only present for 2016. In that year, half of the passengers travel with a low-cost flight and almost 40% with a legacy or a charter carrier. Finally, most passengers (67%) have flown only one time in the last 12 months before the interview.

Regarding the passengers' perceptions about the quality of the services provided by the terminal, the five verbal ratings are transformed in numerical ones, where 1 corresponds to "very poor", 2 to "poor", 3 to "fair", 4 to "good", and 5 to "excellent". The average values obtained are reported in Table 3.4, divided by year.

Table 3.4. Average ratings by year about each airport service quality item.

Service quality item	2012	2013	2014	2015	2016
Road links	2.75	3.04	3.31		
Road signposting				3.82	3.79
Flight information display	3.83	3.69	3.71	3.99	3.98
Terminal signposting	3.88	3.81	3.78	3.97	3.95
Announcements	3.83	3.68	3.64		
Information accessibility				4.06	4.02
Airport website				3.88	3.91
Infopoint and security staff	4.17	4.17	4.17	4.07	4.02
Waiting time at check-in				4.27	4.14
Ticket office				3.94	4.05
Baggage and passenger control	4.23	4.11	4.20	4.16	4.22
Personal security	4.17	4.12	4.25	4.16	4.11
Cleanliness of terminal	3.97	3.86	3.80	3.95	3.83
Cleanliness of toilets	3.83	3.77	3.61	3.77	3.49
Terminal air conditioning	3.79	3.82	3.88	3.83	3.67
Lighting inside the terminal	4.10	4.06	4.09		
Noise inside the terminal	4.08	3.96	4.04		
Luggage trolleys				4.18	3.94
Escalators/lifts				3.77	3.93
Charging stations				3.35	3.98
Airport wi-fi				3.13	3.75
Snack machines				3.68	3.54
Shop products				3.74	3.85
Food choices				3.87	3.95
Food prices				3.40	3.50
Food staff				3.99	3.99
Terminal comfort				3.94	3.82
Terminal reliability				3.98	3.94
Overall service	4.02	3.91	3.98		

The results confirm that almost all the services provided inside the terminal are considered as of good quality (averages values over 3.5). During

the three-year period from 2012 to 2014, the service attribute that recorded the lower average ratings is the attribute relating to road links. However, in the following years road signposting received fairly positive evaluations. As regards the information system inside the terminal, all the related service aspects have always been rated very positively. Moreover, in the transition from 2014 to 2015 there has been always an improvement, probably due to the modernization of the terminal carried out in those years. The service aspects with the highest average ratings (greater than or equal to 4.0) are those concerning airport staff, ticketing facilities and security in general. Every year, the cleanliness of the terminal is rated slightly better than the cleanliness of the toilets. In the case of comfort, instead, the air conditioning is the service aspect with lower average values. Regarding the additional facilities, there are no relevant differences observed between 2015 and 2016. In general, a slight improvement in the food choices and food prices items can be observed. Finally, even if in general the overall service aspects can be considered very well valued, it can be noticed a little worsening in the global terminal comfort and reliability.

3.5 Summary

The International Airport of Lamezia Terme, considered as case study for airport services' analysis, could represent an example of great interest in the field of airport service quality evaluation. Its dimensions and its geographical position make it a different case from those analysed in similar literature studies, which usually take into account large international airports. The Lamezia Terme airport has undergone an important evolution over the years, which has made it one of the main reference points for travelling to and from southern Italy. In this context, the continuous monitoring of the level of quality of the services provided inside the terminal acquires a great importance. According to this, the S.A.CAL S.p.a, as managing company, collects users' perceptions every year following the national directives of ENAC. Specifically, CSSs are carried out every year through face-to-face interviews addressed to departing passengers. In this chapter, a preliminary analysis of the available data was carried out. From the sample composition, the main aspect that emerges is the strong tourist vocation of the airport. This finding certainly cannot go unnoticed in a geographical area whose economy is mainly based on tourism. As regards the passengers' perceptions about the provided services, in general high levels of quality resulted, and no particular critical issues were identified. The complete analysis of the data will be covered in the next chapter, where the results obtained from the application of different methods and models will be discussed.

Chapter 4

Airport services data modelling

4.1 Introduction

After the preliminary analysis conducted on the data provided by the S.A.CAL. S.p.a, the research has continued driven by different purposes but with the principal aim of better characterizing passengers' perceptions at the Lamezia Terme International airport and, at the same time, of proposing tools for contributing on the existing literature review. Each of the following sections describes a different application to the data, by providing a brief description of the methodology and the discussion of the results. Specifically, five different applications are reported.

The first one regards the data collected during the three-years period from 2012 to 2014. An OL model is proposed with the aim to investigate on the influence of the various service aspects on the overall service quality, by considering passengers' satisfaction with the services and the overall service as well. Different models for different groups of users are calibrated in order to verify the differences in perceptions of service quality.

The others methodologies refer to the data collected during the two-years period from 2015 to 2016. Firstly, a basic LC modelling approach was used in order to identify the latent classes representing air passengers' attitude towards the different provided service quality aspects, and detecting the sense of passengers well-being in the terminal; then, by introducing covariates the latent class memberships is better explored as a function of socio-economic characteristics, travel habits and flight features.

The subsequent methodology has the aim to explore the factors employed to assess airport service quality. Specifically, through a PCA, latent factors

influencing service quality are identified and the dimensionality of the phenomenon is reduced. After that, a SEM approach is performed in order to define the relationships among the latent variables, and between the observed variables and the latent ones.

Afterwards, the following application regards a model structure based on SEM-MIMIC approach that is able to capture the differences in the opinions of air transport passengers and that is able to identify groups of passengers with similar perceptions about the services. This differentiation can be useful to better understand specific passengers' requirements as a function of their characteristics, and consequently to undertake more targeted intervention for improving the services.

Finally, in order to find the practical implications of the results obtained by the structural equation model, an Importance-Performance analysis is performed. Also a revisited version of the analysis is proposed to provide a graphical representation that is more intuitive and immediate. More specifically, it will suggest to the operator, in a quick look at the graph, if the various service attributes are to be considered as critical aspects, where the financial resources have to be concentrated as performance does not reach users' expectations.

At the end of the chapter, a summary of the obtained results is reported.

4.2 Ordered logit model

4.2.1 Model specification

The Ordered Logit (OL) model is an extension of the logistic regression applied when the dependent variable Y is categorical and has a meaningful order with more than two categories (or levels).

The ordinal variable Y is a function of another variable Y^*, that is continuous and not measured and has various threshold points. The value Y_i of the observed variable depends on whether or not it crossed a particular threshold, as showed by the following formulas:

$$Y_i = 1 \; if \; Y_i^* \leq k_i \tag{1}$$

$$Y_i = j \; if \; k_i \leq Y_i^* \leq k_{i-1} \tag{2}$$

$$Y_i = M \; if \; Y_i^* \geq k_{M-1} \tag{3}$$

The continuous latent variable Y^* is equal to:

$$Y_i^* = \sum_{k=1}^{K} \beta_k X_{ki} + \varepsilon_i \quad (4)$$

in which there is a random disturbance term ε_i normally distributed.

The error term reflects the fact that the variables may not be perfectly measured, and some relevant variables may be not introduced in the equation. The vector of β parameters is estimated by the Maximum Likelihood method and generally the goodness-of-fit of the OL model is verified by Nagelkerke R^2 (Eboli and Mazzulla, 2009).

The statistical impact of variables is based on the $p - values$ of the Wald tests (Eboli et al., 2016).

4.2.2 Preliminary data analysis

The sample referred to the three-year period 2012-2014 was used. The first phase consisted on a statistical descriptive analysis of the data.

By considering the whole sample, 79% of passengers comes from Italy, 14% is from Europe and the remaining 7% is from extra-Europe countries. Most of them travel for leisure (63%), 19% for business and 18% for other purposes. Regarding the passengers' arrival time at the airport, most of them (53%) arrives from one to two hours before flight departure, 10% arrives less than one hour before, and the remaining 37% more than two hours before.

In order to consider the different perceptions among passengers concerning the service aspects, data were analysed according to three different partitions of the passengers; for each division, two different passengers' categories were identified. Specifically, they were divided by nationality, in "Italian" and "Other", by trip purpose, in "Leisure" and "Other", by earliness of arrival, in "Less than 2 hours" and "More than 2 hours" (Figure 4.1).

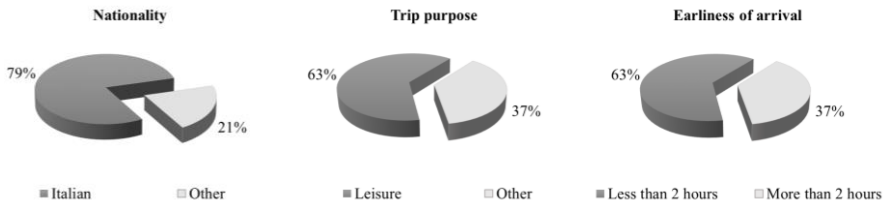


Figure 4.1. Percentage of passengers for each users' category.

Afterwards, service quality data were analysed: the frequency distributions were calculated separately for each of the six categories of users previously identified. The results of the two categories of nationality, trip purpose and earliness of arrival are shown, respectively, in Figure 4.2, Figure 4.3 and Figure 4.4. Some of the service attributes' names, reported in the following figures and tables, have been slightly modified as regards those reported in

Table 3.2. To avoid any confusion, the extended name and their respective modifications are shown in Table 4.1.

Table 4.1. Service attributes for OL model application.

Attribute extended name	Attribute concise name
Road links	Road links
Flight information display	Display
Terminal signposting	Signposting
Announcements	Announcements
Infopoint and security staff	Staff
Baggage and passenger	Control
Personal security	Security
Cleanliness of terminal	Cleanliness
Cleanliness of toilets	Toilettes
Terminal air conditioning	Air conditioning
Lighting inside the terminal	Lighting
Noise inside the terminal	Noise
Overall service	Overall service

The frequency distributions are quite similar for all the attributes analysed and for each passengers' category. In general, the judgement "good" is the most frequently expressed by the passengers. However, some differences between the two categories of passengers divided by nationality can be noted by observing Figure 4.2. As an example, the judgment "good" is expressed more by the non-Italian passengers for all the service attributes. For certain attributes, even twice of the non-Italian users expressed the level "good" as regards the Italian ones, and specifically for all the service attributes concerning information and for all the attributes regarding comfort. Moreover, by observing the distribution of the judgment level "very poor", it can be noted that almost none of the non-Italian passengers expressed this level, while more than 20% of Italian passengers expressed this level. In general, it seems that non-Italian passengers are most satisfied with the service.

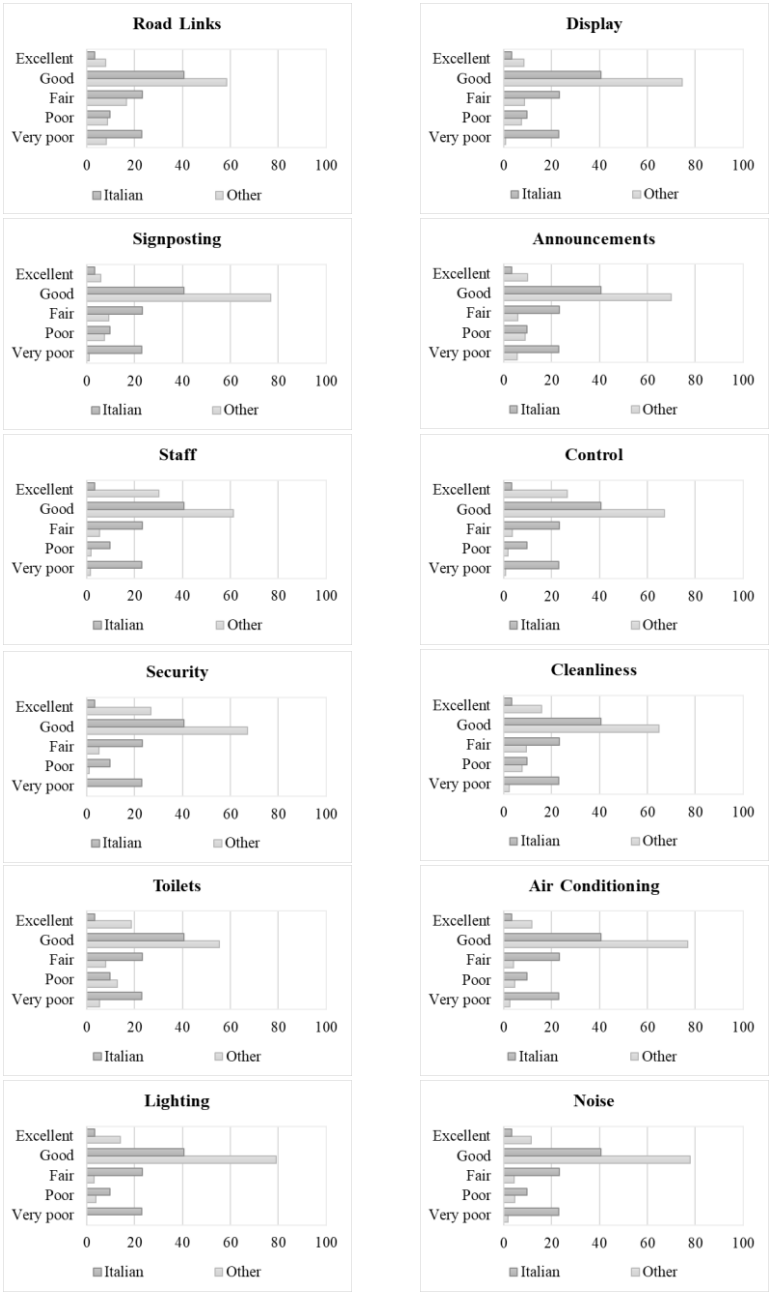


Figure 4.2. Frequency distributions concerning the differences by “Nationality”.

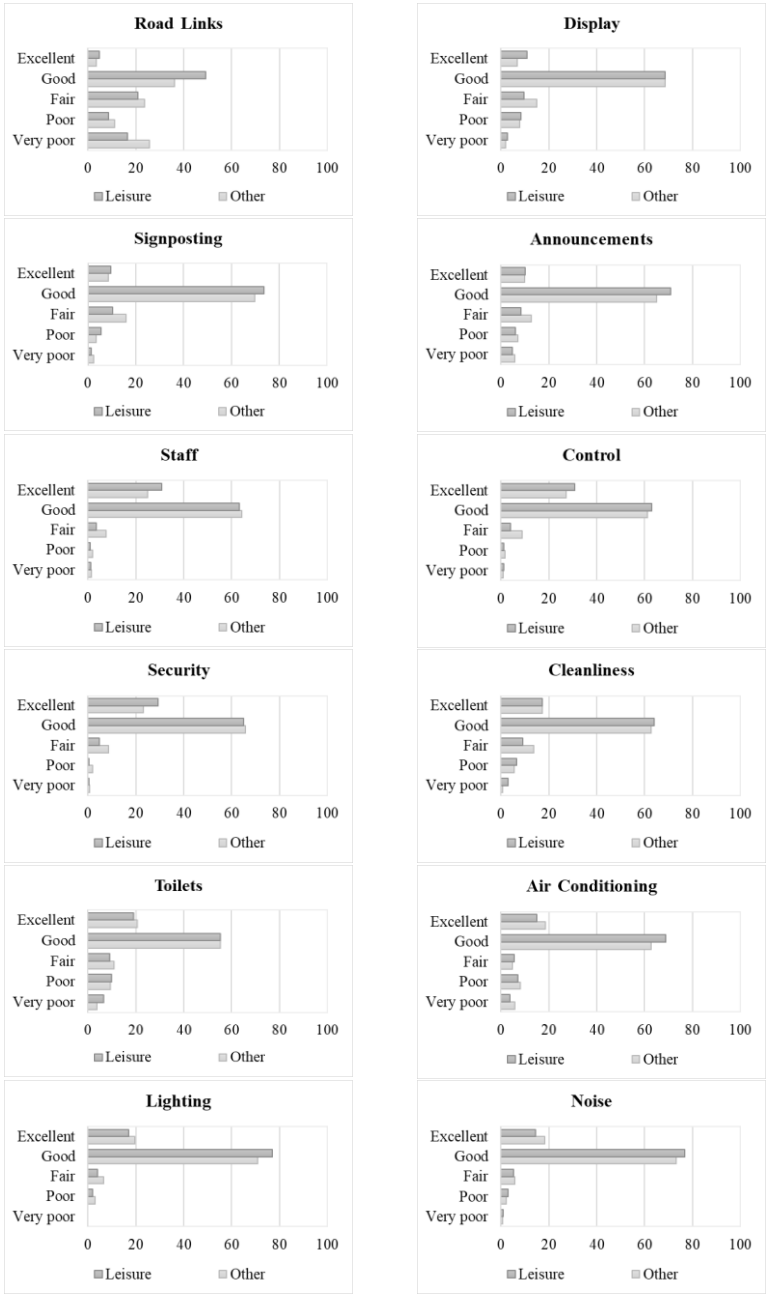


Figure 4.3. Frequency distributions concerning the differences by “Trip purpose”.

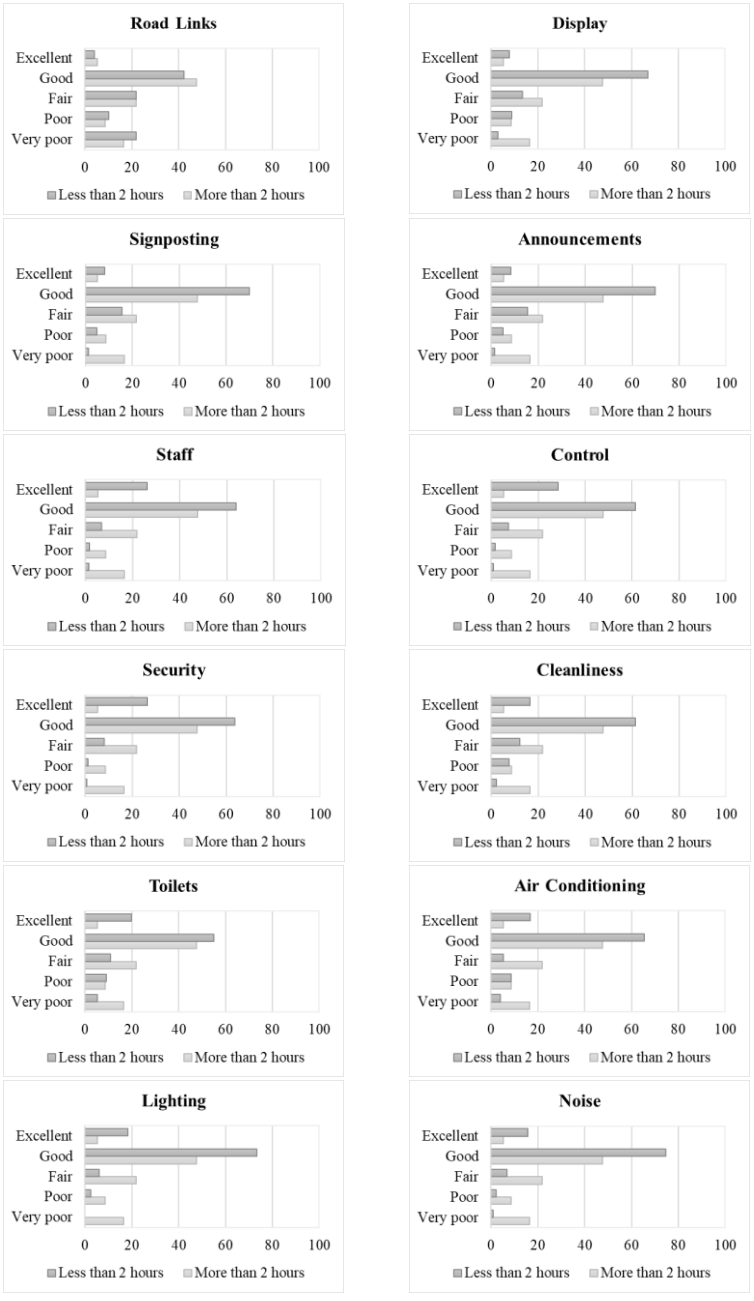


Figure 4.4. Frequency distributions concerning the differences by “Earliness of arrival”.

Concerning the groups of passengers divided by trip purpose, no relevant differences emerged, as Figure 4.3 shows. On the other hand, some interesting differences can be observed concerning the groups of passengers divided by earliness of arrival. As reported in Figure 4.4, passengers arriving more than two hours early are less satisfied with the attributes relating information as they expressed less "good" judgements and more "very poor" judgments as regards passengers arriving late. The same tendency can be observed for the attributes relating staff, security, cleanliness and comfort. It seems that passengers arriving early, as they spend more time in the airport, have also more time to experience the various service aspects, and evidently they discover more criticalities.

Finally, there are no substantial differences of perceptions concerning the overall service, which is judged very similarly by all the categories of passengers (Figure 4.5). Moreover, none of users pronounced "Very poor" judgment regarding overall service.

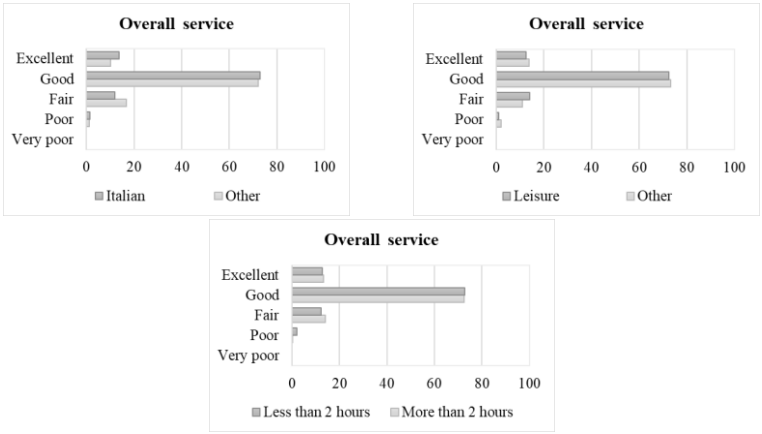


Figure 4.5. Frequency distributions of Overall service.

4.2.3 Results and discussion

The OL model was adopted to estimate the weight of each service attribute on the overall service offered by the Lamezia Terme airport. Specifically, OL models are proposed with the aim to identify which service attributes have an influence on passengers' satisfaction with the overall service, and to investigate about the differences of perceptions among different groups of users. For this aim, seven different OL models were calibrated: one model for the whole sample of passengers, and one for each of the six groups of passengers divided by nationality, trip purpose and earliness of arrival. In these models the independent variables are the

judgments on the investigated service attributes, while the dependent variable is the satisfaction with the overall service (Table 4.2).

Table 4.2. OL Models.

	Global model	Nationality		Trip purpose		Earliness of Arrival	
		Italian	Other	Leisure	Other	< 2 hours	> 2 hours
Roadlinks=0	-0.422**	-0.941***	(n.s.)	-0.361*	-0.670**	-1.075***	(n.s.)
Roadlinks=1	(n.s.)	-0.546**	(n.s.)	(n.s.)	-0.701**	-0.575**	1.021**
Display=0	-1.805***	-1.860***	-2.158***	-1.884***	-2.189***	-1.512***	-2.648***
Display=1	-0.417*	(n.s.)	(n.s.)	(n.s.)	-1.034**	(n.s.)	(n.s.)
Signposting=0	-1.402***	-1.547***	-0.934*	-1.645***	-0.961**	-1.730***	-1.376**
Signposting=1	0.438*	1.023**	-0.958*	(n.s.)	(n.s.)	(n.s.)	(n.s.)
Announcements=0	-2.096***	-2.572***	-1.487***	-1.948***	-2.901***	-2.369***	-1.664***
Announcements=1	-1.328***	-1.803***	(n.s.)	-1.194***	-1.661***	-1.481***	-0.959**
Staff=0	-1.695***	-1.986***	-1.126*	-2.410***	-1.264**	-1.901***	(n.s.)
Staff=1	(n.s.)	(n.s.)	(n.s.)	-0.778*	(n.s.)	(n.s.)	(n.s.)
Control=0	(n.s.)	(n.s.)	-1.587**	(n.s.)	(n.s.)	-0.848**	(n.s.)
Control=1	-0.496*	(n.s.)	-1.890**	-1.590***	0.978**	(n.s.)	-1.298**
Security=0	-0.730*	-1.123**	(n.s.)	(n.s.)	-1.553**	-1.211**	(n.s.)
Security=1	0.521*	(n.s.)	2.358**	0.894**	(n.s.)	(n.s.)	(n.s.)
Cleanliness=0	-1.305***	-1.360***	-1.294**	-1.354***	-1.530**	-1.391***	-1.723***
Cleanliness=1	-0.836***	-0.848**	-0.942*	-1.444***	(n.s.)	(n.s.)	-2.367***
Toilettes=0	(n.s.)	(n.s.)	(n.s.)	(n.s.)	(n.s.)	(n.s.)	(n.s.)
Toilettes=1	(n.s.)	(n.s.)	(n.s.)	(n.s.)	(n.s.)	-0.771**	(n.s.)
Airconditioning=0	(n.s.)	-0.448**	(n.s.)	(n.s.)	-0.671**	(n.s.)	-1.001**
Airconditioning=1	(n.s.)	(n.s.)	(n.s.)	(n.s.)	(n.s.)	(n.s.)	(n.s.)
Lighting=0	-1.758***	-1.528***	-1.650**	-1.981***	-0.958*	-1.355**	-2.445***
Lighting=1	-1.257***	-1.274***	(n.s.)	-2.071***	(n.s.)	-1.292***	-2.324***
Noise=0	-2.083***	-2.418***	-1.629***	-1.986***	-2.473***	-2.953***	-1.297**
Noise=1	-2.509***	-2.777***	-1.400**	-2.866***	-2.071***	-2.778***	-3.293***
k_0 (threshold)	-8.788***	-9.598***	-8.025***	-9.908***	-8.701***	-9.334***	-10.644***
k_1 (threshold)	-4.087***	-4.717***	-3.167***	-3.981***	-5.035***	-4.789***	-3.389***
LL with zero coef.	2402.47	1925.18	546.27	1519.98	963.61	1686.76	816.45
Final LL	1144.66	840.84	315.14	688.56	462.22	751.57	399.47
R^2 of Nagelkerke	0.544	0.597	0.458	0.565	0.584	0.611	0.518

*Significant at level of 90 per cent; ** 95 per cent; *** 99 per cent; (n.s.) Not Significant

The general model, calibrated considering the whole sample of passengers, is useful for identifying the most important service aspects. The models calibrated for each passengers' category allow to compare users according to their own characteristics or inclinations. The calibration of the models was done by SPSS statistical software (IBM, 2017) through the PLUM procedure (PoLytomus Universal Model procedure).

Three levels of quality were defined for the variables: a low level of quality (corresponding to the judgements "Very Poor" and "Poor"), an intermediate level (corresponding to the judgement "Fair") and a high level (corresponding to the judgements "Good" and "Excellent"). Values from 0 to 2 were associated respectively to these three levels of quality. In this way, each independent variable and the dependent one are classified into three categories. The baseline category, or "reference case", is represented by the variable when it takes the level 2. As a consequence of the choice of the reference case, the coefficients (β) of the statistically significant variables have a negative sign. The negative sign means that the contribution to the overall dissatisfaction decreases when the independent variables assume higher values, or rather the users are more satisfied with the single service attribute. The statistics on the goodness of fit of all the models are adequate. The values of Nagelkerke R^2 are all higher or close to 0.5.

The results of the general model drive to the fact that the significant impact on the overall satisfaction is given by the service attributes regarding "Information" (Display, Signposting and Announcement), "Cleanliness of terminal" and "Comfort" (Lighting and Noise). The models calibrated for the passengers' categories allow to establish the most important service aspects according to users' characteristics and inclinations such as nationality, trip purpose and earliness of arrival at terminal.

The comparison between the model "Italian" and the model "Other" shows significant differences. As an example, road links, announcements, staff and noise are very important for Italians and less for Others. An opposite result is obtained for baggage control; also the aspect concerning display is more relevant for the foreign passengers. Finally, signposting inside terminal, lighting and cleanliness are relevant for both categories of passengers.

The most important service aspects for passengers whose trip purpose is "Leisure" are partly different from passengers that travel for other purposes. For the first group of passengers the statistically significant service aspects are: announcements, courtesy and friendliness of staff, cleanliness of terminal, lightning inside terminal, and acoustic comfort, while for the other group road links, display, announcements and noise. So, people travelling for leisure give more importance to the service aspects related to comfort,

unlike the others whose priority are "technical" aspects such as modal integration and information inside terminal.

Finally, there are some differences between the passengers whose earliness of arrival at terminal is "less than 2 hours" and the passengers whose earliness of arrival is "more than 2 hours". More specifically, while announcements, lightning inside terminal and noise are statistically significant for both the categories of users, people arriving early give more importance to lighting than the others, who give more importance to the announcements and the acoustic comfort. In addition, for users whose earliness of arrival at terminal is less than 2 hours, road links are important, instead cleanliness of terminal is important for the others, probably due to their longer stay at the airport.

It can be concluded that the analysis through the OL models allows to find best and more useful results as regards the simple analysis performed through the frequency distribution of the data. In fact, the relevant differences discovered thanks to the model does not emerged by observing the distribution of the frequencies of the passengers differentiated in terms of trip purpose. More specifically, the OL models show that people travelling for leisure retain as most important aspects related to comfort, while people travelling for purposes linked to work or study or other important reasons give priority to "technical" aspects such as modal integration and information inside terminal, maybe because they are less relaxed than people travelling for leisure. Other interesting findings regard people arriving more than two hours early, who give more importance to cleanliness of terminal probably because they stay too time at the airport, or the foreign passengers, who consider as more important the aspect concerning display because they know the airport information less than Italian passengers.

Respect to previous literature studies developing similar models (e.g. Bezerra and Gomes, 2015; Bogicevic et al., 2013; Pantouvakis and Renzi, 2016), the present work has taken into account the different characteristics of the passengers and identified the SQ aspects that affect the perceptions of the several groups of passengers.

In conclusion, the findings resulted from the proposed models demonstrate that it is fundamental to investigate on the passengers' perceptions to discover which are the service aspects mostly influencing passengers' satisfaction, and therefore most important to be monitored by the operators, in order to be competitive and to offer services characterized by good levels of quality. In addition, the results highlighted the importance to understand the differences of perceptions among groups of passengers, with the aim to identify marketing strategies based on the different categories of users.

4.3 Latent class model

4.3.1 Methodology

The methodology described in this section has the aim to explore the sense of passengers well-being in the terminal of Lamezia Terme International airport. The proposed methodology performs into two stages: (1) to use a basic LC modelling approach in order to identify the latent classes representing air passengers' attitude towards the different provided service quality aspects, and detecting the sense of passengers well-being in the terminal; (2) to introduce covariates in order to better explore latent class memberships as a function of socio-economic characteristics, travel habits and flight features.

LC analysis is a statistical technique for the analysis of multivariate categorical data like useful for analysing individual-level voting data and for identifying and characterizing clusters of similar cases (Linzer and Lewis, 2011). The LC model seeks to stratify a number of observed variables by an unobserved latent unordered categorical variable that eliminates all confounding between the observed variables. The unobserved latent variable is nominal, namely the membership of a class. Conditional upon values of this latent variable, responses to all of the observed variables are assumed to be statistically independent: the model probabilistically groups each observation into a latent class, which in turn produces expectations about how that observation will respond on each observed variable (Linzer and Lewis, 2011). Although the model does not automatically determine the number of latent classes in a given data set, it offers a variety of parsimony and goodness of fit statistics that the researcher may use in order to make a theoretically and empirically sound assessment. An extension of this basic model permits the inclusion of covariates to predict latent class membership. While in the basic model every observation has the same probability of belonging to each latent class prior to observing the responses to the observed variables, in the more general LC regression model these prior probabilities vary by individual as a function of some sets of independent concomitant variables (Linzer and Lewis, 2011).

For estimating LC models and LC regression models, poLCA user-friendly package in R software was used (Linzer and Lewis, 2016, 2011; R Foundation for Statistical Computing, 2010).

4.3.2 Preliminary data analysis

The data supporting this analysis refer to the two-year period 2015-2016. The sample is made up of more females (53%) than males; about 70% of

users are under 50, half of them with a high school diploma. The major part of the sample comes from Italy (60%), but about 40% of the passengers is going towards other European countries. Domestic flights account for 48% of the total flights. Regarding travel habits, it emerges that most of the interviewed passengers travel with other people (93.3%), and arrive at the airport by car (82%), especially by a car driven by someone else (47%). Almost half of the sample arrives at the airport from one to two hours before the departure time of the flight, 43% of users arrive more than two hours early, and the remaining part of passengers less than one hour before. In Table 4.3, statistics about the judgements expressed by the passengers for each analysed service aspects were reported.

Table 4.3. Judgements about each airport service quality aspect.

Service quality aspect	Valid data	Very poor (%)	Poor (%)	Fair (%)	Good (%)	Excellent (%)
Road signposting	1765	1.8	5.8	9.1	74.7	8.5
Flight information display	1743	0.5	1.8	4.9	84.2	8.5
Terminal signposting	1814	0.2	3.7	3.4	84.5	8.3
Infopoint and security staff	1742	0.2	0.8	4.0	83.0	12.1
Information accessibility	1702	0.0	0.2	4.2	85.0	10.6
Waiting time at check-in	1345	1.0	1.9	4.2	60.7	32.1
Baggage and passenger control	1840	0.6	0.8	4.2	67.2	27.2
Personal security	1768	0.2	0.8	3.9	73.8	21.3
Cleanliness of terminal	1791	2.4	4.1	7.1	71.9	14.5
Cleanliness of toilets	1429	8.7	7.5	6.4	65.1	12.4
Terminal air conditioning	1780	1.9	11.5	5.9	69.5	11.2
Terminal comfort	1782	0.7	4.4	9.4	77.4	8.8
Terminal reliability	1453	0.0	0.4	6.9	88.8	3.9

Regarding the judgements expressed by the passengers, it results that the most frequent one is “good” for all the service aspects. However, certain aspects were less satisfactory for the passengers; as an example, “cleanliness of the toilets” shows 16.2% of negative judgements (ranging from “very poor” and “poor”), and also “terminal air conditioning” shows a percentage of negative judgements closed to 13%. On the whole, the judgement expressed about the terminal reliability is very positive, with a percentage of 92.7% between “good” and “excellent”. The service quality aspects with the highest percentage of “excellent” judgements are “waiting time at check-in” (32.1%) and “personal security” (21.3%). Probably, the perception of the passengers could be related to the low percentage of passengers making the check-in at the desk (in the first case), and to the geographical favourable position of the airport (in the second one). For some attributes a relevant lack of information was registered. As an example, for the attribute “waiting time

at check-in" there is only 71.8% of valid response. This lack of information is due to the large amount of passengers making an online check-in or waiting at the check-in desk only for baggage handling. On the other hand, there is a lack of information about cleanliness of toilets (23.7% of non-response data) because the toilets are not used by all the passengers during their stay in the airport. A more problematic lack of information was registered for the service quality aspect "terminal reliability" (77.6% of valid data). In this case, the high percentage of non-response data could be due to the fatigue effect, because the last evaluation about the service has been requested after a large amount of questions about food, shopping and additional facilities. The statistics related to these service aspects are not included in Table 4.3 because food and shopping facilities are scarcely used.

4.3.3 Basic Latent Class modelling

The proposed methodology is oriented to use a basic LC modelling approach in order to identify the latent classes representing air passengers' attitude towards the different provided service quality aspects, and detecting the sense of passengers well-being in the terminal.

This approach allows to estimate a class population share on the basis of the judgements expressed by the air passengers about the analysed service quality aspects in the terminal. Each service aspect is represented by a dichotomous variable assuming a value equal to 1 when the judgement expressed by the passengers is non-positive ("very poor", "poor", or "fair") and equal to 2 when the judgement is positive ("good" or "excellent"). In Table 4.4, only the service aspects included in the following analysis are reported.

Table 4.4. Positive and non-positive judgments expressed by the passengers.

V	Service quality aspect	Non-positive judgements		Positive judgements	
		n.	%	n	%
V1	Road signposting	296	16.8	1469	83.2
V2	Flight information display	127	7.3	1616	92.7
V3	Terminal signposting	131	7.2	1683	92.8
V4	Infopoint and security staff	87	5.0	1655	95.0
V5	Information accessibility	76	4.5	1626	95.5
V6	Personal security	86	4.9	1682	95.1
V7	Cleanliness of terminal	244	13.6	1547	86.4
V8	Cleanliness of toilets	322	22.5	1107	77.5
V9	Terminal air conditioning	343	19.3	1437	80.7
V10	Terminal comfort	245	13.7	1537	86.3

The aim of this analysis is examining how subjects might be divided into groups depending upon the consistency of their judgements. A three-class basic LC model was estimated, and Figure 4.6 represents a screen capture of the model results. Each group of red bars represents the conditional probabilities, by latent class, that passengers rated positively each of the ten service quality aspect (labelled V1 through V10).

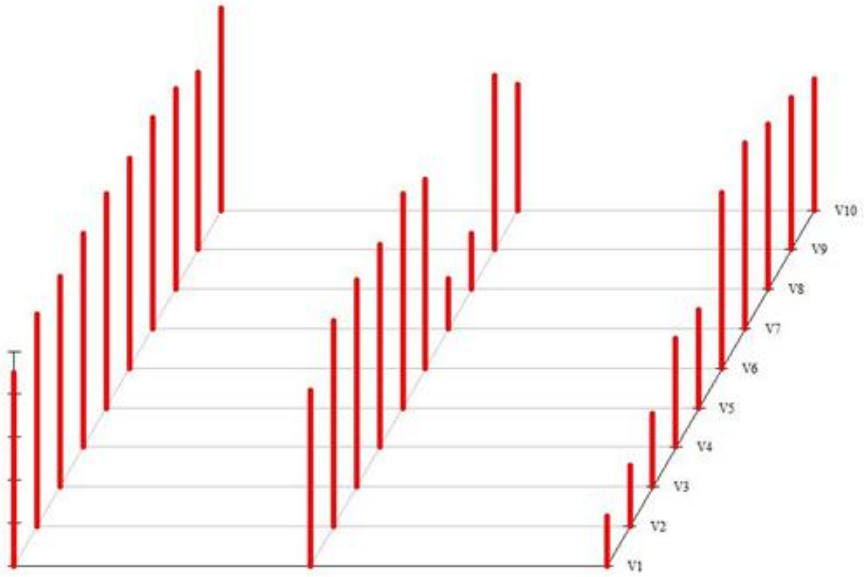


Figure 4.6. Estimation of the three-class basic LC model.

Taller bars correspond to conditional probabilities closer to 1 of a positive judgement. The three estimated latent classes clearly correspond to a pair of classes (the first and the third one) that are consistently rated positive (class population share 79%) or quite non-positive (class population share 14%), plus an intermediate class representing only 7% of the population. In the second class, only the variables V7 and V8 tend to have non-positive judgements whereas the other service aspects tend to have positive judgements. On the contrary, in the third class service aspects from V1 to V5 tend to have a non-positive judgement whereas service aspects from V6 to V10 tend to have positive judgements.

In order to choose the optimal number of latent classes, a number of goodness of fit statistics were performed. Specifically, both the minimum Akaike information criterion, or AIC (Akaike, 1973), and Bayesian information criterion, or BIC (Schwartz, 1978), indicate that the three-class model is most parsimonious: the AIC is 10,321 and the BIC is 10,498. When

a two-class model was performed, AIC resulted equal to 10,816 and BIC 10,932 (about 500 units more than the previous values in both cases); in addition, in this case the predicted class memberships reached more than 90% of share for the first class. On the contrary, when a four-class model was performed, the values of AIC and BIC are quite lower (10,225 and 10,463 respectively) but, conversely, the third and fourth classes registered low class population shares (4% in both cases) by maintaining the same class population share in the first class (79%). Definitively, as suggested by some authors (Greene, 2014; Hensher et al., 2015), the four-class model is over-specified containing very small groups of passengers; therefore, the three-class model was selected.

By following the statistical results of the basic LC model, it can be concluded that air passengers using Lamezia Terme terminal facilities can be subdivided into three classes: (1) the first class represents passengers with a strong sense of well-being in the terminal, and with attitude to express positive judgements towards all the service quality aspects (so-called "non-sensitive passengers"); (2) the second class represents passengers with a soft sense of well-being in the terminal, and with attitude to express positive judgements towards all the service quality aspects except for cleanliness (so-called "cleanliness-sensitive passengers"); (3) the third class represents passengers with a weak sense of well-being in the terminal, and with attitude to express non-positive judgements towards the service quality aspects linked to the information (so-called "information-sensitive passengers").

4.3.4 Exploring Latent Class memberships with covariates

The above introduced latent classes were deeply explored with the aim to explain air passengers' membership as a function of socio-economic characteristics, travel habits and flight features. For this aim, a number of covariates were introduced, as reported in Table 4.5.

Firstly, trip purposes and age interactions were analysed, by distinguishing between traveling for leisure and for other purposes (see Figure 4.7). By examining the estimated class-conditional response probabilities, it seems confirmed that the model finds that the three groups indeed separate as expected, with 80-90% of passengers belonging to the first class, 10-20% to the second one, and 0-10% to the third class. As it can be noted, non-sensitive passengers have a probability of latent class membership invariant with the age when they travel for leisure, whereas the probability tends to increase with the age when they travel for other purposes. Passengers cleanliness-sensitive seem to be also not changing with the age when they travel for leisure, whereas they tend to become less sensitive when traveling for other purposes. On the contrary, information-sensitive

passengers, when travelling for leisure, tend to become more sensitive towards these aspects when they are older.

Table 4.5. Covariates for Latent Class memberships.

Covariate	Item	Value
Gender	Male	1
	Female	2
Age	less than 30	1
	between 30 and 40	2
	between 40 and 50	3
	between 50 and 60	4
	more than 60	5
Level of education	Junior high school diploma	1
	High school diploma	2
	Bachelor or Master degree	3
Country	Italy	1
	other Countries	2
Trip purpose	Leisure	1
	other purposes	2
Time of arrival	less than 1 hour before the flight	1
	from 1 to 2 hours before the flight	2
	more than 2 hours before the flight	3

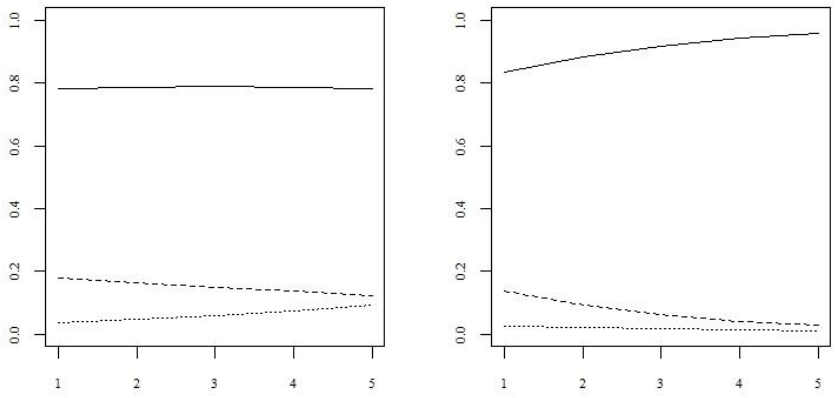


Figure 4.7. Predicted probabilities of latent class memberships for "leisure as trip purpose" (on the left side), and "other trip purposes" (on the right side) and age [less than 30 (1), between 30 and 40 (2) between 40 and 50 (3), between 50 and 60 (4), more than 60 (5)] [continuous line represents the first latent class, dashed line the second one, and dotted line represents the third latent class].

Concerning the interactions between trip purposes and education level, it can be noted that passengers with higher education levels traveling for leisure

are more sensitive towards both cleanliness and information. As it is shown by the Figure 4.8, the probability of belonging to the first latent class tends to decrease whereas the probabilities of belonging to both the second and the third classes increases.

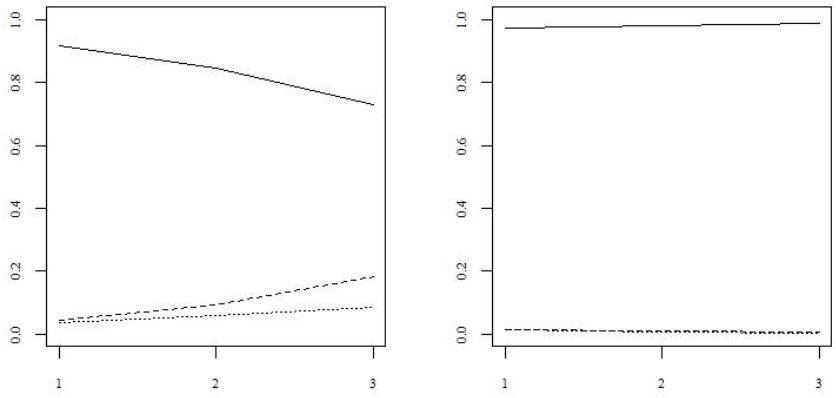


Figure 4.8. Predicted probabilities of latent class memberships for "leisure as trip purpose" (on the left side), and "other trip purposes" (on the right side) and education level [Junior high school diploma (1), High school diploma (2) and Bachelor or Master degree (3)] [*continuous line represents the first latent class, dashed line the second one, and dotted line represents the third latent class*].

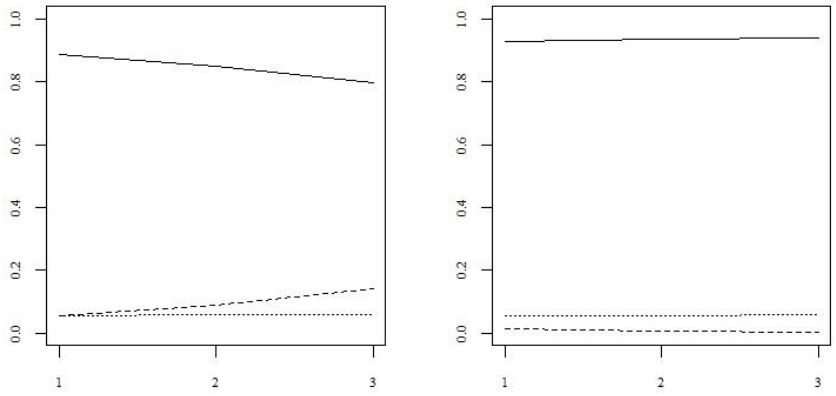


Figure 4.9. Predicted probabilities of latent class memberships for "leisure as trip purpose" (on the left side), and "other trip purposes" (on the right side) and arrival time before the flight [less than 1 hour (1), from 1 to 2 hours (2) and more than 2 hours (3)] [continuous line repre-sents the first latent class, dashed line the second one, and dotted line represents the third latent class].

The same tendency can be noted for passengers traveling for leisure when their arrival time at the terminal increases (see Figure 4.9).

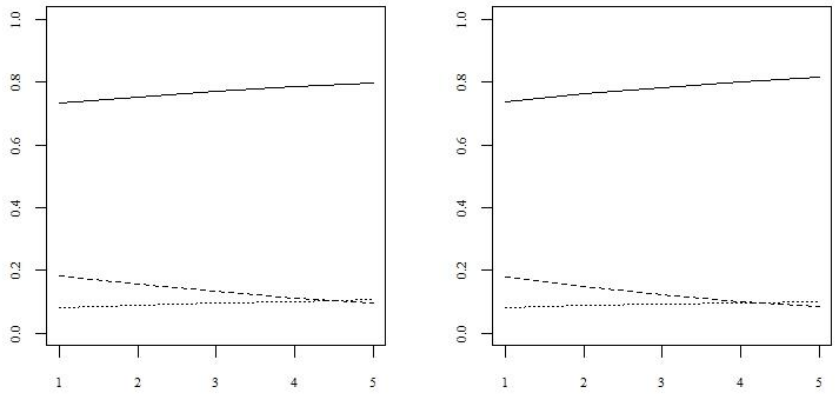


Figure 4.10. Predicted probabilities of latent class memberships for "male" (on the left side), and "female" (on the right side) and age [less than 30 (1), between 30 and 40 (2) between 40 and 50 (3), between 50 and 60 (4), more than 60 (5)] [*continuous line represents the first latent class, dashed line the second one, and dotted line represents the third latent class*].

In Figure 4.10 the interactions between gender and age are shown. In this case, it emerges that there is not difference in the attitude between male and female, and the passengers tend to become less sensitive towards all service quality aspects when their age increases; definitively, aged passengers are less exigent and with a higher sense of well-being in the terminal.

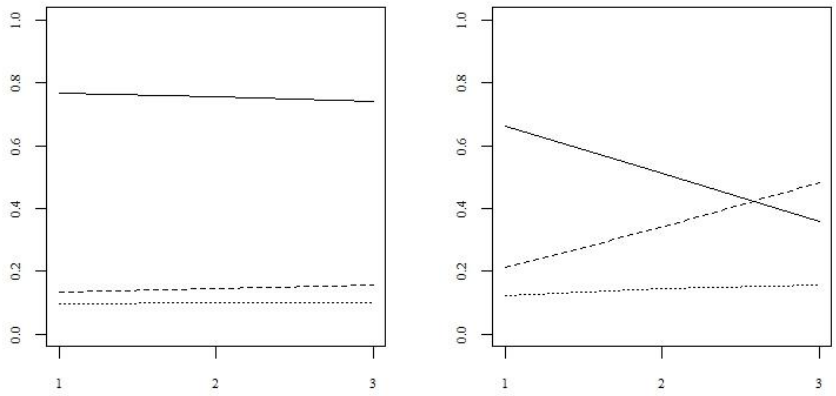


Figure 4.11. Predicted probabilities of latent class memberships for "male" (on the left side), and "female" (on the right side) and education level [Junior high school diploma (1), High school diploma (2) and Bachelor or Master degree (3)] [*continuous line represents the first latent class, dashed line the second one, and dotted line represents the third latent class*].

Relevant differences emerge between males and females when the interactions with passengers' education level are analysed (Figure 4.11). In

this case, male passengers with different education levels have the same probabilities of latent class memberships. Differently, female passengers are not very information-sensitive but their membership to the first latent class drastically decreases when their level of education increases and the sensitiveness towards cleanliness strongly increases.

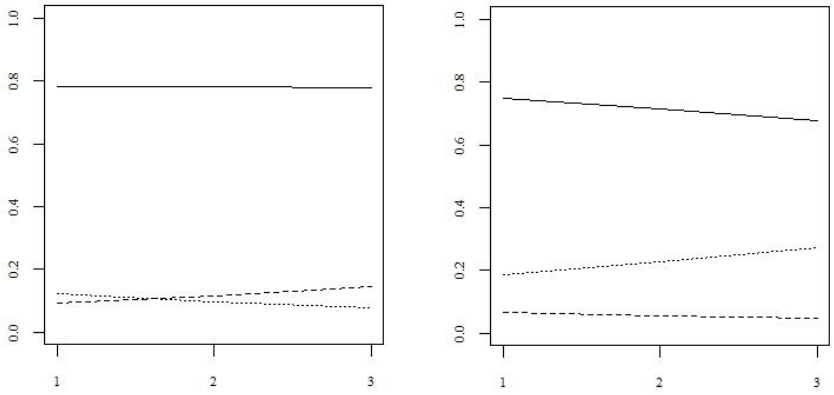


Figure 4.12. Predicted probabilities of latent class memberships for "male" (on the left side), and "female" (on the right side) and arrival time before the flight [less than 1 hour (1), from 1 to 2 hours (2) and more than 2 hours (3)] [*continuous line represents the first latent class, dashed line the second one, and dotted line represents the third latent class*].

Gender differences are highlighted also by Figure 4.12, where predicted probabilities of latent class memberships are shown as a function of the arrival time at the terminal. In this case, females arriving more than 2 hours before the flight become more sensitive towards cleanliness and their sense of well-being decreases. Lastly, differences between Italian passengers and passengers from other countries were analysed (Figure 4.13; Figure 4.14; Figure 4.15). Generally, passengers from countries different from Italy are more sensitive towards all the service quality aspects, because latent class memberships show lower probabilities, but the probabilities to belong to each latent class are quite invariant with age. Conversely, aged Italian passengers become less cleanliness-sensitive and tend to increase their sense of well-being in the terminal. Similar attitudes can be noted from Figure 4.14, where the interactions with nationality and education level are shown. However, in this case passengers from countries different from Italy have a higher probability to belong to the first latent class (more than 80%), showing an attitude to have a good sense of well-being.

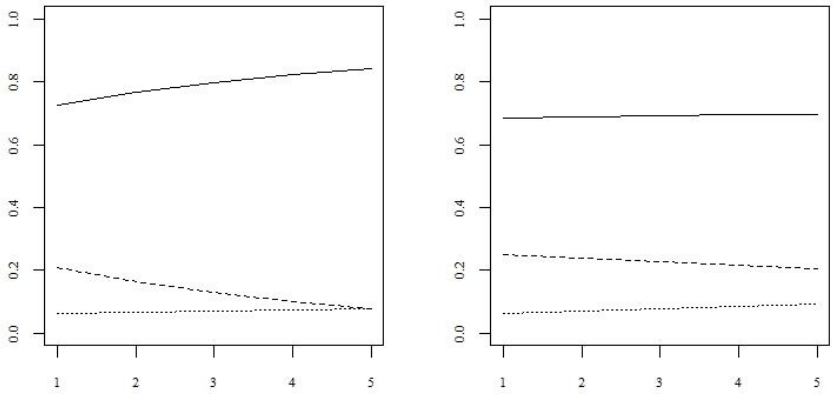


Figure 4.13. Predicted probabilities of latent class memberships for "Italian travellers" (on the left side), and "travellers from other Countries" (on the right side) and age [less than 30 (1), between 30 and 40 (2) between 40 and 50 (3), between 50 and 60 (4), more than 60 (5)] [*continuous line represents the first latent class, dashed line the second one, and dotted line represents the third latent class*].

Differently from Figure 4.13, Italian passengers with higher levels of education increase their sensitiveness to quality aspects, especially those linked to cleanliness.

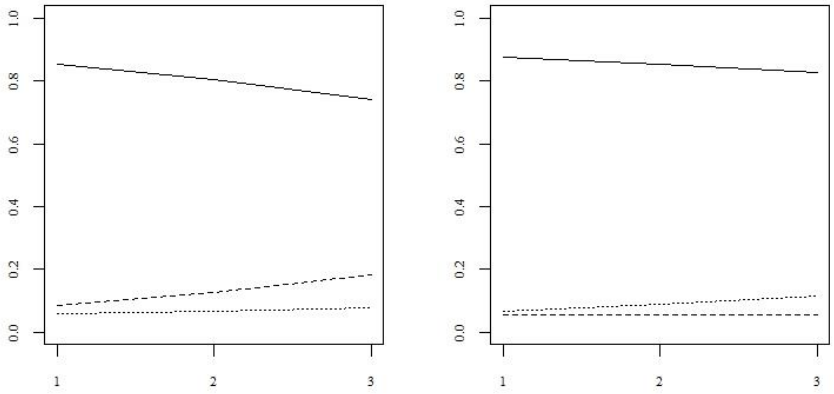


Figure 4.14. Predicted probabilities of latent class memberships for "Italian travellers" (on the left side), and "travellers from other Countries" (on the right side) and education level [Junior high school diploma (1), High school diploma (2) and Bachelor or Master degree (3)] [*continuous line represents the first latent class, dashed line the second one, and dotted line represents the third latent class*].

Finally, attitudes quite different can be noted by comparing Italian travellers with travellers from other countries when arrival time before the flight is considered (Figure 4.15).

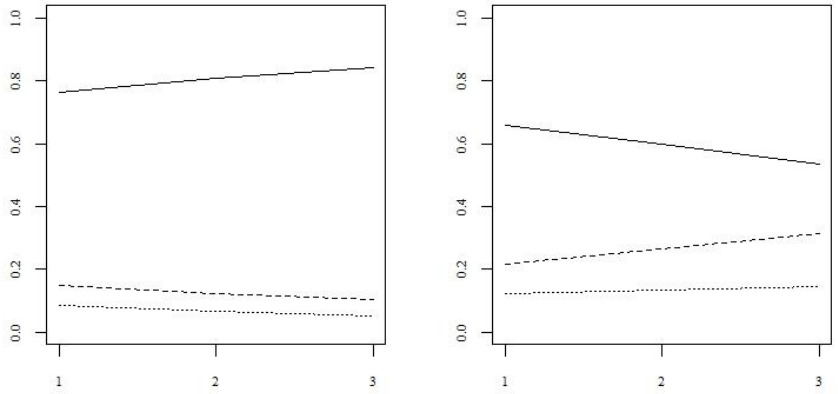


Figure 4.15. Predicted probabilities of latent class memberships for "Italian travellers" (on the left side), and "travellers from other Countries" (on the right side) and arrival time before the flight [less than 1 hour (1), from 1 to 2 hours (2) and more than 2 hours (3)] [*continuous line represents the first latent class, dashed line the second one, and dotted line represents the third latent class*].

In this case, Italian passengers are very inclined to a good sense of well-being, whereas non Italian passengers are more exigent and become more sensitive, especially towards cleanliness and especially when arrival time increases.

4.3.5 Discussion of the results

The influence of age over the class memberships is clear: older passengers tend to be less exigent (increasing the probability to belong to non-sensitive class of passengers) and less sensitive towards terminal cleanliness (decreasing the probability to belong to cleanliness-sensitive class of passengers). This behaviour was observed also in studies investigating on bus service quality; in fact, some authors verified that young people are more exigent than aged passengers (Allen et al., 2019, 2018a). This evidence is particularly relevant when passengers travel for purposes different from leisure and for Italian passengers. Also Bellizzi et al. (2018) registered that people travelling for work or study retain as less important aspects related to comfort. Instead, concerning the perceptions of the Italian passengers, Pantouvakis and Renzi (2016) discovered that the opinions of Italian passengers regarding airport's physical environment and facilities, are less positive than those of the other passengers.

Differently from age, education level contributes to have more exigent passengers, decreasing the probability to belong to non-sensitive class of passengers; at the same time, sensitiveness towards terminal cleanliness and information increases. The emerging results is highlighted especially for female, Italian passengers and leisure travels.

Lastly, the influence of arrival time over the latent class memberships has been considered. It emerges that when arrival time before the flight increase air passengers reduced their sense of well-being in the terminal, probably due to their longer stay at the airport. In this case, the probability of belonging to the non-sensitive class decreases and conversely the probabilities of belonging to the cleanliness and information-sensitive classes increases, by proving a higher passengers' sensitiveness. These attitudes are particularly evident for female, passengers traveling for leisure and from countries different from Italy. Concordant findings were discovered by Bellizzi et al. (2018) who found that people arriving more than two hours early give a certain importance to terminal cleanliness. On the contrary, Bezerra and Gomes (2015) found that the earlier the passenger arrives at the airport, the more likely he/she is to present a higher overall satisfaction. They interpret this evidence by considering that the fact that passenger's level of stress is related to the amount of time available for complying with the required checkpoints.

The obtained results have practical implications because allow the agency managing airport infrastructures and services to better understand the needs and attitudes of air passengers. In turn, these issues can be used for improving the quality levels of the provided services and for suggesting customized services for each class of passengers using the terminal, by taking into account especially the sensitiveness towards cleanliness and information of certain class of users'.

4.4 Structural equation model

4.4.1 Methodology

The aim of the following methodology is trying to find latent factors connected to the overall airport service quality. A PCA was performed as an exploratory approach. The findings become the basic assumption for adopting a SEM approach, which can establish the relationships among latent variables, and between observed variables and latent ones.

A SEM approach differs from a traditional regression model because it introduces latent variables in addition to observed ones. Latent variables represent theoretical concepts or unobservable constructs that cannot be

directly measured by the analyst, whereas observed variables allow latent constructs to be measured by considering latent measurement errors (Bowen and Guo, 2012).

SEM is composed by two components: the structural model and the measurement model. The structural model explains the relationships between the endogenous and exogenous latent variables. On the other hand, the measurement model describes the relationships between the latent and observed variables.

The equation of the structural model is the following (Bollen, 1989):

$$\eta = \mathrm{B}\eta + \Gamma\xi + \zeta \tag{5}$$

where η is the vector of the endogenous latent variable, ξ is the vector of the exogenous latent variables, and ζ is a vector of random variables. B and Γ are the coefficients matrices for the latent endogenous and exogenous variables respectively.

As regards the measurement model, the basic equations are (Bollen, 1989):

$$x = \Lambda_x\xi + \delta \tag{6}$$

$$y = \Lambda_y\eta + \varepsilon \tag{7}$$

where: x and y are the vectors related to the observed exogenous and endogenous variables respectively, δ and ε are the vectors of errors, Λ_x is a structural coefficient matrix for the effects of the latent exogenous variables on the observed ones, and Λ_y is a structural coefficient matrix for the effects of the latent endogenous variables on the observed ones.

Before performing SEM approach, a PCA helped us to determine how service attributes group together into latent constructs. This statistical technique can help to explore the composition of the factors and to analyse the relationships among the measured variables. In other words, the PCA permits to convert a set of correlated variables into a set of uncorrelated variables called principal components (Jolliffe, 2014). Understanding which factors mainly affect overall passengers' satisfaction could help airport management companies to achieve better financial resource administration.

The methodology follows this sequence of stages: (1) a preliminary statistical analysis was conducted in order to characterize the sample, and to better understand users' perceptions about the services in the airport; (2) a PCA was performed to explore service attributes and identify the latent constructs; (3) a structural equation model was calibrated for determining the significance of the relationship among the latent constructs.

4.4.2 The PCA and the conceptual model

The data, object of the following analysis, are those related to the two-year period 2015-2016 (see paragraph 4.3.2).

Firstly, an unobserved endogenous variable representing the overall service quality, so-called "ovservice", was introduced. The theoretical concept of "overall airport service quality" was already introduced by others previous papers specifically focused on air transport service quality (Nesset and Helgesen, 2014; Prentice and Kadan, 2019). This abstract construct is not directly measurable by the analyst; a preliminary analysis of the data permitted to identify two service quality aspects which can be used for measuring this latent construct, and which can be considered as observed endogenous variables: "Terminal comfort" and "Terminal reliability".

From the PCA three latent constructs emerged, which can be considered as unobserved exogenous variables in the model. The obtained results are reported in Table 4.6, where the scores corresponding to that specific principal component are shown with bold characters. The first one (PC1), so-called "access", represents the accessibility to the services, and it is explained by service aspects related to information and signposting. The second one (PC2), so-called "control", comprises all the factors linked to the control operations in the terminal and also includes processes related to check-in and baggage handling. The last one (PC3), so-called "environment", represents the sense of passengers well-being in the terminal, and it is explained by service aspects related to cleanliness and air conditioning.

Table 4.6. PCA.

	PC1	PC2	PC3
Road signposting	**0.578**	0.155	-0.010
Flight information display	**0.766**	0.065	0.087
Terminal signposting	**0.711**	0.070	0.127
Infopoint and security staff	**0.719**	0.145	0.167
Information accessibility	**0.814**	0.187	0.120
Waiting time at check-in	0.076	**0.573**	0.187
Baggage and passenger control	0.216	**0.830**	-0.041
Personal security	0.161	**0.798**	0.166
Cleanliness of terminal	0.095	0.262	**0.801**
Cleanliness of toilets	0.004	0.066	**0.871**
Terminal air conditioning	0.138	0.021	**0.321**

Then, direct and indirect effects among the latent constructs were hypothesised. Specifically, five hypotheses have been introduced to be tested by the SEM approach:

- h_1: “access” latent construct has a direct effect on “ovservice” latent construct.
- h_2: “control” latent construct has a direct effect on “ovservice” latent construct.
- h_3: “access” latent construct has a direct effect on “control” and an indirect effect on “ovservice” latent constructs.
- h_4: “environment” latent construct has a direct effect on “ovservice” latent construct.
- h_5: “access” latent construct has a direct impact on “environment” and an indirect effect on “ovservice” latent constructs.

The conceptual model to test adopting SEM approach can be outlined as in Figure 4.

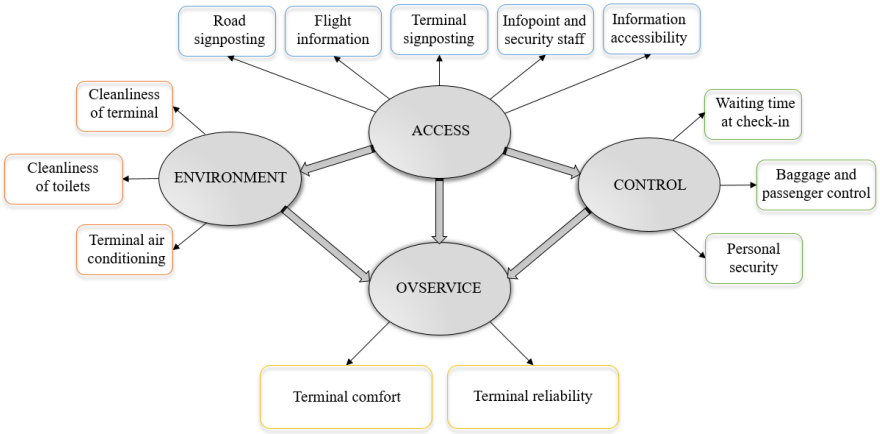


Figure 4.16. Conceptual model.

4.4.3 Results and discussion

From the conceptual model, it can be observed that the “access” variable assumes the role of an antecedent exogenous construct, which impacts “ovservice” both directly and indirectly, with “control” and “environment” latent constructs acting as mediator variables. The results obtained for the measurement model are shown in Table 4.7, where the nomenclature is the same adopted in Bollen (1989). The measurement model defines the relationships among hypothesized latent variables and the observed variables whose scores they influence, by taking into account the results obtained from PCA previously performed. In Table 4.7, (***) in the P-value column indicate that the estimated parameter is significant at a level smaller than 0.001. The standardized regression weights represent the amount of change in the dependent variable that is attributable to a single standard deviation unit’s worth of change in the predictor variable.

Table 4.7. Measurement model.

			RW*	SE*	P*	st.RW*
Road signposting (x_1)	⇦	ACCESS (ξ_1)	1.000			0.477
Flight information display (x_2)	⇦	ACCESS (ξ_1)	0.930	0.051	***	0.653
Terminal signposting (x_3)	⇦	ACCESS (ξ_1)	0.928	0.053	***	0.610
Infopoint and security staff (x_4)	⇦	ACCESS (ξ_1)	0.947	0.049	***	0.740
Information accessibility (x_5)	⇦	ACCESS (ξ_1)	0.934	0.047	***	0.851
Waiting time at check-in (x_6)	⇦	CONTROL (ξ_2)	1.000			0.418
Baggage and passenger control (x_7)	⇦	CONTROL (ξ_2)	1.807	0.120	***	0.757
Personal security (x_8)	⇦	CONTROL (ξ_2)	1.541	0.103	***	0.751
Cleanliness of terminal (x_9)	⇦	ENVIRONMENT (ξ_3)	3.383	0.453	***	0.791
Cleanliness of toilets (x_{10})	⇦	ENVIRONMENT (ξ_3)	3.486	0.462	***	0.647
Terminal air conditioning (x_{11})	⇦	ENVIRONMENT (ξ_3)	1.000			0.208
Terminal comfort (y_1)	⇦	OVSERVICE (η_1)	6.438	0.996	***	0.674
Terminal reliability (y_2)	⇦	OVSERVICE (η_1)	1.000			0.203

(*) RW (Regression Weights), SE (Standard error), P (Probability level), st.RW (standardised Regression Weights)

In Table 4.8, the results obtained for the structural model are reported. The significance of the resulting statistics of the SEM model confirmed all the formulated hypotheses.

Table 4.8. Structural model.

			RW*	SE*	P*	st.RW*
OVSERVICE (η_1)	⇦	ACCESS (ξ_1)	0.055	0.012	***	0.299
OVSERVICE (η_1)	⇦	CONTROL (ξ_2)	0.059	0.014	***	0.235
OVSERVICE (η_1)	⇦	ENVIRONMENT (ξ_3)	0.194	0.040	***	0.544
CONTROL (ξ_2)	⇦	ACCESS (ξ_1)	0.360	0.033	***	0.493
ENVIRONMENT (ξ_3)	⇦	ACCESS (ξ_1)	0.179	0.029	***	0.348

(*) RW (Regression Weights), SE (Standard error), P (Probability level), st.RW (standardized Regression Weights)

The model consists of 13 observed variables, and 21 unobserved variables, including four latent constructs and 17 error terms, one for each observed variable and latent construct. The estimated parameters were finally 52, consisting of 35 regression weights and 17 variances. Chi-square Minimum (CMIN) is 900.816 with 60 Degrees of Freedom (DF). As reported in Hu and Bentler (1999), CMIN/DF was calculated to indicate the magnitude of discrepancy between the sample and fitted covariance's matrix.

The obtained value (15.02) is significant at a 0.000 probability level, and it is higher than the recommended value of 5.0 (Hooper et al., 2008).

An acceptable fit is confirmed also by the Root mean square error of approximation (RMSEA) equal to 0.08 (Hu and Bentler, 1999). The Goodness of Fit Index (GFI equal to 0.93) indicates a well-fitting model, with a recommended cut-off point of 0.90 (Hooper et al., 2008). However, Adjusted Goodness of Fit Index (AGFI) presents a lower value (0.90).

The model comparisons fit indices indicate that the hypothesised model fits the observed variance-covariance matrix (Normed Fit Index, NFI equal to 0.86) enough. This result is reinforced by the Comparative Fit Index (CFI) that represents a revised form of the NFI, taking into account sample size (CFI equal to 0.87). Although the last indices showed values a little bit lower than the cut-off recommended by several authors (0.90), Bollen (1989) suggests that these criteria are merely guidelines. As an example, some authors report that CFI $\geq$ 0.8 is good enough for the structural validity of the model (Browne and Cudeck, 1993; Hair et al., 2010).

By considering the obtained results (Table 4.8), it is evident that passengers' perceptions about overall service, "ovservice", are directly affected mainly by the latent construct related to terminal environment (0.544), and secondly by the accessibility to the airport services (0.299). However, there are significant indirect effects of the latent construct "access" on the "ovservice" mediated by both the latent constructs "environment" (0.348) and "control" (0.493). Accounting for both direct and indirect effects allows obtaining a total effect of "access" on "ovservice" equal to 0.604. In other words, having precise information and signposting inside the terminal makes the airport services more accessible and, at the same time, increases the sense of passengers well-being in the terminal. In turn, passengers' satisfaction with the overall service is improved.

On the other hand, having precise information and signposting inside the terminal makes control operations easier and check-in or baggage handling faster, improving passengers' satisfaction with "control" and "ovservice" latent aspects. Evidence from the measurement model (Table 4.7) shows that accessibility to the airport services, "access", is better explained by indicators related to information than signposting; specifically, the most significant standardised weight is obtained by the indicator "accessibility of information". This result can be partly counterintuitive; however, probably, this happens because Lamezia Terme is a small airport where all the areas are close to each other. Also, Prentice and Kadan (2019) registered that the airport's signs have a significant role in directing passengers to services/facilities. As expected, "control" latent construct (control operations in the terminal) is better explained by indicators related to passenger control

and personal security. The terminal environment gives a sense of well-being to the passengers more if the cleanliness of terminal and toilets are perceived as satisfactory. As in Suki (2014), air-conditioning in airport results less critical for the passengers staying in the terminal than the cleanliness of the airport toilets, although in the sample there is a significant percentage of passengers who do not use this service. Finally, it emerged that "terminal comfort" is the indicator mainly affecting overall service, "ovservice", whereas "terminal reliability" has a lower influence on it.

4.5 SEM-MIMIC ordinal Probit model

4.5.1 Model specification

The following application shows an SEM-MIMIC model with an ordinal Probit (OP) framework, chosen due to the data ordinal nature. In OP models, the relationship between (X) characteristics and the dependent variable (y) is often assumed:

$$y = X\beta + \epsilon \tag{8}$$

where it is assumed that errors (ϵ) have a standard normal distribution (Greene and Hensher, 2010). Since the dependent variable cannot be directly observed, it is defined as a latent response variable (y^*). The relationship between ordinal y (with K response categories) and y^* is:

$$y = k \;\Leftrightarrow\; \tau_{k-1} < y^* < \tau_k \tag{9}$$

For the categories $k = 1, 2, \ldots, K - 1$; the $\tau_0 = -\infty$ and $\tau_k = +\infty$, and the τ_k values are called cut points or thresholds. By the nature of this model, it is specified that y^* is normally distributed with mean zero and unit variance, following Muthen (1984):

$$y^* \sim N(0,1) \tag{10}$$

In OP models, β_i coefficients represent the change in the 'probit' value per unit increase of x_i (Rosseel, 2014). In SEM these coefficients are named as standard coefficients (Std.Coef.).

For SEM, the basic estimation algorithm is the Maximum Likelihood estimator, which is applicable for an interval, a ratio level, or a continuous data with normal distributions and large sample sizes. For non-normal data, Weighted Least Squares (WLS) is the most recommended estimator (Bollen, 1989). The WLS-estimator makes minimum assumptions about the distributions of the observed items. When variables in the analysis are

ordinal, the recommended analysis matrix is a polychoric correlation matrix (Bowen and Guo, 2012). For this application, the Diagonally Weighted Least-Squares (DWLS) estimator is used. DWLS estimators use only the diagonal of the weight matrix to invert the matrix. Specifically, the DWLS estimator included in the Lavaan package for *R* (Rosseel, 2012) is adopted, which considers all possible ordinal-ordinal pairwise set of variables in the SEM analysis. The MIMIC approach considers the restriction of a group-invariant covariance matrix for the observed indicators, conditional on grouping variables represented by regressors, which can be categorical values (*i.e*. binary variables) or numeric (Joreskog and Goldberger, 1975). Including explanatory variables affords MIMIC extra information about the measurement model and enables the investigation of hypotheses of invariance across subpopulations explicitly. This quality is the key to capture different perceptions across subpopulations. Allen et al. (2018b) applied the SEM-MIMIC framework recently for a Santiago (Chile) case study, specifically for the bus system. In a similar spirit, this application proposes an SEM-MIMIC model that considers all possible socioeconomic, travel and user-type (i.e. "accessory", "technology user") characteristics. The OP framework follows that of Allen et al. (2018a), who applied it to multiyear customer service for Milan's rail system.

The results will be shown in this sequence: (1) first, Principal Component Analyses (PCA) have been conducted for both the user-type constructs and for the service quality attributes items, (2) then a CFA has been performed to test the proposed measurement models, and the full SEM models with the structural relations between the latent constructs and items. Finally, (3) the SEM-MIMIC model has been examined, for the complete sample, to assess heterogeneity in the airport users' perception.

4.5.2 Data application

The data object of the following analysis are those related to the two-year period 2015-2016 (see paragraph 4.3.2). In Table 4.9, the percentages of use of some services are reported. By observing the results, it is clear that most of them are scarcely used because of the airport type.

Since the passenger terminal has not a very large extension (Figure 3.3) and all the operations take place on the same level of the building, usually passengers do not use luggage trolleys or lifts. Moreover, since Lamezia Terme is not a hub airport, the departing passengers arrive at the terminal generally from home, and therefore they do not need charging stations or restaurants. Consequently, the most used food facility (more than 50% in both years) is the Coffee bar. Also, the ticket office is scarcely used, and from 2015 to 2016 it is even less used, surely due to the more and more

increasing use of the internet to acquire the tickets. On the other hand, the airport website and airport wi-fi are quite used (around 25% and 30%, respectively).

Table 4.9. User-type: accessories and technology items used while in terminal.

Category		2015 (%)	2016 (%)
Ticket office	Yes	17.4	10.0
	No	82.6	90.0
Luggage trolleys	Yes	14.7	6.3
	No	85.3	93.7
Escalators lift	Yes	15.8	15.9
	No	84.2	84.1
Charging stations	Yes	19.4	17.6
	No	80.6	82.4
Snack machines	Yes	13.0	2.4
	No	87.0	97.6
Airport website	Yes	14.0	25.5
	No	86.0	74.5
Airport wi-fi	Yes	30.1	31.0
	No	69.9	69.0
Shops products	Yes	29.6	26.0
	No	70.4	74.0
Food facilities	Coffee bar	50.4	56.2
	Restaurants	4.2	0.2
	None	45.4	43.6

4.5.3 Latent factors for provided services and user-type

As recommended by Hoyle (2012) and Jolliffe (2014), different PCA have been conducted in order to uncover how different constructs are formed, by following the Kaiser (1960) rule where an absolute loading >0.4 is considered acceptable for including the item in the construct. For the first PCA, the user-type variables have been coded as dummy variables (i.e. numeric). Results suggest that two different user-type can be considered (Table 4.10). First, the "accessory user" is related to the ticket office, luggage trolleys, escalator lifts and snack machines items. The luggage trolley and escalator lift items hint that the accessory user carries luggage, and thus, uses these accessories. Second, the "technology user" variable is measured by users of the charging stations, airport website, airport wi-fi, and shops products items (Table 4.10). The Cronbach's alphas (1951) are reasonable for a satisfactory fit (>0.5) for the "accessory user" variable; however, the "technology user" variable has a low Cronbach's alpha (0.35).

Hence, different measurement models for the CFA have been tested, in order to determine which items better represent this construct.

From the second PCA, which involves attribute-specific service quality items, four constructs have been obtained: "information", "control", "environment", and "food service" (Table 4.11). The terminal air conditioning item did not comply with the factor loading threshold (>0.4); however, it was left in the "environment" construct for theoretical reasons. All Cronbach's alphas are satisfactory for an acceptable fit (>0.5).

Table 4.10. PCA for user-type.

Category	Accessory user	Technology user
Ticket office	**0.46**	0.01
Luggage trolleys	**0.57**	-0.06
Escalators lift	**0.50**	-0.01
Snack machines	**0.41**	0.16
Charging stations	-0.12	**0.60**
Airport website	0.11	**0.40**
Airport wi-fi	0.13	**0.54**
Shops products	-0.03	**0.40**
Cronbach's alpha (α)	0.60	0.35

Table 4.11. PCA for service quality attributes.

Category	Information	Control	Environment	Food service
Road signposting	**-0.34**	-0.04	0.03	0.08
Flight information display	**-0.46**	0.01	0.03	0.05
Terminal signposting	**-0.47**	0.05	-0.02	0.00
Infopoint and security staff	**-0.45**	-0.03	-0.01	-0.04
Information accessibility	**-0.49**	-0.02	-0.01	-0.03
Waiting time at check-in	0.02	**-0.45**	0.09	0.02
Baggage and passenger control	-0.01	**-0.63**	-0.11	-0.03
Personal security	0.00	**-0.62**	0.08	0.03
Cleanliness of terminal	-0.01	-0.06	**0.67**	0.01
Cleanliness of toilets	0.01	0.05	**0.70**	-0.01
Terminal air conditioning	-0.03	-0.02	**0.17**	-0.15
Food choices	-0.05	0.07	0.02	**-0.57**
Food prices	0.06	-0.02	-0.02	**-0.59**
Food staff	-0.01	-0.06	0.01	**-0.54**
Cronbach's alpha (α)	0.78	0.55	0.55	0.77

4.5.4 SEM: overall satisfaction in the terminal

In the first stage of the study, a full SEM model for overall satisfaction at the terminal was introduced, by including only the user-type constructs and not the socio-economic and flight characteristics, and travel habits. The initial hypotheses to be tested are presented as follows:

- h1: "information" affects "control", "environment", "food service", and "overall satisfaction";
- h2: "control" affects "overall satisfaction";
- h3: "environment" affects "control", "food service", and "overall satisfaction";
- h4: "food service" affect "overall satisfaction";
- h5: user-type constructs affect all specific constructs and the "overall satisfaction", as depending on the accessory and technology gadgets used in the terminal, users will enjoy a different experience.

Overall satisfaction is measured by the service quality items "terminal comfort" and "terminal reliability" representing the two aspects covering the overall services in the terminal. In Figure 4.17, the schema of the SEM model is presented; non-significant links are not included (90%). The ovals represent the latent constructs, and the rectangles represent the single survey items. The SEM is on the top of Figure 4.17, and the measurement system at the bottom.

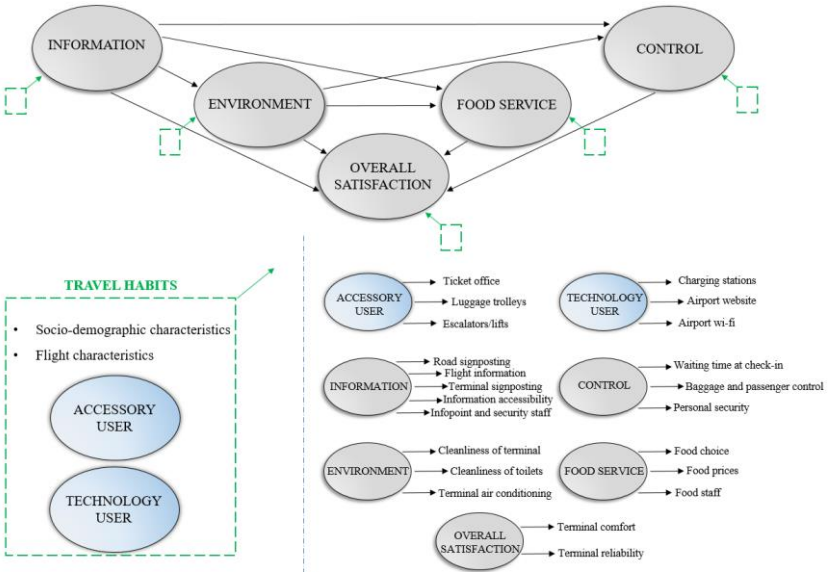


Figure 4.17. Schema of the SEM.

The measurement model is reported in Table 4.12. Standardised coefficients refer to the standard change of the dependent variable when the predictor variable changes one standard deviation. For most of the latent constructs, the items present adequate reliability (>0.5) (*i.e.* Std.Coeff.). Notice that both snack machines and shop products were discarded as they produced very low coefficients. Two exceptions are present for the "technology user", and "overall satisfaction"; in the former, airport wi-fi has a high coefficient (0.94) instead charging stations and airport website have moderate coefficients (0.34-0.36); for the latter, terminal comfort (0.96) dominates over terminal reliability (0.26). Besides these cases, the values lie within the 0.49-0.95 range, implying an adequate measurement of the constructs.

Table 4.12. SEM ordinal Probit: Measurement system.

Latent Variables	Estimate	S.E.	Z-value	p-value	Std.Coef.	R^2
Accessory user						
Ticket office	1.00				0.73	0.53
Luggage trolleys	1.09	0.07	15.11	<0.01	0.79	0.63
Escalators lift	1.07	0.07	16.15	<0.01	0.78	0.60
Technology user						
Charging stations	1.00				0.36	0.13
Airport website	0.95	0.14	6.70	<0.01	0.34	0.12
Airport wi-fi	2.59	0.62	4.19	<0.01	0.94	0.87
Information						
Road signposting	1.00				0.69	0.47
Flight information display	1.21	0.03	46.95	<0.01	0.83	0.69
Terminal signposting	1.17	0.03	43.40	<0.01	0.81	0.65
Infopoint and security staff	1.33	0.03	47.73	<0.01	0.92	0.84
Information accessibility	1.38	0.03	47.20	<0.01	0.95	0.90
Environment						
Cleanliness of terminal	1.00				0.92	0.85
Cleanliness of toilets	0.81	0.02	38.09	<0.01	0.75	0.56
Terminal air conditioning	0.53	0.03	20.35	<0.01	0.49	0.24
Control						
Waiting time at check-in	1.00				0.65	0.42
Baggage and passenger control	1.07	0.04	29.30	<0.01	0.70	0.49
Personal security	1.31	0.04	33.07	<0.01	0.85	0.72
Food service						
Food choices	1.00				0.80	0.65
Food prices	0.98	0.02	46.58	<0.01	0.79	0.62
Food staff	0.96	0.02	54.16	<0.01	0.78	0.60
Overall satisfaction						
Terminal comfort	0.56	0.10	5.58	<0.01	0.96	0.92
Terminal reliability	0.15	0.02	6.37	<0.01	0.26	0.07

The regression part of the SEM ordinal Probit model (Table 4.13) presents low to high R^2 (0.13-0.66), representing the explained variance for the latter four regressions. The R^2 for "information" is very low (0.01); this makes sense as only the "accessory user" variables have a direct path onto it. For the structural (standardised) coefficients, values below 0.1 are considered as very low, between 0.1 and 0.3 as low, between 0.3 and 0.5 as moderate, above 0.5 as high (Allen et al., 2018b; Currie and Delbosc, 2017). For the "information" regression, only "accessory user" has a low and negative coefficient (-0.08). For the "environment" regression, the most relevant item is "information" with a moderate coefficient (0.46), "accessory user" has a significant and positive effect, instead "technology user" a negative one. For the "control" regression, both "information" and "environment" have moderate effects, 0.37 and 0.44, respectively; intuitively "accessory user" has a negative effect (-0.46), as these are mostly users carrying luggage. For "food service" regression, the "environment" has a moderate and positive effect (0.33).

Table 4.13. SEM ordinal Probit: Regressions.

Regressions	Estimate	S.E.	Z-value	p-value	Std.Coef.	R^2
Information						0.01
Accessory user	-0.08	0.04	-2.15	0.03	-0.08	
Environment						0.25
Accessory user	0.27	0.06	4.52	<0.01	0.21	
Technology user	-0.43	0.12	-3.70	<0.01	-0.17	
Information	0.61	0.03	20.86	<0.01	0.46	
Control						0.64
Accessory user	-0.41	0.04	-10.69	<0.01	-0.46	
Technology user	0.12	0.07	1.68	0.09	0.06	
Information	0.35	0.03	12.90	<0.01	0.37	
Environment	0.31	0.03	11.99	<0.01	0.44	
Food service						0.13
Accessory user	-0.08	0.03	-2.33	0.02	-0.07	
Information	0.08	0.04	2.27	0.02	0.07	
Environment	0.28	0.03	11.17	<0.01	0.33	
Overall satisfaction						0.66
Accessory user	0.38	0.15	2.64	0.01	0.16	
Technology user	0.87	0.24	3.57	<0.01	0.18	
Information	0.38	0.10	3.74	<0.01	0.15	
Environment	0.84	0.17	4.87	<0.01	0.45	
Control	0.80	0.21	3.82	<0.01	0.30	
Food service	0.23	0.08	2.97	<0.01	0.11	
CFI	TLI	GFI	AGFI	RMSEA	SRMR	WRMR
0.984	0.981	0.989	0.983	0.065	0.079	2.597

For the "overall satisfaction" regression, all constructs have a positive effect. "Environment" and "control" have the highest effects, 0.45 and 0.30, respectively. "Accessory" and "technology users" have a low effect (0.16-0.18); still, both are significant. "Information" and "food service" also provide a positive effect (0.15-0.11). The explained variance is high (0.66), for "overall satisfaction". Regarding the SEM fit indices, the CFI (Comparative Fit Index), TLI (Tucker-Lewis Index), GFI (Goodness-of-Fit Index), and AGFI (Adjusted Goodness-of-Fit Index) are all above 0.98, exceeding the recommended cut-off (>0.95) values by Hu and Bentler (1999). The RMSEA, the most important index, complies with the cut-off value as well (<0.08), indicating adequate fits for the SEM model, demonstrating that data fit the proposed SEM structure. The WRMR (Weighted Root Mean Square Residual) is preferred over the SRMR (Standardized Root Mean Square Residual) for ordinal SEM models using the DWLS estimator; the lower the value the better it is, and it is useful to compare amongst different models from the same data.

4.5.5 SEM-MIMIC: overall satisfaction in the terminal

Finally, another SEM-MIMIC ordinal Probit model was presented by introducing dummy variables into all the regressions to capture the heterogeneity of perceptions for the service quality constructs and "overall satisfaction" depending on users' travel, terminal-use, and socioeconomic characteristics. Specifically, for all categories *n*-1 dummy variables were added, where *n* is the number of groups in each category. The previous hypotheses were simultaneously introduced and kept the significant variables (90%). The measurement system is presented in Table 4.14.

The regressors (base in parentheses) for travel behaviour characteristics are: one for the year of the data collection (2015), two for trip purpose (Other), one for travelling alone condition (No), and two for flight destination (Italy). Next, three regressors were introduced for mode for reaching the airport (Car dropping-off the passenger), two for time arrival before departure (1-2 hour), one for flight type (Legacy/charter), one for travel frequency (One flight last 12 months), and two for food service use (No). Lastly, the introduced regressors for demographic characteristics are: two for country of origin (Italy), one for gender (Male), four for age (<30 years old), and two for level of education (Upper-secondary). In total, 24 dummy variables for each regression were included and kept those significant at the 90% level.

Table 4.14. SEM-MIMIC ordinal Probit: Measurement system.

Latent Variables	Estimate	S.E.	Z-value	p-value	Std.Coef.	R^2
Accessory user						
Ticket office	1.00				0.63	0.40
Luggage trolleys	1.31	0.10	13.54	<0.01	0.82	0.68
Escalators lift	1.21	0.09	13.76	<0.01	0.76	0.58
Technology user						
Charging stations	1.00				0.38	0.15
Airport website	1.50	0.20	7.59	<0.01	0.57	0.33
Airport wi-fi	1.78	0.24	7.33	<0.01	0.68	0.46
Information						
Road signposting	1.00				0.69	0.47
Flight information	1.24	0.03	43.37	<0.01	0.84	0.71
Terminal signposting	1.21	0.03	41.28	<0.01	0.83	0.68
Infopoint and security staff	1.36	0.03	48.17	<0.01	0.92	0.85
Information accessibility	1.43	0.03	46.89	<0.01	0.96	0.93
Environment						
Cleanliness of terminal	1.00				0.92	0.84
Cleanliness of toilets	0.81	0.02	37.83	<0.01	0.75	0.56
Terminal air conditioning	0.53	0.02	21.82	<0.01	0.50	0.25
Control						
Waiting time at check-in	1.00				0.65	0.42
Baggage and passenger control	1.18	0.04	31.65	<0.01	0.76	0.57
Personal security	1.35	0.04	32.39	<0.01	0.86	0.73
Food service						
Food choices	1.00				0.83	0.69
Food prices	1.00	0.02	42.80	<0.01	0.83	0.69
Food staff	0.93	0.02	48.50	<0.01	0.78	0.61
Overall satisfaction						
Terminal comfort	0.56	0.10	5.68	<0.01	0.98	0.96
Terminal reliability	0.15	0.02	6.78	<0.01	0.28	0.08

The most significant results are presented in Table 4.15 and Table 4.16. The regression part of the SEM-MIMIC ordinal Probit model presents moderate to high R^2 (0.29-0.70), representing the explained variance for the latter four regressions; again, the R^2 for "information" is low (0.08). However, there is a hefty improvement in all R^2 when SEM-MIMIC is compared with the SEM model. For the "information" regression, the most relevant conditions are being "aged between 31-60", "business traveller", and interestingly, having a "low-secondary" or "university" level education; all mentioned conditions present a negative effect. Being a "frequent flyer" and/or having a coffee at the terminal present a positive effect (Table 4.15).

Table 4.15. SEM-MIMIC ordinal Probit Regressions: information, environment, control.

Regressions	Estimate	S.E	Z-value	p-value	Std.Coef.	R^2
Information						0.08
Year 2016	-0.11	0.04	-2.72	0.01	-0.08	
Business	-0.21	0.08	-2.68	0.01	-0.11	
Destination Europe	-0.06	0.03	-2.17	0.03	-0.04	
Bus shuttle	-0.11	0.06	-1.76	0.08	-0.05	
Low-cost flight	-0.11	0.04	-2.57	0.01	-0.08	
Frequent flyer	0.12	0.04	2.71	0.01	0.08	
Coffee bar	0.07	0.04	1.85	0.07	0.05	
Birth Europe	-0.07	0.03	-2.94	<0.01	-0.05	
Age 31-40	-0.26	0.06	-4.55	<0.01	-0.17	
Age 41-50	-0.29	0.06	-4.55	<0.01	-0.17	
Age 51-60	-0.36	0.07	-5.34	<0.01	-0.20	
Age >61	-0.17	0.07	-2.34	0.02	-0.08	
Low secondary	-0.16	0.05	-3.08	<0.01	-0.09	
University	-0.10	0.05	-2.16	0.03	-0.07	
Environment						0.29
Information	0.59	0.03	22.22	<0.01	0.43	
Accessory user	0.26	0.08	3.46	<0.01	0.17	
Technology user	-0.38	0.14	-2.72	0.01	-0.15	
Year 2016	-0.19	0.05	-3.79	<0.01	-0.10	
Destination Europe	-0.06	0.03	-1.97	0.05	-0.03	
Low-cost flight	-0.13	0.05	-2.44	0.02	-0.07	
Frequent flyer	0.28	0.05	5.07	<0.01	0.14	
Coffee bar	-0.09	0.05	-1.76	0.08	-0.04	
Female	-0.13	0.05	-2.50	0.01	-0.07	
Age 41-50	0.26	0.08	3.11	<0.01	0.12	
Age >61	0.19	0.10	1.94	0.05	0.06	
Low secondary	0.14	0.07	1.91	0.06	0.06	
University	-0.10	0.06	-1.65	0.10	-0.05	
Control						0.64
Information	0.39	0.02	17.17	<0.01	0.41	
Environment	0.29	0.02	13.90	<0.01	0.41	
Accessory user	-0.34	0.04	-8.87	<0.01	-0.32	
Year 2016	0.09	0.03	2.83	0.01	0.07	
Business	-0.25	0.07	-3.69	<0.01	-0.14	
Destination Europe	0.04	0.02	1.69	0.09	0.03	
Destination foreign	0.14	0.04	3.37	<0.01	0.06	
Low-cost flight	0.16	0.04	4.68	<0.01	0.12	
Frequent flyer	-0.21	0.04	-5.63	<0.01	-0.15	
Coffee bar	0.08	0.03	2.37	0.02	0.06	
Birth foreign	0.13	0.04	3.15	<0.01	0.06	
Age 41-50	0.14	0.05	2.72	0.01	0.09	
Low secondary	-0.25	0.05	-5.44	<0.01	-0.15	
University	0.17	0.04	4.59	<0.01	0.12	

For the "environment" regression, information has the highest (0.43) and positive effect. After that, the most relevant and positive circumstances are being an "accessory user", "aged between 41-50", and a "frequent flyer". Negative effects are found for "technology users", "year 2016", "flying low-cost", and being a "female". For the "control" regression, both "information" and "environment" have the strongest and positive effects (0.41). The most negative effect is for being an "accessory user" (-0.32), a quite intuitive result because these users are probably carrying luggage. Other negative effects are found for "flying business", "frequent flyers", holding a "low-secondary" level of education. Positive effects are present for "year 2016", "flying low-cost", "aged 41-50", and holding a "university" level of education.

In Table 4.16, the "food service" and "overall satisfaction" regressions are reported. For the "food service" regression, the "environment" has the highest effect (0.29) from the latent constructs; both, having a coffee at the terminal (0.35) and being aged 41-50 (0.23) present moderate and positive effects. "Business" and "leisure travellers", "early arrivals", "frequent flyers", and in general, being "old over 40" have a positive effect. A low negative effect is present for "access by taxi or rental car".

For the "overall satisfaction" regression, "environment" maintains the highest effect (0.50); both "control" and "technology user" has a positive and moderate effect, while "information" and "food service" a positive and low one. Accessing by car and parking, late arrival, and having low-secondary or university level education present a negative effect. Finally, flying low cost, and for business or leisure purposes have a positive effect. It is also highlighted that "accessory user" lost significance to other characteristics from the previous SEM model. Regarding fit indices, CFI, TLI, GFI, and AGFI remain all above the cut-off values (>0.95). For RMSEA, it complies with the strictest cut-off value (<0.05); also, the WRMR is lower for the SEM-MIMIC than for the SEM, implying an improvement from the SEM model. The SEM-MIMIC adjusts amply to the data while also providing more explanatory power via the improved explained variance indices.

Table 4.16. SEM-MIMIC ordinal Probit Regressions: food service and overall

Regressions	Estimate	S.E.	Z-value	p-value	Std.Coef.	R^2
Food service						0.38
Information	0.11	0.03	3.66	<0.01	0.09	
Environment	0.28	0.02	11.75	<0.01	0.29	
Accessory user	-0.08	0.04	-2.23	0.03	-0.06	
Year 2016	0.17	0.04	4.30	<0.01	0.09	
Business	0.24	0.08	3.03	<0.01	0.10	
Leisure	0.15	0.07	2.23	0.03	0.07	
Alone	0.22	0.07	3.03	<0.01	0.06	
Destination foreign	0.15	0.04	4.05	<0.01	0.05	
Taxi rent	-0.23	0.06	-3.89	<0.01	-0.11	
Early arrival	0.18	0.04	4.09	<0.01	0.10	
Frequent flyer	0.24	0.05	5.25	<0.01	0.12	
Coffee bar	0.64	0.05	13.16	<0.01	0.35	
Birth Europe	0.08	0.03	2.48	0.01	0.04	
Birth foreign	0.16	0.04	4.13	<0.01	0.05	
Age 31-40	0.19	0.06	3.15	<0.01	0.09	
Age 41-50	0.51	0.06	7.96	<0.01	0.23	
Age 51-60	0.40	0.07	5.74	<0.01	0.16	
Age 61	0.27	0.07	3.61	<0.01	0.10	
University	-0.09	0.05	-1.76	0.08	-0.04	
Overall satisfaction						0.70
Information	0.35	0.09	3.77	<0.01	0.13	
Environment	0.97	0.18	5.48	<0.01	0.50	
Control	0.66	0.15	4.37	<0.01	0.24	
Food service	0.19	0.06	3.00	<0.01	0.10	
Technology user	1.41	0.35	4.01	<0.01	0.29	
Business	0.49	0.20	2.44	0.02	0.10	
Leisure	0.75	0.23	3.30	<0.01	0.18	
Car parked	-0.39	0.16	-2.47	0.01	-0.08	
Late arrival	-0.45	0.19	-2.37	0.02	-0.07	
Low cost flight	0.33	0.11	2.90	<0.01	0.09	
Birth Europe	-0.15	0.07	-2.16	0.03	-0.04	
Age 31-40	-0.30	0.15	-2.02	0.04	-0.08	
Low secondary	-0.24	0.14	-1.66	0.10	-0.05	
University	-0.24	0.11	-2.21	0.03	-0.06	
CFI	TLI	GFI	AGFI	RMSEA	SRMR	WRMR
0.964	0.987	0.961	0.952	0.048	0.079	2.229

4.5.6 Discussion of the results

From the analysis it emerged that all the latent constructs positively affect passengers' satisfaction with the overall service. The aspects that most influence overall satisfaction concern environment and control, including elements used and perceived by all passengers. On the contrary, Suki (2014) found that environmental factor affects customers' negative emotions. The aspect concerning the environment is mostly represented by the cleanliness of terminal, rather than cleanliness of toilets or terminal air conditioning, while the aspect concerning control is represented by personal security rather than waiting time at check-in and baggage and passenger control. The other constructs, which regard information and food services, are a representation of services that are not necessarily used by all passengers. These aspects also represent positive elements of the terminal experience; improving them will make users more satisfied. The factors mostly affecting the information construct concern infopoint and security staff and information accessibility. On the other hand, the aspect regarding food service is almost equally expressed by all the factors describing it (food choices, food prices, and food staff). More specifically, food service presents the lowest weight, surely because it is a service not used by all passengers, due to the typology of the airport which is medium sized and it is not a hub where generally passengers stay more time for waiting for other flights.

By analysing the effects of the variables expressing passengers' type and characteristics, it emerges that technology users have a higher overall satisfaction compared to other users. This evidence indicates that they probably spend joyful time on-line while waiting at the terminal. Moreover, passengers that use parking services have a lower overall satisfaction, perhaps because it takes more time and effort to park the car and to walk from the parking lot. In the same direction, passengers who are late have a lower overall satisfaction most likely because they are in a hurry and security and control services slow them down.

For every construct, particular nuisances are present, according to user characteristics. As an example, technology users notice environment more negatively, probably because they are sitting down and looking for charging stations. On the other hand, being a frequent flyer and 41-50 years old increases the satisfaction of the aspects concerning the environment.

Secondly, control satisfaction is affected negatively by accessory users, surely because they travel with luggage and for this reason, they spend more time at controls than the other passengers. Popovic et al. (2009), in fact, found that most of the passenger time is devoted to wait for luggage during the security controls.

Likewise, the frequent flyer is less satisfied with the aspects regarding control as well as the passengers travelling for business, probably because they spend more time in the airports. Conversely, more educated people (who have a degree) or people travelling on low-cost flights are more satisfied with control services.

Concerning the aspects linked to information, it emerges that passengers travelling for business and passengers 30-60 years old are less satisfied than the other passengers, probably because they use this service in order to plan their trip and move as quick as possible across the airport. In opposition, (Carstens and Heyns, 2012) found that the purpose of travel (business or other) does not influence the ranking of the attributes significantly.

Related to food services, it emerged that users who frequent the coffee shops or have more possibility to frequent food services because of their early arrival to the airport are more satisfied with these services compared to users who do not use them; for this reason, these latter users do not have a reliable perception of the levels of quality. Food services are particularly appreciated by 41-50 years old passengers as well as by passengers who frequent the coffee services. Apparently, passengers arriving early at the airport are more satisfied with food services rather than the other passengers. Probably, this happens because they have the time to consume foods or drinks with certain calmness.

By comparing the results related to 2015 and 2016, it emerged that the satisfaction of the aspects concerning information and environment went down, while for control and food service it went up. The year variable was not significant for the overall satisfaction, indicating that the latent service quality attributes explain no difference between the two years.

In conclusion, the frequent flyer is mostly satisfied in general compared to the occasional flyer, with the exception of the aspect linked to the control. This fact could be explained by considering that the habitual flyer does not notice the quality levels of the airport because he/she needs to take the aircraft for making a specific activity. The only aspect that could bother this kind of passenger is the control because he/she is forced to make the various controls for accessing to the aircraft and be prone to a certain waiting time before the flight. For the rest, he/she is an informed passenger who does not pay attention to the environment and the other services; probably he/she would travel under any condition because the only interest of that passenger is making that trip in order to accomplish something else. On the contrary, the low-cost passenger is more satisfied with the control aspects compared to the other passengers, probably because he/she does not expect high levels of quality and therefore he/she is more satisfied aside from the offered services.

In general, the proposed model is a comprehensive tool that accounts for user differences in perception. For the overall satisfaction regression, having a high explained variance (0.70) suggests that the model proposed is adequate for predicting overall satisfaction, the model offers insights into the difference between user-types and also sociodemographic characteristics, contributing to the existing literature.

4.6 IPA and Gap-IPA

4.6.1 Methodology

IPA is a simple and effective technique that can assist practitioners in identifying improvement priorities for customer attributes and direct quality-based marketing strategies. IPA is applied based on two dimensions of customer attributes: performance level (satisfaction) and importance. By combining the two dimensions, a graph with four quadrants is determined, where each quadrant defines a certain level of priority of the service attributes falling within it. Data from CSSs are typically used to construct a two-dimensional matrix, where attribute performance (satisfaction) is depicted along the x-axis, and attribute importance (satisfaction) is depicted along the y-axis. Attribute importance is measured using some forms of self-stated importance (e.g. rating scales) or implicitly derived importance (e.g. multiple regression weights, partial correlation weights). Generally, the means of performance and importance divide the matrix into four quadrants (Figure 4.18). Quadrant I, where both performance and importance are high, contains the attributes that can be considered as the significant strengths; they represent opportunities for achieving or maintaining competitive advantage. The management scheme for this quadrant is “keep up the good work”. Quadrant II, where performance is low and importance is high, contains the major weaknesses, which require immediate attention for improvement. The management scheme for this quadrant is “concentrate here”. Quadrant III, where performance and importance are low, contains the minor weaknesses, which do not require additional effort. The management scheme for this quadrant is “low priority”. Finally, Quadrant IV, where performance is high and importance is low, contains the attributes that can be considered as minor strengths, indicating that business resources committed to these attributes would be overkill and should be deployed elsewhere. The management scheme for this quadrant is “possible overkill”. Researchers commonly suggest that major weaknesses (Quadrant II) should be a top priority and targeted for immediate improvement efforts (Martilla and James, 1977). On

the other hand, major strengths (Quadrant I) should be maintained and heavily promoted (Lambert and Sharrma, 1990).

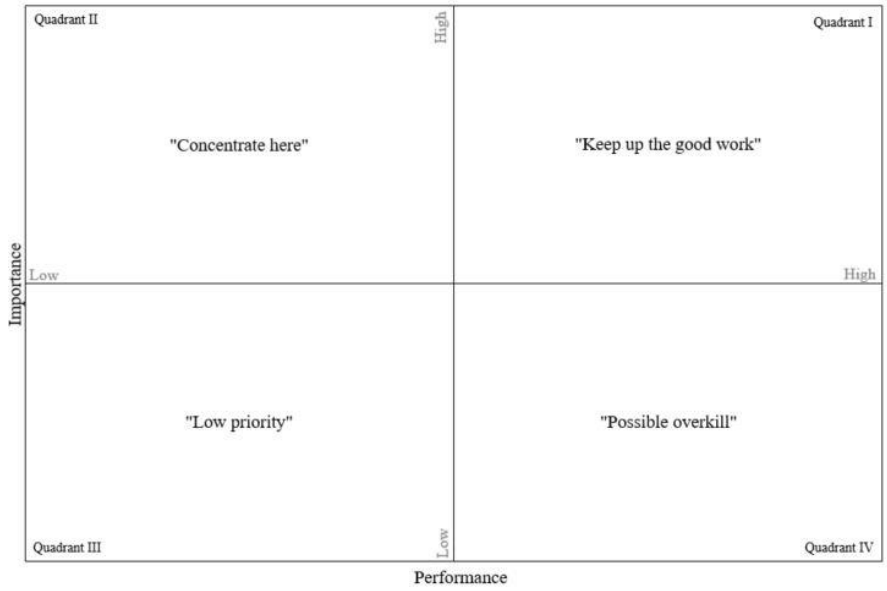


Figure 4.18. IPA

Some studies have modified and extended IPA; however, the basic framework has primarily remained the same (Sampson and Showalter, 1999). Following, an alternative representation of the two dimensions, performance and importance, is proposed; it is named Gap-IPA, using the concept expressed in the SERVQUAL model where service quality is defined and calculated as the gap between customer's expectations and perceptions (Parasuraman et al., 1991). Following the theory of Teas (1993), who stated that expectations could be interpreted as attribute importance, the gap between importance and performance is assumed as the representation of the gap between expectations and perceptions. The distance (gap) between the importance and performance of each service attribute is considered and represented on a circular graph composed of two different sectors (Figure 4.19). The external sector contains the attributes for which importance is higher than performance; in other words, these are the attributes for which the perceptions of the users do not reach the expectations. The inside sector contains the attributes for which importance is lower than performance, that is the attributes for which performance exceed the expectations.

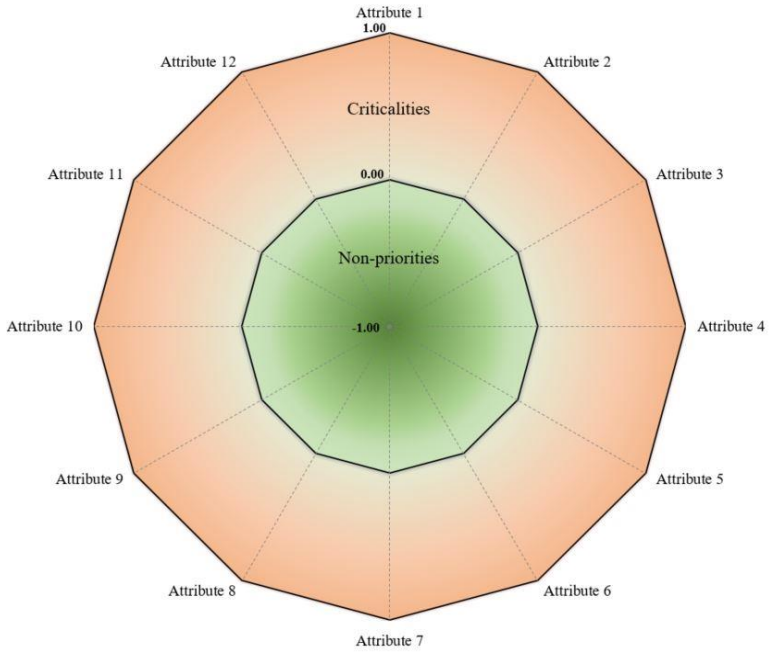


Figure 4.19. Gap-IPA.

The service aspects falling within the external sector can be considered as criticalities, on which financial resources should be concentrated because the performance is distant from the importance. On the other hand, the aspects falling within the inside sector have to be considered as aspects that operators could disregard or consider as not prior because the performance exceeds the importance. The degree of criticality and non-priority varies as a function of the value of the distance between importance and performance. As an example, the attributes located near the border dividing the two sectors could require particular attention because they could easily jump from a sector to the opposite one.

The application of Gap-IPA requires that importance and performance have to be expressed according to the same scale. For this reason, a normalization of the values from 0 to 1 is proposed. Therefore, the external sector contains attributes with a gap from 0 to 1, where 0 indicates that performance is equal to importance, and 1 the maximum gap between importance and performance, or the maximum distance of performance from importance. On the other hand, the inside sector contains the attributes with a gap from -1 to 0, where -1 indicates the maximum gap between performance and importance, or the maximum distance of importance from performance. The value of 0 delineates the border dividing the two sectors.

The graphical representation of Gap-IPA can offer a more straightforward reading of the data regarding the IPA. First of all, IPA proposes a subdivision of the service attributes in well four quadrants, where the reader could be disoriented, while according to Gap-IPA there is a sharper division of the attributes in only two groups. Secondly, for interpreting IPA, a continuous comparison between importance and performance has to be effected, while Gap-IPA adopts only one value, which is the gap between importance and performance, a more immediate approach. In this way, the gap between importance and performance acquires more relevance than the separate concepts. As an example, there could be a first attribute with high performance and higher importance and a second one with low performance and lower importance. These two attributes could fall into the external area, while according to IPA they would be in different quadrants. By analysing the condition of the two attribute, it could be concluded that both the attributes are not priorities and would rightly fall into the internal area of non-priorities. Moreover, the position of the attribute in the graph, which could be near or far the border separating the two sectors would be the difference. This last observation guarantees that applying Gap-IPA there is not a loss of information as regards IPA.

As the technique is applied by adopting the data collected on a sample of air passengers expressing judgements only on the performance of the service, the importance was calculated through a SEM approach because it can consider the relationship between the service attributes, the overall satisfaction, and latent constructs (Eboli et al., 2018). For the following application, the results of SEM discussed in the previous paragraph will be considered.

4.6.2 Importance calculation

In Table 4.17, direct and indirect effects among the latent variables, calculated by taking into account the antecedent and mediator variables (Table 4.8), are shown. Successively, the total effects reported in Table 4.17 were distributed among the service attributes by considering the values of the standardized regression weights. Table 4.18 summarizes the elements used for deriving the importance of the application of IPA and Gap-IPA.

Table 4.17. Direct, indirect, and total effects.

	Direct effect	Indirect effect	Total effect
ACCESS (ξ_1)	0.299	0.305	0.604
CONTROL (ξ_2)	0.235	0.000	0.235
ENVIRONMENT (ξ_3)	0.544	0.000	0.544

Table 4.18. Importance calculation.

	Total effect	st.RW	Importance
Road signposting (x_1)		0.477	0.29
Flight information display (x_2)		0.653	0.39
Terminal signposting (x_3)	0.604	0.610	0.37
Infopoint and security staff (x_4)		0.740	0.45
Information accessibility (x_5)		0.851	0.51
Waiting time at check-in (x_6)		0.418	0.10
Baggage and passenger control (x_7)	0.235	0.757	0.18
Personal security (x_8)		0.751	0.18
Cleanliness of terminal (x_9)		0.791	0.43
Cleanliness of toilets (x_{10})	0.544	0.647	0.35
Terminal air conditioning (x_{11})		0.208	0.11

Before applying Gap-IPA, IPA was applied, for highlighting the analogies and the differences between the two techniques and for better explaining the advantages of Gap-IPA as regards IPA. The values derived multiplying the total effects of the standardized regression weights (Table 4.18) were adopted as the importance of each service aspect. On the other hand, the average value of the judgments directly expressed by the passengers about each attribute was considered as performance. By observing the results of IPA, the importance range varies from 0.10 and 0.51 (with an average value of 0.30), whereas performance range from 3.65 and 4.21 (with an average value of 3.97) (Table 4.19).

Table 4.19. Importance, performance, and gap.

	Imp.	Perf.	Normalized Importance	Normalized Performance	Gap
Road signposting	0.29	3.82	0.46	0.31	0.15
Flight information display	0.39	3.98	0.71	0.59	0.12
Terminal signposting	0.37	3.97	0.65	0.57	0.08
Infopoint and security staff	0.45	4.06	0.84	0.73	0.11
Information accessibility	0.51	4.06	1.00	0.73	0.27
Waiting time at check-in	0.10	4.21	0.00	1.00	-1.00
Baggage and passenger	0.18	4.20	0.19	0.98	-0.78
Personal security	0.18	4.15	0.19	0.90	-0.71
Cleanliness of terminal	0.43	3.92	0.80	0.48	0.32
Cleanliness of toilets	0.35	3.65	0.61	0.00	0.61
Terminal air conditioning	0.11	3.77	0.04	0.21	-0.17

Importance and performance values were normalized for the application of Gap-IPA, as the calculation of the gap, a subtraction, requires that the values are expressed following the same scale. More specifically, the normalization was made by considering the minimum values registered by

the attributes both for importance and performance. For this reason, it can be easily observed that the normalized importance assumes a minimum value of 0.00 for the attribute "waiting time at check-in", which presented the minimum value of 0.10 in the IPA, and a maximum value of 1.00 for the attribute "information accessibility", which assumed the maximum value of 0.51 in the IPA. Analogously, concerning performance, "cleanliness of toilets" has a normalized minimum value of 0.00 (3.65 in IPA) and "waiting time at check-in" a maximum value of 1.00 (4.21 in IPA).

4.6.3 Application of IPA

The results from IPA can be observed in Figure 4.20. The first quadrant contains the service attributes regarding information, which are the strengths of the service; therefore, the airport's managing company should maintain high the level of quality for these attributes for achieving competitive advantage. On the contrary, the service attributes particularly in need of improvements are cleanliness of terminal, cleanliness of toilets and terminal signposting, because they have high importance but relatively low performance. Finally, all the other service attributes, included in the last two quadrants, can be considered as service aspects with a low priority, on which the agency could not focus the efforts. Definitively, for an airport as Lamezia Terme, the areas where policy-based actions will likely result in the most significant improvement have to be identified in such aspects linked to cleanliness and comfort.

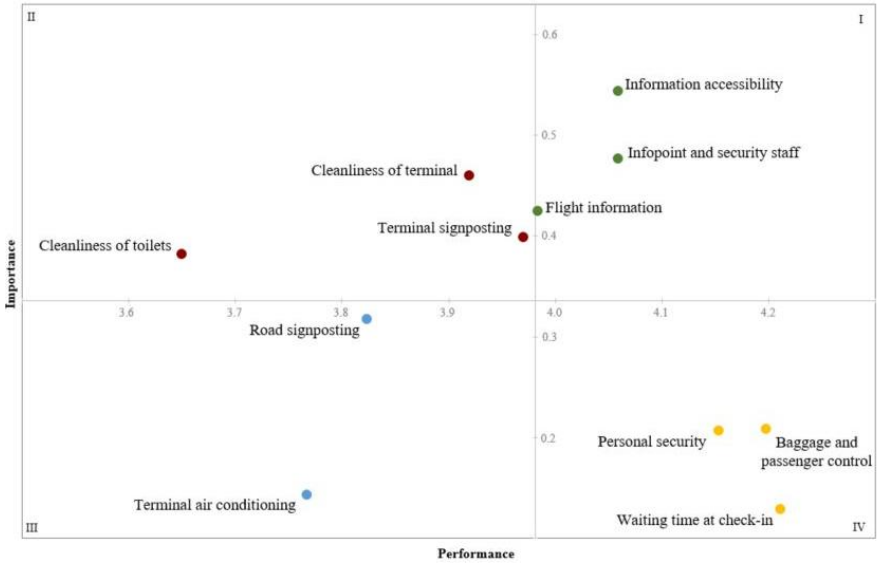


Figure 4.20. Application of IPA.

4.6.4 Application of Gap-IPA

In Figure 4.21, the results of Gap-IPA can be easily observed. Accurately, the difference (gap) between the importance and performance of each service attribute was reported on a circular graph composed of two different sectors. In the external sector, including the aspects for which importance is higher than performance, most of the service attributes are located. More specifically, the significant criticalities are surely represented by the attributes regarding cleanliness, as also discovered through the IPA. The attributes concerning information result as criticalities by Gap-IPA, while according to IPA they were considered as strengths of the service because they registered high values of both importance and performance. But thanks to the calculation of the gap between importance and performance, it can be verified that even if performance is high, it does not achieve the importance, and for this reason, the attributes have to be considered as criticalities according to the concepts at the basis of Gap-IPA. However, it should be highlighted that these attributes are located near the border dividing the two sectors; therefore, with a minimum effort from the company, they could easily pass in the inside sector and be considered as non-priorities.

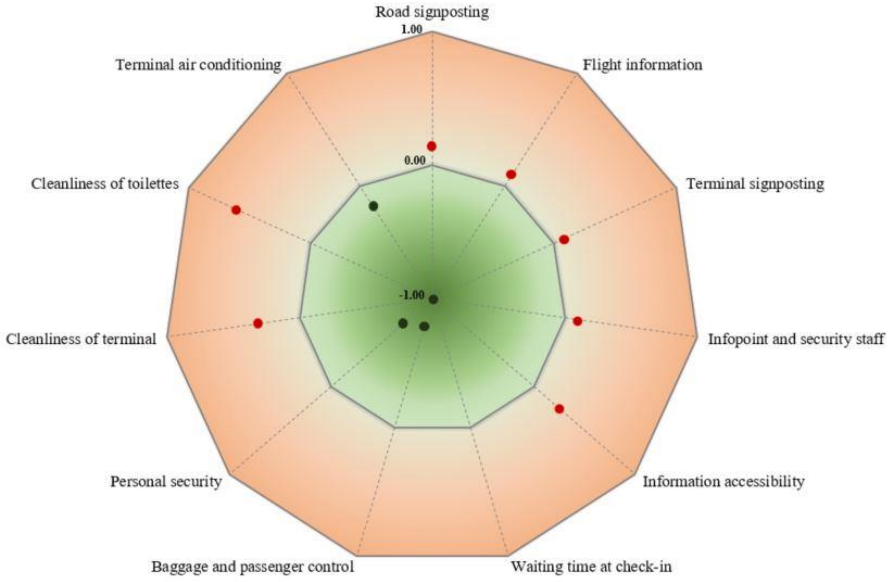


Figure 4.21. Application of Gap-IPA

The most performant attribute is surely "waiting time at check-in", which registered a gap of -1, assuming the highest value of performance and the

lowest value of importance. Other quite performant attributes are "personal security" and "baggage and passenger control", which were possible overkill according to IPA because they registered high values of both performance and importance. Finally, also the attribute regarding terminal air conditioning can be considered as a non-priority, but it is located near the border, and therefore it could pass in the external sector if performance decreases.

4.6.5 Discussion of the results

Evidences emerged from IPA and Gap-IPA demonstrate that the Gap-IPA succeeds in highlighting useful information that IPA is not able to capture. In fact, IPA considers the values of importance and performance but without directly comparing them as it happens in Gap-IPA, where importance and performance are compared through the calculation of the gap. Moreover, the graphical representation of Gap-IPA is undoubtedly more immediate and easily interpretable than IPA. In fact, IPA requires to observe what happens in four quadrants, while in Gap-IPA a simple overlook at two sectors is sufficient for having a clear idea of the criticalities of the service, without missing the most essential information.

From the analysis, it emerged that the service provided by the Lamezia Terme airport presents two main criticalities, which are the attributes linked to cleanliness. Another attribute for which performance is relatively distant to the expectation is “information accessibility”. Finally, the other four criticalities (i.e. the other two attributes regarding information, and the attributes linked to signposting both in the terminal and on-road for reaching airport) are located near the border, and for this reason, they could be considered as less critical.

Starting from the results of Gap-IPA, the right strategies for effectively managing the service can be more conveniently identified. As an example, significant efforts should be concentrated on the cleanliness of terminal and toilets, to satisfy passengers and make their stay in the airport as more comfortable. The aspects concerning information represent less urgent criticalities, but a particular effort should also be reserved for this aspect, in order to make the performance equal to the expectation and make the passengers fully satisfied. A certain level of attention should also be addressed to terminal air conditioning because in this case, the performance is a little more than importance and if the company does not take care of this aspect, it could easily become a criticality of the service. Finally, the policies of the company could focus less on aspects such as “waiting time at check-in”, “personal security”, and “baggage and passenger control”. This kind of result could be due to the peculiarity of the analysed airport, which is a small-sized airport offering, for the most part, national flights, while international

scheduled flights were primarily concentrated in the summer months. Aspects linked to check-in, or baggage and passenger control, or personal security perform well probably because of the small dimensions of the airport and the relatively contained number of passengers. Particularly impressive is the result concerning the attributes linked to information and signposting, which should be improved in order to make it a strength of the service. More specifically, having precise information and signposting inside the terminal make control operations easier, and check-in or baggage handling faster, improving passengers' satisfaction on overall service. Different findings could be registered in studies analysing large-sized airports characterized by relevant traffic data. As an example, Pandey (2016) attempted to measure the service quality of the two gateway airports of Thailand Suvarnabhumi (BKK) and Don Mueang (DMK) by utilizing the Fuzzy MCDM Analysis and also conducting IPA using Fuzzy expert system. He discovered that for both the analyzed airports, there is a need to improve aspects linked to check-in, security, and speed of baggage delivery service, which in this study they can be considered as non-priorities.

It can be concluded that aside from the case study, the proposed methodology represents a useful and practical tool for supporting the operators to identify the most beneficial strategies for improving the service and adequately investing the financial resources. Gap-IPA could be considered an alternative to the well-known IPA, due to the immediateness and easiness of representing and interpreting the results. The key of the work is that Gap-IPA brings the two-dimensional matrix of IPA into a single indicator (i.e. the gap between importance and performance) that can more conveniently help the administration to prioritise the service aspects resulting as the most critical, but also the ones close to become critical.

4.7 Summary

The findings reported in this chapter demonstrate that is fundamental to investigate airport service quality by taking into account the passengers' perceptions. Specifically, the proposed methodologies resulted as useful tools for determining the criticalities and the strengths among the provided services, by considering also the characterization of the airport and of its users as well. Starting from this, the managing companies could improve their strategies addressed to optimize the use of financial resources for satisfying the passengers. Moreover, the conducted research contributes to the existing literature review because the results obtained for the specific case study of Lamezia Terme International airport could be considered as a reference for similar-sized airports, scarcely analysed by other authors.

With these aims, the followed research framework is characterized by methodologies able to determine the service aspects that most influence overall satisfaction, the influence of passengers' characteristics on perceptions, the criticalities of the provided service, and the structure of the overall service quality.

From the OL model, it emerged that generally in an airport such as Lamezia Terme the significant impact on the overall satisfaction is given by the service aspects regarding *information* (flight information display, terminal signposting and announcements), *cleanliness of terminal*, and *comfort* (lighting inside the terminal and noise inside the terminal). Moreover, the results obtained by the OL models calibrated for different groups of users showed that: (1) *comfort* is retained as fundamental by people travelling for leisure; (2) *modal integration* and *information* assume priority for those who travel for purposes such as work and business; (3) passengers arriving more than two hours early give more importance to *cleanliness of terminal*; and finally (4) the foreign users consider as most important the service aspect related to flight information display.

These findings have been confirmed by the subsequent LC analysis, whose results shows that air passengers using Lamezia Terme terminal facilities can be subdivided into three classes: (1) the *non-sensitive passengers*; (2) the *cleanliness-sensitive passengers*; (3) the *information-sensitive passengers*. As expected, when arrival time before the flight increases the probabilities to belong to the *cleanliness* and *information-sensitive* classes increases, and this attitude is particularly evident for female, passengers traveling for leisure and from countries different from Italy. The analysis was increased by considering also the influence of age and education level over the class memberships. Specifically, older passengers tend to be less exigent; conversely, the education level contributes to have more exigent passengers, decreasing the probability to belong to *non-sensitive class* of passengers.

The subsequent aim is trying to find latent factors connected to the overall airport service quality, by adopting a SEM approach. From the results, it emerged that having precise *information* and *signposting inside the terminal* makes the airport services more accessible and, at the same time, increases the sense of passengers well-being in the terminal. Moreover, having precise *information* and *signposting inside the terminal* improve passengers' satisfaction with *control*. Finally, the terminal environment gives a sense of well-being to the passengers more if the cleanliness of terminal and toilets are perceived as satisfactory.

By applying the SEM-MIMIC approach it emerged that the most important item concerning environment is the *cleanliness of terminal*,

indicating that this aspect should be maintained at all costs, in order to keep terminal users satisfied. On the other hand, the attributes mostly affecting the *information* concern infopoint and security staff, and information accessibility. Therefore, the financial resources should be more conveniently addressed on these aspects rather than road signposting or terminal signposting. A final consideration can be made concerning the technology users, who seem to be more overall satisfied, and this indicates that maintaining a good service of airport wi-fi and up and running website can be tactical for those passengers early arriving, who stay in the terminal for some time.

From the last proposed methodology, it was possible to clearly determine the strengths and the criticalities. IPA and Gap-IPA, in fact, are applied for obtaining practical implications of the previous results. From the analysis, it emerged that the two main criticalities at the Lamezia Terme International airport are the service aspects linked to *cleanliness* and those related to *information*. Specifically, the aspects concerning information represent less urgent criticalities, but an effort reserved for these aspects could make the passengers fully satisfied.

Generally, it can be concluded that all the findings could be useful for the companies managing airports similar to Lamezia Terme for identifying the most suitable policy strategies to improve the provided services.

Part 3 – Analysis of Airlines' services

Chapter 5

Airlines services' study case: the online survey at University of Calabria

5.1 Introduction

As it occurs for the airports' managing companies, also the airlines conduct CSSs; however, they often rely on third parties to collect and analyze data and do not generally make data available. In order to obtain evaluations of passengers on airlines' services, an online survey has been designed and realized at the University of Calabria. The population of the University of Calabria has been chosen as case study thanks to the possibility to contact easily a large number of users among students and workers. The following sections have been organized to best describe the questionnaire design process. At the end of the chapter there is also a final section containing the main statistics of the data collected, preliminary to the subsequent data processing and analyses, reported in chapter 6.

The design of the questionnaire is certainly the most sensitive part of the entire CSS design process. In this case, the questionnaire is composed by two main parts: an RP part and an SP one. The RP questionnaire has been designed with the aim to collect the passengers' evaluations about their last flight experience. On the other hand, SP part was designed with the aim to capture the passengers' desires on airlines' services by proposing them hypothetical scenarios. Despite the presence of two so different parts, the design of the entire questionnaire can be summarized as follows. First of all, an analysis of the existing literature was conducted in order to better select the main service aspects to be included in the RP part for the evaluation, and in the SP for the design of choice experiments. Through the literature review, the evaluation scales to be adopted in the RP were also chosen, together with

the variation levels of each service attribute for the SP. After a preliminary draft of the questionnaire, a panel of experts was contacted for collecting suggestions to improve it. Then, a Pilot Survey (PS) was launched to refine the survey design. Once the questionnaire design has been completed, the large-scale survey was launched online.

5.2 The Revealed Preferences survey

5.2.1 Questionnaire design framework

The general objective of this section is to define how the design of a CSS questionnaire addressed to air passengers has to be conducted. As shown in Figure 5.1, the research framework that has been followed until the final questionnaire is organized in three main stages.

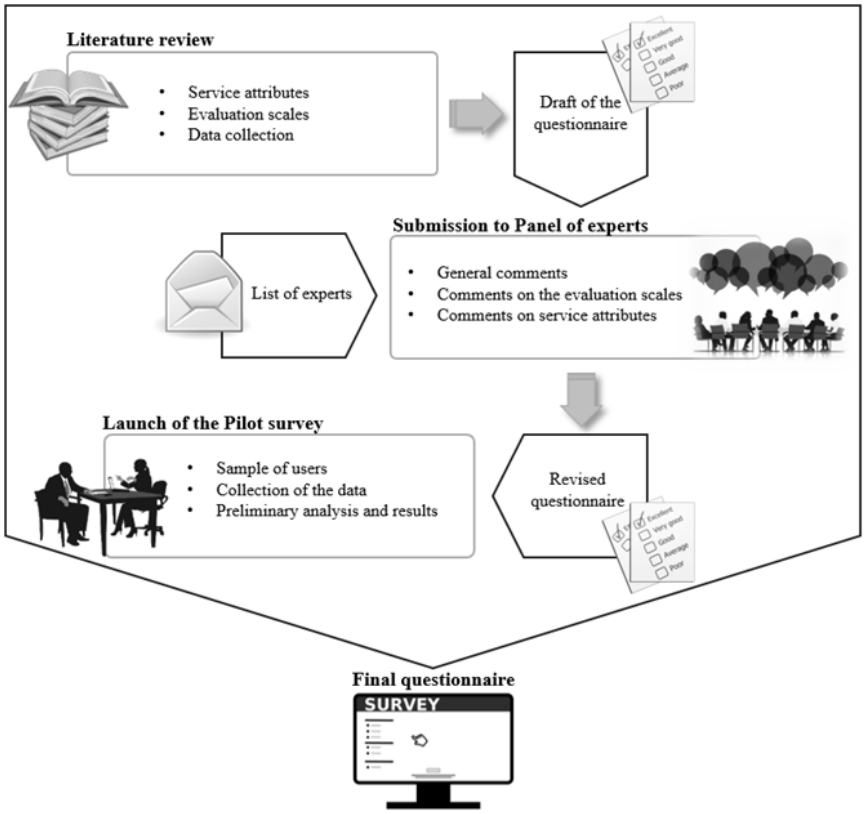


Figure 5.1. Design framework of the questionnaire.

The preliminary stage consists of an analysis of the literature aimed to: (1) establish the service attributes to be included in the questionnaire; (2) define the evaluation scales; (3) determine the most advantageous mode for data collection. The second stage involves a panel of experts, with the aim to take advantage from their competence and experience for improving and refining the questionnaire. This stage began once the draft of the questionnaire was ready and the list of experts to whom submit it compiled. The experts' answers have been filed and the comments grouped in the following categories: general comments, comments concerning the evaluation scale, and comments regarding the service attributes. The third stage of the framework is represented by the PS. A PS is a strategy used to test the questionnaire using a smaller sample compared to the planned sample size. More specifically, the revised questionnaire obtained thanks to the support of the panel of experts was subsequently tested on a sample of users. At the end of this stage, the final questionnaire has been implemented by assessing the results achieved from the analysis of the collected data with the PS. For a survey that requires a large number of participants, spending time and money in the most efficient way is fundamental; the PS was carried out just for this purpose (dell'Olio et al., 2017). Therefore, before starting PS, the drawing up of the questionnaire needs to be completed.

5.2.2 Analysis of the literature

A deep study of the literature review and an analysis of airlines questionnaires were conducted to select the service aspects to be considered in the questionnaire, and to define the evaluation scale. Firstly, by analysing the several studies whose object are the services offered by the airlines, the main aspects of the service have been identified (Table 2.1). It has been found that in most studies the services analysed are not only those provided during the flight, but also the services offered before the boarding and after the landing. According to this and in agreement with Tsafarakis et al. (2018), the draft of the questionnaire was organised by listing the service aspects following the chronological order of passengers' actions from the flight booking to the baggage delivery. In this way, the interviewee will be helped to remind his/her experience from the beginning to the end without messing. These considerations are fundamental because, by conducting an online survey, the interviewees compile a self-administered questionnaire without the support of an interviewer, and moreover he/she has to maintain a certain level of concentration in remembering a past experience.

From the analysis of the literature review, most of the studies analysed data collected at the boarding gates or anyway in the departure area of the airport. In such cases, the collected opinions have to obviously refer to a

previous flight, since in the departure areas passengers are waiting the flight and therefore they have not travelled yet. Only two studies, Chou et al. (2011) and Li et al. (2017), analysed data collected during the flight. In these specific cases, passengers could refer to the current flight. On the other hand, Lim and Tkaczynski (2017) adopted an online survey conducted on the users of their university. Analogously, for this research, it was decided to collect the data by inviting all the population of the University of Calabria (Italy) (e.g. professors, researchers, administrative and technical staff, and students) to respond to an online questionnaire. They answered by reporting their opinions about the services provided by a specific airline for their most recent travel. The online survey was retained as more appropriate than the face-to-face one, just because it allows to investigate on the whole services provided before the boarding, during the flight and after the landing. In addition, through an online survey a large number of people can be reached and complete the questionnaire in a very cheap manner.

A great differentiation of the literature studies emerges concerning the evaluation scales adopted for collecting passengers' opinions. The differences occur in the kind of judgments and in the numbers of levels as well. The major part of the studies refers to evaluation scales on 5 levels, some of these expressed according to satisfaction levels from "strongly dissatisfied" to "strongly satisfied" (Hu and Hsiao, 2016; Liou et al., 2011c) or also from "very unsatisfied" to "very satisfied" (Tsafarakis et al., 2018), and others on judgement from "very poor" to "very good", or from "very low" to "very high" (Chou et al., 2011; Hussain et al., 2015). Analogously, when also importance rates are requested the scale varies from "unimportant" (or "least important") to "important" (or "most important") (Chen, 2008; Hu and Hsiao, 2016; Liou et al., 2011c). Only a limited number of studies adopted scales on seven points (Kuo, 2011; Lim and Tkaczynski, 2017; Wu and Cheng, 2013). For the questionnaire object of this research it was decided to ask for each service attribute both a judgement in terms of rate on an evaluation scale ranging from 1 to 10 (Figure 5.2(a)), and a level of satisfaction among the five proposed ones (Figure 5.2(b)).

As an outcome of the preliminary stage the questionnaire was drafted. Specifically, it was composed by 9 parts from "A" to "I" introduced by a brief presentation of the survey and the questionnaire. The part "A" contains questions for collecting information about the interviewee's last air travel (date, destination, trip purpose, departure and arrival airports, airline, booking and purchase procedures, cost and check-in procedure). Except for the date, the destination and the departure and arrival airports, all the questions are multiple-choice type. After a brief description of the evaluation scales, the two questions related to the evaluation of the overall travel

experience (before, during and after the flight) are reported in part "B": the first one asks to the user a judgment from 1 to 10 (Figure 5.2(a)), the second one requests the level of satisfaction by using the scale of Figure 5.2(b). The questions related to each service aspect are organized from part "C" to "E" as reported in Table 5.1. Specifically, for each service attribute users were asked to express a judgment from 1 to 10 (Figure 5.2(a)) and a level of satisfaction (Figure 5.2(b)).

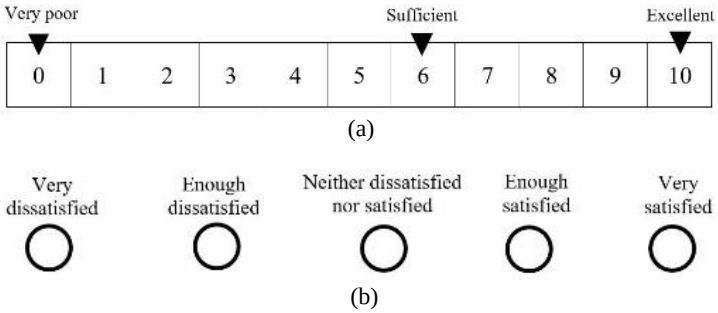


Figure 5.2. Evaluation scales in the draft of the questionnaire submitted to the panel of experts.

Part "F" called "Final considerations" contains the same question of part "B" concerning the satisfaction with the overall travel experience. The reason behind proposing to passengers again this question arises from the will to verify if the opinion about the overall service after the evaluation of the single service attributes is the same expressed before evaluating them. Part "F" contains also a question about the quality/price ratio evaluation, and other two questions aimed to know whether the user will use or recommend the airline in the future, based on the past experience. These concepts are generally known as behavioral intentions or loyalty (i.e. intent to recommend the service). The satisfaction-loyalty relation is a well-established fact in the marketing literature (Oliver, 2010; Olsen, 2007; Paulssen and Birk, 2007), and this is confirmed also in the recent study by Allen et al. (2020).

In the part "G", the interviewee has to express a degree of importance for each service (2nd column of Table 5.1) by using a scale from 0 (= "not important") to 10 (= "extremely important"). Finally, the part "H" contains the SP, that will be object of the subsequent sections. The draft of the questionnaire ends with part "I", where several personal information is requested, such as age, gender and income.

Table 5.1. Service attributes considered in the questionnaire submitted to the panel of experts.

Part of the questionnaire	Services	Service attributes
C. Evaluation of the experience before the flight	C1. Flight booking	Flight booking procedure
	C2. Check-in procedure	Boarding pass procedure
		Seat choosing procedure
		Luggage embarking procedure
		Special services requesting procedure
		Booking changing procedure
	C3. Boarding procedures	Waiting in line before boarding
		Courtesy and competence of the staff for boarding
		Way to get on board
D. Evaluation of the flight experience	D1. Punctuality of departure	Punctuality of the flight departure
	D2. Cabin comfort	Space available inside the overhead bins
		Comfort of the seat
		Temperature inside the cabin
	D3. Cabin cleanliness	Cleanliness of the cabin, tables and seats
		Cleanliness of the toilets
	D4. Flight information	Flight information
	D5. Cabin crew	Courtesy of the cabin crew
		Competence of the cabin crew
	D6. Safety and security	Flight safety
		Personal security
	D7. On-board services	On-board food service
		On-board Wi-Fi
		On-board entertainment services
		On-board sale service
E. Evaluation of the experience at the arrival	E1. Punctuality at the arrival	Flight punctuality at the arrival
	E2. Landing procedures	Waiting time for getting off the aircraft
		Way to get off the aircraft
	E3. Luggage delivery	Waiting for luggage delivery
		Luggage conditions

5.2.3 Panel of experts

In order to collect suggestions and impressions from people specialized in the research field object of study, the draft of the questionnaire was sent to a panel of experts. Specifically, the panel was composed by 30 experts including academics, researchers and employees in transport companies.

In general, the feedback from the panel of experts was positive. The questionnaire has been considered complete, in the sense that it covered almost all the significant aspects of the service provided by airlines. Moreover, although the questionnaire could be considered as quite long, the experts suggested that by submitting it as an online questionnaire it would be quick to complete. As regards the evaluations scales, most of experts found

interesting to discover the perceptions of the users by asking both a judgement and a level of satisfaction. The received advices concerned only the form of presentation and not the chosen type. Specifically, in accordance with the panel, the evaluation scales have been modified as reported in Figure 5.3. In other words, the interviewees have been left free to interpret the levels avoiding to report the description of some levels of the numerical scale; in addition, the description of the satisfaction levels in the verbal scale has been modified by adopting more definite expressions.

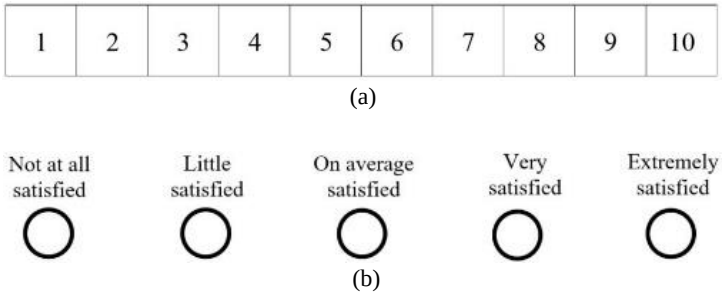


Figure 5.3. Evaluation scales modified after the submission to the panel of experts

As regards the service attributes, some questions have been modified in the form according to the suggestions of the panel of experts. Particularly, all the questions referred to waiting times were changed by considering the procedure as a whole (e.g. "waiting in line before boarding" has been replaced with "boarding operations"). This adjustment was made because from the panel of experts' feedback emerged that it is difficult to express a level of satisfaction or judgement of quality for a negative concept such as the waiting time. Moreover, other changes implied the addition or the deletion of some questions. Specifically, some experts suggested to add a question regarding acoustic comfort, which is a component that could affect the comfort in an aircraft. On the other hand, the question concerning personal security was deleted because on a vehicle such as the aircraft the possibility to be subject of a theft or robbery is a remote possibility compared to the same eventuality on other vehicles such as bus or train. Finally, the attribute concerning safety was split by considering every single phase of the flight (take-off, cruise and landing).

5.2.4 Pilot survey

After the refinement of the questionnaire effected on the basis of the comments received from the panel of experts, the PS was launched by

administering the questionnaire not to a percentage of the total sample population, but just to a convenience sample as in more informal cases. Convenience sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researchers. In this manner, more accurate answers and additional information have been acquired confidentially as in an in-depth interview. People who had made at least one flight has been contacted by e-mail. They were asked to complete the questionnaire and also to provide the eventual difficulties they have encountered in answering the questions. Therefore, the PS allowed not only to test the questionnaire but also to collect key information for improving it before the launch of the large-scale survey. Definitively, a sample of 41 passengers was contacted by e-mail to fill out the questionnaire. The sample is made up of more females (59%) than males, and 37% of users are aged from 31 to 40. 39% of the sample travels by air several times a year and 34% flies at least once a year.

Table 5.2 and Table 5.3 show the results obtained from the PS. Specifically, for each service attribute the mean and mode of the judgments of service quality (Table 5.2), and the frequency distributions of satisfaction levels in terms of percentages were calculated (Table 5.3).

Interesting considerations result from the observation of the obtained values. By analyzing the mean and the mode, two main groups of service attributes can be defined: one composed of the attributes whose mean is greater than 7 and mode is equal to 8, and the other one whose attributes have mean between 6 and 7 and mode equal to 6. For the first group of service attributes the highest percentages of response corresponds to the satisfaction level “very satisfied”, instead in the second group the most chosen level of satisfaction is “on average satisfied”. Thus, as a first impression, the judgment of service quality equal to 8 corresponds to the satisfaction level “very satisfied”, instead the judgment 6 to “on average satisfied”. However, looking at the table in detail, for certain service attributes the connection between the two evaluation scales is not so obvious.

As an example, for the attribute related to the courtesy and the competence of the staff for boarding, and for that related to the luggage conditions, the level “on average satisfied” registered the highest percentage of response though the mean is greater (or equal) to 7 and the mode is 8.

On the contrary, for flight information, whose mean is less than 7 and mode is 6, the users choose more the level “very satisfied” than the middle one.

Table 5.2. Evidences from PS: Judgments of service quality

Service attributes	Mean	Mode
Flight booking procedure	7.8	8
Boarding pass procedure	8.0	8
Seat choosing procedure	7.4	8
Luggage embarking procedure	7.3	8
Special services requesting procedure	n.u.	-
Booking changing procedure	n.u.	-
Boarding operations	6.7	8
Courtesy and competence of the staff for boarding	7.6	8
Way to get on board	6.9	6
Punctuality of the flight departure	7.4	8
Space available inside the overhead bins	6.4	6
Comfort of the seat	6.5	6
Temperature inside the cabin	7.0	6
Acoustic comfort	6.3	6
Comfort during take-of, cruise and landing phases	7.3	6
Cleanliness of the cabin, tables and seats	7.3	8
Cleanliness of the toilets	6.8	6
In-flight information	6.7	6
Courtesy of the cabin crew	7.4	7
Competence of the cabin crew	7.6	7
Safety during the take-off	7.6	8
Safety during the cruise	7.9	8
Safety during the landing	7.4	8
On-board food service	6.7	6
On-board Wi-Fi	n.u.	-
On-board entertainment services	7.6	8
On-board sale service	n.u.	-
Flight punctuality at the arrival	7.8	8
Landing operations	7.3	8
Way to get off the aircraft	7.2	8
Luggage delivery operations	6.6	6
Luggage conditions	7.0	8

"n.u.": not used service

From these evidences it has been retained opportune to investigate more deeply to the conjoint use of both the scales, and both the evaluations scales have been adopted also in the final questionnaire.

Moreover, it has been found that the respondents were confused when their travel was made by more flights (maybe provided by more airlines) and check-in procedure was not strictly linked to the flight they focused on for the service quality evaluation; a similar inconvenience can occur for the luggage delivery procedure evaluation. As a consequence, it has been

decided to ask to the interviewee to refer to a specific flight. In particular, when the travel was made by more flights, the respondent should provide the evaluations referring only to the flight with the longest duration.

Table 5.3. Evidences from PS: Frequency distributions of satisfaction levels in percentage

Service attributes	Not at all satisfied	Little satisfied	On average	Very satisfied	Extremely satisfied
Flight booking procedure	0.0	4.9	26.8	63.4	4.9
Boarding pass procedure	0.0	2.4	24.4	61.0	12.2
Seat choosing procedure	4.5	18.2	27.3	40.9	9.1
Luggage embarking procedure	0.0	6.7	40.0	53.3	0.0
Special services requesting procedure	-	-	-	-	-
Booking changing procedure	-	-	-	-	-
Boarding operations	2.4	24.4	36.6	36.6	0
Courtesy and competence of the staff for boarding	0.0	7.3	43.9	36.6	12.2
Way to get on board	0.0	12.2	53.7	26.8	7.3
Punctuality of the flight departure	4.9	7.3	26.8	53.7	7.3
Space available inside the overhead bins	0.0	24.4	51.2	22.0	2.4
Comfort of the seat	2.4	17.1	56.1	19.5	4.9
Temperature inside the cabin	2.4	14.6	48.8	24.4	9.8
Acoustic comfort	4.9	29.3	41.5	24.4	0.0
Comfort during take-of, cruise and landing phases	0.0	12.2	41.5	34.1	12.2
Cleanliness of the cabin, tables and seats	0.0	17.1	34.1	34.1	14.6
Cleanliness of the toilets	0	26.7	40.0	20.0	13.3
In-flight information	7.3	14.6	29.3	41.5	7.3
Courtesy of the cabin crew	0.0	9.8	36.6	41.5	12.2
Competence of the cabin crew	0.0	7.3	34.1	43.9	14.6
Safety during the take-off	0.0	4.9	31.7	56.1	7.3
Safety during the cruise	0.0	2.4	31.7	53.7	12.2
Safety during the landing	2.4	7.3	34.1	46.3	9.8
On-board food service	6.7	13.3	46.7	26.7	6.7
On-board Wi-Fi	-	-	-	-	-
On-board entertainment services	0.0	10	30.0	50.0	10.0
On-board sale service	-	-	-	-	-
Flight punctuality at the arrival	4.9	4.9	22.0	48.8	19.5
Landing operations	7.3	7.3	34.1	41.5	9.8
Way to get off the aircraft	2.4	14.6	34.1	43.9	4.9
Luggage delivery operations	0.0	10.5	63.2	26.3	0.0
Luggage conditions	0.0	10.5	52.6	31.6	5.3

The final questionnaire was digitally reported in “Google Forms”, the free survey administration app included in Google Drive office suite, as part of the large-scale survey questionnaire reported in Appendix B.

5.3 The Stated Preferences survey

5.3.1 SP experiment design framework

The SP part of the questionnaire was designed with the aim to find out what users of air transport look for in the services provided by the airlines, and what they would like receiving when they travel by air. In other words, this principal aim is to investigate on the quality that passengers expect.

The design of the SP choice experiments was carried out simultaneously with the design of the RP part. So, it was organized in the following stages: (1) the analysis of the literature, conducted for establishing the service attributes to be adopted in the choice experiments; (2) the panel of expert, for receiving the feedback from sector's specialists; (3) the PS, carried out for testing the survey structure and the validity of the experimental design; (4) the refining of the questionnaire before the launch of the large-scale survey.

The existing literature on airlines' service quality was analysed with the aim to identify the attributes that are most influent for a flight traveller. Findings from literature review served as the basis for designing the preliminary version of the questionnaire. The services provided by the airlines include the whole travel experience and not only the time spent in flight. As reported in (Table 2.1), there are many attributes that can be taken into account. Therefore, it has been decided to design two different unlabelled choice experiments, one related to experience "before/after the flight", and the other one "during the flight". The scenarios of each choice experiment are characterized by two choice alternatives described by six attributes. The number of attributes and their levels of variations were chosen by taking into account that more attributes and levels there are in a choice experiment design, the less likely that dominant alternatives will exist (Cherchi and Hensher, 2015); otherwise the interviewees should not be asked to compare too many variables, for avoiding the lack of their concentration in making their choice (dell'Olio et al., 2011; Echaniz et al., 2019b, 2019a).

The alternatives of a "before/after the flight" scenario are described by the following variables: waiting time at check-in, time spent for boarding operations, terminal-aircraft transfer mode, delay of flight departure, time spent for luggage delivery, and cost of the ticket. Instead, the variables chosen for a "during the flight" scenario are: space available on board, temperature on board, cleanliness on board, courtesy of cabin crew, services on board, and cost of the ticket. The levels of variation of these attributes have been chosen for proposing to the interviewees as realistic as possible choice alternatives (Cascajo et al., 2017). In Table 5.4 and Table 5.5 the

levels of variations of each attribute are reported. As regards the "before/after the flight" attributes, only the cost of the ticket presents six values, while the other ones vary on three levels. Moreover, four numerical variables relate to time, one to cost, and one is a nominal variable representing the transfer mode from terminal to aircraft.

Table 5.4. Attributes' levels of variations in "before/after the flight" experiments (PS).

Attribute (unit)	Levels of Variations
Waiting time at check-in (min)	0 (online check-in); 5; 20
Time spent for boarding operations (min)	15; 60; 120
Terminal-Aircraft transfer mode	by external path; by jet bridge; by shuttle
Delay of flight departure (min)	0 (in time); 20; 60
Time spent for luggage delivery (min)	0; 10; 30
Cost of the ticket (€)	20; 60; 180; 360; 720; 1440

Instead, among the "during the flight" attributes, only the cost of the ticket is a numerical variable, and it presents the same six levels of variations chosen for "before/after the flight" experiments. The other variables are qualitative and varying on three levels. It has been retained as more appropriate using only two levels of variations for "cleanliness on board" and "courtesy of cabin crew".

Table 5.5. Attributes' levels of variations in "during the flight" experiments (PS).

Attribute (unit)	Levels of Variations
Space available on board	not fully adequate; adequate; fully adequate
Temperature on board	too warm; adequate; too cold
Cleanliness on board	clean enough; quite dirty
Courtesy of cabin crew	kind enough; quite rude
Services on board	not fully adequate; adequate; fully adequate
Cost of the ticket (€)	20; 60; 180; 360; 720; 1440

After choosing the attributes and their levels of variation, the panel of experts was contacted for collecting suggestions. Specifically, the panel was composed by 30 experts including academics, researchers and employees in transport companies. In general, the feedback from the panel of experts was positive.

5.3.2 Pilot survey

On the basis of the selected attributes and their levels of variations, the PS has been designed through the Ngene software (Choicemetrics, 2018). Specifically, the methodology proposed by Rose et al. (2008) has been

adopted. That methodology uses the D-error to create an efficient design and define the scenarios taking the data collected in the PS as a basis. By using the efficient design, MNL models were estimated by using as prior parameters values coming from experts' advices and from the literature.

Table 5.6 and Table 5.7 show the values of the first prior parameters and the levels of attributes considered for each experiment.

Table 5.6. Attribute levels considered and prior parameters as input of Ngene for "before/after the flight" experiment.

	Utility Function	Coeff.	Prior Parameters	Attributes	Levels
Pilot survey	U(Alt.)	WTC	−0.090	Waiting time at check-in (min.)	0; 5; 20
		TBO	−0.030	Time spent for boarding operations (min)	15; 60; 120
		TM-EP	−1.000	Terminal-Aircraft transfer by external path	1 (yes); 0 (no)
		TM-S	0.000 (fixed)	Terminal-Aircraft transfer by shuttle	1 (yes); 0 (no)
		TM-JB	1.000	Terminal-Aircraft transfer by jet bridge	1 (yes); 0 (no)
		DFD	−0.050	Delay of flight departure (min.)	0; 20; 60
		TLD	−0.050	Time spent for luggage delivery (min.)	0; 10; 30
		CT	−0.020	Cost of the ticket (€)	20; 60; 180; 360; 720; 1440
Large-scale survey	U(Alt.)	WTC	−0.857	Waiting time at check-in (min.)	0; 5; 20
		TBO	−0.060	Time spent for boarding operations (min.)	10; 20; 40
		TM-EP	−1.112	Terminal-Aircraft transfer by external path	1 (yes); 0 (no)
		TM-S	0.000 (fixed)	Terminal-Aircraft transfer by shuttle	1 (yes); 0 (no)
		TM-JB	0.710	Terminal-Aircraft transfer by jet bridge	1 (yes); 0 (no)
		DFD	−0.008	Delay of flight departure (min.)	0; 20; 60
		TLD	−0.431	Time spent for luggage delivery (min.)	0; 10; 30
		CT	−0.002	Cost of the ticket (€)	20; 60; 180; 360; 720; 1440

Table 5.7. Attribute levels considered and prior parameters as input of Ngene for "during the flight" experiment.

	Utility Function	Coeff.	Prior Parameters	Attributes	Levels
Pilot survey	U(Alt.)	SOB-FA	1.100	Space available on board fully adequate	1 (yes); 0 (no)
		SOB-A	0.000 (fixed)	Space available on board adequate	1 (yes); 0 (no)
		SOB-NA	−1.000	Space available on board not adequate	1 (yes); 0 (no)
		TOB-A	1.000	Temperature on board adequate	1 (yes); 0 (no)
		TOB-C	0.000 (fixed)	Temperature on board too cold	1 (yes); 0 (no)
		TOB-W	−1.100	Temperature on board too warm	1 (yes); 0 (no)
		COB	1.000	Cleanliness on board	1(clean enough); 0(quite dirty)
		CCC	1.100	Courtesy of cabin crew	1(kind enough); 0(quite rude)
		SB-FA	1.000	Services on board fully adequate	1 (yes); 0 (no)
		SB-A	0.000 (fixed)	Services on board adequate	1 (yes); 0 (no)
		SB-NA	−1.100	Services on board not adequate	1 (yes); 0 (no)
		CT	−0.020	Cost of the ticket (€)	20; 60; 180; 360; 720; 1440
Large-scale survey	U(Alt.)	SOB-FA	0.354	Space available on board fully adequate	1 (yes); 0 (no)
		SOB-A	0.000 (fixed)	Space available on board adequate	1 (yes); 0 (no)
		SOB-NA	−0.906	Space available on board not adequate	1 (yes); 0 (no)
		TOB-A	0.496	Temperature on board adequate	1 (yes); 0 (no)
		TOB-C	0.000 (fixed)	Temperature on board too cold	1 (yes); 0 (no)
		TOB-W	−0.741	Temperature on board too warm	1 (yes); 0 (no)
		COB	3.133	Cleanliness on board	1(clean enough); 0(quite dirty)
		CCC	0.261	Courtesy of cabin crew	1(kind enough); 0(quite rude)

SB-FA	0.250	Services on board fully adequate	1 (yes); 0 (no)
SB-A	0.000 (fixed)	Services on board adequate	1 (yes); 0 (no)
SB-NA	−0.902	Services on board not adequate	1 (yes); 0 (no)
CT	−0.018	Cost of the ticket (€)	20; 60; 180; 360; 720; 1440

Moreover, in the design, a restriction related to cost of the ticket was applied for avoiding Ngene to generate scenarios with unbalanced choice alternatives, and to compare feasible scenarios that consider separately short, medium and long-haul flight. It has been assumed that the possible scenarios can be only those where:

- a ticket cost equal to 20 € is compared to a ticket cost equal to 20 € or 60 € (short-haul flight);
- a ticket cost equal to 180 € is compared to a ticket cost equal to 180 € or 360 € (medium-haul flight);
- a ticket cost equal to 720 € is compared to a ticket cost equal to 720 € or 1440 € (long-haul flight).

The iterative process of Ngene generated as a result 12 scenarios for "before/after the flight" experiment and 12 for "during the flight" one. The number of generated scenarios is a multiple of the attribute level of variations. Each scenario comprehends two choice alternatives, with a total of 24 for each experiments.

Once the design of the scenarios has been completed, the PS was conducted. The PS represented the basis for designing the large-scale survey. To the PS participants a questionnaire composed of both the complete experiments has been sent. The minimum number of required surveys was established at 10, corresponding to the rounded-up maximum value of S-estimate parameter obtained for all the attributes considered for both the designed experiments (S-estimate obtained for "before/after the flight" experiment equal to 6.51; S-estimate obtained for "during the flight" experiment equal to 9.29). The questionnaire of the PS was reported in a digital format to send as e-mail attachment. PS participants had to complete the questionnaire and also to provide us the difficulties they eventually encountered in compiling. As done for the revealed preference survey, the participants were chosen by convenience sampling, a non-probability technique where subjects are selected because of their convenient accessibility and proximity to the researchers.

Definitively, 41 completed questionnaires were collected. Since all 24 scenarios were presented to each interviewee, 984 observations were

obtained. This number was sufficiently representative to estimate the preliminary MNL models whose coefficients become the prior parameters for designing the large-scale survey (Table 5.6 and Table 5.7). In addition to the new prior parameters, also the level of variations related to "Time spent for boarding operations" have been modified from those reported in Table 5.4 (i.e. 10, 20 and 40 min). All the other settings (number of attributes, number of alternatives, number of scenarios, and so on) remained unchanged in the large-scale survey design.

Once the efficient design of SP survey scenarios had been completed, they were digitally reported in "Google Forms" as part of the large-scale survey questionnaire reported in Appendix B.

5.4 The launch of the large-scale survey and the collection of the data

The large-scale survey questionnaire was transcribed in "Google Forms", a free survey administration app included in Google Drive office suite. The large-scale survey questionnaire is composed of both the types of surveys: the RP and the SP. To begin with, two filter questions were asked. The first one asks the interviewee when he/she last travelled by plane. The question is multiple choice with two possible options: 1) less than 6 months ago; 2) more than six months ago. Considering that those who had travelled by plane more than six months before participating in the survey would not have a vivid memory of the experience, it was decided to submit to them the questionnaire as follows: only the Part F of the R (containing the questions on degrees of importance for each service aspect); and the whole SP (containing 12 choice experiments "before and after the flight" and 12 choice experiments "during the flight"). On the other hand, for those who had made a trip by plane no more than six months before participating in the survey, it was decided to submit the entire questionnaire consisting of: the whole RP, and the SP with only 4 choice experiments "before and after the flight" and 4 choice experiments "during the flight". In this case, the second filter question appears, which asks if the flight was direct or not. In the event of a non-direct flight, the interviewee must be directed to refer to a specific route to be referred to for the subsequent evaluation, especially if the different routes were served by different airlines. Therefore, in order to not create any confusions, it was decided to ask to refer to the longer route and to remove from the RP questionnaire the evaluations relating to flight booking, check-in and luggage delivery procedures. In any case, the questionnaire always ends with a part where several personal information is requested, such as age, gender and income.

All participants have been contacted by their institutional email, supplied by the University of Calabria. The link to the questionnaire was included in the message together with other information about the research project. Specifically, after an initial presentation of the researchers who were conducting the work, the scope and the objectives of the survey were briefly explained in order to get the addressee's attention and to introduce him/her to the questionnaire's topic. Finally, the anonymity and compliance with privacy rules were guaranteed. The large-scale survey was launched on 25 March 2019. After 40 days the participant received a reminder, and the collection of answers was stopped on 30 July. The survey involved about 29,000 people, including professors, researchers, administrative and technical staff, and students.

5.5 Preliminary statistics

5.5.1 The socio-economic characteristics and the travel habits

At the end of the collection period, 1,907 completed questionnaires were collected. Almost all the respondents were from Italy (99.1%), and the 96.6% is from the Calabrian region. The descriptive frequency distributions concerning the socio-economic characteristics of the sample are presented in Table 5.8. By observing the distributions of gender sub-categories, there is a prevalence of females over males. The highest percentage of respondents (60.2%) is between 18 and 25 years old, followed by those between 26 and 30 years old (17.5%). More than half of the sample (54.2%) has as last qualification that of the upper-secondary education (ISCED 3) and the 21.9% has the degree. This result is justified by the fact that most of the respondents are students (80.4%). Professors and researchers are the 10.8% of the sample, and the technical and administrative staff the remaining 8.8%. As regards the monthly income, the highest percentage is reported for the income between 1,000 € and 2,000 €. It can be said that the other income levels are equally distributed. Finally, the obtained results related to frequency of travel suggest that the question has not been understood therefore the answers to this question cannot be considered reliable.

Concerning the travel habits, the respondents usually travelled for leisure purposes, such as: for holiday, for visiting to relatives and friends and for participating at events (Figure 5.4). Lower percentages are linked to travel due to work, study and health care purposes. This trend is also followed by the purpose of the respondents' last air travel. In fact, 40.3 % last travelled by plane for holiday, 27.0% for visiting to relatives and friends, 10.4% for

work, 10.1% for study, 6.9% for participating at events, 4.0% for health care, and the remaining 1.3% for other purposes.

Table 5.8. Frequency distributions of the sample's socio-economic characteristics

Sample characteristics		n	%
Gender	male	738	38.7
	female	1144	60.0
	no response	25	1.3
	total	*1907*	*100.0*
Age	between 18 and 25	1148	60.2
	between 26 and 30	333	17.5
	between 31 and 40	127	6.7
	between 41 and 50	137	7.2
	between 51 and 60	115	6.0
	more than 60	47	2.5
	total	*1907*	*100.0*
Level of education	lower-secondary	58	3.0
	upper-secondary	1034	54.2
	degree	418	21.9
	master degree	222	11.6
	PhD	175	9.2
	total	*1907*	*100.0*
Occupation	technical and administrative staff	168	8.8
	professors and researchers	206	10.8
	students	1533	80.4
	total	*1907*	*100.0*
Montly income	less than 1,000 €	324	17.0
	between 1,000 € and 2,000 €	672	35.2
	between 2,000 € and 3,000 €	314	16.5
	between 3,000 € and 5,000 €	251	13.2
	more than 5,000 €	346	18.1
	total	*1907*	*100.0*
Frequency of travel	several times a week	793	41.6
	several times a month	548	28.7
	several times a year	519	27.2
	at least once a year	46	2.4
	rarely	1	0.1
	total	*1907*	*100.0*

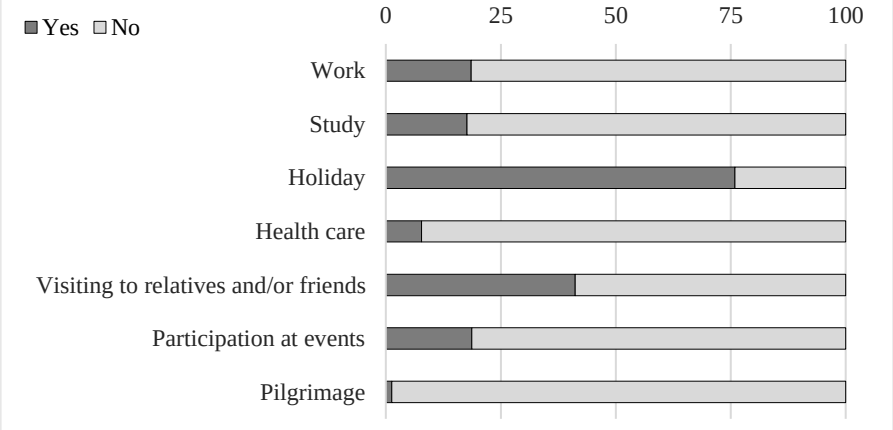


Figure 5.4. Usual travel purpose

Among the 1,907 respondents, 942 declared that they had travelled less than 6 months before, so it was proposed to them the questionnaire including both the RP and the SP (containing 4 choice experiments for "before and after the flight" and 4 choice experiments "during the flight"). On the other hand, the remaining 965 compiled only the SP, including all the 24 choice experiments. In both cases, the obtained numbers of compiled questionnaires greatly exceed the sample size estimated in the survey design phase. In fact, as regard the RP survey, based on Cochran's sample size formula (Barlett et al., 2001), the minimum number of participants to survey amounted to 384. Concerning the SP, the number of completed choice experiments exceeds the sample size estimated in the survey design phase through the S-estimate parameter.

From the second filter question it emerged that for 756 respondents the flight of their last travel was direct. It has been assumed that people who had a direct flight were able to assess all the service aspects (before, during and after the flight) because the last ones were provided by a single airline. On the contrary, the questionnaire for the respondents whose flight is not direct (186) included only the service aspects from the boarding operations to the getting off from the aircraft, and they had to refer to the airline that served the longest route of their travel.

The airports indicated as departure and arrival are several and most of them are Italian (93.2% for departure airports and 58.8% for arrival airports). The major part of respondents referred to a flight departing from Lamezia Terme International airport (SUF: 62.21%), followed by those who departed from Rome (FCO: 9.0%; CIA: 2.4%), Milan (MXP: 4.4%; BGY: 1.8%; LIN:0.7%), Naples (3.8%) and Bari (BRI: 2.0%). By observing the

frequencies related to the arrival airport the results are quite different. The highest percentages are recorded for Milan (MXP: 14.2%; BGY: 11.2%; LIN: 2.4%), followed by Lamezia Terme International airport (SUF: 7.86%), Pisa (PSA: 4.9%), Rome (FCO: 4.1%; CIA: 0.3%), Turin (TRN: 4.1%) and Treviso (TSF: 3.6%). So the interviewees referred mainly to flights that originated and had destination within the Italian national territory. As a consequence, the 69.1% are short-haul flights (duration less than 2 hours), the 25.6% are medium-haul flights (duration between 2 and 6 hours), and the remaining 5.3% are long-haul flights (duration more than 6 hours).

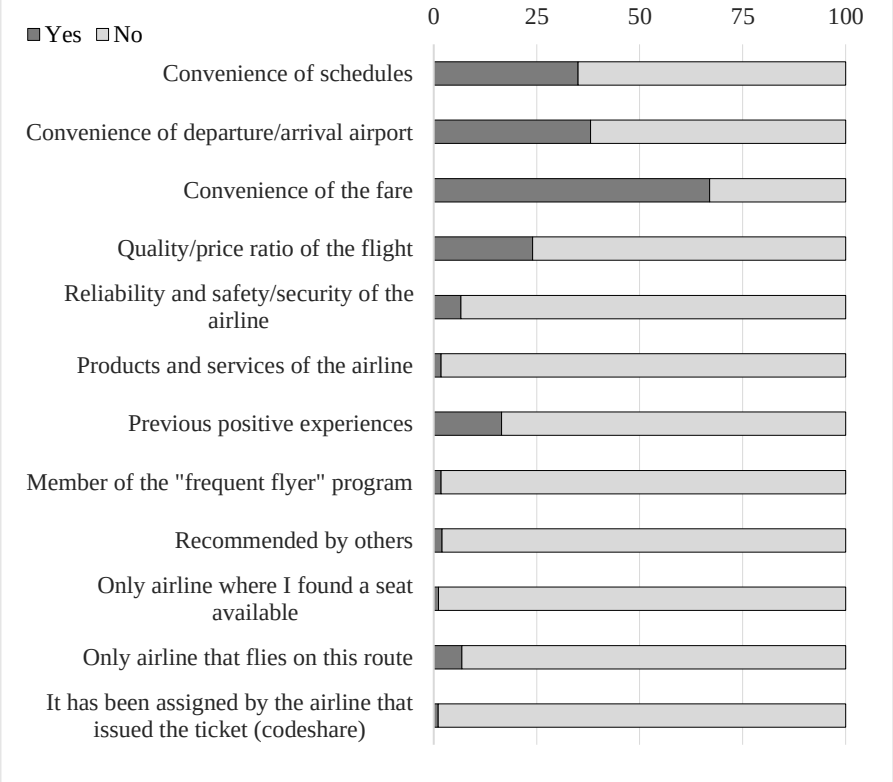


Figure 5.5. Reasons for choosing the airline

The most used airlines are low cost ones with a percentage of 78.2%, and this aspect is clearly confirmed by the reasons for choosing the airline reported in Figure 5.5. It can be easily observed that respondents choose the airlines for their travels primarily for the convenience of the fare. Other reasons related to the choice are the convenience of departure/arrival airport,

the convenience of schedules, the quality/price ratio and the previous positive experiences with the same airline.

For both the procedures for purchasing the ticket and obtaining the boarding pass, the most common choices are the airline's website (64.9% and 52.7% respectively) and the airline's app (20.8% and 35.9% respectively.

5.5.2 Comparing service quality and satisfaction levels

The means and the standard deviations of each service attribute were calculated after transforming the 5-point verbal scale, related to the satisfaction levels, in a 5-point numerical scale ranging from 1 to 5. First of all, by observing the obtained results (Table 5.9), it emerges that there is a different number of observations for each service attribute and this is due to the presence in the questionnaire of filter questions. As an example, the observations for "seat choosing procedure" are 422 because this is the number of respondents who declared they had chosen their seat, instead for "waiting for luggage delivery" is 257 because several passengers had not a hold luggage.

Regarding the means, the highest values occur to the same service aspects both in terms of judgments of service quality and of satisfaction levels. In fact, the service aspects with the highest mean judgment (around 8.0) on a 10-point numerical scale are "boarding pass procedure", "flight booking procedure", "special services requesting procedure", and "flight punctuality at the arrival". The highest mean level of satisfaction (close to 4.0) is found for the same aspects. Similar findings can be observed by analysing the lowest mean values. The service aspects with the lowest mean judgment (less than 6.0) are "booking changing procedure" and "comfort of the seat". The lowest mean level of satisfaction (less than 3.0) is found for the same aspects and for "space available inside the overhead bins", which however registered a judgment slightly higher than 6 on the 10-point numerical scale. Therefore, from the comparison of the mean values does not emerge a relevant difference between the two evaluation scales. The standard deviations follow the same trend for both evaluation scales for the major part of the service aspects. In general, the standard deviation referred to the judgments of service quality shows higher values than the standard deviation of the satisfaction levels due to the major number of levels of the 10-point scale as regards the 5-point one.

In order to compare the judgements of service quality expressed by the passengers and their satisfaction levels with the service aspects, Kendall tau coefficients were used (Kendall and Gibbons, 1990). A Kendall's tau is a

statistic of rank correlation used to measure the ordinal association between two measured quantities. Intuitively, the correlation between two variables will be high when observations have a similar rank, and low when observations have a dissimilar rank between the two variables, where the similarity of the data orderings can be identical for a correlation of 1 and fully different for a correlation of -1. Specifically, in this case it has been used the most appropriate tau-c statistic for testing the strength of association when the underlying scale of both variables has a different number of possible values. It is worth mentioning that one variable is scored on a 5-point verbal scale (not at all satisfied, little satisfied, on average satisfied, very satisfied, extremely satisfied) whereas the other is based on a finer 10-point numerical scale. The Kendall's tau-c (τ_c) coefficient is defined as in the following formula:

$$\tau_c = \frac{2(n_c - n_d)}{n^2 \frac{(m-1)}{m}} \tag{11}$$

where n_c is the number of concordant pairs, n_d is the number of discordant pairs, r is the number of rows, c is the number of columns, and $m = \min(r, c)$.

Measures of ordinal association between two variables can be described by using Davis' conventions (Davis, 1971). By considering tau-c values, coefficients from 0.01 to 0.09 show a negligible association; from 0.10 to 0.29 a low association; from 0.30 to 0.49 a moderate association; from 0.50 to 0.69 a substantial association; and a tau-c equal or higher to 0.70 indicates a very strong association.

For analyzing the correlation values obtained, the following null hypothesis (H_0) has to be tested: there is no relationship between service quality judgements expressed by passengers and the level of satisfaction they had. According to the statistical values of tau-c it can be made a decision to accept or reject the null hypothesis H_0. When the probability calculated with the test statistic is less than alpha (0.05), the null hypothesis must be rejected H_0; alternatively, it must be accepted.

Kendall tau-c coefficients were calculated by using the software SPSS Statistics (IBM, 2017). The obtained results are reported in Table 5.9.

By using Kendall tau-c coefficient, the aim was to measure "how" and "how much" the respondents were satisfied with the services that they have rated of high quality. This because service quality is an abstract concept, difficult to define and often interchangeably used with satisfaction.

Table 5.9. Comparison of service quality and satisfaction levels

		Judgments of service quality		Satisfaction levels		Corr.
Service attributes	N. of obs.	Mean	St. dev.	Mean	St. dev.	Kendall tau-c
Flight booking procedure	756	8.09	1.51	3.76	0.79	0.61(***)
Boarding pass procedure	756	8.17	1.66	3.80	0.87	0.68(***)
Seat choosing procedure	422	7.32	1.87	3.35	0.88	0.64(***)
Luggage embarking procedure	250	7.19	1.98	3.30	0.98	0.75(***)
Special services requesting procedure	13	8.00	2.00	4.00	0.71	0.83(***)
Booking changing procedure	25	5.04	2.89	2.40	1.26	0.81(***)
Boarding operations	942	6.64	1.93	3.08	0.86	0.70(***)
Courtesy and the competence of the staff for boarding	942	7.70	1.66	3.57	0.83	0.65(***)
Way to get on board	942	6.95	1.83	3.21	0.87	0.69(***)
Punctuality of the flight	942	7.47	2.09	3.53	1.01	0.76(***)
Space available inside the overhead bins	942	6.13	1.99	2.79	0.89	0.72(***)
Comfort of the seat	942	5.86	2.14	2.70	0.92	0.77(***)
Temperature inside the cabin	942	6.86	1.76	3.19	0.84	0.69(***)
Acoustic comfort	942	6.38	1.91	2.96	0.87	0.71(***)
Comfort during take-of cruise and landing phases	942	6.96	1.77	3.25	0.82	0.69(***)
Cleanliness of the cabin tables and seats	942	7.44	1.72	3.44	0.86	0.71(***)
Cleanliness of the toilets	282	7.04	1.96	3.29	0.94	0.76(***)
Flight information	942	6.76	2.09	3.17	0.95	0.77(***)
Courtesy of the cabin crew	942	7.83	1.61	3.70	0.80	0.68(***)
Competence of the cabin crew	942	7.88	1.57	3.71	0.80	0.68(***)
Safety during the take-off	942	7.82	1.54	3.68	0.78	0.67(***)
Safety during the cruise	942	7.86	1.54	3.68	0.79	0.68(***)
Safety during the landing	942	7.63	1.74	3.58	0.87	0.71(***)
On-board food service	297	6.62	2.04	3.04	0.95	0.75(***)
On-board Wi-Fi	17	7.00	2.40	3.29	1.21	0.79(***)
On-board entertainment services	122	6.60	2.20	3.00	1.03	0.82(***)
On-board sale service	58	7.36	1.63	3.38	0.83	0.56(***)
Flight punctuality at the arrival	942	7.91	1.90	3.75	0.97	0.76(***)
Landing operations	942	7.07	1.94	3.28	0.91	0.74(***)
Way to get off the aircraft	942	7.15	1.81	3.32	0.89	0.72(***)
Waiting for luggage delivery	257	7.09	1.95	3.29	0.94	0.76(***)
Luggage conditions	257	7.27	2.09	3.37	1.04	0.80(***)

(***) Significance at 1% level, (**) at 5%, (*) at 10%

From the results, it emerges that in all cases there is a statistically significant correlation between the interviewees' satisfaction levels and the judgments of quality they expressed for the service aspects. In addition, the positive sign of the coefficient confirms the expected positive association between users' satisfaction and service quality. In fact, it is well-established that a user who tends to be satisfied with a service aspect is driven to assign a high rate of quality to the same service aspect. However, it is not so obvious that the judgments of service quality expressed on a 10-point numerical scale are strongly correlated with the satisfaction levels on a 5-point verbal scale. In fact, according to Davis conventions, a "very strong association" does not emerge for all the service attributes. The highest values of Kendall's tau-c (greater than 0.79) relate service aspects with a low number of observations due to their little use such as: "special services requesting procedure", "on-board entertainment services", "booking changing procedure", "luggage conditions" and "on-board Wi-Fi". Moreover, in some of these cases, the result should not be considered as reliable due to the scant number of observations. On the contrary, a large number of widely used service aspects registered values of Kendall's tau-c ranging from 0.61 to 0.68. More specifically, this evidence is shown for some aspects regarding the procedures before the flight, such as "flight booking procedure", "seat choosing procedure", and "boarding pass procedure". Another group of aspects concern courtesy and competence of the staff, both the staff for boarding and the cabin crew. Finally, there are two aspects concerning safety (during the take-off and during the cruise). These results would demonstrate that not for all the users there is a real correspondence between the judgement of service quality and the satisfaction level. As an example, this happens for those procedures that users are constrained to do before the flight, or for very subjective aspects such as the perceived opinion about the staff or the perceived level of safety. Evidently, for these aspects it is even more important to request to users an evaluation on two different scales. In other words, thanks to the presence of the two evaluation scales in the questionnaire, the interviewee had the opportunity to express the level of satisfaction independently from the judgment of service quality, and the Kendall's tau-c values confirmed the utility to adopt both the evaluation scales.

5.5.3 Overall evaluations and final considerations

As reported above, the RP part of the questionnaire starts with two questions related to the evaluation of the overall travel experience (before, during and after the flight) and ends with four questions of final considerations. From the initial question about the evaluation of the overall

travel experience by using the numerical scale ranging from 1 to 10, it emerged that the highest percentages are related to the ratings 8 (29.6%) and 7 (25.5%), followed by 6 (13.5%), 9 (11.5%), 5 (8.8%) and 10 (6.4%). The remaining low percentages are attributed to the lowest values of the scale. Consequently, it can be said that the major part of respondents evaluated the overall experience with medium-high ratings. Satisfaction with the overall travel experience was asked both at the beginning of the questionnaire and at the end. From the comparison of the obtained results emerged that both at the beginning of the questionnaire and at the end, most of the respondents stated that they were on average satisfied with the whole travel experience (Figure 5.6). However, there was a reduction of "on average satisfied" responses given at the end of the questionnaire, and an increase of "extremely satisfied" ones.

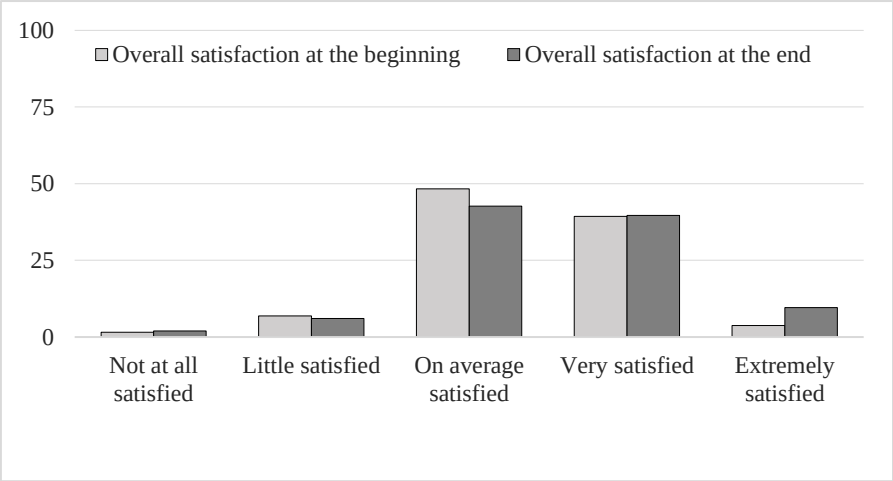


Figure 5.6. Satisfaction with the overall travel experience

The quality/price ratio has been evaluated with medium-high ratings. In fact, the highest percentages of responses are recorded by 8 (26.1%), 7 (22.5%), 9 (16.0%), 6 (14.2%) and 10 (11.7%).

The part of final considerations ends with the two questions about the user's future use or recommendation of the airline on the basis of his/her past experience. In these cases, the adopted scale is a numerical one ranging from 0 to 10, in such a way that the answer can be interpreted as a probability of future use or recommendation to relatives or friends. In both cases, the highest number of responses are recorded for values above 7. Therefore, respondents will again use or recommend the airline used to at least 70%.

5.5.4 Importance ratings

The importance ratings about the different aspects of the service were provided by all 1,907 respondents, as this part of the questionnaire was submitted both to those who compiled the complete questionnaire of RP and SP, and to those who compiled only the SP. As reported in Figure 5.7, the service aspects with the highest percentages of "extremely important" rating are the cost of the ticket (66.9%) and the punctuality of the flight (62.5%), followed by the time spent for luggage delivery (50.2%) and cleanliness on board (48.8%).

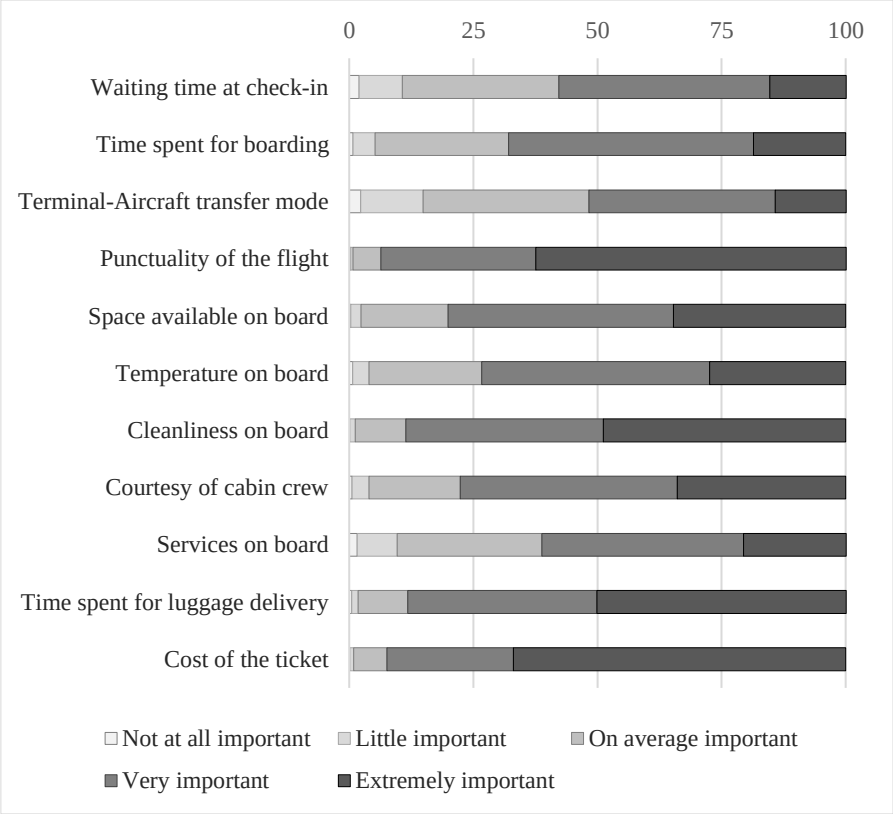


Figure 5.7. Importance ratings

The other ones were mainly considered as "very important". The terminal-aircraft transfer mode is the only aspect with similar percentages for "on average important" (33.4%) and "very important" (37.5%), and with the highest percentages for "not at all important" (2.3%) and "little important" (12.6%).

5.6 Summary

The variety of services provided by the airlines, in all the phases characterizing a travel by air (before, during and after the flight) makes difficult to design the questionnaire for a CSS. In this chapter, the design of a questionnaire aimed to collect the perceptions and expectations of the passengers of airlines services is proposed. The design framework of the CSS questionnaire was described in all its phases, from the analysis of the literature to the final questionnaire.

Starting from the analysis of the literature review, the service attributes that would have be taken into account have been chosen, together with the evaluation scales and the data collection arrangement.

On the one hand, the only sensitive step of the design process for the SP choice experiments was the selection of service attributes and their level of variation. Conversely, regarding the RP part of the questionnaire the most crucial step of the design concerned the decision of the scales to be adopted for collecting passengers' opinions. The choice of the evaluation scale was very difficult, due to the frequent confusion, as discussed in the literature, between the judgments of service quality and the satisfaction of the users. Believing that the concept of perception on service quality is not perfectly coinciding with the concept of satisfaction, and that satisfaction is only a way to measure service quality, it has been decided to adopt two independent evaluation scales for evaluating each service attribute. This choice got a positive feedback from the panel of experts, and interesting findings emerged also by the PS in-depth interviews. In fact, even if some users have reported an initial difficulty to well understand the difference between the two evaluation scales, it appears from the results that the relationships between them is not so obvious. The preliminarily evidences were successively tested on the data collected from the large-scale survey by analyzing the Kendall tau-c correlation values, which showed that there is not a very strong association among the data gathered by means of the two different evaluation scale because of the difference behind the concepts of "user's satisfaction" and "quality of service". So, by adopting both evaluation scales in the questionnaire, the interviewee have the opportunity to express the level of satisfaction independently from the judgment of service quality.

In conclusion, it can be said that from the preliminary analyses conducted on the sample collected by the large-scale survey, it emerged that the amount of data available is sufficient for future processing, which allow a fair evaluation of the air transport services provided by the airlines.

Chapter 6

Airlines' services data modelling

6.1 Introduction

This chapter focuses on the analysis of the passengers' perceptions about the airlines services. The analysis is based on the data collected by the online survey addressed to the students and workers of the University of Calabria. The final aim of this chapter is to provide tools for investigating on passengers' perceptions that can be useful for researchers and practitioners of the sector.

Particularly, two different kinds of analysis were proposed, due to the different nature of the data collected through the first part of the questionnaire as regards the second one. More specifically, a CART approach was proposed for exploring data collected through the first part of the questionnaire. This method has been chosen because of its intuitive visual results and easily understandable If-then decision rules. The interviewees' evaluations of service quality are analysed separately from the satisfaction data. Specifically, three CART were calibrated to identify the key attributes for each phase of the travel affecting the evaluation of the travel experience. So, a CART was estimated by considering the "before the flight" attributes, another one for "during the flight" phase and the last one for "after the flight". The same procedure was applied to satisfaction data. In this case, the question related to the satisfaction with the overall experience appears twice in the questionnaire: once at the beginning and once at the end of the RP part. So, three CART models were developed by considering as depended variable the satisfaction with the overall experience asked at the beginning of the questionnaire, and three CART models calibrating by using as dependent

variable the satisfaction with the overall experience asked at the end of the questionnaire. From the comparison of the obtained results, it was possible to detect how the service attributes affect the overall satisfaction change depending on whether the question is asked at the beginning or at the end of the questionnaire.

The data collected through the second part of the questionnaire, the SP survey, were used as input to calibrate MNL models and Random Parameters Mixed Logit (RPML) models. The first ones are adopted for merely estimating the effect of each variable on the expected service quality in before and after the flight situation, and during the flight as well. The second ones are used to detect heterogeneity of passengers' perceptions.

6.2 Classification and regression tree approach

6.2.1 Methodology

The decision tree approach is a decision support tool useful for discovering previously unknown relationships amongst the data by the classification and prediction of a class variable. When the value of the dependent variable is discrete, a classification tree is developed; otherwise, a regression tree is developed for the continuous dependent variable (de Oña et al., 2012).

Before applying this approach, it is necessary to choose a tree growing method based on the data characteristics and on the objectives to be achieved. Specifically, the CART growing method can be used to develop either types of tree. The CART method divides the data into segments that are as much as possible homogeneous with respect to the dependent variable. A terminal node characterized by cases with the same value for the dependent variable is considered as a homogeneous or "pure" node. In this study, the dependent variable is discrete, and it is represented by the satisfaction with the overall travel experience with air transport. Therefore, classification trees are developed.

The CART growing method starts with all the data concentrated in the root node, generally located at the top of the tree (Breiman et al., 1984). The root node is divided into two child nodes based on an independent variable, named splitter, that maximizes the "purity" of the child nodes. This procedure continues recursively in order to obtain child nodes more and more homogeneous. So, each child node can become the parent node of other two child nodes on the basis of another splitter variable, and so on. The splits are made and ranked according to the Gini reduction criterion. This criterion is based on the calculation of the "worth" of each split in terms of its

contribution toward maximising the homogeneity through the resulting split. The "worth" of each split is calculated as follows:

$$Worth = I(P) - \sum_{b}^{B} P(b) \cdot I(b) \tag{12}$$

where $I(P)$ represents the impurity of the parent node, $P(b)$ denotes the proportion of observations in the node assigned to a branch b, $I(b)$ is the impurity of the child node b, and B is the number of branches into which the parent node is split (in the case of CART growing method this value is always equal to 2). The Gini impurity measure of a generic node t is defined as follows:

$$I(t) = 1 - \sum_{i=1}^{I} \left(\frac{n_i}{n}\right)^2 \tag{13}$$

where I is the number of categories of the independent variables, n_i is the number of cases belonging to the category i, and n is the total number of cases. If a node is "pure", all the cases (observations) in the node belong to one category and the Gini impurity measure will be equal to 0.

The splitting process continues until or all the child nodes are pure, or their purity cannot be increased, or when predetermined growth limits are reached. Specifically, the growth limits allow to contain the number of levels in the tree and control the minimum number of cases for parent and child nodes. In this study, the maximum three depth, that is the maximum number of levels of growth beneath the root node, has been set equal to 10. The minimum number of cases for the parent node has been set equal to 30, otherwise it has been set equal to 15 for the child nodes. From these criteria, the saturated tree is constructed.

To decrease the complexity of the saturated tree, the method allows to prune it to find a tree that does not overfit the information of the data set. Pruning is realised according to a cost-complexity algorithm based on removing the branches adding little to predictive value of the tree (Breiman et al., 1984). In this study, the trees with the highest possible predictive value have been chosen.

This methodology as well as being easily understandable thanks to its graphics, also allows to generate rules in the form of *If-Then*. Specifically, a rule for each leaf node (i.e. terminal child node) can be generated. The logic conditional structure of the rule starts from the root node with *If* and ends with *Then* in the child node, in which is associated the category of the dependent variable with the highest number of cases. The possibility of generating rules makes the model very practical and easy to interpret also by

the air transport operators and managers. Finally, another advantage of the CART growing method is the possibility to obtain the rank of the independent variables according to their importance.

The following elaborations have been carried out through the module "Decision Trees" of SPSS (IBM, 2020).

6.2.2 CART to explore the service quality evaluation

Three CART models were built, one for each travel stage: before, during and after the flight. In each CART, the evaluation of the overall experience is considered as dependent variable and the service attributes as independent ones. To obtain more interpretative results, the 10 levels of numerical evaluation scale were reduced in a three-levels verbal scale comprising the rates from 1 to 4 as "poor", from 5 to 7 as "fair", and from 8 to 10 as "good". For each CART model, the normalized importance of the independent variables in the prediction of the dependent variable were obtained as well.

The precision ratios obtained for the CART models are: 69.0% for "before the flight" services, 73.6% for "during the flight" services, and 66.7% for "after the flight" services. These values can be considered acceptable for all CART models, and they are higher than precision rates obtained in other studies analysing service quality or customer satisfaction (de Oña et al., 2012; de Oña and de Oña, 2015; Wong and Chung, 2007).

The first CART presented below is the one relating to the "before the flight" services. The model produced 4 levels, 9 nodes and 5 terminal nodes (Figure 6.1). The root variable generating the tree is "Boarding operations", and this is the variable obtaining the maximum purity of the two child nodes (Node 1 and Node 2). Therefore, passengers that rated the "Boarding operations" as "good" are on the right branch of the tree, while those that rated the same service aspect as "poor" or "fair" are on the left branch.

From the terminal Node 2, it emerges that passengers that rated the "Boarding operations" as "good" are likely to rate the overall experience as "good" (75.7%). On the other hand, from the left branch, 4 terminal nodes derive (3, 5, 7 e 8). Specifically, Node 1 splits in two nodes by the variable "Courtesy and competence of the staff for boarding". If passengers rated as "poor" or "fair" this service aspect, they rated as "fair" the overall experience in 71.2% of cases (Node 3). On the contrary, Node 4 splits in two nodes by the variable "Boarding pass procedure". As it can be seen from the terminal Node 5, 66.0% of passengers would rate the overall experience as Fair if they rated as "poor" or "fair" the "Boarding pass procedure". Node 6 splits in the last two terminal nodes (7 and 8) by the variable "Way to get on board". Passengers that rated this service aspect as "poor" or "fair" rated the overall

experience as "fair" in 53.2% of cases (Node 7). On the contrary, they rated the overall experience as "good" in 61.0% of cases (Node 8).

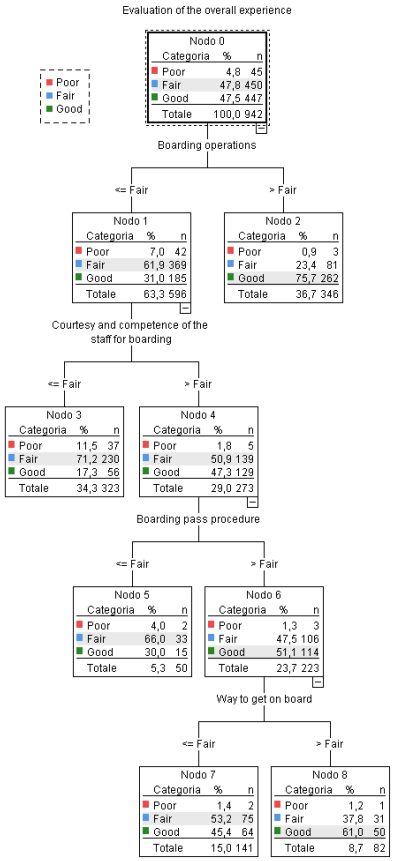


Figure 6.1. CART for "before the flight" services (dependent variable: Evaluation of the overall experience)

Table 6.1. CART for "before the flight" services (dependent variable: Evaluation of the overall experience): independent variables importance.

Independent variable	Importance	Normalised importance (%)
Courtesy and competence of the staff for boarding	0.096	100.0
Boarding operations	0.092	95.8
Way to get on board	0.061	63.5
Flight booking procedure	0.028	29.1
Boarding pass procedure	0.028	28.7

Table 6.1 shows the predicted independent variables' importance. The "Courtesy and competence of the staff for boarding" results as the most important service aspect, followed by the "Boarding operations" and the "Way to get on board". The least important service aspects are those related to the booking of the flight and to the obtaining the boarding pass.

The CART obtained for services provided by the airline during the flight is reported in Figure 6.2. In this case, the model is more complex because the number of independent variables is greater. The model is developed in 6 levels, 17 nodes of which 9 are terminal. The tree is generated by the variable "Comfort during the take-off, cruise and landing". The root node splits in two child nodes (Node 1 and Node 2). Node 1 generates the left branch of the tree, characterized by passengers who rated as "poor" or "fair" the "Comfort during the take-off, cruise and landing". On the other hand, from Node 2 the right branch develops, characterized by those that have evaluated the root variable as "good". The major part of the terminal nodes is on the left branch of the three. The first one is Node 3 where passengers that rated the "Courtesy of cabin crew" as "poor" or "fair" are likely to evaluate the overall experience as "fair" (76.6%). On the contrary, when passengers evaluate the "Courtesy of cabin crew" and the "Temperature inside the cabin" as "good", they evaluate the overall experience as "good" in 64.8% of cases (Node 8). But, if the "Temperature inside the cabin" and the "Punctuality of the flight departure" are considered as "poor" or "fair", the overall experience is likely to be considered as "fair" (Node 11). Node 12 splits in two nodes by the "Space available inside the overhead bins". If passengers rate this variable as poor, 71.4% of them would evaluate the overall experience as "fair" (Node 13). On the contrary, two terminal nodes derive from Node 14. When the "Cleanliness of the cabin, tables and seats" is rated as "poor" or "fair", the 51.4% of passengers evaluate the overall experience as "fair" (Node 15). 61.5% of passengers considered as "good" the overall experience, when they evaluated as "good" the "Cleanliness of the cabin, tables and seats".

The rest of the terminal nodes are on the right branch of the tree (5, 9 and 10). Node 2 splits in the nodes 5 and 6 by the variable "Safety during the landing". If passengers evaluate as "poor" or "fair" this aspect, they evaluate the overall experience as "fair" in 60.0% of cases. In turns, node 6 splits, according to "Safety during the take-off", in nodes 9 and 10. From the terminal node 9, it emerges that when passengers rated this aspect as "poor or "fair" they considered the overall experience as "fair" in 62.5% of cases, on the contrary they are likely to evaluate the overall experience as "good" in 78.7% of cases (Node 10).

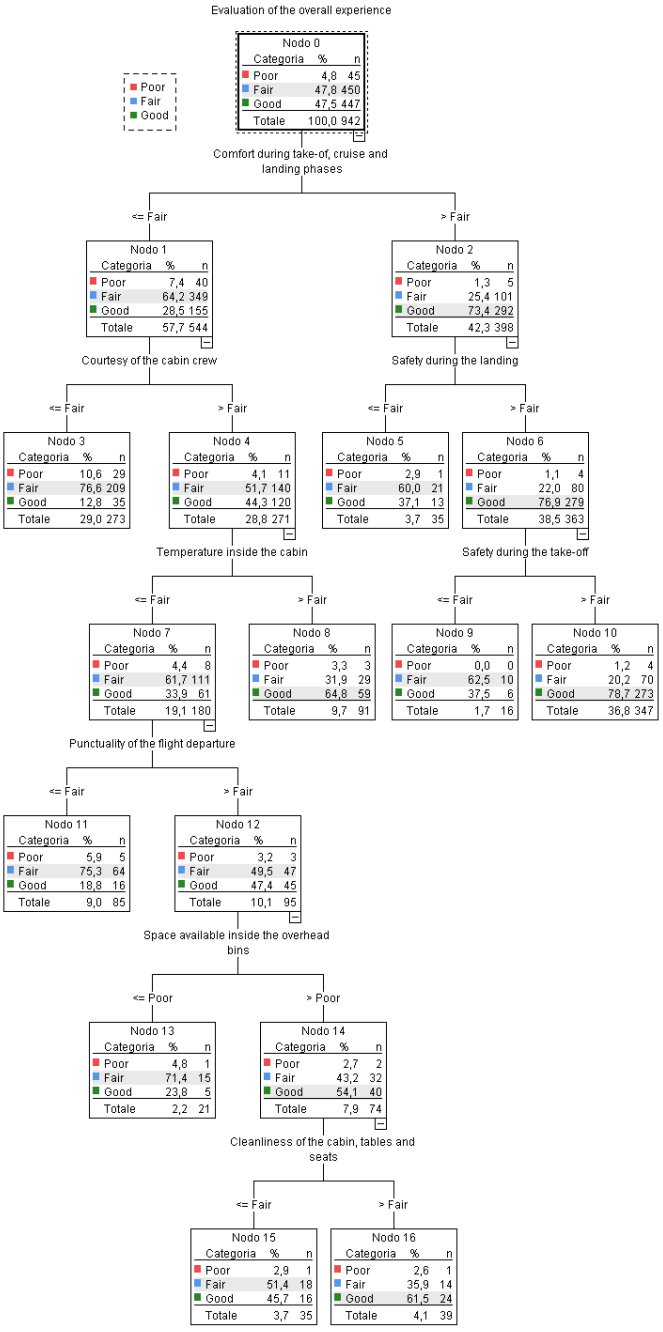


Figure 6.2. CART for "during the flight" services (dependent variable: Evaluation of the overall experience)

The predicted importance of the independent variables related to this model are shown in Table 6.2. Among the most important aspects, there are some related to comfort such as the "Temperature inside the cabin" and the "Comfort during the take-off, cruise and landing phases" and others related to the courtesy and competence of the cabin crew. Following, there are those related to the safety at the beginning and at the end of the flight.

Table 6.2. CART for "during the flight" services (dependent variable: Evaluation of the overall experience): importance of independent variables.

Independent variable	Importance	Normalised importance (%)
Temperature inside the cabin	0.097	100.0
Courtesy of the cabin crew	0.096	98.3
Comfort during take-off, cruise and landing phases	0.093	96.1
Competence of the cabin crew	0.092	94.8
Safety during the take-off	0.089	91.9
Safety during the landing	0.082	84.2
Punctuality of the flight departure	0.079	81.7
Space available inside the overhead bins	0.073	74.9
Comfort of the seat	0.072	74.3
Cleanliness of the cabin, tables and seats	0.071	72.7
Safety during the cruise	0.067	68.7
Acoustic comfort	0.058	59.4
In-flight information	0.054	55.7

The less important aspects are the "Safety during the cruise", the "Acoustic comfort" and the "In-flight information".

Finally, the last CART is that relating to the "after the flight" services and it is the simplest one as it involves fewer service aspects. This model produced 3 levels, 7 nodes and 4 terminal nodes (Figure 6.3). The root variable generating the tree is "Way to get off the aircraft". Therefore, passengers that rated this aspect as "good" are on the right branch of the tree, while those that evaluated the same service aspect as "poor" or "fair" are on the left branch.

From the left branch, three terminal nodes derive (3, 5 and 6). Specifically, Node 1 splits in two nodes by the variable "Flight punctuality at the arrival". If passengers evaluated this service aspect as "poor" or "fair", they rated the overall experience as "fair" in 71.1% of cases (Node 3). On the contrary, Node 4 splits in two nodes by the variable "Landing operations". When passengers considered this aspect as "poor" or "fair" they would evaluate the overall experience as "fair" in 61.8% of case, on the contrary as "good" in 52.8% of cases.

The right branch is composed only by terminal Node 2. So, by considering the experience after the flight, if passengers rated the "Way to get off the aircraft", they are likely to evaluate the overall experience as "good" (69.0%).

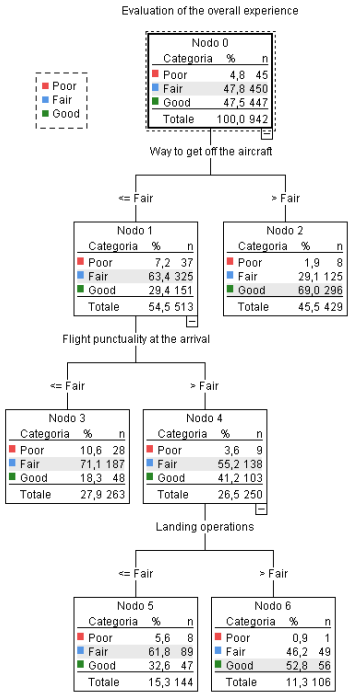


Figure 6.3. CART for "after the flight" services (dependent variable: Evaluation of the overall experience)

Table 6.3 shows the predicted independent variables' importance. The "Way to get off the aircraft" is the most important service aspect followed by the landing operations. The least important service aspect is the flight punctuality at the arrival.

Table 6.3. CART for "after the flight" services (dependent variable: Evaluation of the overall experience): importance of independent variables.

Independent variable	Importance	Normalised importance (%)
Way to get off the aircraft	0.069	100.0
Landing operations	0.067	97.8
Flight punctuality at the arrival	0.054	79.1

It can be definitely said that the CART graphical results are easy to understand, however what gives to the methodology a real practical applicability is the possibility of deducing *If-Then* rules that are even easier to be interpreted by airlines' managers. Specifically, the model referred to "before the flight" services produced 5 terminal nodes (Figure 6.1). Therefore, 6 rules for identifying the "Evaluation on the overall experience" can be extrapolated (Table 6.4): two rules for the overall experience rated as "good", and three rules for the overall experience rated as "fair".

Table 6.4. CART for "before the flight" services (dependent variable: Evaluation of the overall experience): rules

Terminal Node	Rule		Accuracy rate (%)
	If…	Then the evaluation of the overall experience is…	
2	(Boarding operations=Good)	Good	75.7
3	(Boarding operations=Poor or Fair) and (Courtesy and competence of the staff for boarding=Poor or Fair)	Fair	71.2
5	(Boarding operations=Poor or Fair) and (Courtesy and competence of the staff for boarding=Good) and (Boarding pass procedure=Poor or Fair)	Fair	66.0
7	(Boarding operations=Poor or Fair) and (Courtesy and competence of the staff for boarding=Good) and (Boarding pass procedure=Good) and (Way to get on board=Poor or Fair)	Fair	53.2
8	(Boarding operations=Poor or Fair) and (Courtesy and competence of the staff for boarding=Good) and (Boarding pass procedure=Good) and (Way to get on board=Good)	Good	61.0

Passengers are likely to evaluate the overall experience as "good" when the "Boarding operations" are good. Otherwise, they are likely to rate the overall experience as "fair" when the "Boarding operations" and the "Courtesy and competence of the staff for boarding" are not good. Therefore, from the model obtained by taking into account the service provided before the flight, it emerges that the services that have the greatest impact are those relating to the staff for boarding and to the boarding operations in general. This result is confirmed also by the predicted importance values of the model (Table 6.1). In the same manner, the model referred to "during the flight" services produced 9 terminal nodes (Figure 6.2). Therefore, 9 rules can be extracted by the decision tree building (Table 6.5). In this case, 6 rules are related to the overall experience rated as "fare" and 3 rules to the overall experience rated as "good".

Table 6.5. CART for "during the flight" services (dependent variable: Evaluation of the overall experience): rules

Terminal Node	Rule		Accuracy rate (%)
	If…	Then the evaluation of the overall experience is…	
3	(Comfort during the take-off, cruise and landing=Poor or Fair) and (Courtesy of the cabin crew=Poor or Fair)	Fair	76.6
8	(Comfort during the take-off, cruise and landing=Poor or Fair) and (Courtesy of the cabin crew=Good) and (Temperature inside the cabin=Good)	Good	64.8
11	(Comfort during the take-off, cruise and landing=Poor or Fair) and (Courtesy of the cabin crew=Good) and (Temperature inside the cabin=Poor or Fair) and (Punctuality of the flight departure=Poor or Fair)	Fair	75.3
13	(Comfort during the take-off, cruise and landing=Poor or Fair) and (Courtesy of the cabin crew=Good) and (Temperature inside the cabin=Poor or Fair) and (Punctuality of the flight departure=Good) and (Space available inside the overhead bins=Poor)	Fair	71.4
15	(Comfort during the take-off, cruise and landing=Poor or Fair) and (Courtesy of the cabin crew=Good) and (Temperature inside the cabin=Poor or Fair) and (Punctuality of the flight departure=Good) and (Space available inside the overhead bins=Fair or Good) and (Cleanliness of the cabin, tables and seats=Poor od Fair)	Fair	51.4
16	(Comfort during the take-off, cruise and landing=Poor or Fair) and (Courtesy of the cabin crew=Good) and (Temperature inside the cabin=Poor or Fair) and (Punctuality of the flight departure=Good) and (Space available inside the overhead bins=Fair or Good) and (Cleanliness of the cabin, tables and seats=Good)	Good	61.5
5	(Comfort during the take-off, cruise and landing=Good) and (Safety during the landing=Poor or Fair)	Fair	60.0
9	(Comfort during the take-off, cruise and landing=Good) and (Safety during the landing=Good) and (Safety during the take-off=Poor or Fair)	Fair	62.5
10	(Comfort during the take-off, cruise and landing=Good) and (Safety during the landing=Good) and (Safety during the take-off=Good)	Good	78.7

The overall experience is likely to be evaluated as "good" when "Comfort during the take-off, cruise and landing", "Safety during the landing" and "Safety during the take-off" are good. On the contrary, passengers are likely to evaluate the overall experience as "fair" when "Comfort during the take-off, cruise and landing" and "Courtesy of the cabin crew" are poor or fair. So, the aspects related to travel comfort, safety and courtesy of the on-board staff are those that have the greatest impact on the overall quality assessment. From the predicted importance values of this model (Table 6.2), it emerged a certain importance also for the "Temperature inside the cabin". This aspect is confirmed for example by the rule of Node 8 from which it results that the overall experience is good when the "Courtesy of the cabin crew" and "Temperature inside the cabin" are good although the "Comfort during the take-off, cruise and landing" is rated as "poor" or "fair".

Finally, the 4 rules related to CART for "after the flight" services are shown in Table 6.6. The overall experience would be rated as "good" if the "Way to get on off the aircraft" is good. On the contrary, when the "Way to get on off the aircraft" and "Flight punctuality at the arrival" are not good, the overall evaluation would be fair.

Table 6.6. CART for "after the flight" services (dependent variable: Evaluation of the overall experience): rules

Terminal Node	Rule		Accuracy rate (%)
	If…	Then the evaluation of the overall experience is…	
2	(Way to get on off the aircraft=Good)	Good	69.0
3	(Way to get off the aircraft=Poor or Fair) and (Flight punctuality at the arrival=Poor or Fair)	Fair	71.1
5	(Way to get off the aircraft=Poor or Fair) and (Flight punctuality at the arrival=Good) and (Landing operations=Poor or Fair)	Fair	61.8
6	(Way to get off the aircraft=Poor or Fair) and (Flight punctuality at the arrival=Good) and (Landing operations=Good)	Good	52.8

As a conclusion, it can be said that by applying the CART methodology to the service quality data it was possible to identify the most important aspects of the service for each travel stage. In addition, thanks to the CART the collected data are easier to be interpreted because of the intuitive visual branching images and to the easily understandable *If-then* decision rules, that provide useful information to airlines operators and managers.

6.2.3 CART to explore the passengers' satisfaction

In the questionnaire, two questions related to the satisfaction with the overall experience have been inserted. The first one at the beginning of the questionnaire, and the second one at the end. Following, the exploration of passenger satisfaction is shown by considering at first the satisfaction with the overall experience requested at the beginning of the questionnaire as dependent variable, and then the procedure was replicated by considering as dependent variable the satisfaction with the overall experience requested at the end of the questionnaire. So, three CART models (one for each travel phase) were built for the first case, and other three CART models were built for the second case. In this section, a comparison of the obtained results for each travel stage was provided.

To obtain more interpretative results, the 5 satisfaction levels were grouped in two categories, that are named: "not fully satisfied" and "fully satisfied". The first one includes the first three satisfaction levels, the second one the last two. For each CART model, the normalized importance of the independent variables in the prediction of the dependent variable were obtained as well.

The precision ratios obtained for the CART models calibrated for the "Satisfaction with the overall experience" requested at the beginning of the questionnaire are: 73.6%, 78.8% and 69.6% for "before the flight", "during the flight" and "after the flight" services respectively. Otherwise, the precision ratios obtained for the CART models calibrated for the "Satisfaction with the overall experience" requested at the end of the questionnaire are: 71.1%, 77.1% and 74.4% for "before the flight", "during the flight" and "after the flight" services respectively. From these values it emerges that the precision ratios obtained for "before the flight" and "during the flight" CARTs are higher in the first cases. This probably happens because in the case of the overall satisfaction requested at the beginning of the questionnaire, the interviewee thinks about her/his experience by focusing the attention on aspects of the service that are fundamental for her/him. Therefore, there is a greater link between the answer given at the beginning of the questionnaire concerning overall satisfaction and those given immediately afterwards relating to the service aspects provided before and during the flight. On the contrary, for "after the flight" CARTs the value is higher when the dependent variable is the "Satisfaction with the overall experience" requested at the end of the questionnaire. Considering that questions relating to "after the flight" service aspects are asked at the end of the questionnaire, the greater link with the overall satisfaction requested at the end is justified.

Anyway, these values can be considered acceptable for all CART models, and they are higher than precision rates obtained in other studies analysing service quality or customer satisfaction (de Oña et al., 2012; de Oña and de Oña, 2015; Wong and Chung, 2007).

In Figure 6.4 and in Figure 6.5 the CARTs related to "before the flight" are shown. They are very similar in the structure, in fact both are developed on four levels, have 13 nodes of which 7 are terminals. In both classification trees, the growth process did not exclude any independent variable. Therefore, all the five independent variables are present in both CARTs.

The first substantial difference among them is the root variable. In the first case, it represented by the "Boarding operations". Otherwise, in the second case, the root variable is "Courtesy and competence of the staff for boarding".

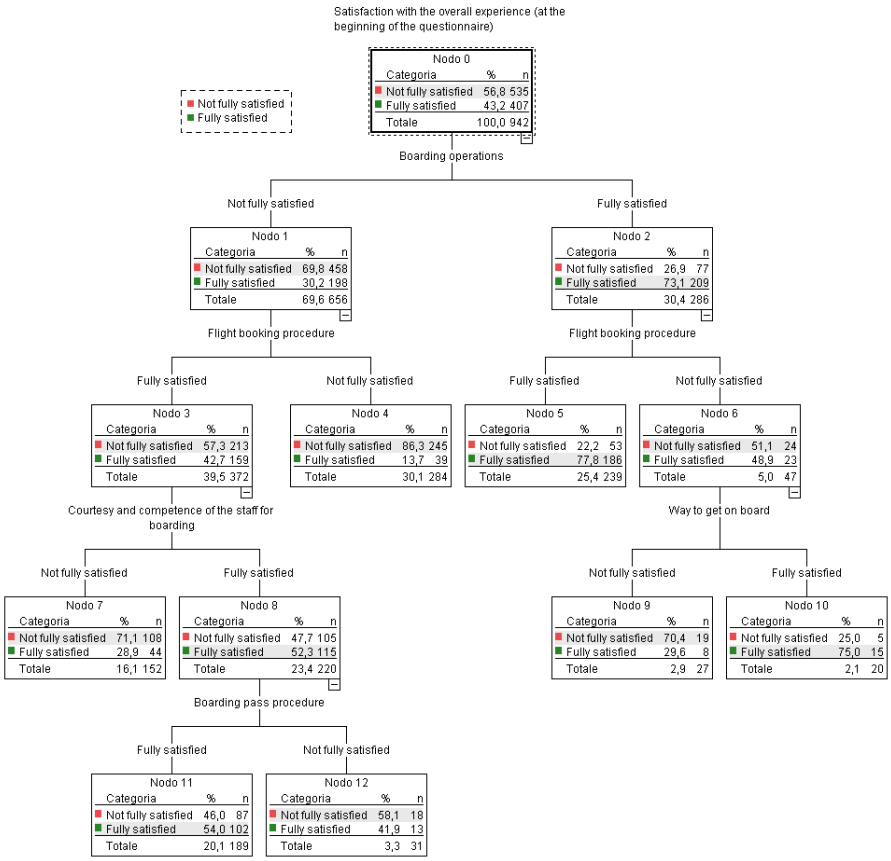


Figure 6.4. CART for "before the flight" services (dependent variable: Satisfaction with the overall experience requested at the beginning of the questionnaire)

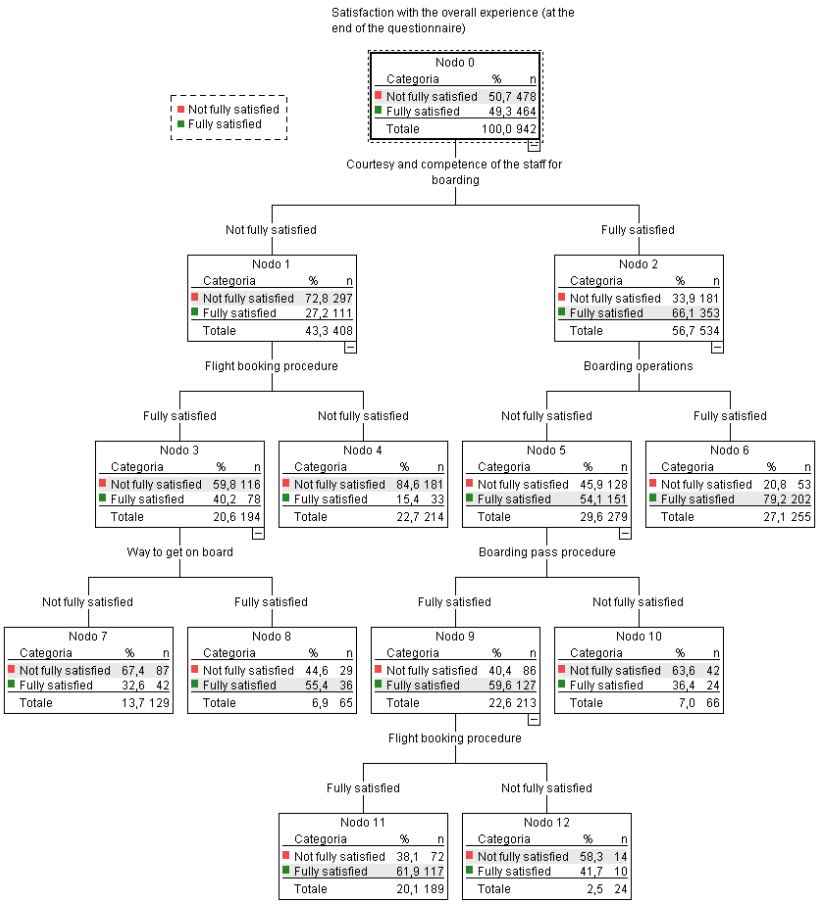


Figure 6.5. CART for "before the flight" services (dependent variable: Satisfaction with the overall experience requested at the end of the questionnaire)

Both in first and second case, passengers that are not fully satisfied with the root variable are in the left branch, and those that are fully satisfied with the root variable are in the right branch.

In the CART reported in Figure 6.4, the independent variables characterizing the left branch are "Flight booking procedure", "Courtesy and competence of the staff for boarding" and "Boarding pass procedure"; instead the variables included in the right branch are "Flight booking procedure" and "Way to get on board".

Regarding the CART reported in Figure 6.5, the independent variables characterizing the left branch are "Flight booking procedure" and "Way to get on board"; instead the variables included in the right branch are

"Boarding operations", "Boarding pass procedure"; and "Flight booking procedure".

The resulting rules of the two CARTs for "before the flight" services are reported in Table 6.7 and Table 6.8. By the rules of nodes 4 and 5 of first model (Table 6.7), it emerges that when passengers are not fully satisfied with "Boarding operations" and "Flight booking procedure", they are likely to be not fully satisfied with the overall experience (86.3%). On the contrary, if they are fully satisfied with the same two service aspects, they are fully satisfied with the overall experience in 77.8% of cases.

Table 6.7. CART for "before the flight" services (dependent variable: Satisfaction with the overall experience requested at the beginning of the questionnaire): rules

Terminal Node	Rule		Accuracy rate (%)
	If…	Then passengers are…	
4	(Boarding operations=Not fully satisfied) and (Flight booking procedure=Not fully satisfied)	Not fully satisfied	86.3
7	(Boarding operations=Not fully satisfied) and (Flight booking procedure=Fully satisfied) and (Courtesy and competence of the staff for boarding=Not fully satisfied)	Not fully satisfied	71.1
11	(Boarding operations=Not fully satisfied) and (Flight booking procedure=Fully satisfied) and (Courtesy and competence of the staff for boarding=Fully satisfied) and (Boarding pass procedure=Fully satisfied)	Fully satisfied	54.0
12	(Boarding operations=Not fully satisfied) and (Flight booking procedure=Fully satisfied) and (Courtesy and competence of the staff for boarding=Fully satisfied) and (Boarding pass procedure=Not fully satisfied)	Not fully satisfied	58.1
5	(Boarding operations=Fully satisfied) and (Flight booking procedure=Fully satisfied)	Fully satisfied	77.8
9	(Boarding operations=Fully satisfied) and (Flight booking procedure=Not fully satisfied) and (Way to get on board=Not fully satisfied)	Not fully satisfied	70.4
10	(Boarding operations=Fully satisfied) and (Flight booking procedure=Not fully satisfied) and (Way to get on board=Fully satisfied)	Fully satisfied	75.0

By observing the rules deriving from the second CART (Table 6.8), it can be said that in 84.6% of cases passengers are not fully satisfied with the overall experience if they declared to be not fully satisfied with "Courtesy and competence of the staff for boarding" and "Flight booking procedure" (Node 4). Otherwise, if passengers declared to be fully satisfied with "Courtesy and competence of the staff for boarding" and "Boarding

operations", they would be fully satisfied with the overall experience in 79.1% of cases.

Table 6.8. CART for "before the flight" services (dependent variable: Satisfaction with the overall experience requested at the end of the questionnaire): rules

Terminal Node	Rule		Accuracy rate (%)
	If…	Then passengers are…	
4	(Courtesy and competence of the staff for boarding =Not fully satisfied) and (Flight booking procedure=Not fully satisfied)	Not fully satisfied	84.6
7	(Courtesy and competence of the staff for boarding =Not fully satisfied) and (Flight booking procedure=Fully satisfied) and (Way to get on board=Not fully satisfied)	Not fully satisfied	67.4
8	(Courtesy and competence of the staff for boarding =Not fully satisfied) and (Flight booking procedure=Fully satisfied) and (Way to get on board=Fully satisfied)	Fully satisfied	55.4
6	(Courtesy and competence of the staff for boarding =Fully satisfied) and (Boarding operations=Fully satisfied)	Fully satisfied	79.2
10	(Courtesy and competence of the staff for boarding =Fully satisfied) and (Boarding operations=Not fully satisfied) and (Boarding pass procedure=Not fully satisfied)	Not fully satisfied	63.6
11	(Courtesy and competence of the staff for boarding =Fully satisfied) and (Boarding operations=Not fully satisfied) and (Boarding pass procedure=Fully satisfied) and (Flight booking procedure=Fully satisfied)	Fully satisfied	61.9
12	(Courtesy and competence of the staff for boarding =Fully satisfied) and (Boarding operations=Not fully satisfied) and (Boarding pass procedure=Fully satisfied) and (Flight booking procedure=Not fully satisfied)	Not fully satisfied	58.3

In Table 6.9 the predicted variables importance obtained from the two CARTs are reported. Firstly, it emerges that regardless of whether the dependent variable was requested at the beginning or at the end of the questionnaire, the most important aspect among the services "before the flight" is "Boarding operations". However, the substantial difference between the two models emerges in the other importance values' distribution. In fact, in the first case it can be seen that the other importance values differ greatly from the most important one. Otherwise, in the second case, the importance values are all high and above 70%. This probably occurs because when the overall satisfaction is required at the beginning of the questionnaire, the respondent tends to focus her/his attention only on those aspects that most impressed her/him during the travel experience. In "before

the flight" stage, the boarding operations are probably the moment that most passengers are led to think about. On the other hand, when the overall satisfaction is required at the end of the questionnaire, the respondents had the opportunity to reflect on all the different aspects of the service thanks to all the previous questions. Then they had the opportunity to think about the different moments of their travel experience and realize that other services also affected their overall satisfaction.

Table 6.9. CART for "before the flight" services (dependent variable: Satisfaction with the overall experience): comparison of independent variables importance predicted by $CART_1$ (dependent variable requested at the beginning of the questionnaire) and by $CART_2$ (dependent variable requested at the end of the questionnaire)

	$CART_1$		$CART_2$	
Independent variable	Imp.	Normalised imp. (%)	Imp.	Normalised imp. (%)
Flight booking procedure	0.040	51.6	0.078	90.9
Boarding pass procedure	0.030	38.7	0.061	71.1
Boarding operations	0.078	100.0	0.085	100.0
Courtesy and competence of the staff for boarding	0.036	46.0	0.074	86.9
Way to get on board	0.047	60.0	0.078	91.1

The CARTs for "during the flight" services are shown in Figure 6.6 and in Figure 6.7. The structures of the two trees are very similar. In both there are 21 nodes, among which 11 are terminal ones. The difference is on the number of levels. In fact, in the first case (Figure 6.6) there are 5 levels and in the second case (Figure 6.7) there are 6 levels.

In the first CART, the growth process has selected nine "during the flight" service aspects: "Comfort during the take-off, cruise and landing", "Safety during the take-off", "Competence of the cabin crew", "Punctuality of the flight", "Temperature inside the cabin", "In-flight information", "Safety during the landing" and "Cleanliness of the cabin, tables and seats". The services included in the second CART are also nine and largely coincide with those of the first CART. Specifically, "In-flight information" and "Safety during the landing" are replaced by "Space available inside the overhead bins" and "Courtesy of the cabin crew".

Regarding the root variable, in the model reported in Figure 6.6 it is represented by "Comfort during the take-off, cruise and landing". Otherwise, "Safety during the take-off" is the root variable of the model shown in Figure 6.7. In the first case, passengers that are fully satisfied with the root variable are in the left branch, and those that are not fully satisfied with the root

variable are in the right branch. The contrary happens in the second CART, but this characteristic is only a graphical choice made by the software.

In the CART reported in Figure 6.6, the independent variables characterizing the left branch, representing passengers that are fully satisfied with "Comfort during the take-off, cruise and landing", are: "Safety during the take-off", "Punctuality of the flight" and "In-flight information". Instead, in the right branch, representing passengers not fully satisfied with the root variable, the independent variables are: "Competence of the cabin crew", "Temperature inside the cabin", "Punctuality of the flight", "Safety during the landing", and "Cleanliness of the cabin, tables and seats".

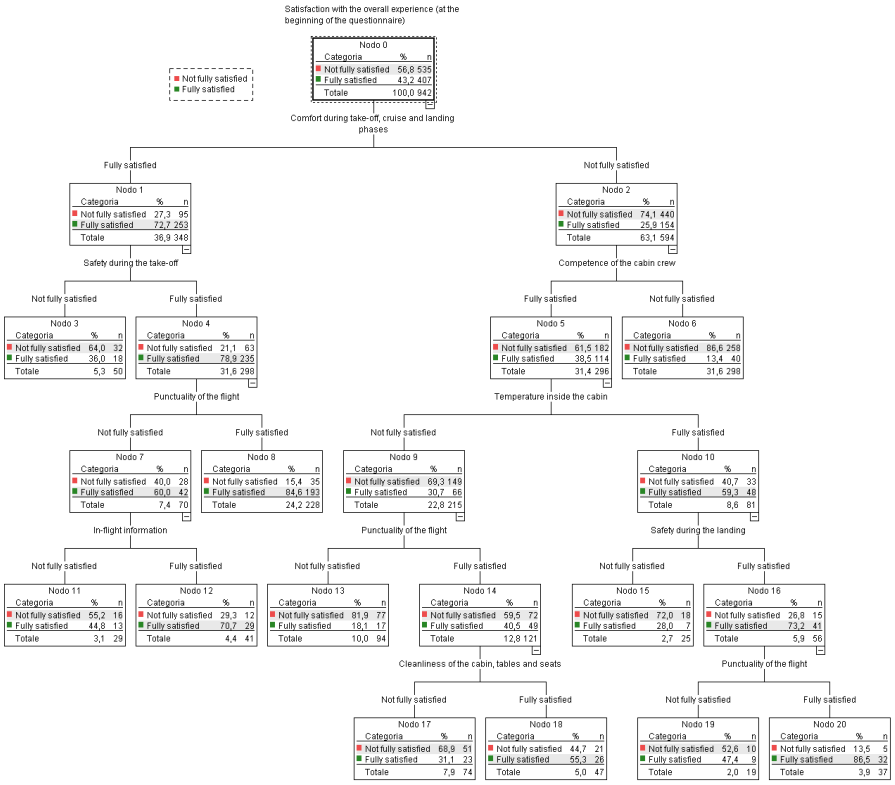


Figure 6.6. CART for "during the flight" services (dependent variable: Satisfaction with the overall experience requested at the beginning of the questionnaire)

Regarding the CART reported in Figure 6.7 the independent variables characterizing the left branch, representing passengers that are not fully satisfied with "Safety during the take-off", are: "Punctuality of the flight" and "Cleanliness of the cabin, tables and seats". Instead, in the right branch,

representing passengers fully satisfied with the root variable, the independent variables are: “Comfort during the take-off, cruise and landing”, “Competence of the cabin crew”, “Courtesy of the cabin crew”, “Temperature inside the cabin”, “Space available inside the overhead bins”, “Punctuality of the flight”, and “Cleanliness of the cabin, tables and seats”.

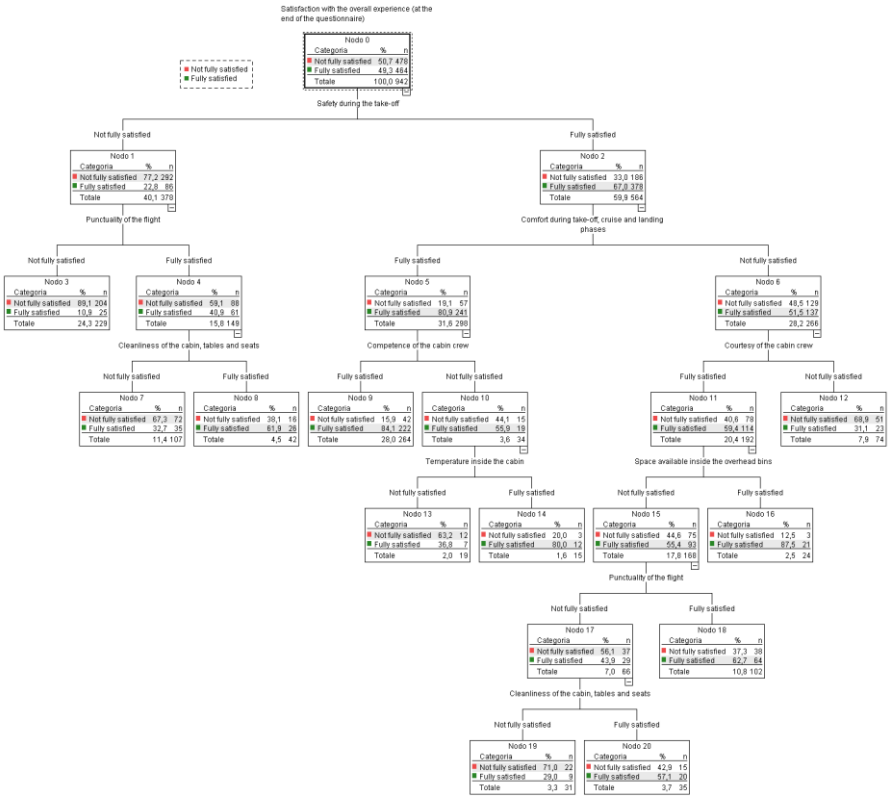


Figure 6.7. CART for “during the flight” services (dependent variable: Satisfaction with the overall experience requested at the end of the questionnaire)

The resulting rules of the two CARTs for “during the flight” services are reported in Table 6.10 and Table 6.11. By the rules of nodes 6 and 8 of first model (Table 6.10), it emerges that when passengers are not fully satisfied with “Comfort during the take-off, cruise and landing” and “Competence of the cabin crew”, they are likely to be not fully satisfied with the overall experience (86.6%). As regards passengers that are likely to be fully satisfied with the overall experience, even if the accuracy rate of the rule related to the node 20 is greater than that related to node 8, it can be retained more

significant this last output because of the number of cases. According to this, passengers are likely to be fully satisfied with the overall experience when they are fully satisfied with "Comfort during the take-off, cruise and landing", "Safety during the take-off" and "Punctuality of the flight".

Table 6.10. CART for "during the flight" services (dependent variable: Satisfaction with the overall experience requested at the beginning of the questionnaire): rules

Terminal Node	Rule		Accuracy rate (%)
	If…	Then passengers are…	
3	(Comfort during the take-off, cruise and landing=Fully satisfied) and (Safety during the take-off=Not fully satisfied)	Not fully satisfied	64.0
8	(Comfort during the take-off, cruise and landing=Fully satisfied) and (Safety during the take-off=Fully satisfied) and (Punctuality of the flight departure=Fully satisfied)	Fully satisfied	84.6
11	(Comfort during the take-off, cruise and landing=Fully satisfied) and (Safety during the take-off=Fully satisfied) and (Punctuality of the flight departure=Not fully satisfied) and (In-flight information=Not fully satisfied)	Not fully satisfied	55.2
12	(Comfort during the take-off, cruise and landing=Fully satisfied) and (Safety during the take-off=Fully satisfied) and (Punctuality of the flight departure=Not fully satisfied) and (In-flight information=Fully satisfied)	Fully satisfied	70.7
6	(Comfort during the take-off, cruise and landing=Not fully satisfied) and (Competence of the cabin crew=Not fully satisfied)	Not fully satisfied	86.6
13	(Comfort during the take-off, cruise and landing=Not fully satisfied) and (Competence of the cabin crew=Fully satisfied) and (Temperature inside the cabin=Not fully satisfied) and (Punctuality of the flight departure=Not fully satisfied)	Not fully satisfied	81.9
17	(Comfort during the take-off, cruise and landing=Not fully satisfied) and (Competence of the cabin crew=Fully satisfied) and (Temperature inside the cabin=Not fully satisfied) and (Punctuality of the flight departure=Fully satisfied) and (Cleanliness of the cabin, tables and seats=Not fully satisfied)	Not fully satisfied	68.9
18	(Comfort during the take-off, cruise and landing=Not fully satisfied) and (Competence of the cabin crew=Fully satisfied) and (Temperature inside the cabin=Not fully satisfied) and (Punctuality of the flight departure=Fully satisfied) and (Cleanliness of the cabin, tables and seats=Fully satisfied)	Fully satisfied	55.3
15	(Comfort during the take-off, cruise and landing=Not fully satisfied) and (Competence of the cabin crew=Fully satisfied) and (Temperature inside the cabin=Fully	Not fully satisfied	72.0

	satisfied) and (Safety during the landing=Not fully satisfied)		
19	(Comfort during the take-off, cruise and landing=Not fully satisfied) and (Competence of the cabin crew=Fully satisfied) and (Temperature inside the cabin=Fully satisfied) and (Safety during the landing=Fully satisfied) and (Punctuality of the flight=Not fully satisfied)	Not fully satisfied	52.6
20	(Comfort during the take-off, cruise and landing=Not fully satisfied) and (Competence of the cabin crew=Fully satisfied) and (Temperature inside the cabin=Fully satisfied) and (Safety during the landing=Fully satisfied) and (Punctuality of the flight=Fully satisfied)	Fully satisfied	86.5

By observing the rules deriving from the second CART (Table 6.11), it can be said that in 89.1% of cases passengers are not fully satisfied with the overall experience if they declared to be not fully satisfied with "Safety during the take-off" and "Punctuality of the flight" (Node 3). Otherwise, if passengers declared to be fully satisfied with "Safety during the take-off", "Comfort during the take-off, cruise and landing", "Courtesy of the cabin crew" and "Space available inside the overhead bins" they would be fully satisfied with the overall experience in 87.5% of cases.

Table 6.11. CART for "during the flight" services (dependent variable: Satisfaction with the overall experience requested at the end of the questionnaire): rules

Terminal Node	Rule		Accuracy rate (%)
	If…	Then passengers are…	
3	(Safety during the take-off=Not fully satisfied) and (Punctuality of the flight=Not fully satisfied)	Not fully satisfied	89.1
7	(Safety during the take-off=Not fully satisfied) and (Punctuality of the flight=Fully satisfied) and (Cleanliness of the cabin, tables and seats=Not fully satisfied)	Not fully satisfied	67.3
8	(Safety during the take-off=Not fully satisfied) and (Punctuality of the flight=Fully satisfied) and (Cleanliness of the cabin, tables and seats=Fully satisfied)	Fully satisfied	61.9
9	(Safety during the take-off=Fully satisfied) and (Comfort during the take-off, cruise and landing=Fully satisfied) and (Competence of the cabin crew=Fully satisfied)	Fully satisfied	84.1
13	(Safety during the take-off=Fully satisfied) and (Comfort during the take-off, cruise and landing=Fully satisfied) and (Competence of the cabin crew=Not fully satisfied) and (Temperature inside the cabin=Not fully satisfied)	Not fully satisfied	63.2
14	(Safety during the take-off=Fully satisfied) and (Comfort during the take-off, cruise and landing=Fully satisfied) and (Competence of the cabin crew=Not fully satisfied) and (Temperature inside the cabin=Fully satisfied)	Fully satisfied	80.0

12	(Safety during the take-off=Fully satisfied) and (Comfort during the take-off, cruise and landing=Fully satisfied) and (Courtesy of the cabin crew=Not fully satisfied)	Not fully satisfied	68.9
16	(Safety during the take-off=Fully satisfied) and (Comfort during the take-off, cruise and landing=Fully satisfied) and (Courtesy of the cabin crew=Fully satisfied) and (Space available inside the overhead bins=Fully satisfied)	Fully satisfied	87.5
18	(Safety during the take-off=Fully satisfied) and (Comfort during the take-off, cruise and landing=Fully satisfied) and (Courtesy of the cabin crew=Fully satisfied) and (Space available inside the overhead bins=Not fully satisfied) and (Punctuality of the flight departure=Fully satisfied)	Fully satisfied	62.7
19	(Safety during the take-off=Fully satisfied) and (Comfort during the take-off, cruise and landing=Fully satisfied) and (Courtesy of the cabin crew=Fully satisfied) and (Space available inside the overhead bins=Not fully satisfied) and (Punctuality of the flight departure=Not fully satisfied) and (Cleanliness of the cabin, tables and seats=Not fully satisfied)	Not fully satisfied	71.0
20	(Safety during the take-off=Fully satisfied) and (Comfort during the take-off, cruise and landing=Fully satisfied) and (Courtesy of the cabin crew=Fully satisfied) and (Space available inside the overhead bins=Not fully satisfied) and (Punctuality of the flight departure=Not fully satisfied) and (Cleanliness of the cabin, tables and seats=Fully satisfied)	Fully satisfied	57.1

In Table 6.12 the importance of predicted variables obtained from the two CARTs are reported. It emerges that predictive importance obtained by the two models are very different. When the dependent variable is required at the beginning questionnaire, the most important aspect among the services "during the flight" are those related to the safety during the three flight stage: take-off, cruise and landing. These aspects are quite important also when the dependent variable is that required at the end of the questionnaire. However, in this case, the three most important service aspects are: "Competence of the cabin crew", "Courtesy of cabin crew" and "Comfort during the take-off, cruise and landing". It is interesting to note that the most important aspect of the second model (Competence of cabin crew) is at the same time the least important of the first model. This probably occurs because when the overall satisfaction is required at the beginning of the questionnaire, the respondents do not think to a specific aspect such as the "Competence of the cabin crew". However, when the overall satisfaction is required at the end of the questionnaire, the respondents had the opportunity to reflect also regarding this aspect thanks to the previous relative question about it. Moreover, the respondent probably recognise how it is important to flight accompanied by a competent and kind cabin crew. At the same manner, physical aspects such

as the “Comfort of the seat” and “Space available inside the overhead bins” becomes less important because compared to more influent and priority items.

Table 6.12. CART for “during the flight” services (dependent variable: Satisfaction with the overall experience): comparison of independent variables importance predicted by $CART_1$ (dependent variable requested at the beginning of the questionnaire) and by $CART_2$ (dependent variable requested at the end of the questionnaire)

	$CART_1$		$CART_2$	
Independent variable	Imp.	Normalised imp. (%)	Imp.	Normalised imp. (%)
Punctuality of the flight	0.033	25.1	0.096	82.6
Space available inside the overhead bins	0.083	62.3	0.025	21.9
Comfort of the seat	0.056	42.3	0.015	12.6
Temperature inside the cabin	0.097	72.9	0.079	68.3
Acoustic comfort	0.060	44.8	0.019	16.3
Comfort during take-off, cruise and landing	0.102	76.7	0.107	92.6
Cleanliness of the cabin, tables and seats	0.079	59.5	0.084	72.3
In-flight information	0.065	48.9	0.059	50.9
Courtesy of the cabin crew	0.079	59.5	0.113	97.6
Competence of the cabin crew	0.020	15.4	0.116	100.0
Safety during the take-off	0.121	91.4	0.094	81.2
Safety during the cruise	0.124	93.3	0.100	86.2
Safety during the landing	0.133	100.0	0.097	83.7

Finally, the CARTs for “after the flight” services are reported in Figure 6.8 and in Figure 6.9. The structures of the two trees are both very simple because there are only three independent variables. In both there are 3 levels. The difference is on the number of nodes and terminal nodes. In fact, in the first case (Figure 6.8) there are 11 nodes among which 6 are terminal, and in the second case (Figure 6.9) there are 7 nodes among which 4 are terminal.

In both CARTs, the growth process did not exclude any of the “after the flight” service aspects. Regarding the root variable, in the model reported in Figure 6.8 it is represented by “Way to get off the aircraft”. Otherwise, “Landing operations” is the root variable of the model shown in Figure 6.9.

In both CARTs, passengers that are not fully satisfied with the root variable are in the left branch, and those that are fully satisfied with the root variable are in the right branch. In the CART reported in Figure 6.8, the

independent variables characterizing both the branches are "Landing operations" and "Flight punctuality at the arrival".

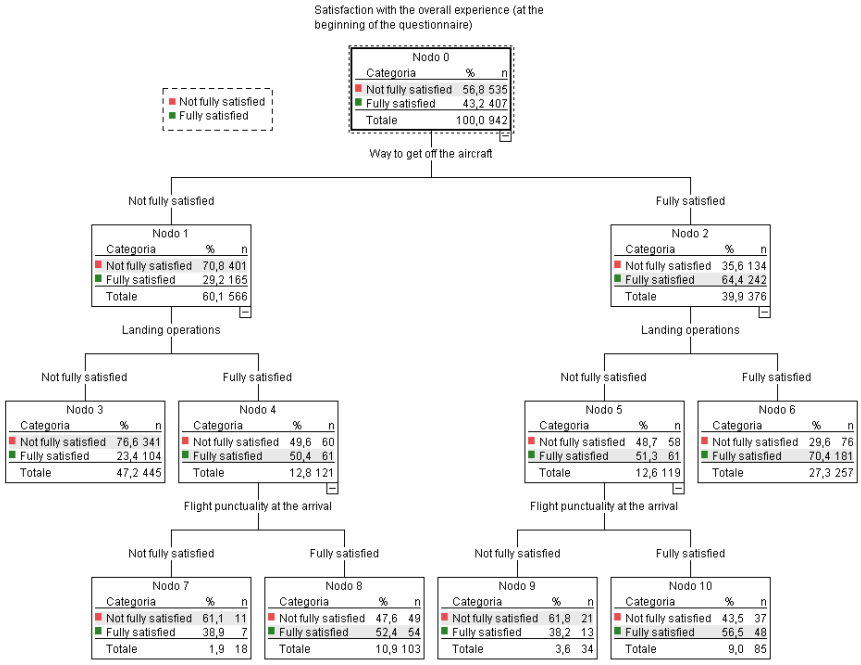


Figure 6.8. CART for "after the flight" services (dependent variable: Satisfaction with the overall experience requested at the beginning of the questionnaire)

Regarding the CART reported in Figure 6.9 the independent variables characterizing the left branch, representing passengers that are not fully satisfied with "Landing operations", are: "Way to get off the aircraft" and "Flight punctuality at the arrival". Instead, the right branch, representing passengers fully satisfied with the root variable, is composed only by the terminal node 2.

The resulting rules of the two CARTs for "after the flight" services are reported in Table 6.13 and Table 6.14. By the rules of nodes 3 and 6 of first model (Table 6.13), it emerges that when passengers are not fully satisfied with "Way to get off the aircraft" and "Landing operations", they are likely to be not fully satisfied with the overall experience (76.6%). On the contrary, passengers are likely to be fully satisfied with the overall experience when they are fully satisfied with the same service aspects.

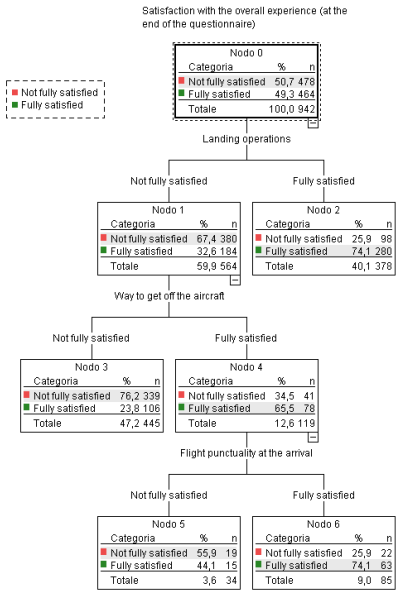


Figure 6.9. CART for "after the flight" services (dependent variable: Satisfaction with the overall experience requested at the end of the questionnaire)

Table 6.13. CART for "after the flight" services (dependent variable: Satisfaction with the overall experience requested at the beginning of the questionnaire): rules

Terminal Node	Rule		Accuracy rate (%)
	If…	Then passengers are…	
3	(Way to get off the aircraft=Not fully satisfied) and (Landing operations=Not fully satisfied)	Not fully satisfied	76.6
7	(Way to get off the aircraft=Not fully satisfied) and (Landing operations=Fully satisfied) and (Flight punctuality at the arrival=Not fully satisfied)	Not fully satisfied	61.1
8	(Way to get off the aircraft=Not fully satisfied) and (Landing operations=Fully satisfied) and (Flight punctuality at the arrival=Fully satisfied)	Fully satisfied	52.4
6	(Way to get off the aircraft=Fully satisfied) and (Landing operations=Fully satisfied)	Fully satisfied	70.4
9	(Way to get off the aircraft=Fully satisfied) and (Landing operations=Not fully satisfied) and (Flight punctuality at the arrival=Not fully satisfied)	Not fully satisfied	61.8
10	(Way to get off the aircraft=Fully satisfied) and (Landing operations=Not fully satisfied) and (Flight punctuality at the arrival=Fully satisfied)	Fully satisfied	56.5

By observing the rules deriving from the second CART (Table 6.14), it can be said that in 76.1% of cases passengers are not fully satisfied with the overall experience if they declared to be not fully satisfied with "Landing operations" and "Way to get off the aircraft" (Node 3). Otherwise, if passengers declared to be fully satisfied with "Landing operations", they would be fully satisfied with the overall experience in 74.1% of cases (Node 2). At the same time, if they are not fully satisfied with "Landing operations" but fully satisfied with the other two service aspects, they would be fully satisfied in 74.1% of cases (Node 6).

Table 6.14. CART for "after the flight" services (dependent variable: Satisfaction with the overall experience requested at the end of the questionnaire): rules

Terminal Node	Rule		Accuracy rate (%)
	If…	Then passengers are…	
2	(Landing operations=Fully satisfied)	Fully satisfied	74.1
3	(Landing operations=Not fully satisfied) and (Way to get off the aircraft=Not fully satisfied)	Not fully satisfied	76.2
5	(Landing operations=Not fully satisfied) and (Way to get off the aircraft=Fully satisfied) and (Flight punctuality at the arrival=Not fully satisfied)	Not fully satisfied	55.9
6	(Landing operations=Not fully satisfied) and (Way to get off the aircraft=Fully satisfied) and (Flight punctuality at the arrival=Fully satisfied)	Fully satisfied	74.1

In Table 6.15 the importance of predicted variables obtained from the two CARTs are reported. The predictive importance obtained by the two models are quite similar. In both cases the least important variable is "Flight punctuality at the arrival".

Table 6.15. CART for "after the flight" services (dependent variable: Satisfaction with the overall experience): comparison of independent variables importance predicted by $CART_1$ (dependent variable requested at the beginning of the questionnaire) and by $CART_2$ (dependent variable requested at the end of the questionnaire)

	$CART_1$		$CART_2$	
Independent variable	Imp.	Normalised imp. (%)	Imp.	Normalised imp. (%)
Flight punctuality at the arrival	0.051	64.4	0.079	68.3
Landing operations	0.079	100.0	0.083	71.4
Way to get off the aircraft	0.059	75.1	0.116	100.0

When the dependent variable is required at the beginning questionnaire, the most important aspect among the services "after the flight" is "Landing operations". Otherwise, when the dependent variable is that required at the end of the questionnaire, the most important aspect is "Way to get off the aircraft".

As it happened for the evaluation data even with the satisfaction data the CART proved to be a valid and easily understandable analysis tool. Moreover, in this specific application, interesting findings emerged by comparing the results obtained with the overall satisfaction asked at the beginning of the questionnaire as dependent variable and those obtained with the overall satisfaction asked at the end of the questionnaire.

6.3 Discrete choice models

6.3.1 Model specification

For analysing the collected data through the SP data collected through the questionnaire, discrete choice models have been proposed; the findings of a such approach application allow identifying useful policy recommendations. For a first application, data relating to the choice experiments were analysed separately. In other words, two different MNL models were calibrated: one considering the "before/after the flight" choice data, and the other one considering the "during the flight" choice data.

The MNL models were estimated to observe the effects of each service attribute on expected quality. This kind of models are based on random utility theory. Specifically, the utility can be represented as follow:

$$U_{iq} = V_{iq} + \varepsilon_{iq} \tag{14}$$

where V_{iq} is the systematic component and ε_{iq} is the random component. The first one can be expressed as:

$$V_{iq} = \sum_{k=1}^{k} \theta_{ik}\, x_{ikq} \tag{15}$$

On the other hand, in order to detect the passengers' heterogeneity on airlines' service, an RPML model was estimated, and in this case the choice data have been considered without being separated by travel phases.

The RPML model assumes that at least one of the parameters is random, following a certain probability distribution (Hensher et al., 2015). These random parameter distributions are assumed to be continuous over the

sampled population. It is considered that, in the choice situation t, the generic individual q takes into consideration the complete set of alternatives and chooses the one maximizing his/her utility. The basic utility specification of the chosen model is as follow:

$$U_{iqt} = \sum_k (\beta_{kq} \cdot x_{kiqt}) + \theta_i \cdot E_{iq} + \varepsilon_{iqt} \quad (16)$$

where U_{iqt} is the utility of alternative i for individual q in choice situation t. β_{kq} is the value of the parameter for individual q, and x_{kiqt} is the value of attribute k (included in Table 6.16 and Table 6.17) of alternative i for individual q in choice situation t. In this case, the choice is between two unlabelled alternatives and each interviewee responded at least to four choice experiments ($t = 4$). The alternative specific random individual effects are represented by E_{iq}. In other words, the variability induced by the alternatives themselves is not considered by the attributes in the model (Greene, 2007). For convenience, this variation is explicitly represented by θ_i, which is the standard deviation estimated by the model. ε_{iqt} is the random error term, which is assumed to be independent and identically distributed (IID) extreme value type I. In addition, β_q is the importance that individual q places on the variable to which the parameter is associated and in the adopted specification is made as follow:

$$\beta_q = \bar{\beta} + \beta_F \cdot F_q + \Gamma \cdot v_q = \bar{\beta} + \beta_F \cdot F_q + \eta_q \quad (17)$$

where $\bar{\beta}$ is the mean parameter (population); F_q are the factors behind the systematic taste variation; β_F are parameters that weigh the effect of the F_q factors on the mean parameter $\bar{\beta}$ (Ortúzar and Willumsen, 2011); η_q distributes among the individuals according to the random variable v_q (generally assumed to distribute normal, lognormal, uniform or triangular) and Γ, represents the elements of the Cholesky matrix, which allow for correlation between random parameters (Train, 2009).

Table 6.16. Attributes' levels for "before/after the flight" experiment.

Attributes	Name	Levels
Waiting time at check-in (min.)	WTC	0; 5; 20
Time spent for boarding operations (min.)	TBO	10; 20; 40
Terminal-Aircraft transfer by external path	TM-EP	1(yes); 0(no)
Terminal-Aircraft transfer by shuttle	TM-S	1(yes); 0(no)
Terminal-Aircraft transfer by jet bridge	TM-JB	1(yes); 0(no)
Delay of flight departure (min.)	DFD	0; 20; 60
Time spent for luggage delivery (min.)	TLD	0; 10; 30
Cost of the ticket (€)	CT	20; 60; 180; 360; 720; 1440

Table 6.17. Attributes' levels for "during the flight" experiment.

Attributes	Name	Levels
Space available on board fully adequate	SOB-FA	1(yes); 0(no)
Space available on board adequate	SOB-A	1(yes); 0(no)
Space available on board not adequate	SOB-NA	1(yes); 0(no)
Temperature on board adequate	TOB-A	1(yes); 0(no)
Temperature on board too cold	TOB-C	1(yes); 0(no)
Temperature on board too warm	TOB-W	1(yes); 0(no)
Cleanliness on board	COB	1(clean enough); 0(quite dirty)
Courtesy of cabin crew	CCC	1(kind enough); 0(quite rude)
Services on board fully adequate	SB-FA	1(yes); 0(no)
Services on board adequate	SB-A	1(yes); 0(no)
Services on board not adequate	SB-NA	1(yes); 0(no)
Cost of the ticket (€)	CT	20; 60; 180; 360; 720; 1440

Both the models were calibrated by Nlogit software (Greene, 2016).

6.3.2 Multinomial logit models

MNL models, which are the simplest among the Logit models, were used for merely estimating the effect of each variable on the expected service quality in before and after the flight situation (Table 6.18) and during the flight as well (Table 6.19). The estimation process considered all the variables, and almost all of them resulted with the correct sign and with a high statistical significance. By observing the results reported in Table 6.18, the negative signs relate to those attributes whose increase reduces the utility of the choice alternative. Specifically, among them, the attributes with the highest weights are "waiting time at check-in" and "time spent for luggage delivery". This result is interesting because it identifies one temporal attribute belonging to "before the flight" experience and one belonging to "after the flight" experience as crucial for the traveller, and demonstrates that she/he suffers for time lost for ground operations. On the contrary, the delay of flight departure has the lowest weight, maybe because the traveller has a different definition of "time lost" once she/he gets on board. As regards the Terminal-Aircraft transfer mode, those by external path was considered as the reference value and equal to 0. Instead, the transfers by jet bridge and by shuttle present positive signs and very high values. So, a more comfortable transfer mode from the terminal to the aircraft (before the flight) and vice versa (after the flight) resulted as a key factor for a traveller. Specifically, the highest positive coefficient resulted for transfer by jet-bridge suggests that a direct and protect path from the terminal to the aircraft and vice versa is highly appreciated by the air travellers.

Table 6.18. Multinomial logit considering "before/after the flight" attributes.

Variable	Coefficient (β)	z	p [|z| > Z*]
Waiting time at check-in	−0.278	−17.15	0.000
Time spent for boarding operations	−0.043	−33.24	0.000
Terminal-Aircraft transfer by jet bridge	1.747	30.34	0.000
Terminal-Aircraft transfer by shuttle	1.670	30.30	0.000
Delay of flight departure	−0.031	−44.23	0.000
Time spent for luggage delivery	−0.139	−16.08	0.000
Cost of the ticket	−0.006	−43.42	0.000
Log-likelihood function		−7045.21	

Interesting findings emerged for the travel experience during the flight (Table 6.19) as well. Even in this case the coefficient related to the cost has correctly a negative sign. The space available on board reduces the utility of the alternative when it is "not fully adequate" and "adequate". The adequate temperature board is the attribute with the highest positive value. Finally, a kinder cabin crew, cleanliness, and adequate provided services on board increase the utility of the alternative.

Table 6.19. Multinomial logit considering "during the flight" attributes.

Variable	Coefficient (β)	z	p [|z| > Z*]
Space available on board not fully adequate	−0.600	−16.71	0.000
Space available on board adequate	−0.098	−3.85	0.000
Temperature on board adequate	0.921	33.61	0.000
Cleanliness on board	0.200	1.97	0.048
Courtesy of cabin crew	0.287	15.01	0.000
Services on board adequate	0.086	2.68	0.007
Cost of the ticket	−0.002	−7.17	0.000
Log-likelihood function		−9567.79	

6.3.3 Random parameters mixed logit model

After analysing the "before/after the flight" scenarios separately from "during the flight" ones by MNL models, the RPML model was estimated. Specifically, various specifications of the utility function were tested, and different probability distributions for the parameters associated with the considered variables were combined. Finally, the model providing the best fit was chosen. By considering that in SP survey the observations are repeated, it has been considered the panel effects that allow to take into account the correlation between the responses given to different scenarios by different individuals. The outcomes of the model are reported in Table 6.20. Specifically, 9 random parameters out of the 15 estimates resulted. Among them, 3 follow a normal distribution (WTC, DFP, CT/I) and 6 a uniform

distribution (SON-NA, TOB-C, TOB-W, COB, CCC, SB-FA). The 6 parameters that follow a uniform distribution are associated to a dummy variable, in line with the international literature that usually associates that distribution with that type of variables (Hensher et al., 2015). In order to consider the income effect, the variable CT/I (Jara-Díaz and Videla, 1989) has been defined, which allows to see how the perception of the travel cost varies depending on the income level of the individual surveyed.

Table 6.20. Results of the RPML model

Service aspect		Parameter	z
Waiting time at check-in	WTC	-0.201$^{(***)}$	-12.58
	N-sigma (WTC)	0.040$^{(***)}$	8.12
Time spent for boarding operations	TBO	-0.041$^{(***)}$	-28.54
Terminal-Aircraft transfer by external path	TM-EP	-1.448$^{(***)}$	-23.87
Terminal-Aircraft transfer by shuttle	TM-S	0.025	0.68
Delay of flight departure	DFD	-0.034$^{(***)}$	-39.73
	N-sigma (DFD)	0.010$^{(***)}$	9.31
Time spent for luggage delivery	TLD	-0.097$^{(***)}$	-11.45
Space available on board fully adequate	SOB-FA	0.056$^{(*)}$	1.84
Space available on board not adequate	SOB-NA	-1.123$^{(***)}$	-24.29
	U-sigma (SOB-NA)	1.119$^{(***)}$	11.64
Temperature on board too cold	TOB-C	-1.245$^{(***)}$	-31.17
	U-sigma (TOB-C)	1.058$^{(***)}$	12.12
Temperature on board too warm	TOB-W	-1.591$^{(***)}$	-32.53
	U-sigma (TOB-W)	1.267$^{(***)}$	13.89
Cleanliness on board	COB	1.762$^{(***)}$	14.92
	U-sigma (COB)	2.341$^{(***)}$	7.73
Courtesy of cabin crew	CCC	0.550$^{(***)}$	18.73
	U-sigma (CCC)	0.913$^{(***)}$	14.19
Services on board fully adequate	SB-FA	0.509$^{(***)}$	13.04
	U-sigma (SB-FA)	0.312$^{(**)}$	2.10
Services on board adequate	SB-A	0.737$^{(***)}$	16.69
Cost of the ticket/Income	CT/I	-18.295$^{(***)}$	-25.56
	N-sigma (CT/I)	18.067$^{(***)}$	23.73
	N. of observations	30696	
	Degree of freedom	24	
	Log Likelihood	-16244.094	
	LL Constant Only	-21276.846	

$^{(***)}$ Significance at 1% level, $^{(**)}$ at 5%, $^{(*)}$ at 10%

As can be seen, all the variables have the expected sign and almost all of them are statistically significant at 95% of the confidence level, except the TM-S variable. This last can be considered statistically equal to zero, therefore, when TM-EP is taken into account, TM-S can be considered as its reference level. This means that flyers consider the terminal-aircraft transfer

by external path as a disutility, but they are indifferent to the transfer by shuttle.

The SOB-FA variable (space available on board fully adequate) is significant at 90% of the confidence level and has a positive sign, contrary to the SOB-NA variable (space available on board not adequate) that is negative and significant at 99% of the confidence level. This remarks that flyers perceive as a disutility to have little space on board, however they do not need to have too much space.

By comparing the weights of the variables with the same unit of measurement, such as the time (WTC, TBO, DFD and TLD), it emerges that the most penalizing aspects for flyers are WTC (waiting time at check- in) and TLD (time spent for luggage delivery). On the other hand, TBO (time spent for boarding operation) and DFD (delay of flight departure) are less penalizing and with similar weights. This indicates that the initial and final stages of the trip have a great impact on the flyers' quality perception, so it is important to improve these aspects for enhancing the whole travel experience. The standard deviations related to the random parameters of WTC (waiting time at check- in) and DFD (delay of flight departure) are not very large. This means that despite the parameters change significantly from a statistical point of view, their values do not vary too much in the population around the mean values.

Removing the parameters analysed so far, and the parameter associated with CT/I, all the remaining variables are dummy. Therefore, even if they represent different service aspects, they can be compared to each other. Specifically, these variables can be divided into two groups: a) those that are perceived as a disutility (TM-EP, SOB-NA, TOB-C, TOB-W); b) those that generate positive utility for the passengers (SOB-FA, COB, CCC, SB-FA, SB-A). Among the former ones, the variable with the greatest negative weight is TOB-W (temperature on board too warm) followed by TM-EP (terminal-aircraft transfer by external path). As regard the temperature on board, both too cold and too hot temperatures are penalizing for the passengers. However, they prefer the environment inside the cabin to be cold rather than warm. By observing the parameters associated with these random variables, there is a significant variation in the population; however, the variation is less than the average value of the parameter. The standard deviation of SOB-NA (space on board not adequate) indicates a variation very close to the average value of the parameter. This means that, although it is a very negatively perceived variable, in some cases it may become of minimal importance for some customers. This may be due to the fact that not all passengers perceive the space on board in the same way due to their body size or adaptability in general.

Among the variables that generate a positive utility for passengers, the variable COB (cleanliness on board) stands out clearly. This variable has a very high weight with respect the other variables, but at the same time it has a higher variability than the average value. This means that there are customers who value the cleanliness on board very much and others who do not take it into account. This result does not mean that for customers is indifferent to travel on a dirty cabin, of course.

Exactly the same thing happens with the variable CCC (courtesy of cabin crew) which, although it is less important than COB (cleanliness on board), has a significant variation and greater value than the mean. Also in this case, the courtesy of the staff is highly valued by many flyers, but for some of them it is not important. The on-board services (SB-FA, SB-A) are important, but their perception among passengers varies moderately.

Finally, the parameter associated with CT/I (cost of the ticket/income) is negative as expected, and it has a significant variability in the population. However, even though this variation is very close to the average value of the parameter, it is slightly lower. This indicates that the perception of the parameter is generally negative among all passengers regardless of their income level, in line with what expected. Therefore, ticket cost is perceived as a disutility, but its perception among passengers varies significantly depending on their income level.

The obtained findings can be usefully compared with the ones discovered in similar literature studies. In several cases, the service aspects related to check-in and baggage handling service are not the most relevant aspects among those regarding airport facilities. As an example, in Chen (2008), factor loadings related to courtesy, cleanliness and willingness to help from staff result as more relevant; on the contrary, interior cleanliness showed a lower level of importance. However, results emerging from the proposed choice experiments showed different findings: in fact, courtesy of cabin crew (CCC) is less important than cleanliness on board (COB). These opposite expectations should be explained by considering the different population involved in the survey (Asiatic vs European people) as well as the different way for collecting the data (RP vs SP techniques).

In Espino et al. (2008) comfort in terms of space between seats showed a positive sign, because the corresponding variable refers to more leg room; this results is comparable with the obtained value for SOB-FA variable in the proposed RPML model. However, in Espino et al. (2008) this parameter showed also a standard deviation higher than the mean value, indicating that there is a considerable heterogeneity among flyers in perceiving this service aspect. In the proposed model, the result obtained for SOB-FA variable has to be compared with the one obtained for SOB-NA variable. From this

comparison, it can be remarked that the flyer perceives as a disutility to have little space on board, but she/he does not need to have too much space. In addition, travel cost showed a negative weight with a comparable standard deviation as for the obtained results. However, a direct comparison between the weights obtained in both cases cannot be considered as totally appropriate. In fact, in Espino et al. (2008) travel cost is a continuous variables defined from ticket price and its variation between a 20% of increase or decrease from the current price, whereas in the proposed choice experiments ticket cost is referred to the personal income of the flyer. Heterogeneity in cost perception was found also by Balcombe et al. (2009), who focused on the in-flight services provided by charter airlines on a flight long about 5 hours. Differently, Wen and Lai (2010) discovered latent classes of flyers depending on personal income.

6.4 Summary

The aim of this chapter was to investigate on airline passengers' perceptions and expectation to pursue the most convenient strategy for increasing their satisfaction and improving the provided service. The data used are those collected through the online survey that involved the whole population of University of Calabria.

To explore the data referred to the first part of the questionnaire, the RP survey, the CART methodology was proposed. In general, it can be said that the CART methodology has proved to be a valuable tool for identifying the most important service aspects for both overall evaluation and overall satisfaction dependent variables. In addition, thanks to the CART the collected data are easier to interpret because of the intuitive visual branching images and to the easily understandable *If-then* decision rules, that provide useful information to airlines operators and managers.

From the analysis of both evaluation and satisfaction data, it emerges that the most important aspects are: "Boarding operations" for "before the flight"; "Courtesy of the cabin crew", "Competence of the cabin crew" and "Comfort during the take-off, cruise and landing" for "during the flight"; "Way to get off the aircraft" for "after the flight". Another interesting finding emerged from the analysis of the satisfaction data. Specifically, even if the precision ratios obtained for "before the flight" and "during the flight" CARTs are higher when the "Satisfaction with the overall experience" has been asked at the beginning of the questionnaire, the obtained results by the models calibrated for "Satisfaction with the overall experience" asked at the end seem to be more reliable. This probably happens because when the overall satisfaction is required at the end of the questionnaire, the respondents had

the opportunity to reflect on the whole travel experience thanks to all the previous questions. On the contrary, when the overall satisfaction is required at the beginning of the questionnaire, the respondents tend to focus their attention only on those aspects that most impressed them.

As regards the SP data, from the calibration of MNL models it was possible to observe the effects of each service attribute on expected quality. Interesting findings emerge from the analysis of the results. By considering the travel experience before and after the flight, it emerges that air travellers give more importance to the transfer mode connecting the terminal and aircraft, and to the waiting times. As regards the travel experience during the flight, the most important service aspects are those related to comfort, like the space available on board and the temperature. Also cleanliness on board and courtesy of cabin crew are essential. In both models, the cost of the ticket assumes the minor relevance, maybe thanks to the low-cost companies. Anyway, in general ticket cost is not considered as the most relevant service attribute for the passengers of transit systems, who considered as fundamental the other several aspects that characterize a transit service.

The relevant finding from the RPML model remarks that perceptions of the flyers on airline's services vary among the different service aspects and individuals. Specifically, the proposed methodological framework allowed us to detect heterogeneity among passengers when standard deviation of the parameters is high. From the results, the service aspects revealing a strong heterogeneity in the perceptions are those linked to cleanliness on board, courtesy of cabin crew as well as temperature on board. In addition, findings from the proposed study remark that the initial and final stages of the trip have a greater impact on the flyers' quality perception than during the flight experience. As a consequence, practical implications of this research suggest actions for improving before and after the flight stages for enhancing the whole travel experience, and especially actions aimed at reducing waiting time at check-in and time spent for luggage delivery.

In conclusion, the results discussed in this chapter can be considered as preliminary outcomes and they want to be just the beginning of more in-depth research addressed to help the airlines to adopt smart strategies for improving their services.

Conclusion

From the various analyses conducted on airport and airlines services' quality, interesting reflections arise. In general, it can be affirmed that providing services characterized by high levels of quality is very important to make the travel more pleasant for the passengers, with the final objective to attract more users.

In an airport such as the case study of this thesis work, characterized predominantly by a traffic of national flights, it is imperative to attract users to the detriment of railway or bus services, which are often chosen as alternative modes to reach the various national destinations, from the South of Italy to the Centre or the North, and vice-versa. Moreover, an adequate level of service quality makes the airport more attractive and can contribute to the development of the surrounding territorial context.

In the existing literature there are few studies relating to airports comparable to the Lamezia Terme International airport in terms of annual passengers' movements. In fact, only Del Chiappa et al. (2016) and Nesset and Helgesen (2014) considered as case study airport with annual passengers' movements less than 3 million. de Barros et al. (2007) and Lupo (2015) referred their studies to airports with movements around to 10 million passengers per year. Otherwise, the rest of the studies refer to either airports with annual traffic between 20 and 30 million of passengers (Bezerra and Gomes, 2020, 2019; Brida et al., 2016; Liou et al., 2011b; Lubbe et al., 2011; Tseng, 2020), to those with passengers traffic ranging from 30 and 40 million (Bezerra and Gomes, 2016, 2015; Jiang and Zhang, 2016b; Pantouvakis and Renzi, 2016; Sricharoenpramong, 2018), or to those who considered the largest airports in the world (Gitto and Mancuso, 2017; Hong et al., 2020; Martin-Domingo et al., 2019; Pandey, 2016; Park and Jung, 2011). For this reason, the thesis could be considered as a meaningful contribution to the related literature. Although most of the adopted techniques and models of

this work are well known and widely used for analysing airport service quality, in this case they were applied to a particular study context. From the findings, it emerged that the service aspects mostly influencing passengers' satisfaction at the Lamezia Terme airport are those concerning information, cleanliness, and comfort inside the terminal. In the literature, when the object of the study is an airport with greater dimensions and the data are analysed with comparable models, it emerges that not only the facilities related to information and ambience are important for passengers, but also those related to security, check-in, passenger attention, special services and new technologies (Bezerra and Gomes, 2015; Brida et al., 2016). According to this, it seems that the most important services for passengers are linked to the terminal size and are context-dependant. In general, having clear information and signposting inside the terminal makes the airport services more accessible and, at the same time, increases the sense of passengers well-being in the terminal. However, in a small sized airport as the case study of this thesis work, information accessibility, Infopoint and flight information assume a more significant role than signposting around and inside the terminal. Therefore, the financial resources should be more conveniently addressed to these attributes rather than road signposting or terminal signposting. By following the finding of the subsequent analyses, the cleanliness resulted also as the most important item of the environment construct which affect significantly other constructs and especially overall satisfaction construct, which include the terminal comfort and terminal reliability. Therefore, it would be useful for airport managers to redouble efforts in maintaining more personnel for cleaning services in the terminal, in order to match the passenger demand.

Furthermore, the obtained results highlighted the importance to understand the differences of perceptions among groups of passengers with the aim to identify marketing strategies based on the different categories of users. Some interesting findings were discovered by analysing the differences among the passengers by considering socio-demographic characteristics and also particular features of the passengers regarding their attitudes and their habits while travelling, e.g. use of accessory and technology services, which have not yet investigated in the literature of the sector. So, for improving the quality levels of the provided services, the managers and practitioners need customized policies for each class of passengers using the terminal. Therefore, the findings of this thesis work could be useful for the companies managing the airports for identifying the most suitable policy strategies to improve the offered services.

Concerning airlines, it is well established that the growing competition has driven them to customer centred strategies. According to this, the authors

agree that CSSs are the starting point for subsequent marketing strategies (Agarwal and Gowda, 2020; Erdil and Yildiz, 2011; Li et al., 2017; Tsafarakis et al., 2018). In this thesis work, the online survey conducted at the University of Calabria has proved to be a useful tool for collecting a considerable number of opinion in a short time and with few resources.

A crucial element of the RP questionnaire design concerned the decision of the scales to be adopted for collecting passengers' opinions. The evidences from PS and the large-scale survey conducted us to discover the difference between two different evaluation scales: a numerical scale for rating judgments of service quality, and a verbal scale for expressing a level of satisfaction. The preliminary evidences emerged from the data collected through the large-scale survey showed that there is not a very strong association among the two different evaluation scales because of the difference behind the concepts of "user's satisfaction" and "quality of service". Concerning the SP part of the questionnaire, the innovative aspect is certainly having designed a survey of this type without referring to a specific route or type of airline. The hypothetical scenarios were designed with the aim of investigating on air transport users' preferences on short, medium, long-haul flights.

Considering the different nature of the data collected through the two parts of the questionnaire, they were analysed separately. Data collected through the RP part of the questionnaire became object of a CART analysis. This methodology allowed to find the most important services in terms of both service quality and passengers' satisfaction. Moreover, thanks to its graphical output and the related If-then decision rules, the methodology has proved to be a very practical and easily understandable tool for air transport managers and practitioners. As regards the SP data, by calibrating discrete choice models it was possible to observe the effects of each service attribute on expected quality and to detect heterogeneity among passengers. Although the methodology applied for the SP data has already been used by other authors (Balcombe et al., 2009; Espino et al., 2008; Martín et al., 2011; Wen and Lai, 2010), no similar studies were found in the literature adopting CART analysis.

In conclusion, it can be said that the analyses on service quality at the Lamezia Terme airport is a good basis for proposing to the management company strategies for improving the provided services, in order to verify through continuous monitoring how the satisfaction of airport's users varies.

Concerning the airlines service quality, the data collected through the online survey have been analysed only preliminarily. Further analyses can be performed for both the RP data and the SP data. For example, a deeper analysis of the heterogeneity is necessary in order to explore the factors

causing the differences in both perception and expectations, and to capture the classes of flyers with similar attitudes. A such analysis could help the airlines to better manage flights services and to customize them in order to optimize the source allocation.

Moreover, one the potential limitations of the work could regard the sample to which the survey is addressed. Indeed, the major part of the sample is composed of students, who represent a particular category of subject, with certain preferences and tastes. According to this, a future development of the research could regard an extension of the survey to other groups of people, who could be easily reached for example through social networks.

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Appendix A

Questionnaire used by the S.A.CAL for the survey at the Lamezia Terme international airport[1]

A. PERSONAL INFORMATION

A1. Where are you from?
- □ Italy
- □ Europe
- □ Extra-Europe country

A2. Please, state your gender.
- □ Male
- □ Female

A3. Please, state your age.
- □ Less than 30
- □ Between 30 and 40
- □ Between 40 and 50
- □ Between 50 and 60
- □ More than 60

A4. Please, state your level of education.
- □ Lower secondary education (ISCED 2)
- □ Upper secondary education (ISCED 3)
- □ Degree (ISCED 5,6,7)

B. TRAVEL CHARACTERISTICS

B1. What is the purpose of your trip?
- □ Work/business
- □ Holiday
- □ Study
- □ Medical care
- □ Other

B2. How did you reach the airport?
- □ By my own car, which I parked at the parking space of the airport
- □ Someone drove me by car
- □ By taxy
- □ By rental car
- □ By rental bus
- □ By bus
- □ By the "al volo" shuttle
- □ By the "FFSS" shuttle

B3. Are you travelling alone?
- □ Yes
- □ No

[1] Questionnaire used in 2016. For the differences from the questionnaires used in previous years, see section 3.3.

B4. What time did you arrive at the airport?

(hh:mm)

B5. What is the departure time of your flight?

(hh:mm)

B6. What is the destination of your flight?

(Flight destination)

B7. Which is the kind of your flight?

- ◻ Low cost
- ◻ Legacy line
- ◻ Charter

B8. How many times have you travelled by air in the last 12 months?

- ◻ One time
- ◻ More than one time

Now, please express your judgement on the next service attributes according to the following evaluation scale:

Very poor	Poor	Fair	Good	Excellent
◯	◯	◯	◯	◯

C. MODAL INTEGRATION

C1. Road signposting for reaching the airport

Very poor	Poor	Fair	Good	Excellent
◯	◯	◯	◯	◯

D. INFORMATION

D1. Flight information display

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

D2. Terminal signposting

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

D3. Information accessibility

Very poor	Poor	Fair	Good	Excellent
◯	◯	◯	◯	◯

D4. Airport website

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

E. AIRPORT STAFF

E1. Infopoint and security staff

Very poor	Poor	Fair	Good	Excellent
◯	◯	◯	◯	◯

F. TICKETING FACILITIES

F1. Waiting time at check-in

Very poor	Poor	Fair	Good	Excellent
◯	◯	◯	◯	◯

F2. Ticket office

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

G. SECURITY

G1. Baggage and passenger control

Very poor	Poor	Fair	Good	Excellent
◯	◯	◯	◯	◯

G2. Personal security

Very poor	Poor	Fair	Good	Excellent
◯	◯	◯	◯	◯

H. CLEANLINESS

H1. Cleanliness of terminal

Very poor	Poor	Fair	Good	Excellent
◯	◯	◯	◯	◯

H2. Cleanliness of toilets

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

I. COMFORT

I1. Terminal air conditioning

Very poor	Poor	Fair	Good	Excellent
◯	◯	◯	◯	◯

I2. Luggage trolley

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

I3. Escalators/lift

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

I. ADDITIONAL FACILITIES

J1. Charging stations

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

J2. Airport wi-fi

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

J3. Snack machines

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

J4. Shop products

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

K. FOOD FACILITIES

K1. Food choices

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

K2. Food prices

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

K3. Food staff

Very poor	Poor	Fair	Good	Excellent	Service not used
◯	◯	◯	◯	◯	◯

L. OVERALL SERVICE

L1. Terminal comfort

Very poor	Poor	Fair	Good	Excellent
◯	◯	◯	◯	◯

L2. Terminal reliability

Very poor	Poor	Fair	Good	Excellent
◯	◯	◯	◯	◯

Appendix B

Questionnaire used for the online survey at the University of Calabria

A. INFORMATION ABOUT YOUR LAST AIR TRAVEL

A1. When was your last air travel?

- ◻ Less than 6 months ago
- ◻ More than 6 months ago

A2. Was it a direct flight?

- ◻ Yes
- ◻ No

A3. Please, indicate the departure airport and the arrival airport of the flight.

(Departure airport) (Arrival airport)

A4. How long was the flight?

- ◻ Less than 2 hours (short-haul flight)
- ◻ Between 2 and 6 hours (medium-haul flight)
- ◻ More than 6 hours (long haul flight)

A5. Which airline did you travel with?

- ◻ Alitalia
- ◻ Air Berlin
- ◻ Air France
- ◻ Blue Air
- ◻ Blue Panorama Airlines
- ◻ British Airways
- ◻ Deutsche Lufthansa
- ◻ Easyjet
- ◻ Emirates
- ◻ Eurowings
- ◻ Iberia
- ◻ Klm Royal Dutch Airlines
- ◻ Meridiana Fly – Air Italy
- ◻ Neos
- ◻ Ryanair
- ◻ Swiss Air International
- ◻ Turkish Airlines
- ◻ Volotea
- ◻ Vueling Airlines
- ◻ Wizz Air
- ◻ Other (please, specify)

A6. Why was this airline chosen?

- ◻ Convenience of schedules
- ◻ Convenience of the departure/arrival airport
- ◻ Convenience of the fare
- ◻ Quality/price ratio of the flight
- ◻ Reliability and safety/security of the airline
- ◻ Products and services of the airline
- ◻ Previous positive experiences
- ◻ I am a member of the “frequent flyer” program

- ☐ Recommended by others
- ☐ Only airline where I found a seat available
- ☐ Only airline that flies on this route
- ☐ It has been assigned by the airline that issued the ticket (codeshare)
- ☐ Other (please, specify)

A7. How was the ticket purchased?

- ☐ Using the airline's website
- ☐ Using the airline's app
- ☐ Using the airline's call center
- ☐ At the ticket office of the terminal
- ☐ Through a traditional travel agency
- ☐ Through an online travel agency
- ☐ Purchased by others
- ☐ Other (please, specify)

A8. How was the check-in done?

- ☐ Using the airline's website
- ☐ Using the airline's app
- ☐ At the airline's check-in counter of the terminal
- ☐ Using the self check-in station at the terminal
- ☐ Through a traditional travel agency
- ☐ Through an online travel agency
- ☐ Done by others
- ☐ Other (please, specify)

In the following, we ask you to express a judgment for different aspects of the service provide by the airline, using a numerical scale from 1 (minimum rate) to 10 (maximum rate):

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 ○

We also ask you to express how satisfied you are with the same aspects of the service, indicating a level among the five proposed ones in the following verbal scale:

Not at all satisfied	Little satisfied	On average satisfied	Very satisfied	Extremely satisfied
○	○	○	○	○

B. EVALUATION OF THE OVERALL EXPERIENCE

B1. How do you evaluate the overall flight experience? (before, during and after the flight)

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 ○

B2. How satisfied are you with the overall flight experience? (before, during and after the flight)

Not at all satisfied	Little satisfied	On average satisfied	Very satisfied	Extremely satisfied
○	○	○	○	○

C. EVALUATION OF THE EXPERIENCE BEFORE THE FLIGHT

C1. Flight booking *(In case of positive answer to the question A.2)*

C1.1. How do you evaluate the flight booking procedure?

1 2 3 4 5 6 7 8 9 10

C1.2. How satisfied are you with the flight booking procedure?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

C2. Check-in procedure *(In case of positive answer to the question A.2)*

C2.1. How do you evaluate the boarding pass procedure?

1 2 3 4 5 6 7 8 9 10

C2.2. How satisfied are you with the boarding pass procedure?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

C2.3. Did you have the opportunity to choose the seat?

- ☐ Yes
- ☐ No

C2.4. (*In case of positive answer*) How do you evaluate the seat choosing procedure (e.g. availability of seats, ease of choice)?

1 2 3 4 5 6 7 8 9 10

C2.5. (*In case of positive answer*) How satisfied are you with the seat choosing procedure (e.g. availability of seats, ease of choice)?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

C2.6. Have you embarked some luggage in the hold?

- ☐ Yes
- ☐ No

C2.7. (*In case of positive answer*) How do you evaluate the luggage embarking procedure?

1 2 3 4 5 6 7 8 9 10

C2.8. (*In case of positive answer*) How satisfied are you with the luggage embarking procedure?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

C2.9. Have you requested special services? (e.g. wheelchair, accompanying person, special meals, special facilities, special seat)

- □ Yes
- □ No

C2.10. (*In case of positive answer*) How do you evaluate the special services requesting procedure?

1 2 3 4 5 6 7 8 9 10

C2.11. (*In case of positive answer*) How satisfied are you with the special services requesting procedure?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

C2.12. Did you have to change your booking?

- □ Yes
- □ No

C2.13. (*In case of positive answer*) How do you evaluate the booking changing procedure?

1 2 3 4 5 6 7 8 9 10

C2.14. (*In case of positive answer*) How satisfied are you with the booking changing procedure?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

C3. Boarding procedures

C3.1. How do you evaluate the boarding operations (time spent in the queue at the gate, check of documents and tickets, transfer time from the gate to the aircraft)?

1 2 3 4 5 6 7 8 9 10

C3.2. How satisfied are you with the boarding operations (time spent in the queue at the gate, check of documents and tickets, transfer time from the gate to the aircraft)?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

C3.3. How do you evaluate the courtesy and the competence of the staff for boarding?

1 2 3 4 5 6 7 8 9 10

C3.4. How satisfied are you with the courtesy and the competence of the staff for boarding?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

C3.5. How did you get on board?

- □ By jet-way (pedestrian connector between the gate and the aircraft)
- □ By bus-shuttle
- □ On foot by external path

C.3.6. How do you evaluate the way to get on board?

1 2 3 4 5 6 7 8 9 10

C3.7. How satisfied are you with the way to get on board?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D. EVALUATION OF THE EXPERIENCE BEFORE THE FLIGHT

D1. Punctuality of departure

D1.1. How do you evaluate the punctuality of the flight departure?

1 2 3 4 5 6 7 8 9 10

D1.2. How satisfied are you with the punctuality of the flight departure?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D2. Cabin comfort

D2.1. How do you evaluate the space available inside the overhead bins?

1 2 3 4 5 6 7 8 9 10

D2.2. How satisfied are you with the space available inside the overhead bins?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D2.3. How do you evaluate the comfort of the seat?

1 2 3 4 5 6 7 8 9 10

D2.4. How satisfied are you with the comfort of the seat?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D2.5. How do you evaluate the temperature inside the cabin?

1 2 3 4 5 6 7 8 9 10

D2.6. How satisfied are you with the temperature inside the cabin?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D2.7. How do you evaluate the acoustic comfort of the cabin?

1 2 3 4 5 6 7 8 9 10

D2.8. How satisfied are you with the acoustic comfort of the cabin?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D2.9. How do you evaluate the travel comfort during take-off, cruise, and landing phases?

1 2 3 4 5 6 7 8 9 10

D2.10. How satisfied are you with the travel comfort during take-off, cruise, and landing phases?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D3. Cabin cleanliness

D3.1. How do you evaluate the cleanliness of the cabin, tables and seats?

1 2 3 4 5 6 7 8 9 10

D3.2. How satisfied are you with the cleanliness of the cabin, the tables and the seats?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D3.3. Did you use the toilets?

- ☐ Yes
- ☐ No

D3.4. (*In case of positive answer*) How do you evaluate the cleanliness of the toilets?

1 2 3 4 5 6 7 8 9 10

D3.5. (*In case of positive answer*) How satisfied are you with the cleanliness of the toilets?

Not at all satisfied	Little satisfied	On average satisfied	Very satisfied	Extremely satisfied
○	○	○	○	○

D4. Flight information

D4.1. How do you evaluate the in-flight information? (e.g. outside temperature, weather conditions, cruising speed, covered distance)

1 2 3 4 5 6 7 8 9 10

D4.2. How satisfied are you with the in-flight information? (e.g. outside temperature, weather conditions, cruising speed, covered distance)

Not at all satisfied	Little satisfied	On average satisfied	Very satisfied	Extremely satisfied
○	○	○	○	○

D5. Cabin crew

D5.1. How do you evaluate the courtesy of the cabin crew?

1 2 3 4 5 6 7 8 9 10

D5.2. How satisfied are you with the courtesy of the cabin crew?

Not at all satisfied	Little satisfied	On average satisfied	Very satisfied	Extremely satisfied
○	○	○	○	○

D5.3. How do you evaluate the competence of the cabin crew?

1 2 3 4 5 6 7 8 9 10

D5.4. How satisfied are you with the competence of the cabin crew?

Not at all satisfied	Little satisfied	On average satisfied	Very satisfied	Extremely satisfied
○	○	○	○	○

D6. Safety

D6.1. How do you evaluate the safety during take-off?

1 2 3 4 5 6 7 8 9 10

D6.2. How satisfied are you with the safety during take-off?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D6.3. How do you evaluate the safety during cruise?

1 2 3 4 5 6 7 8 9 10

D6.4. How satisfied are you with the safety during cruise?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D6.5. How do you evaluate the safety during landing?

1 2 3 4 5 6 7 8 9 10

D6.6. How satisfied are you with the safety during landing?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D7. On-board services

D7.1. Have you consumed meals/drinks supplied by the on-board food service?

- □ Yes
- □ No

D7.2. (*In case of positive answer*) How do you evaluate the on-board food service?

1 2 3 4 5 6 7 8 9 10

D7.3. (*In case of positive answer*) How satisfied are you with the on-board food service?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D7.4. Have you used the Wi-Fi during the flight?

- ☐ Yes
- ☐ No
- ☐ Not available

D7.5. (*In case of positive answer*) How do you evaluate the on-board Wi-Fi?

1 2 3 4 5 6 7 8 9 10

D7.6. (*In case of positive answer*) How satisfied are you with the on-board Wi-Fi?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D7.7. Have you enjoyed of on-board entertainment services (tv, cinema, music, magazines)?

- ☐ Yes
- ☐ No
- ☐ Not available

D7.8. (*In case of positive answer*) How do you evaluate the on-board entertainment services?

1 2 3 4 5 6 7 8 9 10

D7.9. (*In case of positive answer*) How satisfied are you with the on-board entertainment services?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

D7.10. Did you purchase something different from food and beverage on board?

- ☐ Yes
- ☐ No

D7.11. (*In case of positive answer*) How do you evaluate the on-board sale service?

1 2 3 4 5 6 7 8 9 10

D7.12. (In case of positive answer) How satisfied are you with the on-board sale service?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

E. EVALUATION OF THE EXPERIENCE AT THE ARRIVAL

E1. Punctuality at the arrival

E1.1. How do you evaluate the flight punctuality at the arrival?

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 ○

E1.2. How satisfied are you with the flight punctuality at the arrival?

Not at all satisfied ○ Little satisfied ○ On average satisfied ○ Very satisfied ○ Extremely satisfied ○

E2. Landing procedures

E2.1. How do you evaluate the landing operations (time spent in the queue before getting off the aircraft, transfer time from the aircraft to the gate)?

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 ○

E2.2. How satisfied are you with the landing operations (time spent in the queue before getting off the aircraft, transfer time from the aircraft to the gate)?

Not at all satisfied ○ Little satisfied ○ On average satisfied ○ Very satisfied ○ Extremely satisfied ○

E2.3. How did you get off the aircraft?

- □ By jet-way (pedestrian connector between the gate and the aircraft)
- □ By bus-shuttle
- □ On foot by external path

E2.4. How do you evaluate the way to get off the aircraft?

1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 ○

E2.5. How satisfied are you with the way to get off the aircraft?

Not at all satisfied ○ Little satisfied ○ On average satisfied ○ Very satisfied ○ Extremely satisfied ○

E3. Luggage delivery *(In case of positive answer to the question A2)*

E3.1. Did you have luggage in the hold to collect?

- □ Yes
- □ No

E3.2. (*In case of positive answer*) How do you evaluate the luggage delivery operations?

1 2 3 4 5 6 7 8 9 10

E3.3. (*In case of positive answer*) How satisfied are you with the luggage delivery operations?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

E3.4. (*In case of positive answer*) How do you evaluate the luggage conditions?

1 2 3 4 5 6 7 8 9 10

E3.5. (*In case of positive answer*) How satisfied are you with the luggage conditions?

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

F. FINAL CONSIDERATIONS

F1. How do you evaluate quality/price ratio of the flight?

1 2 3 4 5 6 7 8 9 10

F2. How satisfied are you with the overall flight experience? (before, during and after the flight)

Not at all satisfied | Little satisfied | On average satisfied | Very satisfied | Extremely satisfied

F3. Based on this experience, how likely will you travel with this airline again?

Definitely not 0 1 2 3 4 5 6 7 8 9 10 Definitely yes

F4. Based on this experience, how likely will you recommend the airline to relatives or friends?

Definitely not 0 1 2 3 4 5 6 7 8 9 10 Definitely yes

G. ASSESSMENT OF THE IMPORTANCE OF THE SERVICE ASPECTS

G1. How important are for you the following service aspects?

- Waiting time at check-in

Not at all important | Little important | On average important | Very important | Extremely important

- Time spent for boarding operations

Not at all important	Little important	On average important	Very important	Extremely important
○	○	○	○	○

- Terminal-Aircraft transfer mode

Not at all important	Little important	On average important	Very important	Extremely important
○	○	○	○	○

- Punctuality of the flight

Not at all important	Little important	On average important	Very important	Extremely important
○	○	○	○	○

- Space available on board

Not at all important	Little important	On average important	Very important	Extremely important
○	○	○	○	○

- Temperature on board

Not at all important	Little important	On average important	Very important	Extremely important
○	○	○	○	○

- Cleanliness on board

Not at all important	Little important	On average important	Very important	Extremely important
○	○	○	○	○

- Courtesy of cabin crew

Not at all important	Little important	On average important	Very important	Extremely important
○	○	○	○	○

- Services on board

Not at all important	Little important	On average important	Very important	Extremely important
○	○	○	○	○

- Time spent for luggage delivery

Not at all important	Little important	On average important	Very important	Extremely important
○	○	○	○	○

- Cost of the ticket

Not at all important	Little important	On average important	Very important	Extremely important
○	○	○	○	○

H. DISCRETE CHOICE EXPERIMETS

Before and after the flight

H1.1 If you had to travel on a **SHORT-HAUL flight** (LESS THAN 2 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	0 minutes (online check-in)	5 minutes
Time spent for boarding operations	40 minutes	10 minutes
Terminal-Aircraft transfer mode	by external path	by jet-way
Delay of flight departure	60 minutes	0 minutes (in time)
Time spent for luggage delivery	10 minutes	10 minutes
Cost of the ticket	20 €	20 €

H1.2 If you had to travel on a **SHORT-HAUL flight** (LESS THAN 2 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	20 minutes	20 minutes
Time spent for boarding operations	20 minutes	20 minutes
Terminal-Aircraft transfer mode	by shuttle	by external path
Delay of flight departure	20 minutes	20 minutes
Time spent for luggage delivery	10 minutes	10 minutes
Cost of the ticket	20 €	60 €

H1.3 If you had to travel on a **MEDIUM-HAUL flight** (BETWEEN 2 AND 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	0 minutes (online check-in)	5 minutes
Time spent for boarding operations	20 minutes	20 minutes
Terminal-Aircraft transfer mode	by external path	by shuttle
Delay of flight departure	20 minutes	20 minutes
Time spent for luggage delivery	30 minutes	30 minutes
Cost of the ticket	360 €	360 €

H1.4 If you had to travel on a **LONG-HAUL flight** (MORE THAN 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	0 minutes (online check-in)	0 minutes (online check-in)
Time spent for boarding operations	20 minutes	20 minutes
Terminal-Aircraft transfer mode	by shuttle	by external path
Delay of flight departure	0 minutes	60 minutes
Time spent for luggage delivery	10 minutes	10 minutes
Cost of the ticket	1440 €	720 €

H2.1 If you had to travel on a **MEDIUM-HAUL flight** (BETWEEN 2 AND 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	5 minutes	20 minutes
Time spent for boarding operations	10 minutes	40 minutes
Terminal-Aircraft transfer mode	by external path	by jet-way
Delay of flight departure	60 minutes	0 minutes
Time spent for luggage delivery	30 minutes	0 minutes (no luggage to claim)
Cost of the ticket	360 €	180 €

H2.2 If you had to travel on a **MEDIUM-HAUL flight** (BETWEEN 2 AND 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	20 minutes	0 minutes (online check-in)
Time spent for boarding operations	10 minutes	40 minutes
Terminal-Aircraft transfer mode	by jet-way	by external path
Delay of flight departure	60 minutes	0 minutes
Time spent for luggage delivery	0 minutes (no luggage to claim)	30 minutes
Cost of the ticket	180 €	360 €

H2.3 If you had to travel on a **LONG-HAUL flight** (MORE THAN 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	0 minutes (online check-in)	0 minutes (online check-in)
Time spent for boarding operations	10 minutes	40 minutes
Terminal-Aircraft transfer mode	by shuttle	by jet-way
Delay of flight departure	0 minutes	60 minutes
Time spent for luggage delivery	10 minutes	0 minutes (no luggage to claim)
Cost of the ticket	720 €	1440 €

H2.4 If you had to travel on a **LONG-HAUL flight** (MORE THAN 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	20 minutes	20 minutes
Time spent for boarding operations	40 minutes	10 minutes
Terminal-Aircraft transfer mode	by jet-way	by shuttle
Delay of flight departure	0 minutes	60 minutes
Time spent for luggage delivery	0 minutes (no luggage to claim)	0 minutes (no luggage to claim)
Cost of the ticket	720 €	720 €

H3.1 If you had to travel on a **SHORT-HAUL flight** (LESS THAN 2 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	20 minutes	5 minutes
Time spent for boarding operations	20 minutes	40 minutes
Terminal-Aircraft transfer mode	by external path	by jet-way
Delay of flight departure	0 minutes	60 minutes
Time spent for luggage delivery	0 minutes (no luggage to claim)	30 minutes
Cost of the ticket	60 €	20 €

H3.2 If you had to travel on a **SHORT-HAUL flight** (LESS THAN 2 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	5 minutes	5 minutes
Time spent for boarding operations	40 minutes	10 minutes
Terminal-Aircraft transfer mode	by shuttle	by external path
Delay of flight departure	60 minutes	0 minutes
Time spent for luggage delivery	30 minutes	30 minutes
Cost of the ticket	60 €	60 €

H3.3 If you had to travel on a **MEDIUM-HAUL flight** (BETWEEN 2 AND 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	5 minutes	0 minutes (online check-in)
Time spent for boarding operations	40 minutes	10 minutes
Terminal-Aircraft transfer mode	by jet-way	by shuttle
Delay of flight departure	20 minutes	20 minutes
Time spent for luggage delivery	0 minutes (no luggage to claim)	10 minutes
Cost of the ticket	180 €	180 €

H3.4 If you had to travel on a **LONG-HAUL flight** (MORE THAN 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Waiting time at check-in	5 minutes	20 minutes
Time spent for boarding operations	10 minutes	20 minutes
Terminal-Aircraft transfer mode	by jet-way	by shuttle
Delay of flight departure	20 minutes	20 minutes
Time spent for luggage delivery	30 minutes	0 minutes (no luggage to claim)
Cost of the ticket	1440 €	1440 €

During the flight

H4.1 If you had to travel on a **SHORT-HAUL flight** (LESS THAN 2 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	adequate	not fully adequate
Temperature on board	too warm	too cold
Cleanliness on board	quite dirty	quite dirty
Cabin crew	quite rude	kind enough
Services on board	not fully adequate	fully adequate
Cost of the ticket	20 €	60 €

H4.2 If you had to travel on a **MEDIUM-HAUL flight** (BETWEEN 2 AND 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	fully adequate	adequate
Temperature on board	adequate	too cold
Cleanliness on board	clean enough	clean enough
Cabin crew	quite rude	kind enough
Services on board	adequate	fully adequate
Cost of the ticket	180 €	180 €

H4.3 If you had to travel on a **LONG-HAUL flight** (MORE THAN 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	adequate	not fully adequate
Temperature on board	adequate	too warm
Cleanliness on board	clean enough	quite dirty
Cabin crew	kind enough	quite rude
Services on board	adequate	not fully adequate
Cost of the ticket	1440 €	720 €

H4.4 If you had to travel on a **LONG-HAUL flight** (MORE THAN 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	not fully adequate	fully adequate
Temperature on board	too warm	adequate
Cleanliness on board	quite dirty	clean enough
Cabin crew	kind enough	quite rude
Services on board	not fully adequate	adequate
Cost of the ticket	720 €	1440 €

H5.1 If you had to travel on a **SHORT-HAUL flight** (LESS THAN 2 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	not fully adequate	fully adequate
Temperature on board	adequate	too warm
Cleanliness on board	clean enough	clean enough
Cabin crew	quite rude	kind enough
Services on board	fully adequate	adequate
Cost of the ticket	60 €	60 €

H5.2 If you had to travel on a **SHORT-HAUL flight** (LESS THAN 2 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	not fully adequate	fully adequate
Temperature on board	too cold	too warm
Cleanliness on board	clean enough	clean enough
Cabin crew	kind enough	quite rude
Services on board	adequate	fully adequate
Cost of the ticket	20 €	20 €

H5.3 If you had to travel on a **MEDIUM-HAUL flight** (BETWEEN 2 AND 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	fully adequate	adequate
Temperature on board	too cold	adequate
Cleanliness on board	clean enough	clean enough
Cabin crew	kind enough	quite rude
Services on board	not fully adequate	fully adequate
Cost of the ticket	360 €	360 €

H5.4 If you had to travel on a **LONG-HAUL flight** (MORE THAN 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	fully adequate	adequate
Temperature on board	too cold	adequate
Cleanliness on board	quite dirty	quite dirty
Cabin crew	quite rude	kind enough
Services on board	fully adequate	not fully adequate
Cost of the ticket	720 €	720 €

H6.1 If you had to travel on a **SHORT-HAUL flight** (LESS THAN 2 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	adequate	fully adequate
Temperature on board	too warm	adequate
Cleanliness on board	quite dirty	quite dirty
Cabin crew	quite rude	kind enough
Services on board	fully adequate	not fully adequate
Cost of the ticket	60 €	20 €

H6.2 If you had to travel on a **MEDIUM-HAUL flight** (BETWEEN 2 AND 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	not fully adequate	adequate
Temperature on board	too warm	too cold
Cleanliness on board	clean enough	quite dirty
Cabin crew	kind enough	quite rude
Services on board	fully adequate	adequate
Cost of the ticket	360 €	180 €

H6.3 If you had to travel on a **MEDIUM-HAUL flight** (BETWEEN 2 AND 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	fully adequate	not fully adequate
Temperature on board	adequate	too cold
Cleanliness on board	quite dirty	clean enough
Cabin crew	kind enough	quite rude
Services on board	fully adequate	not fully adequate
Cost of the ticket	180 €	360 €

H6.4 If you had to travel on a **LONG-HAUL flight** (MORE THAN 6 HRS), which of these alternatives would you choose?

	A ○	B ○
Space available on board	adequate	not fully adequate
Temperature on board	too cold	too warm
Cleanliness on board	quite dirty	quite dirty
Cabin crew	quite rude	kind enough
Services on board	not fully adequate	adequate
Cost of the ticket	1440 €	1440 €

I. PERSONAL INFORMATIONS

I1. How old are you?

- ☐ 18 – 25
- ☐ 26 – 30
- ☐ 31 – 40
- ☐ 41 – 50
- ☐ 51 – 60
- ☐ >60

I2. What is your gender?

- ☐ Male
- ☐ Female
- ☐ I'd rather not answer

I3. Where do you live?

(Country, Region, City)

I4. What is your qualification?

- ☐ Qualification of lower secondary education (ISCED 2)
- ☐ Qualification of upper secondary education (ISCED 3)
- ☐ Degree (ISCED 6)
- ☐ Master degree (ISCED 7)
- ☐ PhD (ISCED 8)

I5. What is your occupation?

- ☐ Manager
- ☐ Technical staff
- ☐ Administrative staff
- ☐ Contract worker
- ☐ Professor
- ☐ Researcher
- ☐ Lecturer
- ☐ Research fellow
- ☐ PhD student
- ☐ Student
- ☐ Other (please, specify)

I6. What is your family net monthly income, approximatively?

- ☐ Less than 1,000 €
- ☐ Between 1,000 € and 2,000 €
- ☐ Between 2,000 € and 3,000 €
- ☐ Between 3,000 € and 5,000 €
- ☐ More than 5,000 €

I7. How often do you travel by air?

- ☐ Several times a week
- ☐ Several times a month
- ☐ Several times a year
- ☐ At least once a year
- ☐ Rarely

I8. Why do you usually travel by air?

- ☐ Work
- ☐ Study
- ☐ Holiday
- ☐ Health care
- ☐ Visiting to relatives and/or friends
- ☐ Participation at events (cultural, recreational, sports)
- ☐ Pilgrimage
- ☐ Other (please, specify)

I9. What was the main purpose of your last flight?

- ☐ Work
- ☐ Study
- ☐ Holiday
- ☐ Health care
- ☐ Visiting to relatives and/or friends
- ☐ Participation at events (cultural, recreational, sports)
- ☐ Pilgrimage
- ☐ Other (please, specify)