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Latent factors on the assessment of service quality in an Italian peripheral airport

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Abstract

Compared to the other public transport systems, air transport has received limited attention on the assessment of service quality. This paper aims to explore the factors employed to assess airport service quality, taking as case study the International Airport of Lamezia Terme, a peripheral airport placed in the south of Italy. Specifically, through a Principal Component Analysis latent factors influencing service quality are identified and the dimensionality of the phenomenon is reduced. After that, a Structural Equation Modelling approach is performed in order to define the relationships among the latent variables, and between the observed variables and the latent ones. For these purposes, we analyse a database derived from Customer Satisfaction Surveys conducted during 2015-2016 in the Lamezia Terme airport. The results confirm that overall airport service quality is significantly related to latent factors such as accessibility to the services, control operations and environment in the terminal.

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Keywords: Airport services; service quality; latent factors; SEM

1. Introduction

In public transport research, the assessment of service quality is a well-known topic. Improving the services provided by public transport operators is fundamental to attract new users and increase their level of satisfaction with the service. Users' perceptions about the service are generally collected through the Customer Satisfaction Surveys (CSS), in which the interviewees express their judgements on a certain number of aspects characterizing the service according to a measurement scale. In the field of road and rail public transport, many studies dealt with the

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assessment of service quality based on the users' perceptions (see, for example, de Ona et al., 2016; Allen et al., 2018; Eboli et al., 2018; Allen et al., 2019), and service quality is well established. Only in recent years this topic has become of interest also in the field of air transport, due to the sudden increase in the number of passengers travelling by air (IATA, 2018). In the field of air transport, services provided on the ground side by the airport management companies have to be distinguished from those provided on the air side by the airlines. In this work, we focus on the services provided in the airports, because a good level of service quality makes the airport more attractive and can contribute to the development of the surrounding territorial context. Indeed, Prentice and Kadan (2019) found that overall service quality is related to the airport reuse and destination revisit, with interesting socio-economic impacts. Furthermore, the role of airport service quality is fundamental both for users and airport management companies; in fact, improving the level of quality related to the provided service is important because travellers would be certainly more attracted from a comfortable and well-functioning airport. On the other hand, understanding which are the factors mainly affecting overall customer satisfaction could help the airport management companies to achieve a better financial resource administration. For these purposes, Bellizzi et al. (2018) found different points of view regarding the airport service quality, considering that users could come from several parts of the world and have different habits. Moreover, considering that in an airport many and varied services are provided, Lee and Yu (2018) affirm that not all service attributes are equally important for airports of different sizes. Based on these findings, we focus on a small-sized airport (about two millions of passengers per year), and we try to find latent factors connected to the overall airport service quality. A Principal Component Analysis (PCA) was performed as an exploratory approach. The findings become the basic assumption for adopting a Structural Equation Modelling (SEM) approach, which can establish the relationships among latent variables, and between observed variables and latent ones. Previous studies showed that SEM approach is able to well understand latent constructs affecting overall air service quality, and to explore observed indicators for measuring the introduced latent constructs themselves. As an example, Prentice and Kadan (2019) examines the relationship between airport service quality, passenger satisfaction, and behavioural intentions; specifically, the authors investigate whether airport service quality is related to airport and destination choice, by using data from Australian major airports. Sunran and Min-su (2012) analysed the relationships among the servicescape of an international airport, emotional states, and behavioural intentions; the constructs are identified as the ambient, functional, aesthetic, safety, and social factors. Nesset and Helgesen (2014) analysed impacts of switching costs on customer attitude loyalty to an airport operator in a Norwegian multi-airport region. They found that satisfaction and image perception are mediators of loyalty attitude to the airport. Park and Jung (2011) focus on transfer passenger's perception of airport service quality and its influence on value, satisfaction, airport image, and passenger behaviour. They consider transfer passengers at Incheon international airport, Korea, and found that airport service quality is positively related to transfer passenger satisfaction; in turn, transfer passenger satisfaction is positively related to transfer passenger behaviour. Literature review on this topic is still incomplete, especially with regard to the use of SEM approach applied to airport services. In addition, more effort should be given also to certain small local infrastructures as the Calabrian airport, which nevertheless assumes an important role at a national level because of its function as hub airport.

The paper is structured as follows. Firstly, we introduce the Lamezia Terme international airport, and describe the data collected from CSS. Then, the methodological background is formalized. Finally, we ended with results, discussion and conclusions.

2. Data

The proposed methodology was applied to the study case of Lamezia Terme international airport, the most important airport in the Calabria region, south of Italy. The airport infrastructures and all the activities of private operators working in the airport are managed by the S.A.CAL. During 2017, Lamezia Terme Airport registered more than 2,500,000 passengers and about 22,000 flights between landings and take-offs (S.A.CAL., 2018). The data supporting this study were collected through face-to-face CSS addressed to the departing passengers, who spend in the terminal more time then the arriving passengers because Lamezia Terme is not a hub airport. The survey consists of a number of questions regarding all the services offered by the airport, such as signposting of the terminal, airport staff, waiting time at the check-in, personal security, cleanliness and comfort. Interviewed passengers had to evaluate the selected service aspects by expressing a rating through a verbal measurement scale ranging from "very poor" to

"excellent". S.A.CAL. collected 2,087 interviews during the period from January 2015 to December 2016; after a preliminary selection of valid data, a sample of 1,873 records was obtained.

Table 1. Sample characteristics.

Sample characteristics	Percentage
Gender	Female (52.8%), Male (47.2%)
Age	Less than 30 (13.2 %), between 30 and 40 (23.7%), between 40 and 50 (16.2%), between 50 and 60 (13.3%), more than 60 (10.1%), No answer (23.5%)
Travelling alone	Yes (6.7%), No (93.3%)
Trip purpose	Work/business (15.5%), Holiday (74.2%), Study (1.2%), Medical care (4.0%), other (5.2%)
Nationality	Italy (60.5%), other Europe Countries (28.9%), extra Europe Countries (10.6%)
Flight destination	Italy (47.8%), other European Countries (40.8%), extra European Countries (11.4%)
Level of education	Junior high school diploma (7.2%), High school diploma (28.8%), Bachelor or Master degree (24.0%), No answer (40.0%)
Mode for reaching the airport	Car as driver (16.0%), Car as passenger (46.8%), Taxi (3.7%), Rental car (15.5%), Rental bus (7.3%), Bus (5.8%), Bus shuttle (4.9%)
Time of arrival	Less than 1 hour before the flight (8.1%), From 1 to 2 hours before the flight (48.7%), More than 2 hours before the flight (43.2%)

The sample is made up of more females (53%) than males; about 40% of users are aged from 30 to 50 (Table 1). The major part of the sample comes from Italy (60%), but about 50% of the passengers is going towards other European or extra-European countries. A strong tourist vocation of the airport is highlighted by the high percentage of users who travel for holiday (74%) and with other people (93.3%). Most of the passengers 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 2, the judgements expressed by the passengers about the various aspects of the service provided in the airport were reported.

Table 2. Judgements about each airport service quality aspect

Service quality aspect	Valid data	Very poor	Poor	Fair	Good	Excellent
Road signposting	1765	32 (1.8%)	103 (5.8%)	161 (9.1%)	1319 (74.7 %)	150 (8.5%)
Flight information	1743	9 (0.5%)	32 (1.8%)	86 (4.9%)	1468 (84.2 %)	148 (8.5%)
Terminal signposting	1814	3 (0.2%)	67 (3.7%)	61 (3.4%)	1533 (84.5%)	150 (8.3%)
Infopoint and security staff	1742	3 (0.2%)	14 (0.8%)	70 (4.0%)	1445 (83.0 %)	210 (12.1%)
Information accessibility	1702	0 (0.0%)	4 (0.2%)	72 (4.2%)	1446 (85.0 %)	180 (10.6%)
Waiting time at check-in	1345	13 (1.0%)	26 (1.9%)	57 (4.2%)	817 (60.7 %)	432 (32.1%)
Baggage and passenger control	1840	11 (0.6%)	14 (0.8%)	77 (4.2%)	1237 (67.2 %)	501 (27.2%)
Personal security	1768	3 (0.2%)	14 (0.8%)	69 (3.9%)	1305 (73.8 %)	377 (21.3%)
Cleanliness of terminal	1791	43 (2.4%)	74 (4.1%)	127 (7.1%)	1288 (71.9 %)	259 (14.5%)
Cleanliness of toilets	1429	124 (8.7%)	107 (7.5%)	91 (6.4%)	930 (65.1 %)	177 (12.4%)
Terminal air conditioning	1780	34 (1.9%)	204 (11.5%)	105 (5.9%)	1237 (69.5 %)	200 (11.2%)
Terminal comfort	1782	12 (07%)	66 (4.4%)	167 (9.4%)	1380 (77.4 %)	157 (8.8%)
Availability and efficiency of the airport services	1453	0 (0.0%)	6 (0.4%)	100 (6.9%)	1290 (88.8 %)	57 (3.9%)

Regarding the judgements expressed by the passengers, we can note 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 availability and efficiency of all the services provided by the airport 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%); in our opinion, 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" we have 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, we have 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 "availability and efficiency of the airport services" (77.6% of valid data). In our opinion, 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 facilities and shopping activities. These questions are not included in the analysis because food and shopping facilities are scarcely used in a peripheral airport as Lamezia Terme.

3. Methodology

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). 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 (Joliffe, 2014).

Our methodology follows this sequence of stages: (i) a preliminary statistical analysis was conducted in order to characterize the sample, and to better understand users' perceptions about the services in the airport; (ii) a PCA was performed to explore service attributes and identify the latent constructs; (iii) a structural equation model was calibrated for determining the significance of the relationship among the latent constructs. Firstly, we introduce the theoretical concept of "overall airport service quality" (so called OVSERVICE) supported by a rigorous literature review and a deep personal experience on this topic. This abstract construct is not directly measurable by the analyst; therefore, we introduced an unobserved endogenous variable representing it. The evidence from a preliminary analysis of the data drove us to two service quality aspects which can be used for measuring the introduced latent construct, and which can be considered as observed endogenous variables: "Terminal comfort" and "Availability and efficiency of the airport services"; this hypothesis was confirmed by PCA. Secondly, from PCA we discover three latent constructs which can be considered also as unobserved exogenous variables in the model. The first one, so called ACCESS, represents the accessibility to the services, and it is explained by certain service aspects related to information and signposting. The second one, so called CONTROL, comprises all the factors linked to the control operations in the terminal, and includes also operations related to check-in and baggage handling. The last one, so called ENVIRONMENT, represents the sense of passengers well-being in the terminal, and it is explained by certain service aspects related to cleanliness and air conditioning. For each aspect, passengers expressed their judgements, therefore each of them can be considered as an observed endogenous variable in the model, with an error term representing unobserved exogenous variables. We hypothesize direct and indirect effects among the latent constructs. Specifically, five hypotheses have been introduced to be tested by SEM approach:

- h1: ACCESS latent construct has a direct effect on OVSERVICE latent construct
- h2: CONTROL latent construct has a direct effect on OVSERVICE latent construct
- h3: ACCESS latent construct has a direct effect on CONTROL and an indirect effect on OVSERVICE latent constructs
- h4: ENVIRONMENT latent construct has a direct effect on OVSERVICE latent construct
- h5: ACCESS latent construct has a direct effect on ENVIRONMENT and an indirect effect on OVSERVICE latent constructs

Therefore, the conceptual model we aim to test adopting SEM approach can be outlined as in Figure 1.

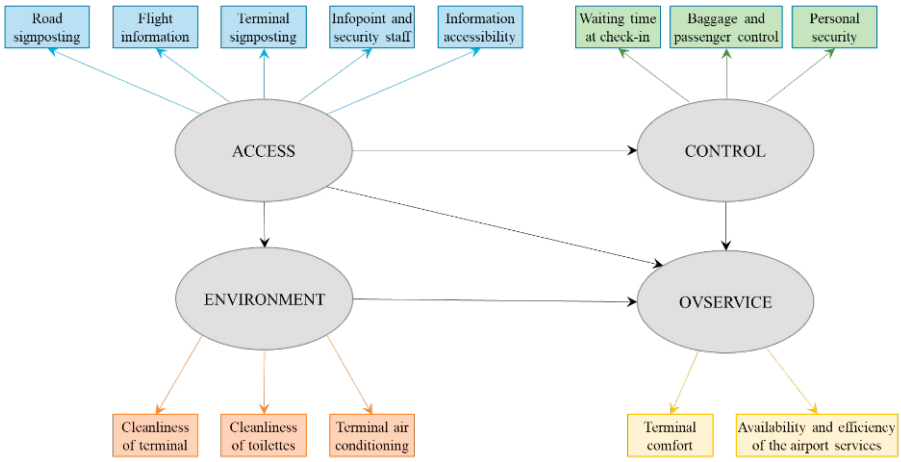

Fig. 1. Conceptual model

From the conceptual model, we can observe that 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.

4. Results and discussion

The results obtained for the measurement model are shown in Table 3, 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 3, (***) 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 3. Measurement models.

			RW*	SE*	P*	st.RW*
Road signposting (x_1)	⇦	ACCESS (ξ_1)	1.000			0.477
Flight information (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
Availability and efficiency of the airport services (y_2)	⇦	OVSERVICE (η_1)	1.000			0.203

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

In Table 4, 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. 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	0.04	***	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 4 latent construct 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 is 900.816 (CMIN) with 60 Degrees of Freedom (DF). As reported in Hu and Bentler (1999), CMIN/DF was calculated in order 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). Goodness of Fit Index (GFI equal to 0.93) indicates well-fitting model being recommended a cut-off point of 0.90 (Hooper et al., 2008), although Adjusted Goodness of Fit Index (AGFI) presents a lower value (0.90). The model comparisons fit indices indicate that the hypothesized model fits enough the observed variance-covariance matrix (Normed Fit Index, NFI equal to 0.86). This result is reinforced by the Comparative Fit Index 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 a 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), it is evident that passengers' perceptions about overall service OVSERVICE is directly affected mainly by the latent construct related to terminal environment ENVIRONMENT (0.544), and then by the accessibility to the airport services ACCESS (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 to obtain a total effect of ACCESS on OVSERVICE equal to 0.604. That is to say that 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. In turn, passengers' satisfaction with the overall service is improved. On the other hand, having clear information and signposting inside the terminal makes control operations more easy and check-in or baggage handling faster, improving passengers' satisfaction with CONTROL and OVSERVICE latent aspects. Evidence from measurement model (Table 3) shows that accessibility to the airport services (ACCESS) is better explained for indicators related to information than signposting; specifically, the biggest standardized weight is obtained by the indicator "accessibility of information". This result can partly surprise but, in the authors' opinion, this happens because Lamezia Terme is a small airport where all the areas are close to each other. Also in Prentice and Kadan (2019) the airport's signs were found having a significant role in order to clearly direct passengers to services/facilities; however, a higher weight is found for the item considering the airport's physical layout because it permits easy movements to passengers. As expected, CONTROL latent construct (control operations in the terminal) is better explained by indicators related to passenger control and personal security. Terminal environment gives a sense of well-being to the passengers more if cleanliness of terminal and toilets are perceived as satisfactory. As in Norazah (2014), air-conditioning in airport results less important for the passengers staying in the terminal than cleanliness of the airport toilets, although in our sample we have a significant percentage of passengers who do not use this service. Sunran and Min-Su (2012) found that temperature is an indicator strongly influencing ambient terminal, but they establish that also humidity, light, noise and scent give relevant contribution in explaining this latent construct. Differently from our results, they found that comfort, signage and layout are observed indicators explaining functional latent factor. Nesset and Helgesen (2014) found that the indicator related

to toilets in the airport, included in facilities latent construct, has a more relevant weight than luggage delivery facility or waiting room. On the contrary, the indicator related to information has a weight lower that indicators related to personnel's friendliness or professional skills.

Finally, we found that "terminal comfort" is the indicator mainly affecting overall service (OVSERVICE), as confirmed by Sunran and Min-Su (2012), whereas "availability and efficiency of the airport services" has a lower influence on it.

5. Practical implications

In order to highlight the practical implications which can be deduced from SEM approach, the obtained results were explored by using Importance-Performance Analysis (IPA) (Martilla and James, 1977). IPA was performed for identifying service improvement priorities by classifying service attributes into four quadrants on the basis of their Importance and Performance values. We use standardized Regression Weights obtained from the measurements models as Importance, and the average value of the judgements about each airport service quality aspect as Performance. A numerical value was assigned to each rating of the verbal scale, ranging from 1 (very poor) to 5 (excellent). Therefore, Importance range from 0.20 and 0.85 (with an average value of 0.60), whereas Performance range from 3.65 and 4.21 (with an average value of 3.97).

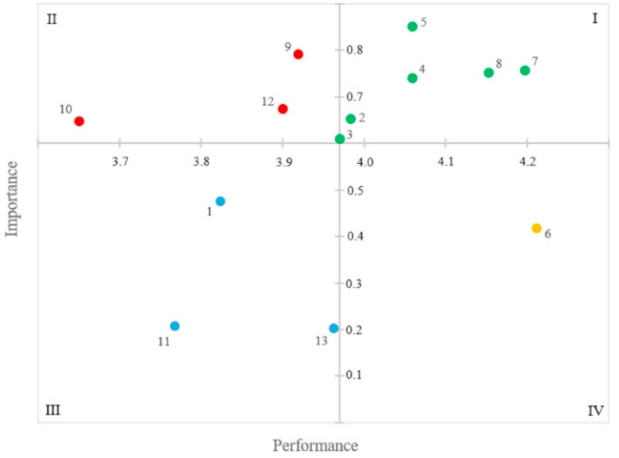

Fig. 2. Importance-Performance Analysis (IPA)

As shown in Figure 2, the attributes in Quadrant I are important and perform well, so the airport management company should keep up the good work. The attributes placed in Quadrant II are important but perform poorly, therefore the airport management company has to dedicate resources to these attributes. The attributes in Quadrant III are unimportant and do not perform well, making them of low priorities. Finally, the attributes in Quadrant IV are unimportant but perform well, suggesting that there might be more resources devoted to these attributes than necessary. By considering the result emerging from IPA, service aspects particularly in need of improvements are cleanliness of terminal (9), cleanliness of toilets (10) and terminal comfort (12), because they have high importance but relatively low performance. Definitively, for a small-sized airport as Lamezia Terme airport the areas where policy-based actions will likely result in the greatest improvement were identified in such aspects linked to cleanliness and comfort, being "cleanliness of terminal" the best candidate for policy making because it has the most importance, but a performance lower than the average value obtained for all the service aspects.

6. Conclusion

The paper aimed to explore factors employed to assess airport service quality, taking as case study a peripheral airport placed in the south of Italy. Latent constructs influencing air service quality were identified by using a PCA

approach, and therefore SEM approach was performed in order to define the relationships among the latent variables, and between the observed variables and the latent ones. Evidence from CSS conducted during 2015 and 2016 years in Lamezia Terme airport confirmed that overall airport service quality is significantly related to latent factors such as accessibility to the services, control operations and environment in the terminal. From our analysis can be concluded that 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 information accessibility, Infopoint and flight information assume a more significant role than signposting around and inside the terminal. In addition, having clear information and signposting inside the terminal make control operations more easy and check-in or baggage handling faster, improving passengers' satisfaction on overall service.

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