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Development of a robust customer satisfaction index for domestic air journeys

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ABSTRACT

This research proposes a Robust Customer Satisfaction Index for air domestic journeys (RCSI), which could be less sensitive to outlier data than index scores based on the American customer satisfaction index (ACSI) formulation. Since traveler experiences in air journeys are a chain of services related to departure airport service, airline service, and arrival airport service, a new index for measuring passenger satisfaction for air journeys is required. In a sense then, this study is the first step towards integrating satisfaction literature to propose a robust index for air journeys. The Structural Equation Model (SEM) was used to validate the theoretical model. The RCSI model was tested in the context of Colombian major domestic air-route where traveler's perceived quality and perceived value were found to predict significantly overall passenger satisfaction. In this study, we found that the RCSI score is similar to the average for the airline industry in ACSI. The findings show that the RCSI is less sensitive to outlier data than customer satisfaction indexes (CSIs) based on the ACSI model formulation. The RCSI model also allows the airline and airport managers to understand the specific factors, which significantly influence overall traveler satisfaction, by reading the causal relationship in the RCSI model.

1. Introduction

The transportation industry, and especially air transportation, is one of the major global economic sectors (Abdullahi, Adesogan, & Alhaji, 2018; Hu, Xiao, Deng, Xiao, & Wang, 2015; Obioma, Wokili, Victor, & Benjamin, 2013). Therefore, a challenge for airlines and airports is, among many other elements, to provide high service quality to travelers, which in turn, leads to high passenger satisfaction and has consequently an impact on their decision-making process (Park, 2019; Prentice & Kadan, 2019).

The rapid growth in passenger traffic has been experienced in the domestic commercial airline market worldwide (Chen & Chang, 2005). Over the last two decades, the Colombian air transportation market has expanded considerably due to a high passenger growth rate (Díaz & Pulido, 2019). It had grown from 10.7 million passengers in 2000 to 37.8 million passengers in 2018. This is equivalent to 76 trips per 100 Colombians. This represents a substantial growth performance, broadly in line with the world average over the same period. Colombia, with its advantageous geographical location and its potential to act as a regional center stands out as a very important network of connections. To which can be added the fact that Medellin is the Latin America center for the fourth industrial revolution, which makes it a particularly attractive destination.

In some cases, air travelers can choose between different airlines and airports, which serve the same air-route. Park (2019) suggested that customer satisfaction is one of the fundamental foundations for maintaining customer loyalty in the air transportation industry. Therefore, airlines and airports face some challenges. For example, meeting customers' needs rather than that of their competitors. In fact, customers' satisfaction strategies are useful for improving service quality in the air transportation market. Therefore, airlines, as well as airport managers must offer high-quality service in order to satisfy travelers and to win customer loyalty. In this way, evaluating different aspects of air transportation service could highlight the areas in which it has poor performance in order to enhance service and, as a consequence, to capture new travelers.

The assessment of customer satisfaction usually has adopted CSI models. A CSI is an evaluation system based on customer, and it measures the quality of service or product according to customer consumption experience. Therefore, CSI has been used to assess the performance of industries. The well-known American Customer Satisfaction Index (ACSI), for instance, is built by using an econometric

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approach, which is based on the weighted mean, as can be seen in Fornell, Johnson, Anderson, Cha, and Bryant (1996). Additionally, ACSI has provided a basic framework for many other index models created elsewhere in the world (Bruhn & Grund, 2000; Eklöf & Westlund, 2002; Martensen, Gronholdt, & Kristensen, 2000). However, most CSIs applied to the air transportation market, have been mostly focused on measuring customer satisfaction for the airline industry (Fornell, 1992; Fornell et al., 1996). Therefore, a suitable customer satisfaction index is used to understand the state of traveler satisfaction and loyalty behaviors, which is a crucial management issue for air transportation. However, to date, a customer satisfaction index for the air transportation market, focused on different service quality stages of air journeys, has not been created and tested.

This research contributes to the literature, by developing and testing a new RCSI, which is adapted to the field of air transportation global service. RCSI, introduced in this study, calculates the traveler satisfaction for an air journey. RCSI considers traveler perceptions based on service stages, in which service quality perception is made up of three factors: departure airport service, airline service and arrival airport service (Munoz, Laniado, & Córdoba, 2019). It is important to remark that the new index introduced in this study could be less sensitive to outlier data than CSI scores, which are based on ACSI formulation. The RCSI is also based on an econometric approach. However, the robustness is determined by replacing the mean with the median into the formulation.

In order to achieve a good estimate effect, an SEM was performed in order to find an RCSI score. RCSI was tested in the context of the major Colombian domestic air-route, where it was found to have high robustness compared to ACSI formulation. Therefore, by calculating the RCSI for specific air-route, this study can offer practical assumptions to airlines and airports (departure and arrival airport), which will result in service quality improvements. The paper is organized as follows: Section 2 contains the literature review on CSIs. Section 3 explains the RCSI model research methodology, variables, and formulation. Additionally, the hypotheses are also included in this section. Section 4 describes the questionnaire and data collection. Our findings are outlined in section 5 and discussed in section 6. The last section presents the conclusions and assumptions for further study.

2. Theoretical background of CSIs

Customer satisfaction in air transportation has been defined by Brown and Lam (2008) as an essential element in the relationship between airlines and their market. Customer satisfaction can be an indicator of an organization's good performance. Therefore, companies must invest significant resources in customer satisfaction improvement (Fornell, 1992). In the air transportation industry, airlines enjoy high revenues when customer satisfaction increases because when customers are satisfied, they are more likely to repeat their purchase of airline services. Additionally, customers will be willing to pay a higher price to use the same airline (Dresner & Xu, 1995).

Parasuraman, Zeithaml, and Berry (1985) suggest that service quality is a prerequisite for customer satisfaction. Some studies of the airline industry have found a significant relationship between perceived service quality and passenger satisfaction (See Hussain, Al Nasser, & Hussain, 2014; Mahmud, Jusoff, & Hadijah, 2013; Park, 2010). Therefore, in the air transportation market, customer satisfaction plays an important role in assessing service quality and its influence on loyalty (Park, Robertson, & Wu, 2006).

As stated earlier, customer satisfaction is a relevant factor for the air transportation industry. Therefore, it is important to be able to measure travelers' satisfaction level in a quantitative way. In fact, some service providers already measure and evaluate customer satisfaction, by including even causes and effects, through structural models (Keiningham, Morgeson, Aksoy, & Williams, 2014). This methodology can help to identify and to reform those aspects, which need improvement.

CSIs measure the quality of goods and services as experienced by the customers, who consume and use them. CSIs are considered a type of performance measure of firms, industries, economic sectors, and national economies. Different CSIs have been reported in the literature. For instance, the Swedish customer satisfaction barometer (SCSB) was the first CSI developed by Fornell (1992). The SCSB model showed two primary antecedents of satisfaction: perceived performance and customer expectation, which are expected to have a positive influence on satisfaction. The ACSI introduced by Fornell et al. (1996) considers assessments on the quality of products and services obtained in the United States. The ACSI was designed from a structural model based on the hypothesis that customer satisfaction derives from factors such as customer expectations, perceived quality, and perceived value. These factors are the antecedents for overall customer satisfaction. The structural model also considers customer complaints and customer loyalty as explaining factors of satisfaction. The ACSI has been used for developing customer strategies in different markets around the world. The ACSI is based on customer perceptions, and it provides significant advantages for companies, in particular, when market conditions are change on a daily basis. Consequently, the ACSI has been a benchmark for more than 20 years for knowledge on customer satisfaction levels.

The ACSI has served as the basis for other CSI models developed in many countries. For instance, Bruhn and Grund (2000) developed the Swiss Index of Customer Satisfaction (SWICS) and has been applied in 20 different industries. SWICS measures three factors: customer satisfaction, customer dialogue, and customer loyalty. The European Customer Satisfaction Index (ECSI) is also a modified adaptation of the ACSI model. ECSI does not include customer complaints as a consequence of satisfaction (Eklöf & Westlund, 2002).

In addition to the estimation of the overall index in different countries, structural models have also been estimated for specific industries. For instance, Park, Heo, and Rim (2008) and Turel and Serenko (2006) found CSI models for mobile service with an empirical investigation in Canada and Korea, respectively. Hsu (2008) proposed an index for the online market applied to Taiwan's largest online retailer. Regarding hotel performance, Deng, Yeh, and Sung (2013) integrated consumption emotions into ACSI and found the CSI model for international tourist hotels. Zhang, Han, and Gao (2008) proposed a satisfaction index in higher education based on the theoretical frames of ECSI and ACSI.

In terms of transportation, Eboli and Mazzulla (2009) found a new CSI for evaluating transit service quality, which was named Heterogeneous Customer Satisfaction Index. This index was used to assess the satisfaction of public transportation services in the city of Cosenza, Italy. Friman, Fujii, Ettema, Gärling, and Olsson (2013) proposed and validated a measure of travel satisfaction referred to as the satisfaction with the travel scale index. They applied a confirmatory factor analysis to examine the psychometric properties of the index. Satisfaction was assessed with three constructs related to satisfaction with daily travel, satisfaction with the commute to work, and satisfaction with the commute from work in the different urban areas and with varying modes of travel. Zhang, Liu, Lu, and Xiao (2019) modified the ACSI and introduced a conceptual model of passenger satisfaction index based on characteristics of Chinese public transportation services. They assessed passenger perceived quality through convenience, safety, reliability, comfort, and operational service.

In the context of the airline industry, the ACSI has also analyzed passenger satisfaction with US airlines. It includes nine major airlines and several small carriers. Data summarize traveler perceptions about 11 elements (reservations, flight schedule options, check-in, in-flight services, seat comfort, flight crew courtesy and helpfulness, on-time arrival, baggage handling, loyalty programs, website, and call center). Another important index applied in the US airline industry is the Airline Quality Rating (AQR), found by Bowen and Headley (Kalemba & Campa-planas, 2018). In the AQR, airlines are ranked, by using

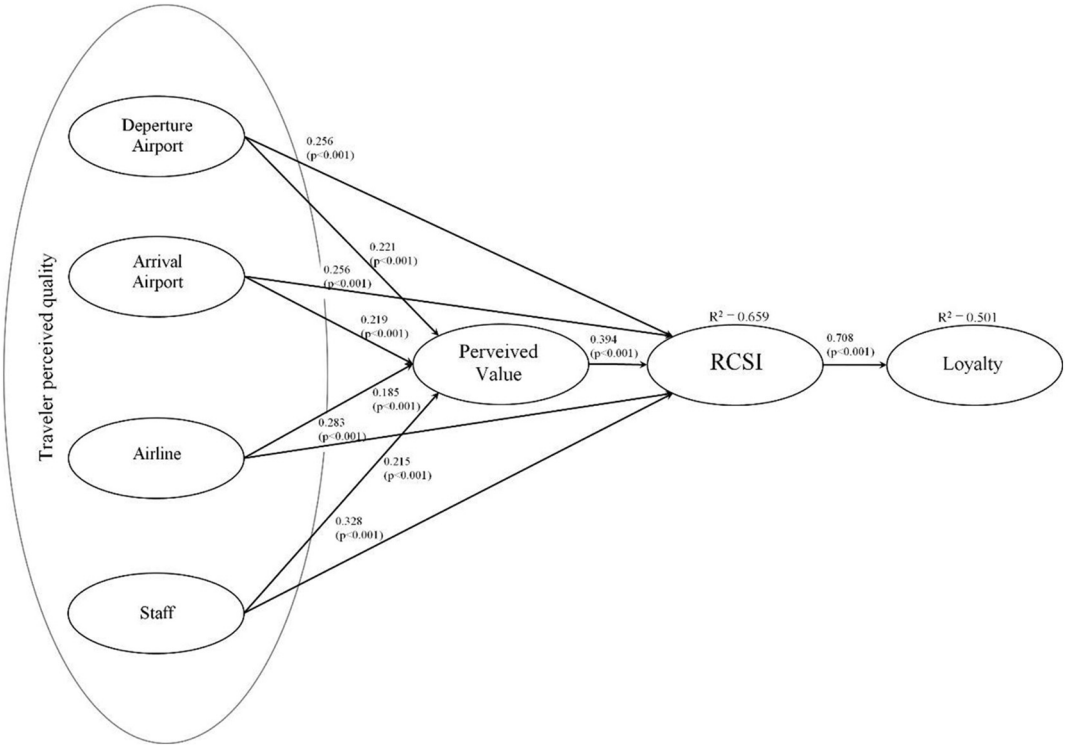

Fig. 1. Conceptual model of traveler satisfaction index.

weighted averages of four quality factors: on-time arrivals, involuntary denied boarding, mishandled baggage, and customer complaints (Bowen & Headley, 2019). Another index is the JD Power airline satisfaction, which measures the satisfaction of airline passengers, by considering seven factors: reservation, cost and fees, check-in, aircraft, flight crew, in-flight service, and boarding/deplaning/baggage. The JD Power Index helps airlines to drive growth and profitability, and it also compares airline performance, by including low cost and network carriers (Kalemba & Campa-planas, 2018). Additionally, the Net Promoter Score (NPS) is another index that measures the customer loyalty effect related to the possibility of a consumer to confirm and to recommend a service to another person. The NPS score is calculated as the mean according to the answer of customers (Kalemba & Campa-planas, 2018). According to most of the analyzed studies, CSI scores are calculated based on the mean weight of observable variables. Therefore, CSI scores may be affected by the presence of outliers.

Numerous studies have found CSI models for specific industries. Within this general framework, the present study is indeed the first one to present a global CSI for air journeys, by considering that traveler experiences are a chain of services related to departure airport service, airline service, and arrival airport service. It is also an important contribution to the literature on CSIs by being the first robust CSI approach, which includes the median as a robust estimator into the formulation.

In regards to research methods, in this study, the conceptual model and formulation of CSI for air journeys are built based on the literature review and the ACSI model, respectively. SEM method is used to construct the RCSI model, and the causality relationship between passenger satisfaction and its influence factors (such as traveler perceived quality, traveler perceived value, overall satisfaction, and traveler loyalty) are addressed. Furthermore, we enrich the concept of passenger perceived quality to detailed air transportation service dimensions. Specifically, based on the air travel service quality (ATSQ) scale proposed by Munoz et al. (2019), in our research, passenger perceived quality was described from the departure airport, arrival airport, airline, and staff.

3. Research methodology

3.1. RCSI

In this study, RCSI is used to measure the level of traveler satisfaction. Therefore, RCSI can be constructed based on the ACSI formulation, which has been widely applied in different industries (Fornell et al., 1996). By taking into account the characteristics of air transportation service, we considered the following aspects in the building process of the RCSI model. First, several studies found that the customer expectation element does not significantly influence the customer satisfaction level (e.g., Johnson, Gustafsson, Andreassen, Lervik, & Cha, 2001; Martensen et al., 2000). Researchers, therefore, suggested that customer expectations should be removed from the CSI model. Second, it is difficult to quantify traveler perception of service quality for air journeys. Munoz et al. (2019) suggested that passenger experience in air travel is a chain of services in which service quality perceptions can vary among three elements: departure airport service, airline service, and arrival airport service.

The RCSI, a modified adaptation of the ACSI, considers air transportation as a whole. In the RCSI model, perceived quality, perceived value, customer satisfaction, and loyalty are modeled the same as in the ACSI. For CSI models, numerous researchers found that perceived quality factors significantly influence customer satisfaction in different industries. For example, CSI models have been used to examine hotel service (Deng et al., 2013), telecommunication (Park et al., 2008; Turel & Serenko, 2006; Türkyilmaz & Özkan, 2007), online market (Hsu, 2008), urban transportation (Zhang et al., 2019), education (Bertaccini, Bacci, & Petrucci, 2020; Zhang et al., 2008), logistic services (Paddeu, Fancello, & Fadda, 2017). Such studies demonstrate the viability of this model to research behaviors and perceptions of air passengers.

To increase satisfaction level by air passengers, and thereby enhance their loyalty to the service provider, we identified a series of perceived quality factors, which influence traveler satisfaction and proposed the RCSI model as described in Fig. 1. The RCSI is based on an SEM, which comprises the antecedents and consequences of customer satisfaction.

Table 1
Latent variables and observable (manifest) variables.

Latent variables	Observable (manifest) variables
Departure Airport (DTT)	DT1. Airport size according to walking distance
	DT2. Proper signage according to spatial orientation at the airport
	DT3. Availability of trolleys in departure airport
	DT4. Security control systems
	DT5. Waiting rooms comfort
	DT6. Free Wi-Fi availability
	DT7. Airport cleanliness
	DT8. Quality of air conditioning
	DT9. Flights status screens
	DT10. Number of shops in departure airport
	DT11. Parking lots availability
Arrival Airport (ATT)	AT1. Airport size according to walking distance from the plane to the baggage claim area
	AT2. Proper signage according to spatial orientation at the airport
	AT3. Availability of trolleys in arrival airport
	AT4. Security control systems
	AT5. Airport cleanliness
	AT6. Quality of air conditioning
	AT7. Comfort of the baggage claim area
	AT8. Information of baggage delivery carousel
	AT9. Availability of different transportation modes at the airport exit
	AT10. Agility in baggage delivery
Airline (ATAN)	AIR1. Airline image
	AIR2. Number of daily flights
	AIR3. Flights schedule
	AIR4. Aircraft cabin cleanliness
	AIR5. Comfort of the airplane seats
	AIR6. In-flight entertainment
	AIR7. Wi-Fi service during the flight
	AIR8. In-flight catering service
	AIR9. Information on flight condition during the flight
	AIR10. On-time departure
	AIR11. Passenger baggage care by airline
	AIR12. On-time arrival
Staff (PER)	EMP1. Courtesy of airline employees
	EMP2. Level of training and experience
	EMP3. Willingness to help passengers
	EMP4. Response time for requests
Perceived value (PV)	PV1. Paid Airfare
	PV2. Consistency between ticket cost and provided service
	PV3. Availability of cheap airfares
Satisfaction (RCSI)	SAT1. My satisfaction with the airline has increased
	SAT2. My impression of the airline has improved
	SAT3. I now have a more positive attitude towards the airline
Loyalty (LOY)	RI1. I consider this airline my first option
	WOW1. I say positive things about this airline to other people
	WOW2. I recommend this airline to someone who seeks my advice

According to the characteristics of air journey services, seven dimensions are used to measure the RCSI. Fig. 1 shows the RCSI model, wherein the left-sided factors (i.e., perceived quality and perceived value) are antecedents of traveler satisfaction while the right-sided factor (i.e., traveler loyalty) is the consequence. The hypothesized relationship between traveler satisfaction and factors are depicted with lines. Although, in reality, there may exist some more relations among factors, the most important ones are considered.

The service quality factors deemed in the RCSI model, which positively influence traveler satisfaction are the following: departure airport service quality, arrival airport service quality, airline service quality, and staff service quality. As suggested in Farooq, Salam, Fayolle, Jaafar, and Ayupp (2018), Kim and Lee (2011), Ming-kei and Yui-Yip (2016) and Mohamed and Rani (2016), perceived service quality has a positive influence on the level of traveler satisfaction. Therefore, in our model, we assumed that the service quality of departure airport, arrival airport, airline, and staff positively affect traveler satisfaction. Consequently, we formulated the following hypotheses:

H1. Traveler perception related to departure airport service quality has a positive effect on traveler satisfaction.

H2. Traveler perception related to arrival airport service quality has a positive effect on traveler satisfaction.

H3. Traveler perception related to airline service quality has a positive effect on traveler satisfaction.

H4. Traveler perception related to staff service quality has a positive effect on traveler satisfaction.

Perceived value is defined as the perceived level of product or service quality relative to the price paid by consumers (Fornell et al., 1996). More specifically, perceived value can be summarized as the trade-off between perceived travel cost and perceived service quality. Service quality has been considered to be one of the primary drivers of traveler satisfaction (Clemes, Zealand, & Gan, 2008). In a similar vein, researchers view perceived value as an antecedent of traveler satisfaction (Chen, 2008). Based on the above, this study hypothesized the following:

H5. Traveler service quality perception related to departure airport has a positive effect on perceived value.

H6. Traveler service quality perception related to arrival airport has a positive effect on perceived value.

H7. Traveler service quality perception related to airline has a positive effect on perceived value.

H8. Traveler service quality perception related to staff has a positive effect on perceived value.

H9. Perceived value has a positive effect on traveler satisfaction.

Air passenger loyalty is defined as the desire to reuse the company service, which includes the willingness to use the same airline even when its ticket price is relatively higher than that of the competition and to recommend the airline company to others. Numerous studies have identified increasing traveler satisfaction as a crucial factor in ensuring traveler loyalty (Gures, Arslan, & Yucel Tun, 2014; Han, Ham, Yang, & Baek, 2012; Leong, Hew, Lee, & Ooi, 2015). For air transportation, loyal passengers are the most profitable traveler type since they tend to purchase the service of the same provider repeatedly. Many studies of traveler satisfaction have identified passenger retention and recommendation as crucial influences on air transportation business success (Han, 2013; Jiang & Zhang, 2016; Kos Koklic, Kukar-Kinney, & Vegelj, 2017). This study then further hypothesized the following:

H10. Traveler satisfaction has a positive effect on traveler loyalty.

Based on the conceptual model of RCSI shown in Fig. 1, structural and measurement equations are developed in the theoretical model of RSCI, which will be introduced in next section.

3.2. RCSI theoretical model

RCSI model consists of the factors mentioned earlier. Variables were chosen based mainly on prior studies. Latent and manifest variables were defined by appropriately modifying them to suit the purposes of this study. Latent variables and their observable (manifest) variables are shown in Table 1.

In the RCSI conceptual model shown in Fig. 1, traveler perceived service quality, traveler perceived value, traveler satisfaction, and traveler loyalty are latent variables, which cannot be measured directly. Therefore, the manifest items are the indicators of the latent variables. The majority of the studies in this category rely on structural equation

modeling as a method for obtaining the global satisfaction index. Therefore, the conceptual model of RCSI evaluation is indicated by the SEM. The first component of the structural equations is the latent concept model:

$$\eta = B\eta + \Gamma\xi + \zeta \tag{1}$$

In Eq. (1), η is the vector of unobserved (latent) endogenous variables. In this study, there are three endogenous concepts, namely traveler perceived value (η_1 = PV), traveler satisfaction (η_2 = RCSI), and traveler loyalty (η_3 = LOY). ξ is the vector of latent exogenous variables. There are four exogenous variables in this research model, which are, service quality perception for departure airport (ξ_1 = DTT), arrival airport (ξ_2 = ATT), airline (ξ_3 = ATAN), and staff (ξ_4 = PER). B (m x m) is a matrix of coefficient parameters for η, and Γ (m x n) denotes the parameter coefficient matrix of exogenous variables ξ. ζ is the noise vector, which is uncorrelated with ξ. Therefore, the relationship in the RCSI model can be translated into the following structural equation:

$$\begin{bmatrix} PV \\ RCSI \\ LOY \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ \beta_{21} & 0 & 0 \\ 0 & \beta_{32} & 0 \end{bmatrix} \begin{bmatrix} PV \\ RCSI \\ LOY \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} & \gamma_{14} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} & \gamma_{24} \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} DTT \\ ATT \\ ATAN \\ PER \end{bmatrix} + \begin{bmatrix} \zeta_1 \\ \zeta_2 \\ \zeta_3 \end{bmatrix} \tag{2}$$

The general equation that associates latent variables and the measurement variables is shown in Eq. (3) and Eq. (4).

$$X = \Lambda_x\xi + \delta \tag{3}$$

$$Y = \Lambda_y\eta + \varepsilon \tag{4}$$

Where $X = (x_1, x_2, \ldots, x_q)$ are the exogenous manifest variables, which refer to service quality perception. Furthermore, $Y = (y_1, y_2, \ldots, y_p)$ are the measured endogenous variables, which refer to traveler perceived value, traveler satisfaction, and traveler loyalty. $\Lambda_x(q\ x\ n)$ and $\Lambda_y(p\ x\ m)$ are the coefficient matrices, which show the relation of X to ξ and Y to η, respectively; and δ and ε are errors of measurement for X and Y, respectively.

The matrix equation corresponding to Eq. (3) for the proposed model is:

$$\begin{bmatrix} DT_1 \\ \vdots \\ DT_{11} \\ AT_1 \\ \vdots \\ AT_{10} \\ AIR_1 \\ \vdots \\ AIR_{12} \\ EMP_1 \\ \vdots \\ EMP_4 \end{bmatrix} = \begin{bmatrix} w_{DT_1} & 0 & 0 & 0 \\ \vdots & 0 & 0 & 0 \\ & & 0 & 0 \\ w_{DT_{11}} & 0 & 0 & 0 \\ 0 & w_{AT_1} & 0 & 0 \\ 0 & \vdots & 0 & 0 \\ 0 & w_{AT_{10}} & w_{AIR_1} & 0 \\ 0 & 0 & \vdots & 0 \\ 0 & 0 & w_{AIR_{12}} & 0 \\ 0 & 0 & 0 & w_{EMP_1} \\ 0 & 0 & 0 & \vdots \\ 0 & 0 & 0 & w_{EMP_4} \end{bmatrix} \begin{bmatrix} DTT \\ ATT \\ ATAN \\ PER \end{bmatrix} + \begin{bmatrix} \delta_{DT_1} \\ \vdots \\ \delta_{DT_{11}} \\ \delta_{AT_1} \\ \vdots \\ \delta_{AT_{10}} \\ \delta_{AIR_1} \\ \vdots \\ \delta_{AIR_{12}} \\ \delta_{EMP_1} \\ \vdots \\ \delta_{EMP_4} \end{bmatrix} \tag{5}$$

Note that customer satisfaction (RCSI) considers three main measurements: (SAT1) increase in traveler satisfaction with airline, (SAT2) improvement in traveler's feelings towards airline and (SAT3) increase traveler's positive attitude towards airline. As a consequence, the index indicates how much travelers are satisfied.

Matrix equation corresponding to Eq. 4 can be represented as:

$$\begin{bmatrix} PV_1 \\ PV_2 \\ PV_3 \\ SAT_1 \\ SAT_2 \\ SAT_3 \\ RI_1 \\ WOW_1 \\ WOW_2 \end{bmatrix} = \begin{bmatrix} w_{PV_1} & 0 & 0 \\ w_{PV_2} & 0 & 0 \\ w_{PV_3} & 0 & 0 \\ 0 & w_{SAT_1} & 0 \\ 0 & w_{SAT_2} & 0 \\ 0 & w_{SAT_3} & 0 \\ 0 & 0 & w_{RI_1} \\ 0 & 0 & w_{WOW_1} \\ 0 & 0 & w_{WOW_2} \end{bmatrix} \begin{bmatrix} PV \\ RCSI \\ LOY \end{bmatrix} + \begin{bmatrix} \varepsilon_{PV_1} \\ \varepsilon_{PV_2} \\ \varepsilon_{PV_3} \\ \varepsilon_{SAT_1} \\ \varepsilon_{SAT_2} \\ \varepsilon_{SAT_3} \\ \varepsilon_{RI_1} \\ \varepsilon_{WOW_1} \\ \varepsilon_{WOW_2} \end{bmatrix} \tag{6}$$

The RCSI score follows the ACSI and PSI formulations presented by (Fornell et al., 1996) and (Zhang et al., 2019), respectively. The population form of RCSI is as follows:

$$RCSI = \frac{E[\xi] - Min[\xi]}{Max[\xi] - Min[\xi]} * 100 \tag{7}$$

Where ξ is the latent variable for overall traveler satisfaction. $E[\xi]$, $Min[\xi]$, and $Max[\xi]$ stand for the expected, minimum and maximum value of the latent variable, respectively. Therefore, the corresponding manifest items x_i determine the minimum and maximum value of the latent variable in Eq. (8) and Eq. (9).

$$Min[\xi] = \sum_{i=1}^{n} w_i Min[x_i] \tag{8}$$

$$Max[\xi] = \sum_{i=1}^{n} w_i Max[x_i] \tag{9}$$

Where x_i is the measurement items of the latent overall traveler satisfaction, w_i are the weights, which is obtained by the SEM approach, and n is the number of measurement variables.

In ACSI, the natural estimator of $E[\xi]$ is given by Eq. (10).

$$E[\xi] = \sum_{i=1}^{n} w_i \bar{x}_i \tag{10}$$

The ASCI score is calculated as following (Fornell et al., 1996):

$$ACSI = \frac{\sum_{i=1}^{3} w_i \bar{x}_i - \sum_{i=1}^{3} w_i}{(Max[x_i] - Min[x_i]) \sum_{i=1}^{3} w_i} * 100 \tag{11}$$

In the ACSI equation, w_i represents the estimated unstandardized weigh for the i item of customer satisfaction, and $\bar{x}_i$denotes the average perception of the i item of customer satisfaction; $Max[x_i]$ and $Min[x_i]$ are maximum and minimum values of the three measurement items, respectively. In the ACSI, measurement items range from 1 to 10.

Based on Eq. (7) and inspired by the ACSI formulation shown in Eq. (11), this study proposes a new index applied to the air transportation market, which can be seen as a robust version of ACSI. Hence, Eq. (11) was modified, by introducing a robust estimator, by considering the median to be a centrality estimator rather than the sample mean. Thereby, the new estimator proposed here will be less affected by outliers. The RCSI is described in Eq. (12):

$$RCSI = \frac{\sum_{i=1}^{n} w_i Me_i - \sum_{i=1}^{n} w_i}{(Max[x_i] - Min[x_i]) \sum_{i=1}^{n} w_i} * 100 \tag{12}$$

In the RCSI equation, Me is the median value of measurement item i, w_i is the unstandardized weight of measurement item i, and n is the number of measurement items. For RCSI, n = 3, since three measurement items in which the observed range is from 1 to 7. Then, the RCSI score is calculated as follows:

$$RCSI = \frac{\sum_{i=1}^{3} w_i Me_i - \sum_{i=1}^{3} w_i}{6\sum_{i=1}^{3} w_i} * 100 \quad (13)$$

4. Data

The proposed RCSI model was applied by considering an experimental case study regarding domestic flights in Colombia. This study included 503 passengers at the major Colombian domestic air-route between Medellin (Jose Maria Cordova international airport (MDE) and Olaya Herrera airport (EOH)); and Bogota (El Dorado international airport (BOG)). This route is particularly relevant because airlines and airports compete over it, by providing passengers with options regarding airfares, frequencies and schedules. This route is currently served by four commercial airlines, Latam Airlines (LAN), Satena (NSE), Avianca (AVA), which represents the dominant domestic air carrier in Colombia, and Viva Air (VVC), which is a low-cost carrier.

4.1. Questionnaire development

The questionnaire was divided into four sections related to socio-demographic characteristics, trip information, and traveler perception with service quality and finally attitude and behavior. Section 1 was used to collect data on travelers' gender, age, occupation, education level, and income. The second section inquired about passenger trip experiences including whether the passenger has membership in a frequent flyer program, journey purpose, and chosen airline. Section 3and 4 ware designed for evaluating indicators of the RCSI model. Measurement scale items of the proposed RCSI model were designed primarily using the questionnaire of the air travel service quality (ATSQ) proposed by Munoz et al. (2019). Therefore, traveler service quality perception related to departure airport, arrival airport, airline, and staff included 11, 10, 12, and 4 items, as Table 1 shows. The final section was designed to evaluate perceived value, traveler satisfaction, and loyalty with nine items. Following Jiang and Zhang (2016), passengers were asked to indicate whether they would consider the same airline to flight next time, which allowed us to evaluate traveler loyalty in this study.

Regarding the measurement of attitudes, Alwin (1997) suggested the seven-point Likert scale is better than a five-point scale because it not only allows the measurement of direction and neutrality but can distinguish three levels of attitude intensity as well. Therefore, by having seven-points tends to be a good balance between having enough points of discrimination without having to maintain too many response options. Regarding air transportation studies, the seven-point Likert scale has been widely used by Al-Refaie, Bata, Eteiwi, and Jalham (2014), Elkhani, Soltani, and Jamshidi (2014), Chen and Chao (2015), Farooq et al. (2018). Respondents were asked to assess each item using a seven-point Likert scale, ranging from 1 (extremely dissatisfied/strongly disagree) to 7 (extremely satisfied/strongly agree).

4.2. Data collection

A pilot study was performed on 50 travelers for domestic flights, who were not included in the real experiment. The pilot questionnaire was tested and modified to be better understood by travelers. A final version of the survey was conducted in 2018 by face-to-face interviews with passengers traveling on MDE/EOH-BOG-MDE/EOH route, which has the most passengers carried per year on domestic flights in the Colombian air market. The questionnaires were completed in the arrival hall and departures waiting rooms at the MDE and EOH airports. Namukasa (2013) pointed out that much literature involving air passenger survey dealt with a sample size between 300 and 600. Hence, the sample size of 503, in this research, is valid and suitable.

Table 2
Descriptive statistics.

Variable	Category	Frequency	Percent (%)
Gender	Male	257	51.1
	Female	246	48.9
Age	18–30	129	25.7
	31–40	182	36.2
	41–50	131	26
	51–60	47	9.3
	61 and over	14	2.8
Employment status	Wage earners	233	51.4
	Self-employed	94	20.8
	Student	89	19.6
	Retired	20	4.4
	Other	17	3.8
Education level	Less than Bachelor	86	17.1
	Bachelor	378	75.1
	Postgraduate	39	7.8
Monthly income	Less than 300 USD	72	14.3
	301–700 USD	90	17.9
	701–1200 USD	117	23.3
	1201–1700 USD	105	20.9
	1701–2200 USD	52	10.3
	2201 USD and over	67	13.3
Frequent Flier Program membership	Non-membership	266	52.9
	Membership	237	47.1
LIFEMILES membership	Non-membership	280	55.7
	Membership	223	44.3
LATAM PASS membership	Non-membership	357	71.0
	Membership	146	29.0

N = 503

4.3. Sample analysis

Table 2 shows that sample is evenly spread between males and females. Most of the interviewed passengers are wage earners (51.4%). The age group peaked at 31 and 40 years, which accounted for 36.2%; only 7.8% of the travelers hold a postgraduate degree. 237 (47.1%) respondents have a membership in any frequent flier program (FFP), within which 223 travelers have a membership in FFP with Avianca airline (LIFEMILES), 146 travelers have a membership with Latam airline (LATAM PASS) and 133 respondents have both memberships in FFP.

5. Findings

Statistical Package for Social Science (SPSS) 24 software was used for descriptive, reliability, and correlation analyses. The proposed model and hypothesized paths were tested on the data collected. Measurement and structural models were tested by Analysis of Moment Structure (AMOS) 21 software. The maximum likelihood method of estimation was used to analyze data. The confidence level was set at 95%. In the first stage, multivariate outlier detection was performed by Mahalanobis distance. The sample size contained 503 respondents, with only 17 outliers identified. Therefore, the new sample size for modeling was 486 respondents.

5.1. Reliability and validity analysis

In the first stage of data analysis, Confirmatory Factor Analysis (CFA) was conducted to test the measurement model and data quality, by including reliability and factor validity checks. Hence, CFA was used to identify if numbers of factors and loadings of measurement variables on them confirm to the proposed model. The standardized factor loadings shown in Table 3 were considered significant as they surpassed the cut-off value of 0.5 recommended by Hair, Black, Babin, and Anderson (2014) and the t-value for all these standardized factor loadings were found to be significant ($p < .01$).

Table 3
Confirmatory factor analysis.

Items	Standardized factor loading	CR	AVE	Cronbach's Alpha
Departure Airport (DTT)		0.920	0.513	0.920
DT1	0.767			
DT2	0.726			
DT3	0.738			
DT4	0.685			
DT5	0.723			
DT6	0.688			
DT7	0.696			
DT8	0.654			
DT9	0.759			
DT10	0.716			
DT11	0.718			
Arrival Airport (ATT)		0.933	0.583	0.933
AT1	0.693			
AT2	0.770			
AT3	0.788			
AT4	0.735			
AT5	0.752			
AT6	0.734			
AT7	0.796			
AT8	0.840			
AT9	0.753			
AT10	0.768			
Airline (ATAN)		0.932	0.533	0.930
AIR1	0.786			
AIR2	0.798			
AIR3	0.781			
AIR4	0.711			
AIR5	0.754			
AIR6	0.684			
AIR7	0.739			
AIR8	0.653			
AIR9	0.728			
AIR10	0.712			
AIR11	0.671			
AIR12	0.726			
Staff (PER)		0.870	0.629	0.867
EMP1	0.745			
EMP2	0.643			
EMP3	0.883			
EMP4	0.876			
Perceived Value (PV)		0.812	0.593	0.815
PV1	0.873			
PV2	0.760			
PV3	0.663			
Satisfaction (RCSI)		0.755	0.506	0.802
SAT1	0.690			
SAT2	0.742			
SAT3	0.702			
Loyalty (LOY)		0.970	0.916	0.974
RI1	0.945			
WOW1	0.983			
WOW2	0.943			

$p < .01$

The reliability of the measured items was tested by assessing the consistency of variables, by using Cronbach's Alpha. A Cronbach's Alpha above 0.7 is considered a good level of reliability (Hair et al., 2014). Table 3 shows that Cronbach's Alphas are among 0.802–0.974, which indicates that the measurement of various potential variables presents good inner coherence, and factors' reliability can be accepted. Table 3 also shows the Composite Reliability (CR) estimates, which ranged from 0.755 to 0.970 and exceed the critical value of 0.7 suggested by Hair et al. (2014), by implying that multiple items, for each study factor, are internally consistent and reliable. Additionally, the Average Variance Extracted (AVE) for all factors was between 0.506 and 0.916, and it was above a 0.5 threshold as the recommended value (Hair et al., 2014), which signifies that more than half of the variances observed in the items were explained by their hypothesized factors. Overall, these findings provide support for dimensionality, reliability, and validity measures.

The discriminant validity of the factors is shown in Table 4. The diagonal in Table 4 shows that the square root of the AVE between each pair of factors was higher than the correlation estimated between factors, thus ratifying its discriminant validity (Hair et al., 2014). Hence, each factor was statistically different from the others. Furthermore, confirmatory measurement of the model demonstrates the soundness of its measurement system.

5.2. Structural model and test of hypotheses

An SEM was applied to evaluate the adequacy of the RCSI model, which is shown in Fig. 2. The path coefficients, given on the lines, are the standardized regression coefficients with their significance level (*p*-values in parentheses). The path coefficients indicate the strengths of the relationships between dependent and independent variables, and R^2 values are the faction of the total variance of the dependent variable, which is explained by independent variables. RCSI was well accounted for by the proposed theoretical framework. About 65.9% of the variance of RCSI was explained by its predictors, which is in line with the findings of Deng et al. (2013) and Türkyilmaz and Özkan (2007). Based on the path coefficient shown in Fig. 2, traveler service quality perception related to departure airport positively affects perceived value ($\beta = 0.221$, $t = 4.510$) and traveler satisfaction ($\beta = 0.256$, $t = 6.106$). Therefore, H1 and H5 are accepted. Traveler service quality perception related to arrival airport was also significantly related to perceived value ($\beta = 0.219$, $t = 4.539$) and traveler satisfaction ($\beta = 0.256$, $t = 6.251$), by supporting H2 and H6, respectively. Furthermore, traveler service quality perception related to airline had a positive effect on perceived value ($\beta = 0.185$, $t = 3.814$) and traveler satisfaction ($\beta = 0.283$, $t = 6.709$). H3 and H7 were therefore confirmed. Traveler service quality perception related to staff was found to be positively associated with the perceived value ($\beta = 0.215$, $t = 4.395$) and traveler satisfaction ($\beta = 0.328$, $t = 7.688$). Thus, H4 and H8 were supported. Perceived value has the highest positive effect on traveler satisfaction ($\beta = 0.394$, $t = 7.949$). Thus, hypothesis 9 was accepted. Accordingly, the above analyses showed that each of the antecedent variables had reasonable power to explain overall RCSI.

Particular attention should be paid to traveler loyalty since it is the ultimate factor in the RCSI model. Traveler satisfaction is the independent latent variable of this construct, with the regression coefficient value of 0.708 ($p < .001$). About 50.1% of the variance in traveler loyalty is explained by the RCSI, which is similar to the findings by Park et al. (2008) and Türkyilmaz and Özkan (2007). These findings mean that the RCSI model closely fits data ($\chi^2/df = 2.676$, $p < .001$, RMSEA = 0.059), and it has satisfactory predictive capability and can help the air transportation market managers to enhance traveler satisfaction.

5.3. CSI for air journeys

By using Eq. (13), the RCSI score for the major domestic journey found to be 72.4 (transformed to a 0- to 100-point scale to facilitate comparisons). Then, the measurement of RCSI enables the evaluation of the level of service of airlines and airports in a comprehensive sense.

In order to test the RCSI performance in the presence of outlier data, we intentionally replace a percentage of the sample with outliers. Then, a new model was obtained, and the RCSI was calculated again with the $w_i Me_i$ as a robust estimator of $E[\xi]$. The RCSI findings were compared to the index formulation suggested by ACSI, where $w_i\bar{x}_i$ is the estimator of $E[\xi]$. Table 5 shows the performance of the new robust estimator in the presence of outlier data. The original data were intentionally contaminated with 1%, 2% and 3% of outliers. Hence, based on the new

Table 4
Discriminant validity.

	Departure Airport	Airline	Arrival Airport	Staff	Perceived Value	RCSI	Loyalty
Departure Airport	**0.716**						
Airline	0.355	**0.730**					
Arrival Airport	0.315	0.360	**0.764**				
Staff	0.143	0.359	0.198	**0.793**			
Perceived Value	0.304	0.354	0.322	0.298	**0.770**		
RCSI	0.462	0.568	0.504	0.482	0.582	**0.712**	
Loyalty	0.382	0.437	0.369	0.408	0.450	0.709	**0.957**
Descriptive Statistics							
Mean	5.511	5.592	5.593	5.691	4.993	5.387	5.529
Standard Deviation	0.739	0.686	0.702	0.872	1.088	0.685	0.851

Correlation is significant at the 0.01 level. Diagonal elements in bold show the square root of AVE

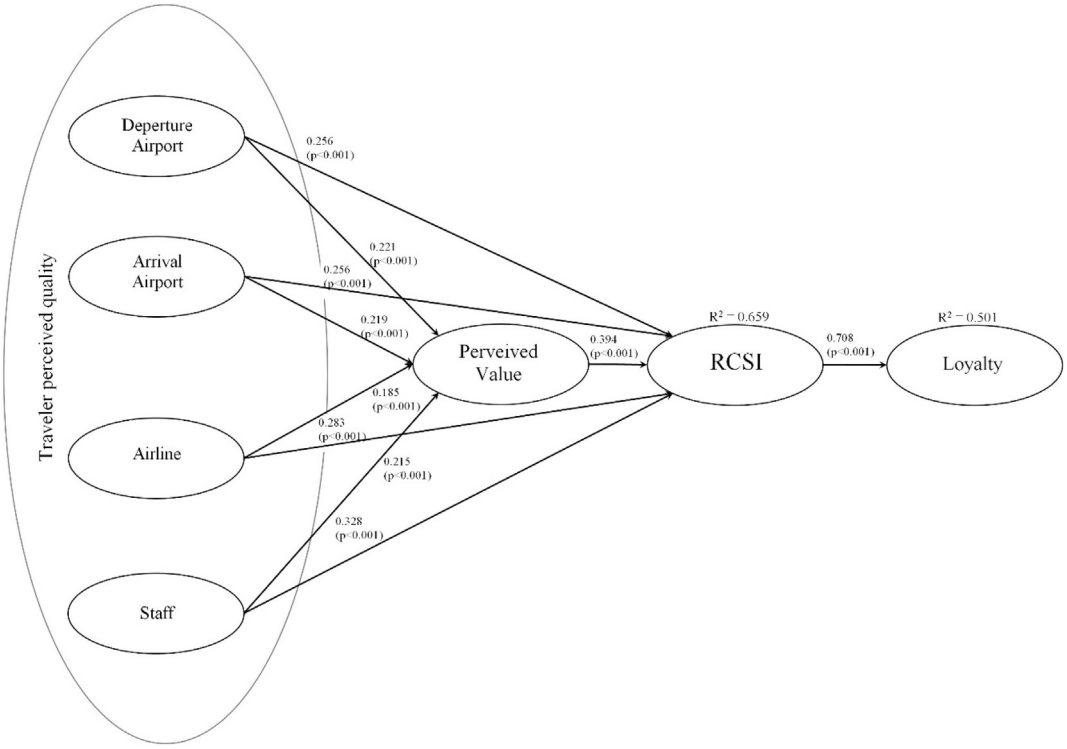

Fig. 2. Results of traveler satisfaction index model and hypothesis testing

models, the RCSI score is calculated, as well as the index score based on ACSI formulation. Clearly, it can be observed that the estimator introduced in this study has less variation that the index calculated with $w_i\bar{x}_i$, as an estimator, as shown in Table 5.

6. Discussion

The RCSI model is an SEM, which is based on well-established theories and approaches in consumer behavior. A major advantage of the RCSI model is the use of generic questions, which are sufficiently flexible to be used across different air journeys. The applicability of a CSI model depends on the reliability and validity of the model results (Türkyilmaz & Özkan, 2007). Therefore, the reliability and validity of the RCSI model were assessed, by checking the consistency of factors, convergent validity, and discriminant validity. All tests suggested by Hair et al. (2014) were found to be satisfactory. The proposed RCSI

Table 5
Performance of RCSI.

% of contamination of the sample	RCSI score $RCSI = \frac{\sum_{i=1}^{3} w_i Me_i - \sum_{i=1}^{3} w_i}{6\sum_{i=1}^{3} w_i} * 100$	RCSI percent change	Score base on ACSI $ACSI = \frac{\sum_{i=1}^{3} w_i \bar{x}_i - \sum_{i=1}^{3} w_i}{6\sum_{i=1}^{3} w_i} * 100$	ACSI percent change
0%	72.42		73.11	
1%	72.48	0.08%	75.62	3.43%
2%	72.37	0.07%	78.55	7.44%
3%	73.20	1.07%	81.83	11.93%

model is an SEM, which incorporates well-established theories and approaches to customer behavior. By the path coefficients of the proposed RCSI model, service quality, and perceived value are positively related to customer satisfaction and, in turn, satisfaction is associated with customer loyalty. These previous relationships are consistent with the results of the ACSI model.

From the results of the RCSI model, we found that traveler satisfaction is mostly affected by perceived value, which is in line with other CSI models (Turel & Serenko, 2006; Türkyilmaz & Özkan, 2007). In other words, when passengers perceive that the money they pay for a trip is worth of its quality, their satisfaction increases. However, traveler perceived quality was found to be a significant predictor of perceived value and traveler satisfaction. Moreover, the staff is the main service quality factor, which affects customer satisfaction, which is consistent with previous studies (Cheng, Chen, & Chang, 2008; Kos Koklic et al., 2017). This factor includes both the ground staff and the crews on board the flight. Especially, passengers feel that having crews on board the aircraft, who swiftly respond to their needs and concerns, is the most relevant aspect of the staff. These findings suggest that air transportation managers should pay more attention to their strategies and to the activities, which improve service quality.

We found that the RCSI score of 72.4 is similar to the one reported by ACSI for the average of the airline industry in the United States in 2018[1] (ACSI score = 73). Although ACSI only reports the score for the airline industry, it is in line with RCSI score for an air journey, which includes airlines and airports in a comprehensive sense. RCSI indicated that the Colombian traveler satisfaction level in the major domestic journey was high. The RCSI model can help managers to estimate traveler satisfaction better and to understand specific influence on customer satisfaction, by examining the causal relationships involved. Therefore, providers of passenger transportation should concentrate their efforts on maintaining the performance of service quality factors in order to keep high satisfaction levels.

7. Conclusion

This study contributes to the literature by developing and testing a new robust customer satisfaction index (RCSI), which was applied within a Colombian framework. Therefore, the present research contributes to previous works. First, because it offers an overview of how service quality perception can be measured for air journeys, and second, because it introduces a new robust traveler satisfaction index which is less sensitive to outlier data than CSIs based on the ACSI model formulation. The proposed RCSI model is an SEM, which integrates well-established approaches and theories to traveler behavior.

This research has provided empirical support to the causal relationships among service quality, perceived value, and traveler satisfaction, and loyalty. Additionally, we enrich the previous study by Munoz et al. (2019), by validating the concept of traveler perceived quality to detailed service dimensions in a domestic air journey. Specifically, this study assessed the service quality perception related to all contact points (departure airport, airline, and arrival airport) during an air journey.

Additionally, this study has management implications. First, findings of the RCSI model as a whole can be helpful to managers in formulating competitive marketing strategies. For airlines and airports, measurement characteristics of the RCSI model provide a useful tool for tracking performance, by allowing benchmarking over time. Furthermore, by considering the findings of the RCSI model, significant resources of airports and airlines can be allocated for critical factors, which have an important impact on traveler satisfaction. Therefore, in today's highly competitive airline industry environment, it is essential that the airline companies make their best effort to attract and to retain their customers, as well as to differentiate themselves from the competitors through offering an adequate standard of service quality for consequently reaching higher profitability. The study results show the importance of staff in customer satisfaction. Therefore, managers should invest in staff training in order to improve their courtesy, sympathy, and willingness to help. This strategy would significantly enhance traveler perceptions of service quality.

While the proposed RCSI model had been validated by the major Colombian domestic air journeys, this theoretical framework should be further validated, by using samples from other countries in order to generalize the applicability of the robust index. Further studies may need to expand the research scope. For instance, by assessing the RCSI commercial potential as a business model, by estimating the economic value related to services for air journeys. Although ACSI and RCSI report scores for the national airline industry and domestic air journeys (including airlines and airports), respectively. Further studies should attempt to find customer satisfaction indexes across different transportation modes based on the RCSI approach. These indexes must be able to assess traveler perceptions based on specific service quality items. This may provide an opportunity to compare customer satisfaction scores based on different transportation modes for domestic trips. Thus, a global index for national transportation could also be found, which could be useful to compare different national indexes.

[1] The ACSI score for the airline industry can be obtained at https://www.theacsi.org/acsi-benchmarks/benchmarks-by-industry

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Declaration of Competing Interest

None.

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