



Analysis of the operational performance of brazilian airport terminals: A multicriteria approach with De Borda-AHP integration



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ABSTRACT

Objective: This study proposes a multicriteria approach for the comparative analysis of the operational performance of Brazilian airport terminals.

Methodology: Two multicriteria decision aid (MCDA) methods – De Borda and Analytic Hierarchy Process (AHP) – were applied in an integrated manner to the database of the performance report from the Brazilian Department of Civil Aviation (Secretaria de Aviação Civil – SAC/PR), composed of evaluations issued by 18,062 respondents regarding 15 airport terminals, 12 of which are analyzed in this study considering 8 evaluation criteria. On the first level, the AHP method was used to assign weights to the criteria. On the second level, the De Borda method was applied to rank the alternatives.

Results: The proposed method resulted in a final ranking of alternatives that was significantly different from the one presented in the SAC/PR report.

Contribution to knowledge: The employment of the integrated De Borda-AHP method is not common and ensured a greater approximation with the overall user satisfaction indicator, showing that it is the more appropriate methodological option when compared with the arithmetic mean commonly used in public reports.

Contribution to society: Based on the obtained ranking, air transport users will be able to have a more realistic comparative picture of the main airport terminals analyzed.

Contribution to the management of the airport system: This work contributes to the strategic planning and allocation of investments seeking to adapt and expand the sector, and also to the continuous improvement of the service levels provided at airports.

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1. Introduction

Civil aviation plays a strategic role in development, either by the transport of people and goods it provides, or by the generation of jobs and financial transactions, particularly in a country of continental size such as Brazil. In alignment with its development plans, Brazil needs to devote efforts to make an airport infrastructure available that is consistent with the circulation of people by air forecast for the next few years, because in addition to the growing domestic circulation, the country will host large-scale international

events. For the 2016 Olympic Games in Rio de Janeiro, for example, more than 10,500 athletes from around 205 nations, in addition to thousands of press and support professionals and tourists from all over the world are expected.

As a result of these activities, various factors associated with the Brazilian airport infrastructure and issues related to the operational performance of the airports, in addition to the way these are assessed from a passenger's perspective, began to be the subject of debate. The uncertainty regarding the existing infrastructure's capacity to meet the demand in a timely manner and according to passenger expectation was put on the agenda. As such, it has become important to identify methodologies that are able to assess the operational performance of Brazilian airports in order to enable the planning of future availability in a way that is consistent with the quality standards in force.

Thus, in order to measure the operational performance of

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Brazilian airport terminals, the Department of Civil Aviation (*Secretaria de Aviação Civil - SAC/PR*) has been conducting a survey *in loco* at the main airports to capture general data on passenger perception regarding the established operational performance metrics. This measure represents a support to Brazilian airport management and seeks to guide actions for improvements in the provision of airport services to passengers (*SAC/PR, 2014*). The research conducted by SAC/PR is consolidated in quarterly reports and presents the operational performance of airports for each indicator through arithmetic means of the passengers' general assessments. The final result is also only presented using the arithmetic mean of the indicators, i.e. in a compensatory way, without taking into account the allocation of importance (weights) to criteria.

In this context, faced with the existence of this data source and its currently non-existent treatment in the public report, the following research question arises: can the comparative analysis of the operational performance of Brazilian airport terminals be enhanced by employing a method that comes closer to the reality perceived by passengers?

Customer satisfaction is an important issue concerning organizations of all types (*Grigoroudis and Siskos, 2002*). Customer satisfaction measurement may be considered as the most reliable feedback system, considering that it provides in an effective, direct, meaningful and objective way the clients' preferences and expectations.

In this way, customer satisfaction is a baseline standard of performance and a possible standard of excellence to the air transport industry. Considering judgments on the importance of criteria, based on the Analytic Hierarchy Process (AHP) and the De Borda methods a new methodology is proposed to evaluate airport terminals.

The objective of this study, therefore, is to perform a comparative analysis of the operational performance of the main Brazilian airport terminals through a non-compensatory multicriteria approach, which aggregates two methods: the Analytic Hierarchy Process (AHP) and the De Borda.

The work is organized in four more sections, in addition to this introduction. The second section presents a review of the literature on the evaluation of service quality in airport terminals. The third section lays out the methodology used in the study. The results of the research are presented and evaluated in the fourth section. And in the fifth and final section, the concluding remarks are summarized.

2. Airport service quality evaluation

The growth in air transport across the world has caused a considerable increase in studies on the service quality at airport terminals, especially in the last two decades. Today, and keeping up with this trend, there is an increased urgency among airport managers to differentiate their airports based on the needs of customers. These managers also clearly understand the importance of the quality of service perceived by passengers (*Fodness and Murray, 2007*). The quality of service at airports is often expressed in terms of the perception of the service levels offered to the users of airport terminals (*Francis et al., 2003*).

Models that assess service levels are being addressed in studies applied to airport terminals located in different regions of the world. *Chien-Chang (2012)* presented a fuzzy decision making method applied at airports in Taiwan. *Kuo and Liang (2011)* also used a fuzzy multicriteria approach to evaluate seven international airports in North-East Asia. *Lubbe et al. (2011)*, on the other hand, investigated the perceptions of passengers on the quality of service at the international airport of Johannesburg, in South Africa. In the

same sense, *Atalik (2009)* addressed the expectations of passengers at the international airport in Istanbul, Turkey. *Gkritza et al. (2006)*, in turn, investigated the satisfaction of users regarding the applied security procedures by access control point in American airports.

The issue of passenger perception regarding the quality of service offered in airport terminals in Brazil has also been addressed by several scientific papers. Some of these employ a generalist vision, adopting procedures that include both comments from passengers and the collection of socioeconomic and physical variables that could influence the evaluation of the user of the airport infrastructure as a whole (*Correia et al., 2008a, 2008b; Fernandes and Pacheco, 2010; Gregui et al., 2013*). Other studies, however, use a more specific vision, assessing components of airport infrastructure individually, such as boarding, unboarding and check-in (*Correia and Wirasingue, 2007, 2008; Borille and Correia, 2013*).

Correia and Wirasingue (2004) conducted an extensive review of the research on service level assessments in airport terminals. The main purpose of the study was to categorize the works with respect to the objective and the employed technique, pointing to the following groups of studies: investigations of factors that influence the level of service; assessments of service levels using statistical analysis; uses of the perception-response (P-R) curve concept; applications of fuzzy theory; applications of Data Envelopment Analysis (DEA); and assessments focused on the passenger guidance factor at terminals.

The study by *Correia and Wirasingue (2004)* also presents some interesting conclusions about the service level evaluation surveys in airport terminals:

- There is no globally accepted standard procedure for the assessment of service levels at airports;
- Several researchers have concluded that their approaches required more data to validate the methodology, particularly with regard to the overall assessment of the service level of the terminal.
- There has been little research designed to evaluate terminals in developing countries; and
- Most studies consider only boarding passengers. There has been little research effort on passengers who are disembarking or transferring.

Assessing the quality of service at airport terminals is therefore a very complex task, since it involves conflicting factors that need to be taken into account. The employed methodology should be able to properly handle the collected data and make use of techniques that come as close as possible to the reality perceived by passengers in the analyzed airport terminals.

On the other hand, as reported in *Costa et al. (2013)*, the assessment of the quality of a service involves its evaluation in light of multiple criteria, some of which are subjective. This observation, coupled with the fact that the principles and methods of Multi-criteria Decision Aid (MCDA) have been developed for the modeling of problems with these characteristics (multiple criteria and presence of subjectivity), has led *Freitas and Costa (1998)* to propose the adaptation of the ELECTRE III method (*Roy, 1978*) to assess the quality of services.

Variations of this proposal have been developed, such as in *Costa et al. (2007)* and *Nepomuceno and Costa (2015)*, who developed models based on ELECTRE TRI (*Mousseau and Slowinski, 1998*) for the evaluation of services; and in *Sant'anna et al. (2015a; 2015b)*, who adopted the CPP-TRI for the assessment of quality of services. CPP-TRI merges the Probabilistic Composition of Preferences (CPP) with the principles of trichotomic segmentation presented in ELECTRE TRI.

In spite of the progress achieved by the use of the ELECTRE and

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