Measuring quality of services in airport passenger terminals management essay

Environment, Air

Measuring the performance of airport passenger terminals provides a valuable feedback to airport managers. Researchers and practitioners alike have recognized that measuring terminal performance through purely operational approaches (i. e., based on airport ability to process passengers and baggage) is not sufficient. Innovative techniques studying passenger needs and their perception of service quality have been developed during the last couple of decades. A new generation of terminal assessment models incorporating issues, such as comfort, convenience, and ambience in the evaluation models has emerged. Existing models vary according to the type of decisions supported, evaluation perspective, type of measurements, and evaluation approach used. The objective of this research is to review state of the art and state-of-practice methods and techniques used for assessing the performance of airport passenger terminals, identify their strengths, weaknesses, and synergies, and provide directions for future research.

1. INTRODUCTION

The importance of passenger satisfaction for enhancing airport passenger terminal performance and generating top commercial revenues is widely recognized. Recently, the Airport Cooperative Research Program (ACRP) proposed funding for research activities with the objective to develop innovative concepts for terminal planning and design centred at superior passenger satisfaction (REFERENCE).

Two major trends dictate the need for research for airport passenger terminal performance assessment, namely: i) privatisation and liberalisation of airport operations (REFERENCE Graham), and ii) the continuous increase

of air traffic demand (1, 2). Thus, airports have to set their targets so as to balance strategies for accommodating additional demand and providing adequate service quality to passengers in order to compete effectively in the emerging competitive market landscape.

In the academic literature and in professional practice, airport performance is most commonly assessed from three perspectives: passenger, airline, or airport authorities (3). Given that passengers constitute the main source of airport revenues, their point of view merits further attention. The service quality provided by an airport terminal is also affecting airline terminal selection decisions. Gaining insight on how airlines assess terminal performance provides useful information to airport managers.

The objective of this paper is threefold: first to provide an overview of the state-of-the-art and state-of-practice in the area of airport passenger terminal performance assessment, second to identify strengths, weaknesses, and synergies between existing models, and third to propose directions for future research.

The remainder of the paper consists of five sections. Section 2 presents the classification of existing models and techniques, section 3 presents terminal performance assessment based on objectively measured LOS, section 4 discusses terminal performance assessment based on perception, while section 5 reviews passenger satisfaction surveys. Finally, Section 6 summarizes the research findings and provides directions for future research.

2. METHODOLOGY

The objective of this section is to introduce the methodology followed to classify existing research and applications in the area of airport passenger terminal assessment. Three main streams of research are identified: terminal performance assessment based on objectively measured Level of Service (LOS), terminal performance assessment based on perception, and passenger satisfaction surveys (see Figure 1).

FIGURE 1 Classification of Airport Terminal Quality Assessment Models

“ Terminal performance assessment based on objectively measured LOS standards” focuses on measuring the performance of airport terminals. Models under this category evaluate airport passenger terminal facilities using objectively measured metrics (e. g., waiting time, processing time, and available space). Depending on the types of models used to estimate the parameters expressing LOS, this category is further divided in two subcategories: i) ‘ analytical models’ and ii) ‘ simulation models’.

“ Terminal performance assessment models based on perception” measure the perceived (by users) quality of service offered by airport passenger terminal facilities from various types of facilities and/or service providers. These models evaluate the performance of individual facilities or the entire terminal. Data incorporated in the models are subjective (e. g., perceived waiting time, ambience of terminal, and courtesy of staff) and/or objective. This category is divided into two subcategories: ‘ defining LOS based on passenger perception’ and ‘ developing combined LOS index’.

“ Passenger satisfaction surveys” measure the performance of the entire airport passenger terminal based on passenger perception. Data incorporated in the satisfaction surveys is subjective. Satisfaction surveys are applied to a large number of airports and provide a possibility to compare the performance of an airport terminal against other terminals. Three surveys for performing this type of analysis are reported: the Airport Service Quality (ASQ) index developed by Airports Council International (ACI) (4), index developed by SKYTRAX (5), and index developed by J. D. Power (6).

In what follows, we provide an overview of the models, methods, and techniques used in each one of the above mentioned categories.

3. TERMINAL PERFORMANCE ASSESSMENT BASED ON OBJECTIVELY MEASURED LOS

Level of Service (LOS) standards provide airport planners, designers, and operations managers with vital information regarding the performance of various types of facilities. For design purposes the required space for terminal facilities is estimated based on required space per passenger and forecasted traffic levels. At a subsequent step the results are fitted to the architectural concept. For operational analysis observed or estimated values of parameters expressing the LOS are compared against tabulated values determining the corresponding LOS. The variables required to assess terminal LOS (i. e., space per passenger, waiting time, etc.) can be obtained through: i) field measurements (for terminals in operation), ii) the use of analytical models, and iii) the use of simulation models. In the following

subsections, analytical and simulation models and LOS standards incorporated in these models are presented.

Analytical and Simulation Models

Analytical models provide an aggregate representation of airport operations using a set of mathematical expressions. Analytical models tend to be simpler, less data intensive, faster, and less accurate as compared to their simulation counterparts. Analytical models are more suitable to support strategic decisions (7, 8).

Simulation models provide a detailed analysis and deal with a larger number of operational issues. Simulation models are more suitable to support operational decisions. According to the level of their detail simulation models are classified into microscopic, mesoscopic, and macroscopic. Simulation models require more effort for their development and more detailed data inputs for performing analysis (7, 8). For a detailed review of existing analytical and simulation models, the reader is referred to (7, 9, 10, 11, 12, 13).

Analytical and simulation models estimate capacity, delays, and LOS of airport terminals or terminal facilities using established LOS standards. A discussion of existing LOS standards follows.

Terminal LOS Standards

LOS standards measure the actual performance of airport terminals based on objective indicators. Transport Canada (14) defines the level of service as the area provided to each person at a given time (i. e., measured in m2 per

passenger). This approach uses a six-point scale (i. e., LOS is measured ranging from A “ excellent” to F “ system breakdown”). The Transport Canada level of service concept supports the assessment of five types of facilities in the airport terminal: check-in, waiting/circulation facilities, hold rooms, baggage claim area, and pre-Primary Inspection Line (PIL).

A manual measuring airport landside capacity was developed in the 1980s by the Transportation Research Board (TRB) (15). The manual provides to airport operators, planners, and other stakeholders guidelines to assess terminal capacity and LOS. Landside components (i. e., passenger security screening, ticket counter and baggage check, parking area, ground access, etc.) are evaluated on the basis of objectively measured metrics. Metrics incorporated in the analysis are: space available in waiting and circulation areas, seating and waiting geometry, flight schedule, number of passengers, service rate, etc. The LOS of landside facilities is assessed independently for each facility. Therefore, the approach does not consider the effect of crowding and congestion in one terminal facility on the demand and LOS of upstream and downstream facilities.

IATA LOS standards (16, 17) provide support for terminal design and operational assessment. LOS standards are based on available space per passenger and implicitly incorporate dwell time (i. e., total time spent at a terminal facility) stating that decrease of dwell time results in decrease of space required. IATA standards adopted and slightly modified the six-point scale (i. e., from A “ excellent” LOS to F “ unacceptable” LOS) initially developed by Transport Canada. Metrics used for assessing the performance

of terminal facilities are: available space, number of passengers, passenger demand, and service rate. The 2004 version of the manual provides a more detailed analysis incorporating additional parameters (e. g., required space for passengers using baggage carts, required space based on number of bags per passenger and probability for availability of baggage carts) (17).

The Federal Aviation Administration (FAA) also developed standards for assessing the performance of airport passenger facilities (18). FAA standards suggest a single space requirement per passenger, which ensures comfortable stay in the terminal building. These standards were originally developed implying a specific set of conditions reflecting operational procedures (i. e., dwell time of domestic and international passengers, type of customs procedures, percentage of passengers using ticket counters, etc.). Given the fact that major changes in airport terminal operations have occurred since the introduction of these standards (e. g., remote check-in and stricter security procedures), FAA standards may not be directly applicable (19).

It has to be acknowledged that currently no overall accepted LOS standard exists. However, the 2004 version of IATA LOS standards (17) is used by a wide range of airport professionals. IATA standards are applicable to any type of airport (e. g., grouped by size, geographical position, air carrier type, and point of termination of passenger trips). IATA standards measure separately the LOS in each terminal facility (i. e., processing, waiting, and circulation) and can support terminal planning and design, and operations analysis.

4. TERMINAL PERFORMANCE ASSESSMENT BASED ON PERCEPTION

This category involves models assess airport terminal performance by incorporating passenger and/or expert opinions. Models belonging to this category aim at identifying: i) the factors affecting the perception of terminal quality, ii) threshold values for defining LOS based on passenger perception, and iii) the relative importance of these factors in determining a single performance index either for a single facility or for the entire terminal. These models are based on passenger and/or expert surveys and use a variety of techniques to determine the weight assigned by the respondents to the different types of facilities and/or services in determining the overall Level of Service. Research related to terminal performance is divided in two groups: i) defining LOS based on passenger perception and ii) developing combined LOS index.

Defining LOS Based on Passenger Perception

Models under this category aim at developing LOS scales comparing actual with perceived quality determinants. Thus, an index assessing LOS of a single facility or a group of facilities is being developed. A framework evaluating check-in facilities using psychometric scaling was developed and tested for the San Francisco International Airport (20). Through psychometric scaling, a scale assessing the LOS of check-in facilities is developed. A single quantitative index measuring LOS based on waiting time and crowding is provided.

A scale measuring the perception of check-in performance at the São Paulo International Airport was developed (21). Passengers were asked to rate their experience at check-in counters on a five-level scale (i. e., from 1 “ unacceptable” to 5 “ excellent”). Parallel to these data, waiting time, processing time, and available space at the check-in counter were also recorded. Three criteria for measuring the performance of check-in counters on a five level scale were developed: i) waiting time, ii) processing time, and iii) available space. Waiting and processing time were measured based on the number of minutes that passengers wait at check-in, while available space was evaluated based on the square meters provided per passenger. A separate LOS index for each of the three criteria is provided (i. e., waiting time, processing time, and available space). A combined index, which measures the overall LOS considering simultaneously the waiting time, processing time, and available space of check-in facilities, was developed.

The actual and perceived by arriving and departing passenger performance of a terminal was measured (22). The model was validated at the Chiang Kai-Shek International Airport. Passengers were asked to state their perceived waiting and processing time for either check-in (i. e., in case of departing passengers) or baggage claim facilities (i. e., in case of arriving passengers) and rate the quality of the assessed facilities. In addition, actual waiting and processing times at check-in and baggage claim facilities were video recorded. Applying the fuzzy concept, five-point scales assessing actual and perceived LOS based on objective and subjective time were developed. The analysis revealed that the perceived by passengers time is greater than the

actual time. For instance, passengers assign to check-in facilities a service level A when the actual waiting time is less than 4, 4 minutes, while the threshold for the perceived waiting time is 3, 4 minutes.

A similar type of research is reported (23). The research compares passenger perception of congestion level with the actual density. Data were collected from both departure and arrival passengers at Taipei international and domestic airports. Standards measuring service quality on a five-level scale based on the perception of available space for peak and non-peak periods were developed. The research provides comparisons of results for: i) the same facilities in the same airport at different periods (i. e., peak and off-peak), ii) different facilities at the same airport, and iii) similar and different facilities at both airports. It is concluded that passengers are less tolerable towards congestion in baggage claim than in check-in areas. Also, passengers travelling during peak hours might expect terminal congestions and, thus, have lower standards (i. e., greater crowding thresholds).

The performance of processing facilities (e. g., check-in, baggage claim, and security check) has been assessed through the Perception-Response (P-R) model (24-26). The model was applied at the Birmingham, Manchester, and East Midlands airports in the United Kingdom. The P-R model measures perceived service quality of waiting facilities based on the passenger perception of time spent in those facilities. A three-level scale measuring the perceived service quality as “ good”, “ tolerable”, or “ bad” based on perceived waiting time was developed.

Psychometrical scaling has been used to develop LOS scales for total service time, total walking time, orientation I, and orientation II (27). The first orientation index is measured as the ratio between actual and minimum walking distance, while the latter is measured as the difference in walking time between novices and experts, divided by the route length. Passengers were asked to evaluate the walking distance, orientation, and total service time. Also, data regarding the actual walking distance was collected. Level of service standards measuring the perceived performance of terminal according to total service time, total walking distance, orientation I, and orientation II were developed.

Developing Combined LOS Index

In the previous sections, methods and standards for assessing the LOS of individual airport passenger facilities were presented. However, besides assessing the performance of the individual facilities, it is useful for airport terminal planners and operators to be able to assess the overall performance of the entire terminal. Since the terminal consists of a series of facilities and their performance may be measured with different indicators, the assessment of the relative importance of the various indicators should be determined. Different methodologies have been used to determine the relative importance of the facilities affecting the passenger perception of the Level of Service offered by a terminal.

The models of this category aim at developing an index measuring the LOS of the entire terminal. Terminal quality as perceived by transfer passengers has been researched (28). Transfer passengers have quite different needs as

compared to departing and arriving passengers. For instance, transfer passengers do not utilize access network or check-in facilities. A survey conducted at the Bandaranaike International Airport in Sri Lanka asked transfer passengers to assess a number of facilities affecting the performance of the airport terminal. These facilities included: transit, rest rooms, restaurants and bars, duty free shops, security, other facilities, and overall airport. Factors influencing the perceived LOS are: quality of guidance/ signage/ directions, quality of audio information/ information staff, quality of Flight Information Displays, availability of seats in transfer area, availability of drinking water, and courtesy/ helpfulness of security staff. It was determined that the courtesy/helpfulness of security staff has the greatest influence on perceived service quality.

The factors influencing the quality of service of airport passenger terminals has been researched through a personal interview surveys with departing passengers at the Montreal International Airport (29). The findings of this study suggest that passengers assign different importance to factors depending on the type of airport facility under consideration. For circulation facilities provision of information was identified as the most important determinants of the quality of service. For waiting facilities seat availability received the highest ranking, while for the processing facilities waiting time, was identified as the most important factor. Here it is important to stress the fact that the service quality determinants differ among passenger groups i. e., passengers are grouped according to their purpose of trip, sex, and age.

Another study conducted at the same airport (29) identified six variables that exert the highest influence on airport passenger terminal performance (30): i) information, ii) waiting time, iii) convenience, iv) availability of seats, v) concessions, and vi) internal environment. On the basis of these six variables, the authors propose four indices to measure the performance of the terminal in terms of information provision, waiting time, availability of seats, and concessions. At the same time, it is recognized that specific surveys are required to identify preferences regarding convenience and internal environment. Although this research provides an approach for measuring the four quality indicators, it does not provide any interpretation or suggestions regarding the target levels.

The factors affecting the quality of airport passenger terminal operations have been identified using expert opinions (e. g., airport directors and consultants) (31). On the basis of this study, the following four factors were identified as influencing airport passenger terminal service quality: passenger service (i. e., food and beverage, rest-room facilities, retail and duty free, and special services), airport access (i. e., parking, rental car services, and ground transportation), airline-airport interface (i. e., gate boarding areas, baggage claim facilities, and information displays), intra-terminal transportation (i. e., this factor contains a single indicator).

The fuzzy multi-attribute decision making approach was used to develop a composite index for assessing the performance of airport passenger terminals (32). The six attributes assessing passenger terminals were: comfort, processing time, convenience, courtesy of staff, information

visibility, and security. Five travel experts took part in the survey rating the performance of 14 Asia-Pacific international airports. Through the fuzzy concept, an overall service performance index combining all performance dimensions was developed. This index was used to rank 14 airports in Asia-Pacific.

The overall performance of the passenger terminal of São Paulo International Airport was assessed using AHP (33). The AHP model was implemented using data from 100 randomly selected passengers. The following types of facilities and their attributes were used in this study: parking (courtesy, security, and availability of parking spots), departure hall (security, orientation, information, comfort, and services), check-in (processing and waiting time, and courtesy), departure lounge (courtesy and comfort), and concessions (courtesy and variety of stores. This study identified that the most important facility in determining terminal service quality is check-in, while concessions were identified as having the lowest importance. Facility attributes with the highest influence on perceived service quality include security, orientation, processing time, and comfort.

An index for determining overall terminal performance was developed in (34). Facilities included in the analysis were: enplaning curbside, ticket counter and baggage deposit, security screening, departure lounge, circulation areas, concessions, walking distance, and orientation. Passengers at the São Paulo International Airport were asked to evaluate the performance of each type of facility. The following facilities affecting terminal quality were identified: curbside, check-in, security screening, gate lounge,

orientation, and concessions. Through Regression Analysis, it was determined that curbside has the greatest impact on perceived service quality, followed by orientation, gate lounges, and check-in facilities.

The majority of the above reviewed studies consider as service quality constructs only factors controllable by the airport. It is suggested that along those factors, the service personnel affects the perception of terminal quality (35). Three dimensions of terminal quality are identified in (35): i) servicescape (i. e., objective factors, which are controllable by the service provider), ii) service personnel, and iii) services. Each dimension is explained by sub dimensions: servicescape (i. e., spatial layout and function, ambient conditions, and signs and symbols), service personnel (i. e., attitude, behaviours, and experience), and services (i. e., productivity, maintenance, and leisure).

Models assessing the perceived performance of airport passenger terminal provide useful input for : i) developing a combined index measuring the quality of service for the entire passenger terminal as opposed to individual facilities and services, and ii) incorporating the preferences of the terminal users in determining the level of service offered.

5. PASSENGER SATISFACTION SURVEYS

Satisfaction surveys provide information related to the measurement of the performance of airport terminals from a passenger perspective. Since passenger surveys are somehow standardized and performed at different

types of terminals, they provide the basis for a comperative performance assessing similar types of facilities.

Airports Council International (ACI) performs the Airport Service Quality (ASQ) survey, which measures the passenger satisfaction at airports (4). ASQ measures the performance of both terminal facilities and the entire terminal. The performance of the following five service areas is measured through 16 attributes. The attributes include: ground transportation to/from airport, availability of parking facilities, value for money of parking facilities, availability of baggage carts/trolleys, waiting time at check-in queue/line, efficiency of check-in staff, courtesy and helpfulness of check-in staff, waiting time at passport/personal ID inspection, courtesy and helpfulness of inspection staff, courtesy and helpfulness of security staff, thoroughness of security inspection, waiting time at security inspection, feeling of being safe and secure, ease of finding your way through the airport, flight information screens, and walking distance inside the terminal. ASQ can be used to rank airport terminals. A prioritization analysis identifies service areas, which require further improvements.

A survey assessing airport terminal performance and comparing performance among airports has been developed by (5). Over 655 airports participate in the survey. According to passenger satisfaction airports are ranked in five categories (i. e., from one to five star airports). Passenger satisfaction is measured based on 27 items divided into five categories: terminal comfort and amenities, security and immigration, shops, food, and beverages, getting around, and general items. Through the “ Passenger

Reviews and Traveller Reports” feature, SKYTRAX collects data related to passenger desires. Passengers are asked to evaluate online an airport and share their suggestions for further improvement. The company does not provide guidance as to how to satisfy passenger desires, however, lists suggestions for improvement for each participating airport.

A survey measuring passenger satisfaction has been developed in (6). Six factors assessed through 27 attributes are determined to affect terminal performance: airport accessibility, baggage claim, check-in/baggage check process, terminal facilities, security check, and food and retail services. A ranking of North American airports grouped by size (i. e., large, medium, and small) is presented (36).

Beside the presented organizations measuring passenger satisfaction, airports undertake their own initiatives for improving the air traveller experience. Airports analyse passenger comments aiming at identifying quality problems and taking actions to eliminate them. Analysing the collected data on annual basis supports airport management in the process of continuous performance improvement.

In conclusions, satisfaction surveys are performed at a large number of airports. The most widely applied technique is the survey developed by ACI (4). Over 100 airports take part in the ASQ survey conducting over 200. 000 passenger interviews yearly. The index not only measures overall passenger satisfaction, but also introduces a benchmarking tool, which provides a possibility to compare performance among a large pool of airports.

Satisfaction surveys support operations analysis and marketing decisions. In order to validate the models, subjective data is required. Surveys in this category evaluate overall terminal satisfaction from passenger perspective.

6. CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

A state-of-the-art and state-of-practice review of models assessing airport passenger terminal was presented. Relevant research was classified to three categories (i. e., terminal performance assessment based on objectively measured LOS, performance assessment based on perception, and passenger satisfaction surveys). Table 1 summarizes terminal evaluation models, their applications, and types of decisions supported.

The field of airport passenger terminal Level of Service performance assessment has evolved over time. Early approaches included only objective measures of individual facilities (e. g., check-in, baggage claim, and security screening) comprising the airport passenger terminal. These objective measurements (e. g., waiting time, processing time, and available space) are used in order to design and/or assess the Level of Service for a given terminal. Subsequent developments had led to the introduction of the point of view of passengers in determining the Level of Service. Another important development in the modelling of airport passenger terminal LOS assessment is the effort to assess not only individual facilities, but also to provide an index measuring the Level of Service for the entire terminal.

A conclusion emerging from this literature review is that there is a convergence on the types of facilities that should be used in assessing the

Level of Service and the Key Performance Indicators (KPIs) that should be used in order to assess them. The relative importance of the factors affecting the performance of different types of facilities varies according to the type of facility. Also, the perception of the LOS differs among the different types of passenger groups (e. g., frequent vs. less frequent flyers). Furthermore, it should be stressed that there is complementarity among the different approaches. More specifically, models developed for individual facilities can be used in conjunction to models assessing the relative importance of each facility in order to assess the Level of Service for the entire airport passenger terminal.

Due to the increasing importance of passenger perception in assessing the quality of service of airport passenger terminals, a need for models considering the overall passenger experience at the terminal is emerging. Future research for developing these models should: i) consider both tangible and intangible measures of performance (e. g., comfort of terminal and quality of information), as well as measures associated with the performance of the service personnel, ii) provide the capability of measuring both the relative importance of each service determinant and the degree of satisfaction perceived by the passengers in relation to the service provided to them, and iii) recognize the effect of passenger characteristics on the perceived quality of services. These models will provide useful support for making decisions that will improve the passenger experience at airport terminals and consequently will increase airport passenger terminal attractiveness.

TABLE 1 Airport Passenger Terminal Assessment Models

Terminal Assessment Model

Decisions Supported

Evaluation Approach

Model Scope

Evaluation Perspective

Type of Data

Related Work and Validation

Terminal LOS Performance Assessment Based on Standards

Terminal planning and design

Operations analysis

Terminal LOS Standard

Check-in

Waiting/circulation

Holdroom

Baggage claim

Pre-Primary Inspection Line

Airport operator

Objective

Transport Canada, 1979 (14)

Transport Research Board, 1987 (15)

FAA, 1988 (18)

IATA, 1995 (16)

IATA, 2004 (17)

Analytical Model

Terminal

Airport operator

Objective

SLAM (9)

ACRP Spreadsheet Models (10)

Simulation Mo