Operational performance indicators of Brazilian Airport Services, 2013-2016

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Abstract — Introduction: The main services provided at airports were converted into indicators by the International Airports Council (ACI) and measured at Brazilian airports since the FIFA World Cup 2014. Objective: to describe the operational quality of 15 Brazilian airports, according to passenger size and management model (public/private), in the 2013-2016 quadrennial. Methods: A total of 48 operational quality indicators in the airport services of 15 airports, measured on a Likert scale, were aggregated into ten intermediate indices and five total indices (tangibility, agility, reliability, assurance and empathy). In the 4 years under study, there were an average of 13,000 respondents each quarter in the year. Results: Among the ten Intermediate indices, Competence was the item best evaluated by the users (average of 4.42) and Costs was the worst (average of 2.61). Among the five total indices, Agility and Reliability were the best-evaluated (averages of 4.25 and 4.15, respectively), while Empathy was the worst evaluation (mean of 3.82). Conclusion: The linking of operational performance indexes to the administrative management model (public or private) in the period under study, pointed out the Curitiba International Airport, of public administration (average of 4.29), as the best rated in the opinion of the respondents/users. It received the best evaluations in the intermediate operational performance indices, as well as by sector of the airport.

Keywords — Aeronautical sector, Public administration, Quality indicators, User satisfaction.

I. INTRODUCTION

Studies on the quality of services at airports are recent, with a greater range since the decade of the 2000s. Exemplary are the studies that presented the perception-response method, through graphics constructed from the opinion of passengers about the service level of some airports in England [1]; the review of common performance measurement practices at airports [2]; the dimensions of service quality involving three primary dimensions – service scape, service personnel and services [3]; and the identification of critical airline performance factors, exploring the differences and expectations between two airports located in very different locations, England and Taiwan [4].

Brazil also took part in this process, with a study addressing passengers' perceptions of five items (company store, check-in, connection services, boarding and disembarking) [5]; the most relevant factors for the provision of air transport services to passengers, in qualitative, figurative and functional scope [6]; a performance comparison of 61 Brazilian national and international airports [7]; the efficiency of 138 airports in various parts of the world in 2005 [8] and 26 international airports [9,10].

However, there is not much research in the national literature that addresses the theme of airport efficiency. This is mainly due to the difficulty in obtaining reliable and standardized data until the year 2011, when the National Civil Aviation Agency (ANAC) started to prepare and disclose the Annual Report of Operational Performance of Brazilian Airports.

Until 2011, the airport administration model in Brazil was concentrated in the public sphere, through the Brazilian Airport Infrastructure Company (INFRAERO), which operated in passenger and cargo transportation. This year, concessions began in Brazil through the international airport of Natal (RN); in 2012 it was the turn of the international airports of Guarulhos (SP), Campinas (SP) and Brasília (DF). In 2013, from Galeão (RJ) and Confins (MG). The last round of airport concessions included Porto Alegre (RS), Salvador (BA), Florianópolis (SC) and Fortaleza (CE).

All airports were in critical situations [11], were located in host cities for the 2014 FIFA World Cup and should meet the requirements of the Federation of International Football Associations (FIFA), that is, international standards of quality of airport services, due to the great events that Brazil would host - Federations Cup (2013), Soccer World Cup (2014) and Olympics (2016).

In this context, the objective of this study is to describe the operational quality of 15 Brazilian airports, according to the size of passengers and management model (public/private), in the 2013-2016 quadrennium.

II. METHODS

The method employed involved collecting data on Brazilian airports at the Brazilian Civil Aviation Secretariat; in the quarterly general reports of the airport's operational performance indicators; and in the airport operational performance reports, available on the official website of the National Civil Aviation Agency (ANAC) and the Brazilian Airport Infrastructure Company (INFRAERO).

Secondary data from this study were taken from a quarterly survey conducted by the Technical Committee for Operational Performance of the Civil Aviation Secretariat of the Presidency of the Republic. These surveys had as a goal the evaluation of performance indicators in airport operations and actions aimed at improving the provision of airport services to passengers and their satisfaction.

Data collection took place through the application of a standard questionnaire covering 48 performance indicators and was carried out from 2013 to 2016, at the 15 airports under study. One company was hired to apply the instruments at the airports, with a target of applying 13,000 questionnaires per quarter. The passengers interviewed evaluated the indicators by assigning values from 1 to 5 for each of them, with 1 being the lowest possible score (= totally dissatisfied) and 5 the highest (= totally satisfied).

A total of 15 airports were studied, subdivided by category of number of passengers into:

a) Category I, up to 5 million passengers/year (3 airports): International Airports of Cuiabá (MT), Manaus (AM), and Natal (RN).

b) Category II, from 5 to 15 million passengers/year (8 airports): International Airports of Fortaleza (CE), Salvador (BA), Recife (PE), Confins (MG), Campinas (SP), Rio de Janeiro (Santos Dumont - RJ), Curitiba (PR) and Porto Alegre (RS).

c) Category III, more than 15 million passengers/year (4 airports): International Airports of Brasília (DF), Rio de Janeiro (Galeão - RJ) and Guarulhos (SP), in addition to Congonhas Airport - São Paulo (SP).

As for each of the 48 performance indicators, there would be four quarterly results per year, for the four-year period, it was decided to present the data based on the total for the four-year period and a reconfiguration of the 48 performance indicators respecting the ten dimensions of quality proposed by Parasuraman, Berry and Zeithaml [12]. The ten dimensions are: Tangibility (quality and/or appearance of any physical evidence of the service); Reliability (consistency in service performance as well as its consistency); Responsibility (willingness to help the customer and promptly provide a service); Competence (skills and knowledge needed by the employees involved); Courtesy (good manners, respect, consideration and friendly contact of employees involved in providing the service); Credibility (trust, credit, honesty and involvement with the client's interests); Safety (service free from dangers, doubts or risks); Access (ease of approach and contact); Communication (ease of interaction between service provider and customer); and, Knowledge of the user/customer (effort to understand the customer's needs clearly and thus be able to satisfy them) [13].

In a second step, there was a reclassification of the ten intermediate indices, generating five performance indices (Tangibility, Reliability, Agility, Assurance and Empathy) – Table 1.

The data values of the 48 user satisfaction performance indicators obtained in the four evaluations/year were inserted in an electronic spreadsheet, using descriptive statistics in the management of the data (mean and frequency).

Finally, a comment: there was no similar study or approach using the same indicators, since each country adapts them to its socio-cultural reality; which greatly limited the discussion of the data found.

Table 1 - Configuration of the indices according to the five and ten dimensions of quality and the 48 indicators of airport operational performance

Dimensions (5)	Dimensions (10)	Airport Performance Indicators
Tangibility	Tangibility	Availability of luggage trolleys
		Outlet availability
		Availability of toilets
		Cleaning the toilets
		Availability of seats in the departure lounge
		General airport cleaning
		Comfort in the departure lounge
		Airport thermal comfort
		Airport acoustic comfort
		Vehicle parking facilities
		Quantity and quality of snack bars / restaurants
		Availability of banks / ATMs / exchange offices
		Quantity and quality of commercial establishments
		Quality VIP Lounge
		Overall passenger satisfaction
Reliability	Reliability	Flight information panels
		Information on baggage claim converyors
	Responsibility (Flexibility)	Ease of making connections
Agility	Ability	Check-in staff efficiency
	Courtesy (Service or Atmosphere)	Friendliness of the security inspection staff
		Friendliness of airport staff
		Friendliness of cafeteria / restaurant staff
		Friendliness of the check-in staff
		Friendliness of trade officials
		Friendliness of emigration officials
		Friendliness of immigration officials
		Friendliness of customs officials
Assurance	Credibility	Internet quality / *Wi-Fi*
	Safety	Security inspection rigor
		Feeling of protection and security
		Baggage integrity
Empathy	Access	Curb availability
		Ease of finding your way at the airport
		Walking distance at the passenger terminal

		Public transportation
		Taxi availability
	Communication (Service Speed)	Security inspection queue time
		Queue time at cafeterias / restaurants
		Queue time at commercial establishments
		Queue time at check-in (self-service)
		Queue time at check-in (ticket window)
		Speed of baggage claim
		Emigration queue time
		Immigration queuing time
		Customs queue time
	User Knowledge (Costs)	Parking cost
		Value of snack bar / restaurant products
		Value of commercial products

III.   RESULTS AND DISCUSSION

Table 2 lists the average and total of each of the ten intermediate indexes of operational quality, by airport under study.

Table 2 - Ten intermediate operational performance indexes according to the 15 airports under study - average for the 2013-2016 period.

Airports	Tangibility	Reliability	Responsability	Ability	Courtesy	Credibility	Safety	Acess	Communication	Costs	Mean
Cuiabá	3.28	3.99	3.91	4.37	3.92	2.22	3.90	3.72	3.81	2.39	3.55
Manaus	3.75	4.01	3.90	4.00	3.96	3.35	4.02	3.81	3.89	3.05	3.77
Natal	3.91	4.38	4.54	4.65	4.14	3.02	4.47	4.47	4.07	2.66	4.03
Campinas	4.03	4.35	4.24	4.57	4.40	3.17	4.32	4.2	4.21	2.83	4.03
Confins	3.78	4.05	4.09	4.5	4.32	3.22	4.21	4.05	4.09	2.6	3.89
Curitiba	4.16	4.60	4.41	4.63	4.54	2.54	4.52	4.43	4.43	2.94	4.12
Fortaleza	4.01	4.14	3.93	4.28	4.23	3.33	4.10	4.02	4.08	2.69	3.88
Porto Alegre	3.99	4.23	4.12	4.51	4.26	3.00	4.20	4.15	4.17	2.83	3.95
Recife	4.07	4.26	4.14	4.41	4.26	2.95	4.27	4.18	4.17	2.68	3.94
Santos Dumont	3.94	4.31	4.29	4.48	4.24	3.19	4.37	4.05	4.21	2.50	3.96
Salvador	3.65	4.10	4.17	4.40	4.25	2.72	4.03	3.88	4.02	2.71	3.79
Brasília	3.80	4.28	4.23	4.58	4.31	3.76	4.13	3.68	4.19	2.07	3.90
Guarulhos	3.77	4.03	3.79	4.05	3.99	2.94	3.93	3.74	3.84	2.47	3.66
Galeão	3.81	4.01	4.05	4.25	4.14	3.28	4.14	3.98	4.00	2.67	3.83
Congonhas	3.99	4.14	4.16	4.60	4.36	2.53	4.25	3.93	4.12	2.03	3.81
Mean	3.86	4.19	4.13	4.42	4.22	3.01	4.19	4.02	4.09	2.61	

Among the ten intermediate indices of operational performance, Competence had the highest total average (4.42), followed by the Courtesy (4.22) and Reliability (4.19) indices, all at the "partially satisfactory (good)" level. Costs (2.61) and Credibility (3.01) were the two indexes with the worst averages among all airports.

The average of the ten intermediate indexes of operational performance indicated Curitiba as the best rated airport by users in the period, with an average of 4.12 (partially satisfactory). Cuiabá, at the other end of the ranking, had the lowest average (3.55), considered as regular/indifferent by passengers who responded to the data collection instrument.

Considering the ten intermediate operational performance indexes (Table 1), Natal International Airport (privately managed) was the best rated in category I,

Curitiba International Airport (public management) in category II and Brasília International Airport (private management) in category III.

Table 3 shows the averages for each of the five operational performance indexes, systematized by the 15 airports under study. This new systematization, with the transformation of ten intermediate indexes into five, brought a positive increase in the averages, in four of the five indexes. The exception was Tangibility, which remained unchanged (3.86).

Table 3 - Quadrennial average (2013/16) for each of the five operational performance indexes, systematized by the 15 airports under study.

Airports	Tangibility	Reliability	Agility	Assurance	Empathy	Mean
Cuiabá	3.28	3.96	3.99	3.48	3.48	3.64
Manaus	3.75	3.97	3.96	3.85	3.72	3.85
Natal	3.91	4.43	4.20	4.11	3.94	4.12
Campinas	4.03	4.29	4.42	4.03	3.97	4.15
Confins	3.78	4.06	4.34	3.96	3.81	3.99
Curitiba	4.16	4.54	4.55	4.03	4.16	4.29
Fortaleza	4.01	4.07	4.23	3.90	3.82	4.01
Porto Alegre	3.99	4.19	4.29	3.92	3.93	4.06
Recife	4.07	4.00	4.28	3.94	3.91	4.04
Santos Dumont	3.94	4.30	4.28	4.07	3.79	4.08
Salvador	3.65	4.13	4.27	3.70	3.75	3.90
Brasília	3.80	4.26	4.34	4.04	4.04	4.10
Guarulhos	3.77	3.95	4.00	3.68	3.57	3.79
Galeão	3.81	4.02	4.16	3.93	3.76	3.94
Congonhas	3.99	4.15	4.40	3.82	3.60	3.99
Mean	3.86	4.15	4.25	3.90	3.82	

Agility and Reliability presented the best averages among the operational performance indexes, being partially satisfactory (4.25 and 4.15, respectively). Of regular/indifferent evaluation, at the upper limit of this evaluation level, are the other three indices: Assurance (3.90), Tangibility (3.86) and Empathy (3.82). Empathy got the lowest score when evaluated by users of airport services in the 15 Brazilian airports mentioned in the period from 2013 to 2016, demonstrating the lack of care in offering individualized attention to users in the provision of airport services. The Agility index, which is responsiveness, willingness to help the user and provide a

service with quick response and promptness, was the best rated in providing airport services to users among the five indexes studied [14].

Curitiba continued as the best rated airport (4.29), followed by Campinas (4.15) and Natal (4.12), now ranked second and third. On the opposite, Cuiabá remained the worst rated airport by users (3.64), followed by Guarulhos/SP (3.79). For Graham [14], the results obtained are part of a process of privatization that has affected the world airline sector in the last decades, manifested in airport infrastructures in three different ways (commercialization, privatization and property diversity),

thus consolidating the concession and the privatization of airports. Something verified at least in the results obtained from the airports of Natal and Brasília (Categories I and III, respectively). Curitiba Airport (Category II) deserves a special mention for having the best average rating of the five general indices and the ten intermediate performance indices among the 15 airports studied.

Table 4 shows the public and private airports of categories I, II, III according to the sectors of airport services and performance indexes in the period 2013-2016.

Table 4 - Public and Private Management Airports by performance indexes in the different sectors, 2013-2016 period.

	Tangibility			Confiabilidade		Agility				Assurance		Empathy				
	Airp.	Comercial Airport	SGA	Airp.	Air lines	Airp.	Air lines	Comercial Airport	Public agencies	Airp.	Air lines	Transp.	Airp.	Air lines	Public Agencies	Comercial Airport
Cuiabá	3.50	2.85	3.43	3.99	3.91	4.04	4.38	3.55	*	3.38	3.77	3.72	3.85	3.92	*	2.81
Manaus	3.90	3.51	3.90	4.01	3.90	4.08	4.06	3.61	4.06	3.84	3.90	3.74	3.93	4.01	4.00	3.21
Natal	4.34	3.08	4.22	4.38	4.54	4.65	4.67	3.51	4.05	4.06	4.26	4.34	4.58	4.47	3.95	2.94
Campinas	4.21	3.67	4.22	4.35	4.24	4.49	4.60	4.02	4.51	3.98	4.18	4.16	4.29	4.28	4.33	3.22
Curitiba	4.32	3.84	4.36	4.60	4.41	4.64	4.66	4.26	4.60	3.92	4.35	4.54	4.43	4.47	4.41	3.47
Fortaleza	4.09	3.83	4.17	4.14	3.93	4.14	4.31	4.14	4.30	3.85	4.07	3.77	4.15	4.18	4.08	3.21
Porto Alegre	4.15	3.68	4.11	4.23	4.12	4.27	4.55	4.05	4.29	3.89	3.95	4.10	4.25	4.17	4.22	3.29
Recife	4.14	3.91	4.27	4.26	4.14	4.41	4.48	4.05	4.21	3.88	4.12	4.11	4.27	4.19	4.23	3.17
S. Dumont	4.10	3.61	4.08	4.31	4.29	4.41	4.50	3.94	*	3.98	4.35	3.79	4.30	4.47	*	2.97
Salvador	3.84	3.30	3.80	4.10	4.17	4.34	4.43	3.90	4.36	3.71	3.38	3.62	4.08	3.99	4.17	3.13
Brasília	3.97	3.47	3.98	4.28	4.23	4.20	4.64	4.04	4.44	4.09	3.89	3.61	3.93	4.13	4.36	2.78
Guarulhos	3.85	3.58	3.91	4.03	3.79	4.05	4.10	3.61	4.15	3.65	3.79	3.74	3.87	3.84	3.94	2.89
Congonhas	4.11	3.76	4.08	4.14	4.16	4.39	4.53	4.27	*	3.74	4.05	3.57	4.27	4.18	*	2.74

Obs.: Airp.= Airport; SGA = General Airport Satisfaction;; Transp. = Transport.

At the National Airports of Cuiaba, Santos Dumont (RJ) and Congonhas (SP) are not counting government agencies.

In category I, Natal International Airport (under private management) was best rated in 11 sectors out of the 16 addressed, especially in the four sectors involving airport, general airport satisfaction, airlines and transport. In category II, Curitiba International Airport (under public management) obtained the best evaluations in 14 performance indexes by sectors.

At category III airports, Congonhas Airport does not include Agility and Empathy performance indices in the item "public agencies", with a total of 14 operational performance indices remaining. In these, Congonhas presented the best averages attributed in 8, losing in the Reliability (airport and airlines), Agility (airport) and Assurance (airport) indices for Brasília airport; and for the only two indexes that Guarulhos airport obtained the best averages: Empathy in the commercial airport (2.89) and transport (3.74) sectors. Two components of the Agility index (airport and airlines) and one of the components of the Reliability index (airport) received values above 4 (partially satisfactory) for all airports in this category. The indexes that had the worst evaluations in category III were Empathy (commercial airport) with partially unsatisfactory evaluation, and regular/indifferent in Tangibility (commercial airport) and Empathy (transport).

As for the lowest overall indexes in the airport sectors, the Empathy of the commercial airport constantly presented the lowest performance evaluations, due to the costs of services not meeting the needs of users and due to the lack of ease of interaction between the service provider and the user/client [13].

IV. CONCLUSION

Among the ten intermediate indices, in the quadrennium from 2013 to 2016, Competence presented the best evaluation (average of 4.42), while Costs was the worst evaluated (average of 2.61). Bearing in mind that Costs (intermediate index of Empathy) portray the user's knowledge through the effort to understand their needs

clearly, thus being able to satisfy them - in this case, users understood that they are not satisfying their needs.

As for the five performance indices, Agility was first (average of 4.25) and Empathy was last (average of 3.82), reaffirming the same situation identified in the ten intermediate indices. Recalling that Agility is the ability to respond, willingness to help the user and provide a service with quick response and promptness; and Empathy are the care in offering individualized attention to users in the provision of airport services.

The linking of operational performance indexes to the administrative management model (public or private) in the 2013/16 four-year period, pointed to Curitiba International Airport, of public administration (average of 4.29), as the best rated in the opinion of the respondents/users among all 15 airports studied, receiving the best evaluations in the intermediate operational performance indices, as well as by sector of the airport. The third best-rated airport belongs to category I, Natal International Airport, the first to be privatized (average of 4.12), also received the best evaluations in the intermediate performance indices, as well as by sector of the airport in its category. In category III, of the airports with annual movement above 15 million pax/year, the Brasilia International Airport, of private administration, obtained the best scores in relation to the performance indexes (average of 4.10). But not in terms of sectors, when the publicly managed Congonhas National Airport received the best scores.

REFERENCES

[1] Mumayiz SA, Ashford NJ. Methodology for planning and operations management of airport terminal facilities. Transportation Research Record 1094, TRB, National Research Council, Washington DC, 1986, p. 24-35.

[2] Humphreys I, Francis G, Fry J. Performance measurement in airports: a critical international comparison. Public Works Management and Policy 2002; 6(4): 264-275.

[3] Fodness D, Murray B. Passengers' expectations of airport service quality. Journal of Services Marketing 2007; 21(7): 492-506.

[4] Chau VS, Kao Y-Y. Bridge over troubled water or long and winding road? gap-5 in airline service quality performance measures. Managing Service Quality 2009; 19(1): 106-134.

[5] Spoljaric EA. Qualidade nos serviços de terminais de passageiros em aeroportos. Dissertação (Mestrado). Instituto Técnico da Aeronáutica, São José dos Campos, 1998.

[6] Costa DGM, Borrás MAA, Fontes ARM, Silva JEAR. Avaliação da qualidade da infraestrutura e serviços em aeroportos do estado de São Paulo, Brasil. Revista Iberoamericana de Engenharia Industrial 2013; 5(9): 89-112.

[7] Kabbach-Castro LR. Productivity measurement of airports in Brazil: an application of DEA approach and Malmquist Index decomposition. São Paulo: Universidade de São Paulo, 2008.

[8] Souza ALL. Análise comparativa do desempenho a nível mundial utilizando conceito DEA. Rio de Janeiro: Universidade Federal do Rio de Janeiro, 2010.

[9] Almeida MR, Mariano EB, Rebelatto DAN. Análise de eficiência dos aeroportos brasileiros. Revista Produção Online 2007; 7:1-17.

[10] Périco AE, Santana NB, Capelato E. Eficiência financeira dos aeroportos brasileiros: uma análise envoltória de dados. Gestão da Produção, Operações e Sistemas 2015; 10(3): 83-96.

[11] IPEA - Instituto de Pesquisa Econômica Aplicada. Panorama e Perspectivas para o transporte aéreo no Brasil e no Mundo. Brasília: IPEA, 2010 (Série eixos do desenvolvimento, n. 54).

[12] Parasuraman A, Berry LL, Zeithaml VA. A conceptual model of service quality and its implications for future research. Journal of Marketing 1985; 49(4): 41-50.

[13] Parasuraman A, Zeithaml VA, Berry LL. Servqual - a multiple-item scale for measuring consumer perceptions of service quality. Journal of Retailing 1988; 64(1): 12-40.

[14] Graham A. Managing airports: a international perspective. 4 ed. London: Routledge, 2014.