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Artículo

Evaluation of Ground Handling Services in an International Airport

Evaluación del nivel de servicios de *handling* aeroportuario en una terminal aérea internacional

Gretell Hartman Romero[1]* https://orcid.org/ 0000-0002-0212-9807
Sonia Caridad Ruiz Quesada[2] https://orcid.org/0000-0001-6251-6457
Elena Saumell Fonseca[1] https://orcid.org/0000-0001-7931-1853

[1]Faculty of Economic and Entrepreneurial Sciences, University of Oriente, Cuba
[2]Commission for Scientific Degrees, University of Oriente, Cuba

*Corresponding author: gretell.hartman@nauta.cu

ABSTRACT

Aim: To evaluate the level of ground handling services at *Antonio Maceo Grajales* International Airport, and to propose improvement actions.

Methods: Econometric techniques (exponential smoothing) to estimate the demand of these services; the Fischer survey for internal customers, and servqual questionnaire for external customers. The quantitative analysis consisted in calculating airport capacities, and their relation to demands, whereas qualitative analysis focused on assessment of services to internal and external customers.

Results: A procedure to make quantitative and qualitative evaluations of the level of airport handling services was designed. It helped identify the main problems of this service, and to recommend improvement actions to optimize the decision-making process.

Conclusions: The entity was in possession of a theoretical and practical tool that helped detect, among others, the existence of infrastructure sub-utilization and excess in

capacities compared to the demand. The action plan is directed to increasing customer satisfaction.
Key words: airport capacities; airport handling; service level.

RESUMEN

Objetivo: Evaluar el nivel de servicios de *handling* aeroportuario en el Aeropuerto Internacional *Antonio Maceo Grajales* de Santiago de Cuba, Cuba y proponer acciones de mejoramiento.

Métodos: Técnicas econométricas (alisamiento exponencial) para la estimación de la demanda de estos servicios; la encuesta de Fisher para clientes internos y el cuestionario SERVQUAL para clientes externos. El análisis cuantitativo consistió en el cálculo de las capacidades aeroportuarias y su relación con la demanda; mientras que el cualitativo se fundamentó con la valoración de los clientes internos y externos respecto a los servicios.

Resultados: Para el cumplimiento del objetivo propuesto se diseñó un procedimiento que evalúa cualitativa y cuantitativamente el nivel de servicios de *handling* aeroportuario. Así fue posible identificar los problemas fundamentales respecto a la prestación de estos servicios y proponer acciones de mejora con el fin de contribuir al perfeccionamiento del proceso de toma de decisiones.

Conclusiones: Se dotó a la entidad de una herramienta teórico práctica con la cual se detectó, entre otros aspectos, subutilización de la infraestructura y exceso de capacidad respecto a la demanda. El plan de acciones está dirigido a elevar la satisfacción de los clientes.
Palabras clave: capacidades aeroportuarias; *handling* aeroportuario; nivel de servicio.

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INTRODUCTION

The evaluation of service levels is an important currently ongoing issue for organizations, due to their close relationship with the determination of capacities, service quality, and customer satisfaction. In air transportation, this analysis requires higher relevance due to the growing demand of airport services worldwide. Several tools have been used for calculation and evaluation of the level of services applied in several airport areas, operations, and services. Most of them are characterized by a high level of complexity.

This research was done at Antonio Maceo Grajales International Airport (AMG IA) that belongs to Aeropuerto Santiago de Cuba Basic Unit (UEB), Cuban Company of Airport and Airport Services (ECASA, Ltd). At the airport, there are several conditions that have a negative effect on the volume of airport operations, services, decision-making, and company performance, which are summarized as follows: growing level of operations, still.

lower than other Cuban international airports, and under the real airport capacities; poor use of airport operating hours and airport infrastructure, and absence of tools (procedures, methodologies, or models) for calculation and evaluation of airport service levels. Accordingly, a study was conducted to evaluate the level of airport handling services at AMG IA, in Santiago de Cuba province, which contributed to better decision-making in this facility.

DEVELOPMENT

Nowadays, companies are not trained to produce and sell, but to manufacture based on customer demands. Hence, the production capacity (maximum level of activity that can be reached by a productive or service structure), must adapt to the condition of satisfying customer needs, and those of the company's, simultaneously.

There are different measures of productive capacity, as well as associated concepts that permit to analyze whether an organization can satisfy the demand. The design capacity is the maximum theoretical production that an organization can reach, which is also known as desired capacity; whereas the real or effective capacity is the real quantity of production or services made in a particular period. The utilization of the capacity

suggests how much of the design capacity is being used in the company, and efficiency refers to how the productive resources are being used to meet the needs of the organization. Often, the effective capacity is lower than the design capacity.

In airport activities, the service level focuses on the quality of the system from a customer's perspective. Consequently, the service level measures the operational conditions of a particular airport system, and its perception by customers. The term airport capacity is closely related to the above idea; it can be understood as the levels of services provided by an airport per time unit (hours, days, or years).

Upon bibliographic review (Arca, 2009; Chávez, 2016; Ramírez, 2018; Roldán, 2017), various models linked to the calculation of capacities or the level of services in airports were analyzed. They offer experiences and practical results in several areas, operations, and services. Among the models reviewed, the following stand out: ATC sector capacity model used in Brazil; runway capacity calculation models in Brazilian and Colombian airports; and the model used by the *Federal Aviation Administration* (FAA), to calculate the theoretical apron capacity, and models for the determination of airport service levels supplied to passengers. It was concluded that the main limitations of these models within the object of study lie in the high level of complexity and technicalities; they require high knowledge of airport activities, operations, services, and particularities for application.

The procedure suggested allows for calculation and evaluation of airport handling service levels[1] qualitatively, by calculating airport capacities to provide these services, and their relationship with demand. On the other hand, a qualitative analysis is performed by measuring quality, external customer satisfaction, and staff opinions regarding ground support services.

Agustí (2013, p. 11) defines airport handling as "(...) the set of airport activities and services, whose end is to load and unload airplanes efficiently". This concept only refers to ramp handling, as it explicitly acknowledges airplanes as the final client, overlooking that the purpose of these services is far-reaching, since passengers are also final clients of airport handling.

A more comprehensive definition was provided by Mariano Domingo Calvo, in *Descubrir el handling aeroportuario* (2005) (Discovering Airport Handling), cited by Agustí (2013):

> Handling is the rendering of a particular set of airport services to airplanes, passengers, baggage, and merchandise, which are necessary for exchanges in the transfer from air to ground transportation or vice-versa, or from air to air transport. (p.11)

Procedure proposal for evaluation of airport handling services

Objective: To conduct qualitative and quantitative evaluation of airport handling services in a particular airport, in order to improve company decision-making.

Scope: It is applicable to the particular airport chosen for the study, and others with similar conditions and context.

Premises and assumptions for the design and implementation of the procedure

The above mentioned theoretical referents were used for the design. The application requires basic knowledge, by the implementer, of ramp and passenger handling services, their procedures, required infrastructure, and internationally established standards and regulations of airport security. The period necessary for application of the procedure designed, and the results, varies depending on the characteristics of the airport, infrastructure, current state of ground support services, and feedback between phases and stages of the procedure.

Description of the procedure

The procedure suggested for evaluation of the level of airport handling services comprises 4 stages: I. Preliminary, II. Analysis of airport demand-capacity balance for handling services, III. Evaluation of airport handling service levels, and IV. Continuous improvement. Each phase is developed through three stages and steps, which will be explained, and duly broken down in the validation. Fig. 1 shows the scheme of the procedure suggested.

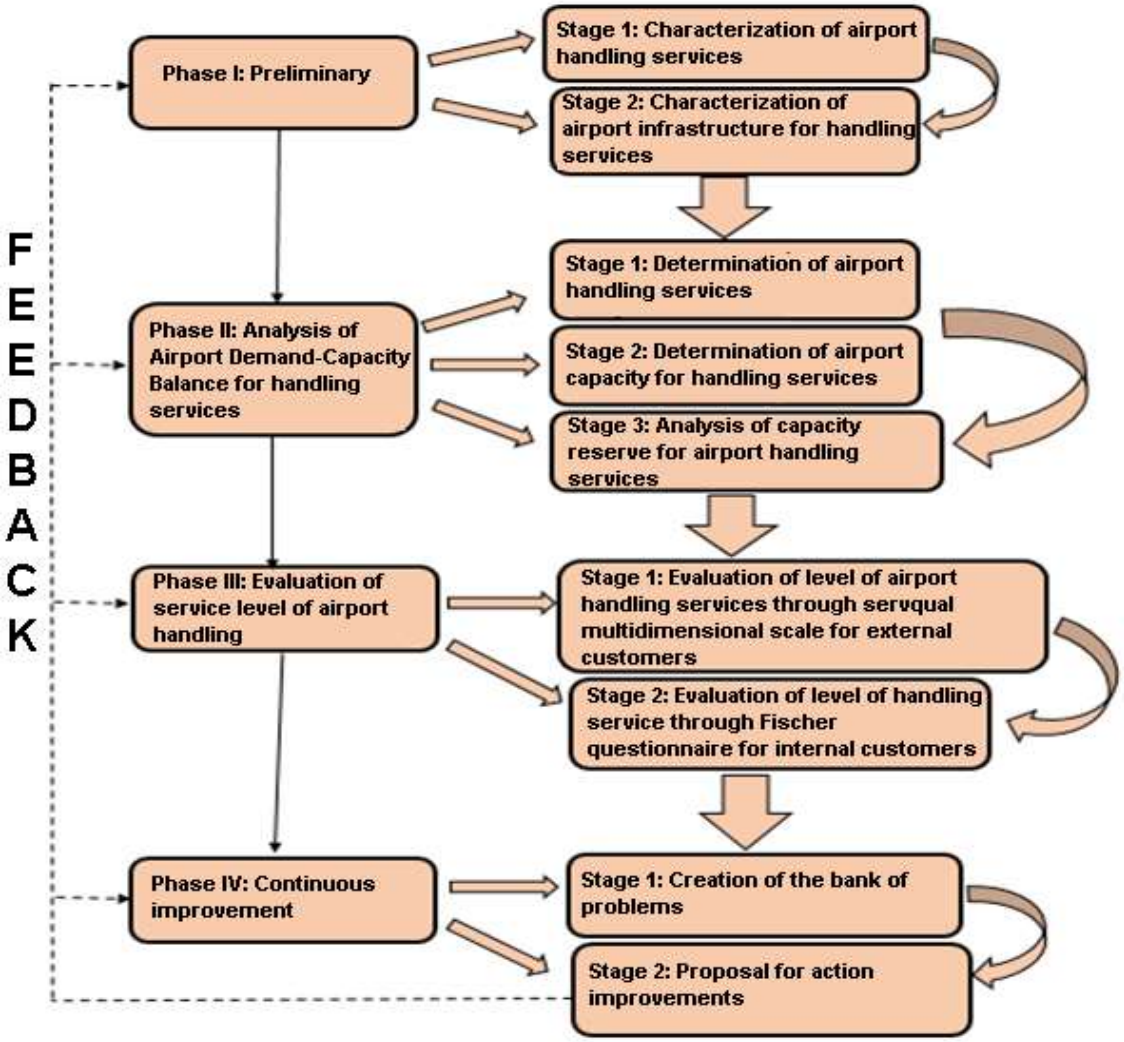

Fig. 1: Procedure scheme for evaluation of airport handling service

Results of the validation of the procedure at the airport chosen

The procedure for evaluation of airport handling services was implemented at AMG IA, UEB Aeropuerto Santiago de Cuba, Oriente Sur Airport Zone, since it is the only airport classified as a 2nd category international airport within the three airports in this category, and the largest, in terms of physical, air, and infrastructure spaces. Besides, it has the widest range of operations and services.

Phase I. Preliminary

Stage I. Characterization of airport handling services

Airport handling services to airplanes and passengers are coordinated and provided by the Ground Operations Unit of AMG IA, which runs three departments: Passenger Services, Operations, and Flight Line.

AIRPLANE GROUND SUPPORT SERVICES

1. Airplane loading. Service related to manipulation and distribution of loads and baggage into airplanes.
2. Airplane unloading. It will be performed according to the type of compartment in which baggage and merchandise are placed; the cargo will be placed starting at the front and toward the back part, and unloading will be done inversely.
3. Cleaning. Overall type A cleaning in the interior of airplanes; type B cleaning is done at the end of the day.
4. Drinking water supply to airplanes. Included as part of cleaning. The application field comprises some departments: Special Equipment and Flight lines of Handling Units, ECASA, Ltd, Airport UEB.
5. Collection of residual water. Service related to cleaning, including draining, and chemically treated water to airplanes.
6. Technical services to grounded airplanes. These are performed and controlled depending on operational notice of the day, the special equipment available, and material and human resources required for each activity. The technical services consist in checking and applying technical norms, and procedures that guarantee navigable air space of the airplane at all times, as well aeronautical safety. These are performed by skilled, certified personnel, with an active license to operate any particular airplane.
7. *Catering*. Cubacatering Ltd, offers air catering and gastronomic services to passengers, crew members, and companions.
8. Fuel servicing. AMG IA includes a fuel unit; whose driver-operators of special equipment are in charge of this service. The facility only offers Jet-A-1 turbo fuel for airplanes.
9. Power supply. The operators of special equipment energize the airplane with self-driven or towed equipment, using 208 Vol/400Hz, so the stationed airplanes can operate the electric equipment on board, provided that its generators are not working.

Not all the airplanes receive the totality of airport handling services as described; it will depend on the contract signed with ECASA Ltd., and service requests upon landing.

PASSENGER SUPPORT SERVICES ON GROUND.

1. Ticket sales. Sales comply with internationally set standards.
2. Safety filters. It consists in checking carry-on baggage through metal detectors and X-rays, ensuring that no dangerous material or object is transported.
3. Assistance to handicapped passengers. This is done by AVSPCI handling personnel (salespeople, passenger services, and international air cargo), who know the ways to proceed in each case.
4. Boarding/unboarding. AVSPCI personnel is in charge of checking passenger tickets, and direct them to the loading/unloading area. When the airplane is ready for boarding, the gate personnel makes the necessary calls over loudspeakers. The servicing time may vary depending on the boarding policies by the particular airline, and the type of passengers. Lastly, when all the passengers are on board, the gate personnel prints passenger lists and delivers them to the onboard personnel.
5. Further assistance. These services include printing new board passes at the air side, and information concerning the status of flights, and location of boarding gates. The Lost and Found offices are located at the baggage claim area.

Stage 2: Characterization of airport *infrastructure for handling services*

1. Runway. The airport has two runways made of asphalt concrete. Runway 10-28, 4 002 m long, with turning areas on both ends covering 100 x 70 m of hydraulic concrete floor. It features all the signals established for the category and reference number of the airfield, which are in good shape, and under programed maintenance. Runway 01-19, 1 800 m long, turning areas on the ends of hydraulic concrete floor. It is currently closed, under repair.
2. Airport apron. It has two main sections, the one in front of the terminal building is long, narrow (80 x 100 m), which makes operations difficult when several airplanes are grounded; it features a centralized airplane ignition system. The other is roughly squared (100 X 100 m), far from the building; it requires transportation for passengers. Although

it is not operational, it can have centralized fuel supply and ignition systems. The total surface of the apron is 18 000 m^2, and includes four 16 m high lighting towers. It features 8 positions for stationing, each corresponding to a single plane of these categories: 4 large airplanes, 1 mid-sized plane, and 3 small planes, which can park alternately.

3. Terminal building or terminal area. The terminal serves national and international passengers, with a total surface of 6 400 m^2, and 308.8 m^2 exit portal. There are 5 boarding gates, two in the national lounge, and three in the international lounge, apart from three gates for last-minute passengers (LMP): two in the international lounge, one in the national lounge. The national LMP area is 300 m^2, with a 200-passenger capacity, whereas the LMP lounge is 828 m^2, with up to 300-passenger capacity.

The exit VIP lounge is 67.2 m^2, whereas the entry VIP lounge has an A lounge (for nationals who request it), and a B lounge (international passengers), of 72 m^2 each. Lounge C is 20 m^2, and a smoking area of 30.5 m^2; this area is additional to the VIP lounge, and is not included in the total number of passengers admitted (45-50) in the VIP lounge.

The terminal building has 10 checking counters: 5 for national passengers, and 5 for international travelers. The waiting area at the ticket sales area —not including the counter area, belts, circulation areas, commercial and ticket sales areas— is approximately 235.68 m^2 for national, and 255 m^2 for international passengers. The baggage claim area (not including the baggage carousels, balances, retention or confiscation, etc.) is 48 m^2 for national flights (200 passengers), and 531 m^2 (300 passengers) for international flights.

The airport covers 2 222.55 m^2 for commercial use in the form of leased spaces. Public car parking covers 1 948 m^2 with a total 120 spaces (4 buses, 68 taxis, 48 cars). The current area is insufficient, though there is more land for extension works.

4. Special and technological equipment. The handling services to airplanes and passengers have two conveyor belts for baggage, checking machines, container carriages, baggage carriages, towing tractors, conveyor belts, ladders, airplane towing tractors, residual water deposits, drinking water deposits, fuel truck, elevator catering truck, elevators, and passenger transportation vehicles with restricted mobility, airplane

stabilizing support, walk-through metal detectors, and X ray equipment for carry-on baggage.

5. Personnel. The Ground Operations Unit is composed of 90 workers: 30 general assistants of airport services, 15 special aviation equipment operators, 28 ticket sales, and international cargo service agents, 9 technical coordinators of airport operations, 4 airplane parking operators, and 4 executives in charge of running the departments of Passenger Service, Operations, Flight Lines, and the Head of Ground Operations.

6. Other material resources. The airport has 17 immigration cabins for passport control, six currency exchange cabins (CADECA), one LMP money exchange cabin, two ATMs, and 10 phone booths for passengers. The customs area features six balances and four cabins for customs tax payment and currency exchange (CADECA).

Phase II: Analysis of airport demand-capacity balance for handling services

Stage 1. Determination of airport handling service demand

To forecast the demand of 2020, the main indicators used were monthly airplane and passenger mobility in 2000–2019, since these are excellent indicators that measure the level of airport operations. The tool used for time series analysis was exponential smoothing.

Exponential smoothing, based on the application of seasonal and non-seasonal models, permitted to choose the most accurate prediction possible, given by Winters additive model for airplane mobility, and the simple seasonal model for passenger mobility, whose values of route mean square error (RMSE) were minimum (Table 1).

Table 1. RMSE value for seasonal and non-seasonal models of exponential smoothing

	RMSE (route mean square error)	
Models	Airplane mobility	Passenger mobility
Simple	60.891	4 532.143
Holt	60.899	4 541.567
Brown	64.689	4 838.126
Damped trend	61.029	4 551.410
Simple seasonal	40.790	2 212.334
Winters additive	40.242	2 213.330
Winters multiplicative	40.575	2 246.787

Source: Made by the authors with information retrieved from IBM SPSS Statistics Visor. Version 22.

According to the forecast, the demand did not show substantial monthly variations throughout 2020; however, it is necessary to remark that this activity has a high season (October to March, covering the winter season), and a low season (April to September, covering summer), in which, the operational volume, and therefore, airplane and passenger mobility differ (Table 2).

Table 2: Airplane and passenger mobility forecasting in 2020

	Months											
	J	F	M	A	M	J	J	A	S	O	N	D
Airplanes	469	423	484	432	388	361	439	400	349	347	399	455
Passengers	32 533	29 914	32 631	28 977	24 708	22 374	29 453	29 025	21 908	21 985	25 897	29 093

Source: Made by the authors with information retrieved from IBM SPSS Statistics Visor. Version 22.

Stage 2: *Determination of airport capacities for handling*

Depending on the size of airport infrastructure at AMG IA, the designed capacity (DC), according to experts, is approximately 700 passengers per hour, during the busiest hours, 350 entering, and 350 exiting. Consequently —and considering that airport services are offered between 6:00 am and 12:00 am (eighteen hours)— that would be 12 600 passengers (national and international) a day, 378 000 a month (30 days), and 4 536 000 a year.

Concerning the number of airplanes in an hour, it depends on the size and availability of special and technological equipment; the airport can service 2 large airplanes (if captains request 2 ladders for each plane); 4 mid-sized, and 2 small airplanes (which do not require ladders), or a large airplane, and 2 small planes. Accordingly, AMG IA can service 4 airplanes in one hour (2 arriving and 2 departing), which means 72 planes a day, 2 160 airplanes (national and international) a month, and 25 920 a year.

The real or effective capacity (RC) was assumed as the monthly behavior of airplanes and passengers in 2019. The utilization percent (U) of airport capacity for handling services has varied in the last 20 years (2000-2019), considering the real mobility of airplanes and passengers, the high and low seasons, the national and international contexts, the relations of Cuba with the rest of the world, ECASA Ltd. contracts with

national and international airlines, and the characteristics of the province and neighboring territories.

Passenger mobility accounts for 7.52% use during that period, which demonstrates that airport capacities for handling services to passengers at AMG IA are being underused. Regarding seasons, the high (October 2018-March 2019) and low (April 2019-September 2019) seasons were used as reference, showing that the utilization percents were 7.19 and 9.22%, respectively. Airplane mobility accounted for 22.23% in the last 20 years, considering the seasons, and using 2018 and 2019 as references. In the winter (high season) it was 18 96%, and in summer (low season), it was 20.66%. The usual is that in the high seasons, the utilization percents are higher; however, the rates showed the opposite behavior, since in 2019, the operational mobility was higher than in 2018.

To calculate efficiency (E), the plan and real behavior of 2019 were used as references, which corresponded to airplane and passenger mobility. Having the designed capacity, and upon calculating the utilization and efficiency percents, the capacity rates (CR) for airplanes and passengers could be calculated, and the third stage of this phase was initiated.

Stage 3: Analysis of capacity reserves for airport handling services

The capacity reserves were determined; the references used were the capacity rates calculated in the previous stage, and the projected monthly demand (PD) in 2020. It permitted to visualize the response level of airport capacities to variations of the monthly demand throughout the year. Tables 3 and 4 show the calculations of utilization (U), efficiency (E), capacity rates (CR), and capacity reserves for airplane and passenger mobility corresponding to stages 2 and 3 of Phase II of the procedure suggested.

Table 3. Monthly and annual capacity rates and reserves for airplane mobility

Months	Plan 2019	Real 2019	Utilization (EC/DC)	Efficiency (EC/Plan)	Capacity rate DC*U*E)	Projected demand	Capacity reserve (CT-PD)
Jan	445	466	0.216	1.05	488	469	19
Feb	416	367	0.170	0.88	324	423	(99)
Mar	434	455	0.211	1.05	477	484	(7)
Apr	423	421	0.195	1.00	419	432	(13)
May	423	440	0.204	1.04	458	388	70

Jun	415	432	0.200	1.04	450	361	89
Jul	442	479	0.222	1.08	519	439	80
Aug	442	482	0.223	1.09	526	400	125
Sep	393	423	0.196	1.08	455	349	107
Oct	404	407	0.188	1.01	410	347	63
Nov	406	414	0.192	1.02	422	399	23
Dec	439	450	0.208	1.03	461	455	6
Annual	**5 082**	**5 236**	**0.202**	**1.03**	**5 395**	**4 945**	**450**

Source: Made by the authors.

Table 4: Monthly and annual capacity rates and reserve for passenger mobility

	Plan 2019	**Real 2019**	**Utilization (EC/DC)**	**Efficiency (EC/Plan)**	**Capacity rate (DC*U*E)**	**Projected Demand**	**Capacity Reserve (CT-PD)**
Jan	31 642	30 660	0.081	0.97	29 708	32 533	(2 824)
Feb	28 857	29 611	0.078	1.03	30 385	29 914	471
Mar	30 597	34 194	0.090	1.12	38 214	32 631	5 583
Apr	27 836	33 392	0.088	1.20	40 057	28 977	11 080
May	27 029	34 812	0.092	1.29	44 836	24 708	20 128
Jun	26 105	33 422	0.088	1.28	42 790	22 374	20 415
Jul	27 471	39 667	0.105	1.44	57 278	29 453	27 825
Aug	27 802	39 139	0.104	1.41	55 099	29 025	26 074
Sep	24 914	28 678	0.076	1.15	33 011	21 908	11 103
Oct	25 104	29 882	0.079	1.19	35 569	21 985	13 584
Nov	25 739	29 069	0.077	1.13	32 830	25 897	6 933
Dec	27 900	28 068	0.074	1.01	28 237	29 093	(856)
Annual	**330 996**	**390 594**	**0.086**	**1.18**	**460 923**	**328 498**	**132 425**

Source: Made by the authors.

The utilization percents of airport capacities for handling services differ considerably. The annual airplane mobility utilization is 20.2%, whereas it is 8.6% for passenger mobility; both show underutilization of airport infrastructure. Considering the behavior of the plan and real in 2019, efficiencies are 103% for airplanes, and 118% for passengers. The capacity rates show that, based on the AMG IA utilization percents and efficiency levels calculated, the airport can service approximately 5 395 and 460 923 passengers a year. As shown, utilization, efficiency, and the other indicators calculated vary throughout the months.

AMG IA has a positive annual capacity reserve, both for airplanes and passengers, which means the existence of capacity excess over the current demands foreseen for 2020, with 450 airplanes and 132 425 passengers arriving and departing. Hence, the infrastructure of this airport allows for a higher demand, and with it, a greater volume of operations, thus confirming the sub utilization of this facility.

A monthly analysis of the capacity reserve not only shows correspondence of this behavior; in some months, the airport capacity is insufficient to cope with the demand of airport handling services, and consequently, the capacity reserve is negative. It is caused by the fact that at some moments of the day, and even months, infrastructure is a limitation to proper handling services to airplanes and passengers, mainly due to the availability of special and technological equipment, the capacity of national and international lounges, the number of airplanes arriving, and their sizes, and the volume of handling service requested.

Phase III: Evaluation of airport handling service level

Stage 1: Evaluation of airport handling services through servqual multidimensional scale for external customers

The application of servqual was based on a sample of 139 external customers, calculated through the Fischer formula, 1981, for infinite populations (>100 000 elements), considering the following parameter: standardized units according to the confidence level (Z = 1.96, with 95% confidence level); positive variability expressed in decimals (percentage of true hypothesis, based on experience), considered p = 0.90; negative variability expressed in decimals, being q = 1 – p, considering q = 0.10; error percentage of E = 0.05.

The sample was classified into 6 large groups of chosen customers at random: national passengers, international passengers, crew members, tour operators, companions, and airline representatives. Taking into account the values granted to perceptions and expectations of these customers in all the items assessed, the following results were achieved:

1. Tangible elements, the satisfaction index is 78.18%, the breach is negative, customers are not completely satisfied with the physical appearance of facilities, equipment or communication materials.
2. Liability, with an index of 76.99%, negative breach, customers do not feel completely satisfied with the ability of staff to offer proper airport handling service.
3. Response capacity, higher satisfaction index in relation to previous dimensions, with 85.41%. In spite of it, customers do not feel completely satisfied with the desire of the staff to assist and serve quickly, expectations are higher than perceptions.
4. Safety, satisfaction index of 78.37%, whereas the empathy dimension was the worst assessment, with a 75.51% index, as customers do not feel satisfied with the capacity of staff to provide care and customized attention.

According to the results achieved by dimension, an average satisfaction index was calculated, which showed that 78.89% of external customers of AMG IA are satisfied with the handling services provided.

The servqual matrix (Fig. 2) shows that customer expectations are very high in relation to the handling services they expect to receive; however, their perceptions are above the mean, not valued as excellent, but as good. The strategy is to watch and exploit, since every aspect in the dimensions studied is important for customers, and are well assessed, based on their perceptions; further efforts should be made to reduce or eliminate the existing breaches between expectations and perceptions. Accordingly, the airport could have highly satisfied customers, and given the category of the airport, the index could be 100%.

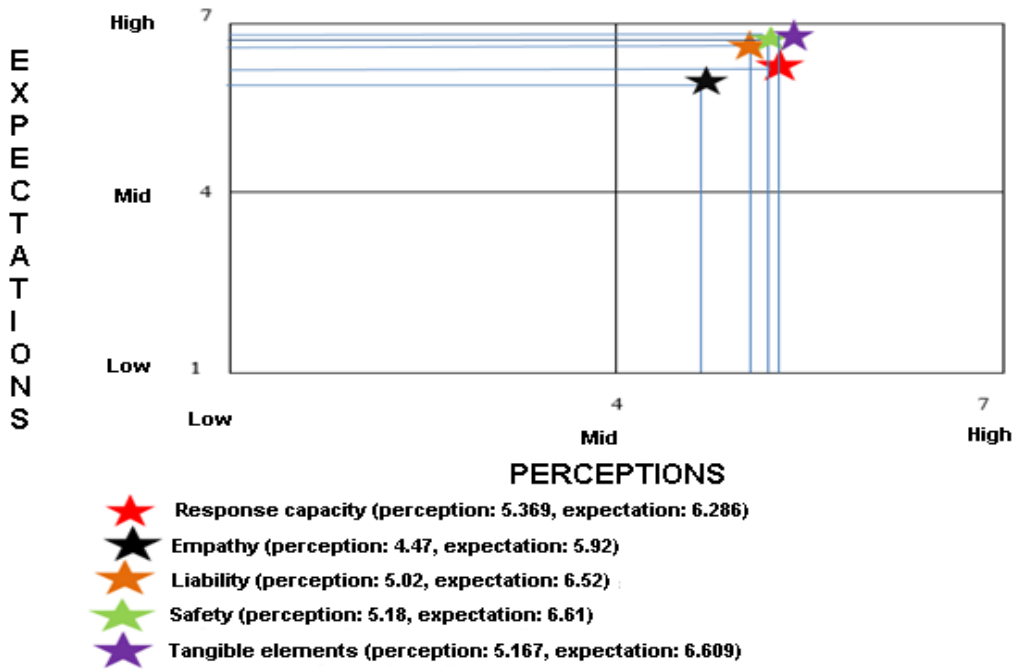

Fig. 2. SERVQUAL matrix

Source: Made by the authors.

Stage 2: *Evaluation of airport handling services through the Fischer questionnaire for internal customers.*

The application of this survey included 55 internal customers (Ground Operations Unit at AMG IA), calculated through the Fischer formula for finite populations, which considered the following parameters: Population N = 90 (total workers of Ground Operations Unit at AMG IA); standardized units based on the confidence level, considering Z = 1.96 with 95% confidence level; positive variability expressed in decimals (true percent of hypothesis, based on experience), considering p = 0.90; negative variability expressed in decimals, being q = 1 – p; considering q = 0.10; error percentage was E = 0.05.

Upon processing the survey, and considering the opinions of the handling personnel in relation to relational and operational dimensions, the outcome shows that the staff consider this service as very technical and little warm, since, they are focused on complying with the procedures and standards set for handling services. However, they are not committed to customers; the relationship between the staff and customers is not close, as shown in the Fischer matrix (Fig. 3).

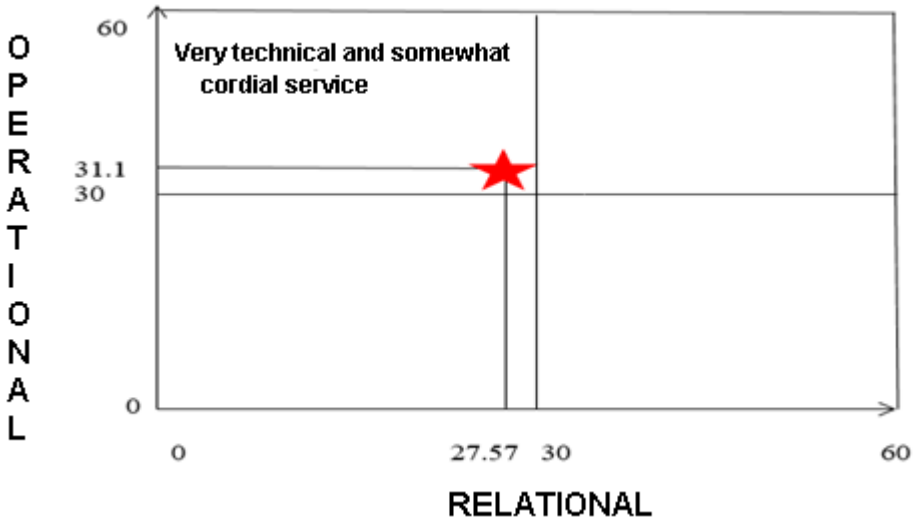

Fig. 3. Fischer matrix

Source: Made by the authors

Phase IV: Continuous improvement

Stage 1: Creation of the problems bank

Following the development of the previous stages, and corresponding analyses, the following problems were identified:

1. Sub-utilization of airport infrastructure, which means the existence of a positive capacity reserve throughout the year.
2. Underused airport capacity has led to high costs at AMG IA, with a considerable influence on accounting losses of the UEB at the end of each period.
3. Occasionally, airport infrastructure is a limitation of airport handling services to airplanes and passengers.
4. AMG IA customers are not completely satisfied with the handling services received, since their high expectations do not correspond to their assessment of the service provided.
5. Customer dissatisfaction responds mainly to the fact that the relation between staff and customers is not the expected one.
6. The airport handling staff considers the service is very technical and little warm.

Stage 2: Improvement action proposal (Table 5)

Table 5. Action plan

Problems	Actions	Responsible part:	Period
Use of infrastructure and airport capacity.	1. To conduct analysis of infrastructure feasibility and airport capacities based on the operational volume, and the characteristics of this activity in this particular airport.	UEB director, head of Airfield Unit, head of Economic-Accounting Department.	2021-2022
	2. To increase operational mobility through: a) Recovering national destinations of interest to tourist, such as Varadero and Baracoa, which were operating years ago. b) Increasing the frequency of Santiago-Havana itinerary depending on the high and low seasons, and airplane availability. c) Dealing with tour operators, and international airlines operating in the country, to include Santiago de Cuba as a destination.	UEB director, head of Ground Operations Unit.	2021-2022
	3. Using the working hours of airport handling efficiently, in order to avoid congestions, and reduce costs.	UEB director, head of Ground Operations Unit.	2021
Customer satisfaction	1. Incorporating attractive products of services that provide added value to handling services.	Head of Ground Operations Unit and general UEB coordinator	2021
	2. Attending customer suggestions duly.	Quality specialist and head of Ground Operations Unit	2021
	3. Improving the physical appearance and conditions to provide handling services in airport facilities.	Quality specialist and head of Ground Operations Unit	2021-2022
	4. Achieving greater integration among directly related processes to passenger and airplane services (Airport Terminal, Airfield, Fuel, Assurance, and Operations Unit).	Head of Ground Operations Unit, and UEB director	2021
	5. Training airport handling staff to improve personnel-customer relationship.	Head of Human Capital, and head of Ground Operations Unit	2021

CONCLUSIONS

A procedure to evaluate the level of airport handling services was designed, due to the need of AMG IA management to have theoretical and practical tools to measure and evaluate the levels of airport services, seeking perfection in decision-making.

The application of this method showed the sub utilization of airport infrastructure and capacities in relation to handling services, and the existence of capacity excess in relation to the demand in this particular airport.

With the existing infrastructure, AMG IA in Santiago de Cuba can increase the operations level and reach with a higher demand, as soon as national destinations are recovered, flight frequency is increased, and new agreements are made with international airlines.

The results of quality analysis of external and internal customers showed negative breaches, and satisfaction indexes that failed to reach the desired values, mainly linked to staff assistance.

The application of the procedure suggested has allowed the authors to design a plan of actions directed to efficient airport infrastructure and capacity use, and to elevate customer satisfaction in terms of airport handling services at AMG IA.

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Conflicts of interest and conflict of ethics statement

The authors declare that this manuscript is original and has not been submitted to another journal. The authors are liable for the content of this article, adding that it contains no plagiarism, conflicts of interest or conflicts of ethics.

Author contribution statement

Gretell Hartman Romero. Conceptualization of ideas and research aim. Data examination in terms of administration activities to make annotations. Formal analysis of study data. Research. Methodology. Visualization of preparation, creation, and submission of manuscript, data presentation. Redaction (first draft, review, and editing) of the manuscript.

Sonia Caridad Ruiz Quesada. Visualization of preparation, and submission of manuscript, data presentation. Redaction-proofreading, and editing of the manuscript.

Elena Saumell Fonseca. Visualization of preparation, and submission of manuscript. Redaction (review and editing) of the manuscript.

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[1]Ground support services to airplanes and customers