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Assessing Passenger Satisfaction with Smart Airport Technologies: An Empirical Study

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Abstract:
Airports serve as crucial components within the air transport value chain, necessitating continual adaptation to meet evolving technological demands and enhance passenger experiences. The evolution towards Smart Airports or Airport 3.0 underscores the imperative for modernization to facilitate safe, efficient, and seamless travel experiences, particularly pertinent amidst the challenges posed by events like the COVID-19 pandemic. This study delves into the concept of Smart Airports, focusing on passenger perceptions of technology and its role in shaping competitiveness within the tourism sector. Through an analysis of passenger perceptions and expectations, this research aims to provide a clearer understanding of the Smart Airport concept, considering gender perspectives, which represent a novel contribution to existing literature. Recognizing the pivotal role of air transport infrastructures in destination competitiveness, this study investigates the impact of technology improvements on passenger satisfaction and overall travel experience. By examining the relationship between airport technologies and passenger perceptions, satisfaction, and enjoyment, this research underscores the importance of integrating new technologies to enhance airport services and meet evolving passenger needs. The study further explores the potential of ICT in reducing travel time and enhancing overall passenger experiences, with a particular emphasis on understanding gender-specific influences on perceptions of airport technologies. Through a comprehensive analysis, this paper seeks to contribute to the ongoing discourse on Smart Airports and their significance in shaping the future of air travel.

Keywords: Smart Airports, Passenger Perception, Airport Technology, Travel Experience, Gender Perspective

1. INTRODUCTION

Airports play a crucial role in the air transport value chain and must consistently adjust to technology requirements from various stakeholders. It is essential to upgrade airports in order to improve passenger transit (Bao et al., 2016) in order to offer better experiences and enhanced satisfaction. This is leading airports to transition towards the Smart Airport or Airport 3.0 concepts (Fattah, 2009). Smart airports strive to offer secure and efficient travel experiences, which are especially important during the era of COVID-19. This is achieved by leveraging advanced technologies across all airport services. By avoiding delays, cancellations, overbooking, and baggage losses, airports can improve passenger satisfaction and perception of service quality (Greghi et al., 2013).

Passenger experience is enhanced by technology, shaping their perception of the service. The concept of a "Smart Airport" is not fully understood by passengers. This study aims to provide a clearer understanding of what constitutes a "Smart Airport," taking into account how passengers perceive technology as an

essential aspect and key competitive factor in tourist destinations. It will analyze differences in passenger perceptions of Smart Airports versus traditional airports, with a focus on gender perspective - which is an innovative addition to existing literature. This topic holds significance because air transport infrastructures are projected to be crucial for the competitiveness of supported destinations according to the World Economic Forum. As competition in the tourism sector intensifies, airports face increasing pressure to differentiate themselves and swiftly adapt to passenger needs (Fodness & Murray, 2007).

The literature contains numerous discussions regarding the influence of advancements in airport technology on the traveler's experience (Abdelaziz, 2009) Assess the advantages of Common User Self Service technologies at airports compared to traditional operations and equipment (Yang et al., 2015) examined the expectations of airport customers and found that they are typically not met. (Bogicevic et al., 2013) The author created a tool to gather passenger opinions about airport technology and conducted a study that examines the connections between airport technologies and traveler confidence, contentment, and enjoyment. The results all point to a positive link between the use of self-service technology in airports and the extent of traveler confidence and enjoyment, contributing to higher satisfaction levels. Additional research has shown that passenger satisfaction is also influenced by the quality of airport services such as on-time flights, timely information availability, efficient security measures, clear signage, terminal amenities, among others ((Tuchen et al., 2020); (Barros et al., 2007); (Fodness & Murray, 2007)).

New advancements in technology, when incorporated into suitable platforms, offer a distinct possibility of enhancing the idea of a futuristic intelligent airport. This paper centers on airports making active efforts to enhance the passenger experience, considering airports as providers of experiences and leveraging the collective experience of all airport users as a crucial element for the aviation industry (Tuchen et al., 2020). It explores the previously mentioned idea based on traveler expectations and measures of satisfaction, taking into account gender perspectives as a key aspect. The aims of this study are: (i) to assess the level of satisfaction resulting from the utilization of Information and Communication Technology in airports, and (ii) to broaden this examination to encompass the entire End-to-End travel experience – referring to the holistic travel journey beginning from ticket search and reservation through to arrival at the destination In this sense, (Alansari et al., 2019) Airports and airlines have a significant chance to establish a cohesive and strategic approach in catering to travelers, from the booking stage through airport transit to the completion of their journey within the overall travel experience framework. Furthermore, it is important to evaluate the benefits of technology in reducing travel time and enhancing passenger satisfaction. Additionally, female travelers' socio-demographic characteristics are analyzed to understand their impact on shaping opinions and perceptions about airport technologies.

First, a thorough analysis of the Smart Airport concept is conducted, examining the technologies encompassed within it from start to finish. This is followed by an assessment of traveler satisfaction with these technologies to evaluate whether expectations align with perceptions. Lastly, gender dimensions are examined and specific research questions are formulated for investigation through empirical study.

2. SMART AIRPORT CONCEPT

The concept of Smart Airports has emerged due to the convergence of the Internet of Things, which connects everyday objects to the Internet and supports new business models through digital transformation, and Industry 4.0, where physical and cyber worlds merge to enable remote device control. This development is in line with the overall growth in global commercial air traffic (Koroniotis et al., 2020). The SA concept has increasingly integrated sustainability in recent years. The development of

Sustainable or Green Airports is also relying on advanced IT that aligns with the SA concept to accomplish sustainability objectives (Santa et al., 2020);
reaching a stage where both ideas are mutually developed. The most evident and immediate connection between technology and sustainability in airports is the generation, control, and utilization of energy in efficient manners with the help of technology. SA is being examined in various ways in the literature: from the viewpoint of passengers, from an airline perspective, from a management standpoint, or in relation to the concept of smart cities. Concentrating on passengers – which is the primary focus of this research – airports should offer superior services to ensure that they provide the best, most pleasant, and quickest experience possible (Barkham et al., 2022), and all of this can be accomplished with the help of cutting-edge technologies. By comprehending passenger requirements and experiences, airport management can improve their ability to leverage intelligent technology (Buhalis & Amaranggana, 2014).Airports now consider travelers as their main clientele and are increasingly mindful of passenger requirements during the entire travel process. Airports should allocate resources to technological solutions that cater to health and safety issues, enhance the passenger journey, and deliver significant long-term returns on investment . According to (Alabsi & Gill, 2021), Cooperation among airport facilities, data, and applications has been made possible by digital technology, allowing for more personalized customer experiences. This has given rise to the concept of smart airports. Modern smart airports make use of various digital technologies like self-service options, flight information systems, baggage tracking, and intelligent parking. Understanding passengers' perceptions of this concept is crucial.
Other studies have also shown interest in the integration of services, as seen in the literature (Alansari et al., 2019), (Koroniotis et al., 2020), and (Raj & Raman, 2017)establish a connection between the SA and Airport 3.0 ideas, with Airport 3.0 serving as the framework for integrating IoT concepts and services. An all-encompassing technology platform is necessary to ensure effective and secure management of information from various parties and applications involved (Fattah, 2009), CISCO stated that Airport 3.0, also known as SA, necessitates a live integration of all components within the ecosystem.
The authors emphasize the importance of process integration for enhancing operational efficiency, service quality, and safety across various aspects such as airports, logistic services, cities, and institutions (Sohn et al., 2012) The concept of intelligent service involves the proactive provision of information in two main categories: guidance within the airport and assistance with mobility, all integrated into an automated system (Sohn et al., 2012) The development of a comprehensive plan, utilizing advanced technology to enhance customer satisfaction and improve system efficiency More recently, in 2020, Koronitis et al. The provided SA definition states that a smart airport integrates cyber security-aware IoT devices to enhance efficiency, productivity, security, and service. All definitions of smart airports emphasize the importance of IT, reflecting the significant advancements in wireless technologies, satellite positioning systems, widespread use of portable devices (smartphones, tablets), wearable technology (smartwatches, fitness bands), and user-customized products and services based on Artificial Intelligence. This study aims to analyze which technologies could shape the concept of a smart airport from the perspective of potential users. The literature focuses on studying smart airports in relation to customer expectations and airport effectiveness(Sohn et al., 2012) or when examining the correlation between various airport technologies and travelers' confidence, satisfaction, and enjoyment (Bogicevic et al., 2013). However, there is a paucity of literature that specifies the technologies included in the Smart Airport concept. In the aviation industry, various organizations have suggested the adoption of technologies, and members of the Airport Council International acknowledge the advantages of implementing biometrics to simplify, streamline, and

enhance the passenger travel experience (Zamorano et al., 2020). According to ACI (2021) New technologies and digitalization have the potential to address airport capacity challenges in new ways, aiding in the recovery of pre-pandemic levels of air traffic. Experts from the tourism sector emphasize the importance of smart travel facilitation, which allows passengers to book flights and check in online, access boarding passes on their smartphones, use automated clearance gates, and validate boarding passes electronically. These measures are aimed at enhancing both travel facilitation and security. Additionally, experts from other sectors point out that intelligent airports will utilize various digital and automation technologies that must work together seamlessly. They also note that these technologies assist airport operators in improving passenger experience, operational efficiency, compliance standards while laying a foundation for future growth.

High levels of maturity in airports worldwide have been made achievable through extensive research and advancement. Consequently, IoT-driven systems and services empower airports to achieve greater resilience and efficiency, while also facilitating real-time oversight. As part of their development strategies for 2019, airports allocated resources towards self-service procedures, cybersecurity measures, biometric identification, cloud-based services, and business intelligence. A significant majority of airports - specifically eighty percent - are currently implementing or preparing to adopt these technologies. For instance, in 2017 alone, airport investments in technology amounted to US$8.6 billion (SITA, 2018). Embracing technology is essential for airports to adjust to rapid changes like the COVID-19 pandemic ((Saud & Kamal, 2021); (Khan et al., 2021). Increased levels of automation and improved airport process efficiency are in line with an effective approach to adapting to changing COVID-19 demands and limitations. Utilizing personal devices through ICT can reduce congestion and limit the interactions between service staff and passengers. This research also examines the most highly valued technologies by passengers in terms of their potential for the near future. Digital identity security control is considered the most valuable (34%), followed by AI (17%) and wireless 5G (13%). The study also mentions an increase in the utilization of mobile apps for reservations (16%) and check-in (13%). Passengers have also indicated a preference for using their smartphones both at the airport, during security checks and boarding (57%), as well as while on-board flights (62%). Additionally, passengers are interested in utilizing technologies to promote sustainability, with 45% supporting the use of mobile data to reduce fuel consumption, carbon emissions, and noise pollution (SITA, 2018).

Finally, according to the SITA (2017) report, A complete travel experience encompasses every stage from booking tickets to reaching the destination. Travelers anticipate a smooth and secure process, with efficient transitions through check-in, security checks, immigration controls, and access to quality information about nearby services such as restaurants, bars, and hotels. Providing a satisfactory end-to-end travel experience at the airport calls for an integrated SA architecture that covers all aspects of the journey.

After examining the idea of smart airports as perceived by travelers, the following section will seek to explore the satisfaction generated by these technologies and their impact on specific services.

3. PASSENGER CONTENTMENT DUE TO THE IMPLEMENTATION OF NEW TECHNOLOGIES

Extensive research has been conducted in the social sciences on the concept of satisfaction (See for example (Anderson & Narus, 1990):(Mohr & Spekman, 1994)). In this research, we assessed satisfaction by considering customer perceptions of how well products and services meet their needs and expectations, in line with the provided definitions as "global evaluative judgment about product usage/consumption",

or Satisfaction is often influenced by pre-existing expectations and whether they are met or not. So, The key components of contentment include anticipations and interpretations .

Satisfaction at airports is influenced by the way travelers think. How travelers perceive their airport experience depends on their behavior and what they expect ((Westbrook, 1987); (Tuchen et al., 2020)). (Bogicevic et al., 2013) Travellers value cleanliness, shopping choices, Wi-fi availability, and comfortable seating. The primary areas of dissatisfaction include security checks, inadequate signage, and long lines. Once in the airport terminal, a considerable portion of traveller contentment comes from operational and optional activities. Process activities refer to the essential tasks required for boarding and unboarding aircraft, such as baggage check-in, security control, and moving to boarding gates. On the other hand, discretionary activities are those that passengers can engage in during the waiting periods between process activities, including shopping, resting, currency exchange, dining or drinking at eateries, withdrawing cash etc. The value of process activities is measured based on efficiency parameters like time consumption frequency congestion levels personnel attitude cleanliness and screen indications. Meanwhile,the value of discretionary activities is assessed according to a customer's perception of their convenience such as originality luxury feeling entertainment capability and comfort.Consequently,discretionary activity's significance has been growing as they are seen as a means of differentiating and attracting both passengers and airlines.

As previously mentioned, the contentment of passengers in airports is connected to the quality of service and their perception of that service. Various international organizations like Airport Council International and International Air Transport Association have conducted satisfaction surveys. Additionally, researchers have also conducted studies on this topic.(ex. (Bezerra & Gomes, 2015); (Brida et al., 2016); (Fernandes & Pacheco, 2008)) focusing on various quality factors like processing times, congestion, effectiveness, or the influence on satisfaction for particular services including check-in, security, accessibility, environment, boarding processes and information systems (ex. (Barros et al., 2007) ; (Tuchen et al., 2020)). In many instances, the emphasis is on measuring efficiency, for example using ACI metrics or statistical techniques in survey analysis (such as factorial analysis or probabilistic models). The commonly assessed areas include: (i) Accessibility of airports; (ii) Security measures; (iii) Infrastructure and terminal facilities; and (iv) Flight experience (including airline services). Consequently, technology can influence both airport efficiency and the perception of convenience. Presently, technology plays a role in saving time, enhancing security, and improving passenger services . Despite the advantages of technology, it can also result in dissatisfaction at times. For instance, automated check-in kiosks may not be well-received by all passengers. However, information and communication technologies like mobile apps providing flight and boarding details are generally embraced by both travelers and airlines. Subsequently, we will explore the satisfaction that technologies can bring from a gender standpoint.

4. CONCEPTUALIZING A GENDER-INCLUSIVE SMART AIRPORT

This research aims to explore passenger contentment concerning the utilization of IT across all stages of travel, specifically from a gender-based viewpoint. This aspect has been overlooked in current literature, where studies on traveler satisfaction related to airport IT usage often provide summarized findings without considering gender differences ((Putnick & Bornstein, 2016); (Yang et al., 2015);(Huang et al., 2018); (Venkatesh et al., 2003)). There is a lack of gender perspective in most Studied the satisfaction of travelers with services at Melbourne airport using a survey that included an equal number of male and female participants. The findings indicated that female passengers prioritize comfort, convenience, and

pleasure dimensions in airport services, scoring higher on improvements in these areas. This suggests a gender influence on (Jiang & Zhang, 2016) passenger satisfaction, (Negri et al., 2019), in their examination of Brazilian airports, it was demonstrated that there were minor variations in the tendency for men and women to utilize them, with 83.70% of men and 82% of women in favor of using these facilities. Additionally, they looked into Technology Anxiety to assess its impact on the use of different Self-Service Technologies options by (Meuter et al., 2003). The demographic factors appear to have some effect on the usage of SST options, although their influence is not entirely clear (men tend to use SSTs more often). Some research also examines age and gender variations in online travel reviews and user-generated content adoption within the Technology Acceptance Model (Assaker, 2019) studies expanding the technology acceptance model by incorporating credibility theory. The findings offer further insights into the impact of gender and age on online travel reviews, contributing to advancements in both theory and practice.

Following this review of literature, the study examines the following exploratory research questions.

RQ1. Are there notable gender variances in how travelers perceive the various technologies that could be integrated into the concept of a smart airport?

RQ2 Are there notable disparities between genders in the satisfaction levels resulting from or potentially generated by the utilization of these technologies in all aspects of the traveler experience during their journey?

This study explores the potential impacts of information technology on quality, competitiveness, and sustainability in the context of airports. It acknowledges the significant role of information and communication technologies in airport functionality and their influence on quality. This is supported by (Brida et al., 2016), Those who found a promising chance to enhance airport services by utilizing technology to offer flight updates and information about various airport facilities. The goal of this research was to pinpoint areas within the airport's functional services that could be enhanced through the use of information and communication technologies, thereby boosting travelers' satisfaction with these services. The study involved an equal participation from both men and women in the survey, although gender distinctions were not accounted for in its findings. Air travel infrastructure is a key element in assessing the competitiveness of the tourism sector, as per the World Economic Forum (Hitt et al., 2001) The rapid advancement of technology and the increasing demands of consumers are two key features of the 21st century economy. Both significantly impact SA's competitiveness. In this research line, (Johannessen & Olsen, 2010) companies need to develop expertise in knowledge-intensive tasks to enhance their capacity for innovation and foster a customer-centric approach. The success of innovation hinges on the organization's ability to address customer requirements. In terms of sustainability, women are more attuned and supportive of initiatives related to sustainability, as highlighted by (Brough et al., 2016). (Rice et al., 2020) surveyed individuals about their inclination to pay higher ticket fees in order to decrease greenhouse gas emissions. Women travelers displayed a greater willingness compared to men to bear these additional costs, recognizing sustainability enhancements as an extra benefit of their tickets. Additionally, female passengers demonstrated a heightened awareness of the economic advantages associated with sustainability improvements at airports by (Rice et al., 2020). This study also suggests that women, in general, show a greater interest in environmental issues compared to men. Based on this review of the literature, it can be inferred that gender plays a significant role in shaping passengers' perceptions of sustainability initiatives and the extensive use of information and communication technologies in SA. As a result, an additional research question is offered:

RQ3 Are there substantial gender variations in how SA is perceived in terms of competitiveness, effectiveness, and long-term viability?

This research also examines sociodemographic variations among female passengers' perceptions of SA in terms of age, occupation, nationality, travel motives, and participation in the aeronautics industry. In academic writings (Potgieter, 2020) It has been discovered that gender plays a role in the decision-making process for business travel (Chiappa et al., 2020) gender variances also exist in the process of making travel expenditure decisions and shopping behavior. This was determined through a survey conducted on passengers at Athens airport, (Anderson & Narus, 1990) Studied the perceptions of travelers regarding social networks and their influence on choosing the Mediterranean Sea as a destination, discovering notable variations across various age brackets. Other research examines the correlation between age and technology, with less emphasis on gender (Venkatesh et al., 2003) concluded that advancing age reduces expectations related to: technology use efficiency and intention; anticipated effort and intention of use; social influence and intent to use; as well as the presence of access conditions for technology. On the other hand (Zamorano et al., 2020) Age is associated with the use of technology across three stages of the complete travel process: boarding, tagging, and baggage check-in. Additionally (Zamorano et al., 2020) The correlation between the age of passengers and their utilization of new technologies, video games, and biometric passports could be demonstrated. Focusing on other demographic factors, (Sohn et al., 2013) and (Jung & Yoo, 2014) identified the driving force for travel (business or pleasure) as a pivotal factor in making travel choices (Schmalz et al., 2021) age and gender have an impact on the experience of traveling for business by air, and (Namukasa, 2013)The impact of airline service quality on passenger satisfaction is examined in relation to demographic variables including age, gender, occupation, and education.

Finally, in relation to nationality and gender variables, (Pantouvakis & Renzi, 2016) provide evidence that satisfaction or dissatisfaction perceptions of passengers in airports vary according to their national ities, but there are not many studies relating both Latin-American and Spanish nationalities with gender in this subject. For instance, (Zamorano et al., 2020) concluded that the satisfaction of Spanish passengers who used technology in the boarding processes - issuing baggage tags and checking-in – is greater than that of passengers who did not use it this ratio being higher in baggage check-in. But in this study the gender variable is not studied. Besides, studying Latin American passengers, (Brida et al., 2016) empirically analyse users at Santiago de Chile's Arturo Merino Benítez International Airport (AMB) – with a sample of 64.05% Chilean passengers and almost no gender differences (male 52.28% and female 47.72%)- to show that investment in new ways of communication based on ICTs would improve passenger's perception of airport service quality. Following with Latin American passengers, a global survey of 23,000 people from 20 countries conducted by Trav- elport revealed that travelers demand a further digitalization of the tourism experience, while Latin American passengers feel "frustrated" by not being able to talk to a human during the process. Having identified room for further research after the literature review, a new research question is formulated:

RQ4 Are there sociodemographic and cultural characteristics of female passengers that support differences in their answers

5. MATERIAL AND METHODS

5.1. Measurement instruments

A comprehensive survey consisting of 29 closed questions utilizing a Likert scale ranging from 0 to 10 was conducted among a target sample of 6400 individuals. The estimated time for completion was

approximately 10 minutes. The objective of the survey was to assess the technologies utilized in modern airports, focusing on processes that directly impact passengers. The goal was to unearth future trends and gain a more precise understanding of the "Smart Airport" as an essential element in enhancing competitiveness within tourist destinations. This involved evaluating the satisfaction levels associated with these technologies among passengers, as well as measuring their impact on airport quality due to the integration of new technologies.

Questions are grouped in three blocks devoted to:

- Assessment of satisfaction with technology usage in SA: Rate the level of satisfaction from 0 to 10 for each technology used in airport services, with 0 representing minimum satisfaction and 10 indicating maximum satisfaction.
- Assessment of satisfaction with technology usage in end-to-end travel process: Evaluate the level of satisfaction that the use of technologies produces or would produce during each stage of the passenger experience throughout their trip, using a scale from 0 (minimum) to 10 (maximum).
- Evaluation on perception of impacts by SA: Provide your level of agreement from 0 to 10 regarding statements related to smart airports employing these technologies and their impact on tourism quality and competitiveness. The survey was circulated in October and November 2018 in both Spanish and Portuguese using Survey Monkey. The questionnaire link was predominantly shared via email and WhatsApp. Five different nationalities took part: Brazil, Chile, Spain, Mexico, and Peru.

Table 1 Sociodemographic characteristics of the interviewees.

Characteristic	% total	%Women
Gender		
Male	46	-
Female	41.9	-
Prefer not to answer	12	-
Age		
Under 26	38.5	45.7
26 to 35	14	13.9
36 to 45	16.9	17.5
46 to 55	17.5	15.3
Over 55	13.1	7.7
Education		
Basic-compulsory	9.3	11.6
High School	14.3	15.1
University Degree	39.8	42.3
Master - PhD	36.6	31
Nationality		
Brazilian	6.9	5.7
Chilean	12.5	7.2
Spanish	23.3	22.7
Mexican	47.1	53
Peruvian	4.5	4.3
Other	5.7	7.1
Occupation (multiple choices are possible)		
Student	32.4	43.1
Private sector employee	29.7	29
Public sector employee	11.1	13.2
Entrepreneur	9.1	5.9
Self-employed	7	8.1
Other	4.7	8.8
Computing knowledge		
None/Basic	9.3	12.6
Intermediate	37.4	42.2
Advanced	42.3	40.3
Professional	10.9	4.9
Flights during the last year		
0	10.4	11.5
1 to 5	47.9	53.4
6 to 10	21.7	19.5
11 to 15	8.7	8
15 or more	11.3	7.7
Travel motivation		
Leisure	50.6	60.5
Work or business	25.3	14.8
Leisure and work or business	13.5	10.5
Other	8.3	11.5
Involvement in sectors		
Aeronautic	12.2	7.6
Tourism	13.7	16.8
Tourism and Aeronautic	1.5	1.1
Other	72.6	74.5

The survey was distributed to the contacts of project team members, most of whom were professionals in aeronautics and tourism, university professors, and students. The sample reflects the contexts of the project researchers as this is a collaborative project focusing on training, research, and cultural activities in Latin America. Therefore, it should be noted that the resulting sample is convenience-based rather than random. 1703 acceptable responses were gathered (with a response rate of 27%). Under the assumption that the sample population is reflective of the overall population, we can estimate a sampling error of 0.01% at a significance level of 5%. The gathered data was utilized to conduct descriptive analysis, various hypothesis contrasts (both parametric and non-parametric), and exploratory factorial analysis. The software program SPSS was employed for these tasks.

Table 2 Mean differences according to gender.

Question	Male Mean	Female Mean	Significance
Q1. SMARTPHONES.	8.8	8.93	0.128
Q2. QR CODES	8.05	8.42	0.002
03. WIFI.	9.49	9.55	0.365
Q4. Near Field Communication (NFC).	7.98	8.09	0.298
05. Radio Frequency Identification (RFID).	8.05	8.44	0
Q6. Biometric Passports	8.71	8.75	0.709
Q7. Beacons	7.43	7.54	0.364
Q8. Mobile applications (Apps)	8.72	8.91	0.03
Q9. Internet of Things (IoT).	8.04	8.31	0.014
Q10. Self-service kiosk	8.32	8.53	0.039
Q11. Recommendation systems	6.66	6.69	0.835
Q12. Ticket reservation or booking (PC, smartphone, self-service kiosk)	8.92	9.02	0.14
Q13. Luggage check-in, boarding pass obtention (PC, smartphone, self-service kiosk, biometric service)	8.87	8.97	0.235
Q14. Security control (x-ray scanner, metal detector, body scanner, biometric system)	8.27	8.53	0.017
Q15. In customs (electronic ID, electronic passport, or biometric systems)	8.58	8.75	0.072
Q16. Dwell time (beacons, GPS, RFID, recommendation systems)	8.01	8.16	0.161
Q17. During the boarding process (bar codes, QR, digital documents or biometric systems)	8.64	8.83	0.028
Q18. During baggage collection and transit (messaging to Passenger mobile devices about luggage location and transit status)	8.77	8.89	0.163
Q19. Transportation to and from city/town (GPS info about transport services, app-based transports such as Cabify)	8.61	8.77	0.065
Q20. Passengers using SA will perceive a higher service quality	8.65	8.74	0.328
Q21. Passengers using SA will enjoy a substantial reduction of time spent through all processes (booking, check-in, security, boarding),	8.73	9.01	0.001
Q22. Passengers using SA will reduce their stress when going through the different processes conforming air transit	8.23	8.61	0
Q23. Passengers using SA will take better advantage of dwell time.	8.5	8.87	0
Q24. Passengers using SA will enjoy the opportunity of doing new activities enhancing their experience at the airport.	8.14	8.36	0.03
Q25. Passengers using SA will benefit of services lower prices compared to traditional airports.	7.27	7.74	0
Q26. A traveller having to choose between a SA and a traditional airport competing in the same tourist destination will choose the SA (under similar conditions of price and transit time).	8.17	8.45	0.013
Q27. SA's will enhance destination competitiveness as SA will be preferred choices.	7.67	8.05	0.003
Q28. SA will enable that the other air transport stake holders (airlines, handling suppliers,	8.42	8.67	0.008
Q29. Extensive use of emerging technologies in SA will positively impact economic development of regions served by said SA.	7.9	8.33	0

6. RESULTS

6.1. Analysis of survey profiles

The survey's identification section presents its findings in Table 1. The fourth section of the questionnaire illustrates the distribution of responses for each question, showing the breakdown by percentage and including the percentages based on gender, with almost equal representation from male and female respondents. The majority fell into two age groups - younger than 26 or between 36 and 55 - with a notably higher percentage of women in the younger category. Most participants had completed university studies (degree, master's or Ph.D.), were predominantly Mexican (with over 50% being female) and Spanish speakers, mainly students (a significantly larger proportion among females) or private-sector employees; possessed intermediate to advanced computer skills; reported using air transport between 1-5 times in the past year for leisure purposes (especially notable among women), without any specific ties to tourism or air transport sectors. However, it is noteworthy that a considerably higher percentage of women expressed involvement in the tourism sector compared to men at 17%, whereas more men than women were involved in the aeronautic sector.

6.2. Gender differences in questions related to information and communication technologies, SA and their effects

A comparison of means for independent samples, using the student's t-test, was conducted for the 29 questions in the first block mentioned earlier, with gender as the independent variable. The key findings from this analysis are presented in Table 2., which includes the mean values for men and women along with their respective bilateral significance levels. Notably, 55% of the comparisons show a value lower than or equal to 0.05 (highlighted in bold), indicating rejection of the null hypothesis that male and female means are equal. These results reveal substantial differences based on gender. A thorough examination of Table 2 yields the following outcomes:

A detail analysis of Table 2 leads to the following results:

In relation to section 1 (questions 1-11), evaluation of contentment with the utilization of technologies in SA

1. Both genders highly rated 10 out of the 11 questions, except for "Recommendation Systems," which received a low rating.
2. The most appreciated questions for both men and women are Q3 - WIFI (9.5) and Q1 - Smartphones.
3. Gender differences are significant in 5 out of the 11 questions: Q2-QR codes, Q5-RFID, Q8-Apps, Q9-IoT, and Q10-Self-service kiosks.
4. Women consistently scored higher than men in every single question, indicating their greater satisfaction with the use of technologies in airports.

In relation to part 2 (questions 12 to 19), evaluation of satisfaction with the utilization of technologies throughout the entire travel procedure:

1. Both males and females give high ratings (over 8) for all eight questions.
2. The top scores are for Q12 – Ticket reservation or booking, and Q13 – Check-in or boarding pass acquisition.
3. The lowest score, although above 8, pertains to dwell time.
4. Only two out of the eight questions show notable differences between males and females, specifically Q14 – During security control and Q17 – During boarding process.
5. Once more, women rated every single question higher than men did, indicating their higher expectations regarding airport processes improving through technology usage.

In relation to section 3 (questions 20 to 29), evaluation of the perception of the impact of SA:

1. The scores are elevated and comparable to those obtained in previous sections.
2. The highest score is achieved in Q21 - Passengers using SA will experience a significant decrease in time spent throughout all processes.
3. The lowest score is linked to Q25 - Passengers using SA will benefit from lower prices for services compared to traditional airports.
4. Once again, women have higher scores than men across all questions, confirming their heightened expectations regarding overall SA impacts.

6.3. Differences among women

To streamline the analysis, one indicator or factor was derived from each group of variables through an exploratory factor analysis. This involved considering only the 714 responses from female participants and utilizing the maximum likelihood extraction method, resulting in the following outcomes:

1. In the EFA pertaining to part 1 on the assessment of technologies utilized in SA, the sample adequacy KMO measure was 0.87, and a Bartlett test indicated sphericity significance at 0.00; two eigenvalues with statistical significance contributed to 45.86% of the total variance, wherein the primary one accounted for 35.19%.
2. In regards to part 2's EFA focusing on satisfaction with technology use throughout end-to-end travel processes, a KMO value of 0.88 was found alongside a significant Bartlett test result of sphericity at 0.00; where only one eigenvalue explained about 54..06% variation.
3. In relation to part three's EFA concerning overall impact of SA, there’s an observed KMO value standing at .93 combined with Bartlett Test indicating spherical Significance stands nearly null ,with statistically significant Eigen Value accounting up-to -58:38 %_variation

After confirming the accuracy of all EFA’s, it was decided to retain the first factor from each analysis as a new variable for regression purposes. This would be used later on to represent its respective group of questions in order to examine the behavior of the 8 population characteristics other than gender.

Non-parametric tests, specifically Kruskal-Wallis tests for independent samples, were conducted to compare response levels across different questions. This test was chosen due to variations in sample sizes among answers and concerns about violating assumptions required for variance analysis with such differences. It allowed us to assess whether there were significant differences in responses among the identified questions.

The asymptotic significance from Table 3 demonstrated cases where p-values were equal or less than 0.05, leading us not reject the null hypothesis that all independent samples are part of identical populations with the same median value. When this null hypothesis was rejected, significant differences emerged within certain identification question groups.

There are notable variations in the responses provided by people from distinct demographics in response to the sets of questions. The most pertinent factor is nationality, as indicated by a relevance score of 0.0 for the three factors, suggesting substantial disparities in answers.

1. In terms of the first section on technologies in SA, Brazilian women provided significantly different answers compared to Mexican and Peruvian women, with an average score of 477.03 indicating a high appreciation for technologies in SA. On the other hand, responses from Mexican and Peruvian women scored 393.35 and 368.15 respectively. Even lower scores were recorded for Chilean (269.41) and Spaniards (291.75).

2. In terms of the second part of processes within SA, Brazilians once again achieve the top score with an average of 408.94. Meanwhile, Mexicans reach 379, Chileans reach 368.75, and Peruvians reach 355.13 on average. At the bottom end are Spaniards with a score of 300.78.
3. In terms of the overall impact in part 3, Brazilians achieved the highest score at 434.21, followed closely by Peruvians with a score of 413.95 and Mexicans with a score of 407.09. Chileans scored 336.61, while Spaniards once again ranked lowest at 230.92.
2. Significant variations in the assessment of airport processes at block two emerge with age. Individuals below 26 years receive low scores (average of 339.41), whereas those above 56 score considerably higher (451.35).
3. Occupation plays a significant role in evaluating airport processes, as demonstrated by the high scores achieved by employees in both private (402.16) and public (392.44) organizations, with students scoring notably lower at 324.63.
4. The motivation to travel also plays a crucial role in the evaluation of airport technologies, demonstrating lower levels of interest from leisure travelers (334.26) and higher enthusiasm from business or work-related travelers (397.66).
5. The significance of SA's impacts is evident in the lower scores (273.90) achieved by women in the aeronautic sector compared to those in the tourism sector and those not affiliated with either sector (365.39).

Table 3 Kruskal-Wallis test results.

Characteristics	Primer Factor/First factor		
	Information and communication technologies	Primer Factor/First factor	SA impacts
Age	0.157	0.001	0.471
Education	0.066	0.464	0.045
Nationality	0	0	0
Occupation	0.839	0.007	0.066
Computer competence	0.145	0.051	0.459
Flights during the last year	0.453	0.489	0.263
Travel motivation	0.003	0.402	0.153
Involvement in tourism and air transport	0.079	0.53	0.008

There were no notable distinctions in the three sets of factors related to education, computer skills, and travel frequency over the past year as their statistical significance exceeded 0.05. In summary, the nationality is a significant factor influencing women's perception of technology in SA, satisfaction with process improvements through technology use, and its overall impact. Brazilians generally scored higher across all these aspects while Spaniards tended to score lower. When examining appreciation forThere were no noteworthy variations in the three sets of factors related to education, computer skills, and recent flight activity as their statistical significance was greater than 0.05.

In summary, nationality is a significant factor that influences women’s perception of technology in SA, their satisfaction with process improvements resulting from technological use, and the impact of SA.

Brazilians scored higher in all three aspects while Spaniards ranked lower. When it comes to recognizing process improvements, age becomes an important aspect (with those over 56 scoring higher), as well as occupation (students scoring lower). Additionally, travel motivation plays a role in how technology use at airports is perceived; business/work travelers score significantly higher compared to leisure travelers.

A similar comparison was conducted with men, revealing numerous similarities and some discrepancies compared to the findings for women. For the same attributes listed in Table 3, it was observed that: (i) no distinctions were found in age, computer proficiency, or recent travel frequency (similar to women); (ii) notable variations emerged in nationality, reasons for travel, education level, and involvement in tourism and air transportation concerning information and communication technologies (with slight variances compared to women); (iii) significant disparities related to SA impacts were also identified based on nationality and engagement in tourism and air transportation - mirroring those of women;and(iv) unlike women where only nationality played a similarly significant role as occupation did for men across all three dimensions.

The examination of significance and the confirmation of test scores is a key aspect of validity. Ensuring that measurements are consistent across different groups, occasions, and cultural backgrounds is essential to demonstrate measurement invariance. When this characteristic exists, it indicates that scores remain unchanged regardless of group differences. Demonstrating measurement invariance implies that individuals from various groups interpret items under the same latent factor similarly.

To confirm that this issue does not affect the study's EFA results and verify if the first factor was saved as a new variable - with only one or two statistically significant factors , a Kruskal Wallis test was conducted on the 29 questionnaire variables. The asymptotic significances can be found in the appendix; these results support previous conclusions reached in the analysis. Thus:

1. Out of the 29 variables in the questionnaire, 27 exhibit statistically significant variances concerning the Nationality question (asymptotic significances less than or equal to zero), as demonstrated in the prior analysis.
2. Amongst the 8 Airport Processes variables, 3 displayed statistically significant disparities in relation to the Age question (Q12, Q15 and Q18), and two were statistically notable at a level of 10%, which is somewhat aligned with our previous observations.
3. Within the set of 8 Airport Processes variables, 4 produced statistically substantial differences (Q12, Q13, Q15 and Q18) with respect to the Occupation question. Others would be significant at a level of 10%, which harmonizes with what we have observed thus far.
4. Of all SA Impacts variables studied, results indicated that among them: for five cases there exist meaningful variations(Q22,Q24,Q25,Q27 and Q29). As regards Education query; while for other two noteworthy outcomes can also be noted even if they are not worth considering seriously because their significance threshold hovers around modest ten percent boundary as per out priory belief System from earlier analyses
5. In view of Information & Communication Technologies problem domain having eleven relevant variable under study only three had shown noticeable departure(from some pre-conceived normal values?) ; While along similar lines another one more was diffrent enough though Not completely conclusive(normally seen). All this epsiode does Not impress me positively To generalize any functioning Model based on just these More facts emerging here(viz. its particular sample national character apart form specific Instrumentation used)?

6. Almost half(i.e., four out often considered parameters have been found pointing towards requirement adjustments); e.g.suppose including Margin errors or simply re-work , basing such opinion cohort response behavior patterns I am able gather little significantly different compared my initial gut feeling .

7. CONCLUSIONS

Airports are the primary and final points of contact for tourists when arriving at or departing from their destination. These initial and concluding experiences play a vital role in encouraging future visits and shaping the international image of a country. Therefore, it is crucial to develop modern, intelligent airports that can offer passengers with enjoyable new experiences through the use of advanced technologies, thereby facilitating their transit.

Following an empirical analysis, we are now able to partially address the objective set at the outset of this study: The overarching aim of this research is to identify which technologies are most valued by passengers in defining an airport as "smart." This involves outlining a scenario encompassing the necessary technologies for an airport to be deemed smart based on passenger perceptions. Additionally, we have reviewed technologies aligned with this concept and implementing comprehensive solutions. Passenger satisfaction serves as a pivotal performance indicator for airport operations; therefore, this study addresses satisfaction-driving technologies.

The findings indicate that Wi-Fi and Smartphones rank highest among valued technologies. Their combined usage contributes to alleviating airport congestion by reducing interaction points – improvements that align with reduced interaction requirements arising from COVID-19 measures. Moreover, utilizing technology during dwell time receives little appreciation as passengers seek to minimize their time spent at airports in order to reduce potential exposure risks.

Passengers place high importance on efficient procedures within airports as waiting times significantly impact customer satisfaction (Otieno & Govender, 2016).

This study shows that investing in airport IT will be advantageous as it improves the traveler's experience, a crucial factor during the current pandemic. As per an article by Rohit Talwar, CEO of Fast and Future Research In the next one to three years, the COVID-19 crisis will have a more substantial impact on technology in company/business markets and the economy as a whole (Serrano & Kazda, 2020).

Passengers are satisfied with the use of technology for ticket bookings, reservations, and check-in or boarding pass issuance. Carmona's research on the integration of digital technology in boarding processes, luggage handling, check-in procedures, customs inspections, and passenger activities during wait times supports these findings. Digital solutions like self-service kiosks for boarding and baggage labeling, biometric passport control systems, interactive guides using augmented reality at airports, and entertainment options such as video games are being increasingly employed in these areas. This study aims to analyze the gender perspective on satisfaction with technology within smart airports. The research indicates that women place higher importance on technology usage, its benefits in end-to-end airport operations,and its impact on overall airport performance.

Female travelers prioritize comfort, convenience, and enjoyment in airport services. They tend to give higher ratings for improvements in these services compared to men. According to Kurtulmus og˘lu et al., the use of technology could further enhance these aspects, emphasizing the importance of gender-specific strategies in the airline industry. Research also shows that women prioritize seat comfort, legroom, and flexibility in modifying reservations more than men do. Bahar et al. (2018) The study also came to similar conclusions. It is crucial to consider gender differences in passenger preferences for technology use and

services at airports, suggesting the need for gender-specific strategies. Additionally, women show more interest in sustainability and have a better understanding of its positive economic impact. Women's increased involvement in technology aligns with efforts by air transport stakeholders to promote gender equality, as outlined in ICAO's goal to achieve gender parity in aviation employment by 2030.

In addition, the general director of Airports Council International emphasized the importance of gender diversity in aviation at the 2020 Airport Experience conference. Attracting a skilled workforce with technical and professional profiles is essential for future airport development. The existing synergy between these programs and women's tech-savviness in airport operations should be leveraged by airport management. This study also recognizes sociodemographic disparities in how women perceive technology use in airports, with nationality playing a pivotal role. Women's cultural backgrounds, age, and occupation all influence their technological preferences while traveling. However, there were no significant differences based on education level, computer skills, or frequency of air travel found. Airport services addressing issues such as wait times and baggage collection are key factors for tourism competitiveness; effective innovations do not necessarily need to be complex but should provide maximum benefits to passengers and airlines.

In addition, evaluating traveler satisfaction provides valuable insights for airport managers to improve service quality by addressing gender, social, and cultural differences. Incorporating passenger willingness to utilize technology for travel processes can help rectify deficiencies in airport services and enhance the overall perception of service quality.

Investing in enhancements for flight information and other services has been proven to enhance passengers' perception of overall service quality. This research emphasizes the importance of analyzing the passenger journey to understand their technological preferences based on demographic factors such as gender; identifying technologies contributing to the concept of a smart airport from travelers' viewpoint; and implementing managerial strategies with specific emphasis on post-Covid crisis management through technology.

It is important to acknowledge that this study has several limitations due to its sample nature. The participants are from 5 countries - Brazil, Chile, Spain,Mexico,and Peru - with a majority being teachers and researchers in tourism and aeronautical sectors who have high levels of education. Moreover, data shows that 46%of female respondents are under26 years old compared to only32%of male respondents which suggests potential biases towards greater computer literacy and more frequent use of air transport than the general population.This was intentional as we aimed to gather insights from individuals with significant knowledge about specific aspects relevant to this study's objectives.

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