AB Journals

British Journal of Computer, Networking and Information Technology
ISSN 2689-5315 • Volume 9, Issue 2, 2026 • pp. 149-169

RESEARCH ARTICLE Received: 13 Aug 2026, Accepted: 25 Aug 2026, Published: 15 Sep 2026

Beyond Operational Efficiency: Understanding How AI-Enabled Service Quality and Trust in Automation Shape Passenger Satisfaction in Airports

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Abstract

In modern times, the airport industry faces rapid changes caused by the implementation of Artificial Intelligence (AI) solutions such as biometrics, automated border control, advanced luggage processing, and AI-powered customer service. While current literature pays much attention to the operational benefits of these technologies, little attention is paid to how customers perceive AI-powered services and how these perceptions lead to higher passenger satisfaction. This paper aims to offer a conceptual model explaining the relationships between AI service quality, trust in automation, and passenger satisfaction in airports.

Based on the E-S-QUAL framework and Trust in Automation theory, the research proposes AI service quality as a higher-order construct comprising four dimensions: efficiency, system availability, fulfilment, and privacy. Each dimension is proposed to affect passenger satisfaction through direct and indirect pathways, with trust in automation serving as a mechanism that influences passengers' confidence in intelligent systems and reduces uncertainty in technology-mediated experiences. Heathrow Airport is used only as an illustrative example of broader airport digitalisation trends, rather than as an empirical case study.

The proposed framework extends E-S-QUAL to AI-based airport services and integrates service quality and trust into a unified conceptual model.

Keywords: Artificial Intelligence; E-S-QUAL; Trust in Automation; Passenger Satisfaction; Smart Airports.

How to Cite: Rambojun, A. (2026). Beyond Operational Efficiency: Understanding How AI-Enabled Service Quality and Trust in Automation Shape Passenger Satisfaction in Airports. British Journal of Computer, Networking and Information Technology, 9(2), 149–159. https://doi.org/10.52589/BJCNIT-JIQD9AD5

INTRODUCTION

Background and Context

The rapid development of artificial intelligence (AI) technologies is changing the provision of services in many industries, among which aviation is a clear-cut example of an industry that has quickly adopted intelligent solutions. Many airports use AI technologies to improve their operational efficiency, increase security levels, allocate resources better, and ensure passengers a hassle-free experience from curb to gate. These technologies include biometric ID systems, facial recognition technologies, automated passport controls, predictive analytics tools, sophisticated baggage handling systems, and operational management tools (Huang & Rust, 2021; Ivanov & Webster, 2019). With the increase in the number of passengers around the world and challenges that arise with regard to improving service delivery in increasingly complicated conditions, AI is becoming a crucial tool for successful service provision.

The incorporation of artificial intelligence (AI) into the operation of airports reflects the larger movement of digitalisation and transformation which is now affecting the entire transportation industry. Contrary to previous conventional operations at airports based on manual procedures and the direct involvement of humans, today's airports are evolving towards becoming service ecosystems relying mostly on automation (Davenport et al., 2020). Within these service ecosystems, the use of automated technologies becomes crucial in facilitating travellers' experiences, controlling their movement across the facilities and ensuring their secure passage (Davenport et al., 2020). The use of AI technologies becomes relevant for international airports due to numerous difficulties related to the provision of efficient and reliable services for thousands of people travelling through them. Therefore, the investment of money into intelligent systems capable of increasing throughput, reducing delays, improving the quality of decisions and providing personalised services is highly important for the operators of airports.

In the major international airports, such as Heathrow Airport, located in London, United Kingdom, the use of AI technologies becomes visible. Being one of the most loaded international aviation hubs, Heathrow is actively investing in digital technologies for improving the process of passenger processing, making them more efficient and improving the quality of service. There are biometric verification systems, automated border control technologies, flow prediction systems, and operational platform for supporting decisions that can be seen in Heathrow. All these innovations demonstrate the way AI is being used for streamlining processes, mitigating possible bottlenecks and providing personalised service experiences.

AI-Driven Transformation of Airport Services

The evolution into AI-based processes has brought about fundamental changes in the nature of encounters at the airport facilities. Before, there was an emphasis on in-person communication with airline representatives, customer service professionals, security guards, and immigration officials. As technological advancements accelerate, many customer services are becoming automated, transitioning from human-based delivery of services to technology-based communications (Huang & Rust, 2021).

Currently, AI plays a role in almost all stages of the passenger journey process. Passengers are now using self-service check-in kiosks and automated systems for document authentication. At the checkpoints and when undergoing immigration control, passengers benefit from the use

of biometrics for identity authentication and fast processing. Predictive analysis driven by AI is used for passenger flow predictions and identification of possible bottlenecks to ensure efficient crowd management. Moreover, intelligent luggage handling system is being utilized to facilitate luggage monitoring and minimize mistakes in handling procedures (Ivanov & Webster, 2019).

Statistics provided by the industry show that acceptance of these technologies among passengers is rising rapidly. According to International Air Transport Association (IATA, 2025), passengers are increasingly accepting digital identities and biometrics when it enhances travel experience.

-However, the growing reliance on AI-based systems has raised certain issues related to privacy, transparency, reliability, and trustworthiness. Usually, airports measure the performance of AI-based systems in terms of speed, efficiency, and cost-effectiveness. On the other hand,-passengers judge such systems based on their perception of service quality, ease of use, security, and trust in the system. It becomes evident that there is a need for a more passenger-oriented approach to the development of AI-enabled airport services.

The Growing Importance of Passenger-Centred Evaluation

Though ensuring operational efficiency continues to be an important goal of airport management, the successful implementation of AI-powered services is possible only if passengers accept them and remain satisfied with their use. Airports cannot be viewed as mere physical infrastructures, as they represent service environments where passengers' perceptions significantly influence the results of service delivery. Thus, assessing airport technologies based only on operational criteria is insufficient.

The extensive literature on service quality reveals that customers' assessments are determined not only by results of a technical nature but also by customers' perceptions of reliability, responsiveness, convenience, trustworthiness, and overall satisfaction (Grönroos, 1984; Parasuraman et al., 2005). In cases where technologies are used to mediate interactions between customers and service providers, the role of these perceptions becomes even more significant. At airports, passengers often interact with AI-powered technologies under the pressure of time, uncertainty, security risks, and absence of human assistance. As a result, perceptions of service quality and trust may have a major impact on the overall assessment of the airport experience.

A growing number of recent studies emphasise the importance of passenger-oriented evaluations within the airport environment (Bezerra & Gomes, 2015; Bogicevic et al., 2013; Halpern & Mwesiumo, 2021). Recent research has also examined airport service quality and passenger satisfaction, including the role of technology in shaping passengers' experiences (Usman et al., 2022; Nwaogbe et al., 2021; Booranakittipinyo et al., 2024). Nevertheless, in spite of the growing interest in airport service quality and smart airport technologies, there are still limited studies focusing specifically on passengers' perceptions of AI-powered services.

Research Problem

The rapid adoption of artificial intelligence (AI) technologies in airports is transforming the way passengers interact with airport services. AI-enabled systems are increasingly being used to support activities such as check-in, identity verification, security processing, passenger assistance and other aspects of airport operations. While these technologies are intended to improve efficiency, speed and service delivery, their increasing use also creates an important

passenger-centred problem. The effectiveness of AI-enabled airport services cannot be determined solely by their technological or operational performance; it also depends on how passengers perceive, evaluate and respond to the services provided through these systems.

Existing research on AI and smart airport technologies has largely emphasised operational outcomes, including efficiency, productivity, capacity management, technological effectiveness and innovation (Halpern & Mwesiumo, 2021; Booranakittipinyo et al., 2024). Although such research demonstrates the potential of AI to improve airport operations, it provides insufficient understanding of passengers' experiences with AI-enabled services. In particular, there is limited understanding of whether passengers perceive these technologies as providing efficient, reliable, secure and satisfactory services and how such perceptions affect their overall satisfaction with the airport experience.

The problem is further complicated by the changing nature of airport service delivery. Traditional airport services have involved substantial interaction between passengers and human employees, whereas AI-enabled systems increasingly mediate or replace aspects of these interactions. This transformation raises questions about whether passengers evaluate technology-mediated services in the same way as conventional services and whether their perceptions of service quality influence their willingness to accept and use AI-enabled systems. Although airport service-quality research has examined passenger satisfaction and different dimensions of airport service quality (Arif et al., 2013; Bakır et al., 2022; Usman et al., 2022), the growing role of AI introduces additional considerations that are not adequately captured by conventional approaches to airport service evaluation.

Trust represents another important dimension of this problem. Passengers may be required to rely on AI-enabled systems when performing activities involving personal information, identity verification, security and other critical stages of their journey. Consequently, passengers' willingness to rely on such systems may depend not only on the quality of the service they receive but also on whether they perceive the technology as reliable, predictable and trustworthy. Recent studies have examined passenger acceptance, satisfaction and perceptions of smart airport technologies (Nwaogbe et al., 2021; Booranakittipinyo et al., 2024; Park & Kim, 2024; Kim et al., 2025), but the relationship between AI-enabled service quality, passenger trust and satisfaction remains insufficiently understood.

The research problem addressed by this study is therefore the limited understanding of how passengers' perceptions of AI-enabled airport service quality influence their satisfaction, particularly where trust in AI-enabled systems forms part of the passenger experience. Without a clearer understanding of these relationships, airports may assess the success of AI implementation primarily through operational indicators while overlooking passenger perceptions that can determine the acceptance and effectiveness of technology-enabled services. Addressing this problem is important for developing a more passenger-centred understanding of AI adoption in airport service delivery and for identifying the factors that contribute to positive passenger experiences in increasingly automated airport environments.

Aim and Objectives

The aim of this paper is to develop a conceptual framework that explains how AI-enabled service quality influences passenger satisfaction through the mediating role of trust in automation within airport environments.

To achieve this aim, the paper pursues four objectives:

1. To critically examine the role of artificial intelligence in contemporary airport service delivery.
2. To evaluate the applicability of the E-S-QUAL framework within AI-enabled airport environments.
3. To explore the role of trust in automation in shaping passenger evaluations of intelligent airport services.
4. To develop an integrated conceptual framework linking AI-enabled service quality, trust in automation, and passenger satisfaction.

LITERATURE REVIEW

AI Transformation of Airport Services

Evolution of Smart Airports

Technological innovations over the past two decades have resulted in the formation of 'smart airports'. It reflects the transition from the traditional manual-based process to a digital ecosystem that employs information and communication technologies (ICTs), data analytics, automation, and artificial intelligence to increase efficiency and improve passengers' experience. In contrast to the traditional airports based on standalone and manual procedures, the smart airports employ the digital technology for data exchange and predictive analysis (Zhang et al., 2019).

The idea is based on the smart city initiative which uses the digital technology to enhance efficiency, sustainability, and service quality (Kazak et al., 2020). Increasing numbers of passengers, high-security requirements, and complexity of operation have made the airports move towards intelligent resources' management, automated service delivery, and customer interaction.

Initially, digitalization of airport services was connected to the automation of the operational process which includes such procedures as electronic ticketing, check-in at self-service kiosks, automated baggage checking, and passenger processing. Although such improvements brought some efficiency, they have not changed the essence of the passenger experience significantly (Fodness & Murray, 2007).

The recent improvements in airport digitalization were associated with big data analytics, cloud computing, Internet of Things (IoT), and artificial intelligence. They allow the airport to collect and analyze huge amount of data about passengers and the airport itself using sensors, cameras, and mobile devices (Ivanov & Webster, 2019; Davenport et al., 2020).

Such development has led to the changes in the competition of airports. Earlier the airport competition was related to the location, connectivity, and infrastructure. Now it becomes dependent on the ability of the airport to provide seamless travel experience to the customers. It makes airports invest a lot into innovation and measure the performance both from the operational and service perspectives (Halpern & Mwesiumo, 2021).

Smart airports can be considered as technologically developed infrastructure. However, recently the approach towards smart airport considers them as passenger-centered service

system. The balance between the technological innovation and the user-oriented service design is seen as crucial for success (Bakır et al., 2022).

Artificial Intelligence in Contemporary Airport Operations

Artificial intelligence (AI) refers to the capacity of computers to perform tasks that require human intelligence, which include learning, making decisions, recognizing patterns and problem solving (Huang & Rust, 2021). The use of AI technology is widespread in airports, where it is employed to increase efficiency, security, resource allocation and enhance the passenger experience.

The increasing number of airport passengers, the complexity of operations, dynamic conditions, security considerations and the need to provide personalized and seamless services create a demand for increased use of AI (Davenport et al., 2020). The use of AI in airports implies massive amounts of data collected about passengers, flights, baggage handling and security procedures. AI analytics is used to process such data in real time to predict delays, optimize resource allocation and reduce waiting time by using queue prediction systems (International Civil Aviation Organization [ICAO], 2022).

Among other areas of the application of AI in airports, there are security and border control, which involve biometrics technology, including facial recognition, fingerprints and irises scanning (ICAO, 2022). Machine learning automated border control systems increase processing speeds, minimize mistakes and reduce manual inspection time (IATA, 2025). In baggage management and logistics, AI algorithms help minimize mishandling, optimize routing and turnaround operations as well as optimize gate allocations.

Another area of the use of AI in customer services is provision of virtual assistants, chatbots and recommendation systems that provide real-time information regarding flights, navigation and baggage handling, thus offering personalized services in a cost-effective way.

However, the use of AI in airports involves numerous challenges, including issues associated with the protection of biometric data and transparency and accountability of automated decision-making (Lee & See, 2004; Huang & Rust, 2021). In addition, passengers might not be willing to use AI-based technologies because of their lack of reliability or complexity.

Thus, in assessing the effectiveness of AI in airports, one needs to consider how passengers perceive quality of services and trust in automation.

AI Applications Across the Passenger Journey

The passenger journey consists of a sequence of service encounters beginning prior to arrival and ending after arrival. Contemporary airports use artificial intelligence in all phases of operations to increase efficiency, convenience, security, and personalization, thus changing service encounters and raising the level of customers' expectations about the quality of service.

Before the travel process begins, the machine learning algorithms powered by AI provide personalized information, make forecasts and suggest solutions according to the preferences and experiences of passengers. The mobile applications give up-to-date information about flight schedules, gates, waiting time in security checks and the status of baggage (Davenport et al., 2020).

In the process of airport operations, the check-in, identity verification and immigration procedures become self-service due to self-service technologies and biometrics like facial recognition and automated border control. These systems contribute to security as well by analyzing behavior and recognizing objects (ICAO, 2022).

The terminals use AI for wayfinding services, chatbots and virtual assistants to answer passengers' questions and provide predictive analytics that allows creating personalized retail offers and communications with clients (Huang & Rust, 2021). Bellizzi, Eboli, and Mazzulla (2020) argue that in baggage management, the tracking and routing systems minimize mistakes and provide precise information for passengers

After the arrival, AI helps passengers to go through customs clearance, arrange their ground transportation and receive information about airport services. Overall, AI affects the whole journey of passengers, not just particular processes. That is why service quality evaluations by passengers are becoming dependent on their encounters with intelligent systems.

Heathrow Airport as a Leading Digital Airport

One of the world's busiest and most popular international airports – Heathrow – can be considered an appropriate example of AI-based digital transformation in airport services. Being responsible for handling millions of passengers yearly, Heathrow has invested heavily into digitalisation aiming at improving efficiency and the quality of services (Heathrow Airport Ltd., 2025).

Thus, the airport uses a comprehensive digitalisation strategy that includes biometric solutions like facial recognition for passenger verification and processing, predictive analytics to observe passenger flows and congestion management, and mobile applications, self-services and automated solutions that help passengers take control over their trip experience. These are some examples of current digitalisation trends in the aviation industry.

However, there are several aspects of digital transformation at Heathrow that highlight the problem's challenges. First of all, an increased usage of biometric technologies leads to a variety of questions related to privacy, security, and ethics. Second, the success of AI projects will depend not only on their technical effectiveness but also on the perception of quality of services by passengers and their willingness to use new technologies.

It is important to note that Heathrow is not a special case but just an example of tendencies typical for other major airports of the world.

Passenger Experience in AI-Enabled Airports

The issue of passenger experience has become one of the most important aspects considered both in terms of practice and scientific research of airport management and service quality. Traditionally, the performance of airports was evaluated in terms of operational measures (e.g. flight operations, passenger handling and infrastructure usage intensity). However, in light of increased competition among airports and rising travelers' expectations, a trend has appeared toward more customer-centered approaches that place passengers at the center of the assessment process (Fodness & Murray, 2007).

Passengers' experience implies all cognitive, emotional and behavioral reactions that travelers express during their interaction with the services provided by airports and the environment where those services are provided. These reactions are determined by such factors as service

quality, the level of convenience and efficiency of the processes, safety, comfort and the quality of staff interactions (Bezerra & Gomes, 2015). The modern era of artificial intelligence contributes to the increasing number of passengers' experiences that occur due to interactions with advanced technologies rather than human services providers.

Scientific studies show that passengers usually positively react to innovations that decrease their waiting time, simplify the procedure and make it convenient (Bogicevic et al., 2013; Kim et al., 2025; Wongyai et al., 2025). Thus, such innovations as self-service kiosks, biometrics and smart navigation are often associated with enhanced efficiency and convenience of procedures (SITA, 2025; ACI EUROPE, 2024). However, these positive attitudes are not necessarily inherent to all innovative solutions. Passengers' reaction to innovations depends on a number of interacting factors such as reliability of technology, its ability to protect travelers' privacy, the level of transparency and trustworthiness (Wongyai et al., 2025; Kim et al., 2025).

Trust is of particular importance when passengers rely on technologies to perform essential tasks such as identity checks, security checks, and luggage handling (SITA, 2025; Wongyai et al., 2025). Unlike traditional services where a human service agent can provide reassurance and explanation in real time, an interaction driven by artificial intelligence requires a passenger to trust a technology whose internal functioning is unclear. Therefore, the trust in automation could become an important mediator between the perception of service quality and passengers' satisfaction (Kim et al., 2025; Lee & See, 2004).

It is worth noting that passengers have varying degrees of readiness for using technologies, different levels of technological literacy, and various preferences for interaction with an automated system. Some of the passengers are quick to adopt new technologies; however, other passengers prefer human interactions or raise issues of privacy. It shows the complexity of the passenger experience in AI-driven airports and highlights the importance of building the framework for understanding the process of evaluation of intelligent service systems.

Although much research has been conducted on airport digital transformation, some critical research gaps still exist in terms of the effects of AI-based services on passengers' experience. In particular, existing literature has paid more attention to the operational aspects, including efficiency, productivity and capacity management, while little consideration has been provided for passengers' service quality and satisfaction assessment (Halpern & Mwesiumo, 2021; Bakır et al., 2022).

Additionally, the traditional airport service quality models might be incapable of accounting for the peculiarities of AI-based interactions (Bellizzi et al., 2020). The same can be said about technology acceptance research that usually deals with the attitude towards the technology itself but not with the quality of the service that is provided with it. Furthermore, the interconnection between service quality and trust in automation has not yet been thoroughly studied (Lee & See, 2004).

Thus, three critical research gaps exist. Firstly, there is a passenger-experience gap since limited consideration has been given to passengers' assessments of AI-based service quality and the impact of that on passenger satisfaction. Secondly, there is a service quality gap, especially concerning the application of E-S-QUAL to AI-based airport services. Finally, there is a theory gap since service quality and trust in automation have not been well-integrated in order to explain the passenger satisfaction.

Therefore, in order to close those gaps, the current research will attempt to integrate E-S-QUAL with Trust in Automation Theory.

Theoretical Foundations

Service Quality Theory

Service quality is a key determinant of customer satisfaction and loyalty in service industry. Grönroos (1984) described service quality as the discrepancy between customers' expectations and service performance, comprising technical quality (results) and functional quality (process). The definition is highly pertinent to airports where customers assess results in the form of baggage delivery and security screening in addition to convenience and responsiveness.

The SERVQUAL framework introduced by Parasuraman et al. (1985) evaluates service quality from five perspectives: reliability, responsiveness, assurance, empathy, and tangibles. SERVQUAL has been extensively used in transport, tourism, and hospitality industries, including in airports where service quality greatly affects customer satisfaction, airport selection, and customer intentions (Fodness & Murray, 2007; Bezerra & Gomes, 2015).

SERVQUAL received criticisms concerning the validity of expectation-perception gap measurements and its limited applicability to technology-based services (Cronin & Taylor, 1992). With the increasing role of AI and automation in airports, there is a necessity for traditional models to be adapted to digital environment. It prompted the development of electronic service quality models, such as E-S-QUAL.

SERVQUAL to E-S-QUAL

The emergence of digital technology makes the existing models of service quality assessment inappropriate to evaluate technology-based services offered via websites, mobile applications, self-service kiosks, and automated systems (Parasuraman et al., 2005). Thus, Parasuraman, Zeithaml, and Malhotra (2005) developed E-S-QUAL – an instrument aimed at measuring electronic service quality.

Unlike the SERVQUAL model that is associated with interpersonal communication, E-S-QUAL considers the process of delivering services via the digital channel. This model includes four important dimensions, including efficiency, system availability, fulfilment, and privacy. It should be mentioned that all of them are significantly related to customer satisfaction, trust, loyalty, and behavioral intention in such sectors as e-commerce, banking, tourism, and others (Gefen et al., 2003; Parasuraman et al., 2005).

It goes without saying that airport environment is highly connected with E-S-QUAL since passengers often use kiosks, biometrics, mobile applications, and automated border control systems which are very similar to those situations for which the model was initially intended. However, E-S-QUAL gives little understanding of how passengers trust modern AI systems.

Dimensions of E-S-QUAL

Efficiency

The definition of efficiency is how easy and quick it is for users to have access and use the service (Parasuraman et al., 2005). In the case of airports, efficiency encompasses self-service check-in, biometric recognition, automatic boarding procedures, and digital wayfinding.

Efficiency plays an important role in predicting customer satisfaction due to their limited time frame (Gefen et al., 2003).

System Availability

System availability is a term used to describe reliability, accessibility, and constant performance of the service systems. When there are malfunctions in biometric systems, baggage handling systems, and self-service terminals at an airport, passengers experience long wait times and frustration. Therefore, passengers value system availability.

Fulfilment

Fulfilment is a measure of how well the services achieve their expected results at the right time (Parasuraman et al., 2005). In the case of an airport, this refers to flight information accuracy, luggage handling efficiency, efficient passenger management, and navigation success.

Privacy

Privacy encompasses the safeguarding of personal information and the guarantee that the collection, storage, and usage of such data is done in a responsible manner. It becomes an important feature in airports employing AI technology owing to the use of biometric and facial recognition technologies.

Trust in Automation Theory

Trust in Automation Theory (Lee & See, 2004) offers great insight into the interaction between humans and intelligent technologies. It conceptualizes trust as the attitude that makes users able to depend on a system to reach their goals while facing uncertainty and vulnerability. In the case of airports, where technologies deal with identification processes, screening of passengers, and managing baggage, trust is crucial since most intelligent technologies function as “black boxes.”

In particular, according to Lee and See (2004), such factors as reliability, predictability, competence, and transparency constitute the antecedents of trust. Empirical data proves that the level of trust impacts the adoption and evaluation of technology in different spheres of human activity such as medicine, finances, and e-commerce (Gefen et al., 2003). Therefore, trust can be regarded as a mediator in relation to airport services based on AI.

Passenger Satisfaction Theory

Passenger satisfaction is described as a judgment that happens post consumption based on the comparison between the passengers’ expectations and performance (Oliver, 1997). At airports, passenger satisfaction is seen as a multi-dimensional judgment where all the service encounters from check-in to luggage collection that include AI-based technology are evaluated.

Satisfied passengers tend to be loyal, endorse the airport, and revisit in the future (Bezerra & Gomes, 2015; Halpern & Mwesiumo, 2021). In an AI-based environment, passenger satisfaction is influenced not just by the service performance but also by the degree of trust that passengers have in intelligent systems.

Theoretical Limitations and Contribution

However, despite the development in these fields, there are still several limitations that remain

unresolved. First, traditional frameworks of service quality research were intended for human-to-human services, and thus they cannot be applied to the case of technology-mediated interaction (Wong et al., 2022). E-S-QUAL framework can adequately represent the notion of technology-related service quality; however, it provides little information about the psychological process behind it, especially trust building. On the other hand, Trust in Automation literature is usually concentrated on the question of adoption rather than services provided by technology.

In addition, most of the studies conducted in airports do not take into account the service quality and trust perspective (Wongyai et al., 2024; Chaiwan et al., 2025). Therefore, the purpose of this paper is to develop an integrative conceptual model using the E-S-QUAL framework and Trust in Automation Theory.

CONCEPTUAL FRAMEWORK DEVELOPMENT

Integrating E-S-QUAL and Trust in Automation

From the analysis conducted during the previous step, a consistent trend was established. The existing literature treats service quality and trust in automation as separate theoretical areas of research. In turn, E-S-QUAL provides a reliable and highly substantiated method of measuring the technological service quality. Nevertheless, it lacks sufficient insights into the psychological mechanisms that determine passengers' level of trust in intelligent technologies. Similarly, Trust in Automation Theory can explain how users perceive and develop trust in automated technologies; however, it fails to provide the information on the aspects of service quality that affect the formation of customers' perceptions.

In this situation, the need to view the issue from a different perspective becomes obvious due to continuous implementation of AI technologies in airports. At the same time, the process of interaction of passengers with biometric verification systems, automated border control systems, intelligent technologies of baggage handling, and AI-based customer service systems involves evaluation of the quality of the services provided and trustworthiness of the technology implemented at the same time. As a result, we need a framework that would allow us to measure passenger satisfaction in the context of such interrelated variables.

Based on the above-stated observations, the paper presents an integrative conceptual framework consisting of E-S-QUAL and Trust in Automation theory. According to this framework as depicted in Figure 1.0, AI service quality represents a higher order construct involving four dimensions, namely, efficiency, system availability, fulfilment, and privacy. Trust in automation is a mediating mechanism explaining the relationship between service quality and passenger satisfaction.

AI-Enabled Service Quality in Airport Environments

1. Service quality via intelligent systems describes the way in which passengers judge airport services provided to them via intelligent technologies. On the basis of the E-S-QUAL model, the following four interrelated factors form this concept:

2. Efficiency: the speed and convenience of completing airport tasks by means of the use of intelligent systems.

3. System availability: the perception of the system's reliability and overall functionality from passengers' perspective.

4. Fulfilment: the ability of intelligent systems to offer promised services in an accurate and consistent manner.

5. Privacy: the passengers' trust that their private data is secure.

These four factors contribute to passengers' perception of the service quality offered to them by airports. The more efficiently the travel process can be completed, the more reliable the technology is, the more successful the results of this process are and the safer the passengers feel about their privacy, the higher the service quality rating will be from passengers' point of view.

Proposition 1

AI-enabled service quality positively influences passenger satisfaction in airport environments.

Trust as the Missing Link in AI-Enabled Service Delivery

Even though service quality continues to be one of the main variables for customer evaluation, there are additional aspects associated with intelligent service environments that need to be considered. For instance, passengers increasingly depend on AI-enabled airport services to facilitate essential processes, including identity verification, security screening, baggage management, and other aspects of travel.

However, it is vital to consider trust because some of the AI systems can function without sufficient information for users. Even though travelers might not understand how some decisions have been made, they are obliged to use these systems for having good experiences while traveling. Thus, reliability, predictability, competence, and transparency become the main drivers of trust formation.

The high level of service quality is expected to promote trust among passengers since they will gain confidence regarding the technologies providing effective outcomes. Efficient, reliable, accurate, and secure systems demonstrate competence, which reduces uncertainty.

Proposition 2

AI-enabled service quality positively influences passengers' trust in automation.

Passenger Satisfaction in AI-Mediated Service Encounters

Passenger satisfaction is a measure of how travelers experience their trips through the airport, comparing expectations and reality in terms of the quality of service provision. With the help of AI, the modern airports are able to create passengers' satisfaction due to the interaction with intelligent technologies that provide guidance during passengers' journey from the moment of check-in to boarding.

One of the factors that influence passenger satisfaction is trust in automation. If travelers trust to the process of automation, they will feel it as something convenient, effective, and efficient. Otherwise, doubts regarding the process itself, privacy issues, and opacity of this process can spoil their experience and influence the final measure of travelers' satisfaction negatively.

Therefore, trust should be considered not just as an outcome of service quality, but also as an important factor influencing evaluation of the travelers' experience.

Proposition 3

Trust in automation positively influences passenger satisfaction in airport environments.

Development of the Integrated Framework

The suggested model starts with the assessment of the quality of AI-driven airport services made by passengers. Such an assessment will be based on a number of practical criteria – efficiency of the services, reliability of the system, service fulfilment, and protection of privacy. The judgments made by passengers regarding such criteria will then shape their level of trust in automation, which in turn will impact passengers' level of satisfaction with their airport experience.

In this manner, the framework takes trust into consideration as a mediating psychological factor between perceptions of service quality and the corresponding satisfaction outcomes. By integrating elements of E-S-QUAL theory and Trust in Automation Theory, the framework not only compensates for gaps identified in previous research but also provides a comprehensive view of the airport experience of passengers in a highly digitized environment.

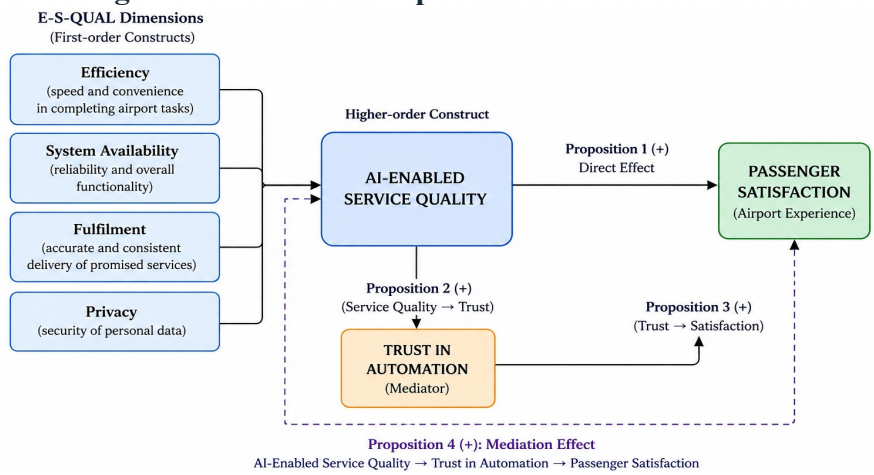
Proposition 4

Trust in automation mediates the relationship between AI-enabled service quality and passenger satisfaction.

Conceptual Framework

According to the framework presented in this paper, AI-based service quality is perceived to be an advanced construct comprising four major dimensions including efficiency, system availability, fulfillment, and privacy. This interrelated set of factors plays an important role in forming trust in automation and passengers' satisfaction. Furthermore, trust serves as a mediating factor connecting service quality perception with satisfaction outcomes. This relationships are illustrated in the conceptual framework presented below in figure 1.

Figure 1: Conceptual Framework of AI-Enabled Service Quality, Trust in Automation, and Passenger Satisfaction in Airport Environments



Source: Author's conceptualisation based on E-S-QUAL (Parasuraman et al., 2005) and Trust in Automation Theory (Lee & See, 2004).

The conceptual model for this study is shown in Figure 1 above presents the integrative conceptual framework, combining E-S-QUAL, Trust in Automation Theory, and passenger satisfaction. The four E-S-QUAL dimensions, namely efficiency, system availability, fulfilment, and privacy, constitute the higher-order construct of AI-enabled service quality. The framework proposes that AI-enabled service quality positively influences passenger satisfaction directly (Proposition 1) and indirectly through trust in automation. Specifically, AI-enabled service quality is proposed to positively influence trust in automation (Proposition 2), which subsequently enhances passenger satisfaction (Proposition 3). Proposition 4 therefore establishes the mediating role of trust in automation in the relationship between AI-enabled service quality and passenger satisfaction.AI-enabled service quality is theorized as an abstract construct made up of efficiency, system availability, fulfillment, and privacy, which were taken from the E-S-QUAL model. The model suggests that passengers' perceptions of AI-enabled service quality have positive effects on their trust in automation and passenger satisfaction. In addition, trust in automation mediates the relationship between perceptions of service quality and passenger satisfaction.

DISCUSSION AND IMPLICATIONS

Reinterpreting Airport Service Quality in AI-Enabled Environments

With the increasing application of AI solutions in daily activities of the airport, there is a need to rethink the way airport service quality is conceptualized and evaluated. Traditionally, the area of airport service quality has been studied from the viewpoint of efficiency, quality of infrastructure, service response and passenger convenience. However, with the development of technologies, the nature of service encounters at the airports has changed and other dimensions are added to passenger experience.

Previously, waiting times, performance of baggage delivery, cleanliness of terminal facilities and rapidness of responses were used as measures of airport service quality. These metrics corresponded to the service environment where all the contacts were performed by people and processes followed traditional rules. However, airport facilities are now increasingly relying on intelligent technologies that influence passengers' experiences at each stage of the travel process. Automated self-service kiosks, biometric solutions, intelligent wayfinding technologies, predictive passenger flow management and AI solutions for customer service are changing the very nature of services and how they are used by passengers.

It means that efficiency alone cannot be considered to understand passengers' assessment of airport services. Though AI-based tools provide more efficiency, reduce wait time and increase resource utilization, passengers evaluate these solutions according to broader set of criteria including reliability, user-friendliness, transparency and trust in the technology. In spite of achieving the airport goals by automation, passengers may still be unhappy with the technologies applied.

This framework adapts to this changing environment through the expansion of E-S-QUAL to allow its implementation at the airport context. Through the inclusion of efficiency, system availability, fulfilment, and privacy, this framework presents an extensive base upon which to understand how passengers perceive the quality of the services provided by the use of AI technologies. In particular, it is important to note that each of these factors includes both functional as well as experiential aspects of service quality. Efficiency includes not only speed but also the convenience with which passengers can engage with the system. The availability

of the system reflects the trust passengers place in the reliability of the technology. Fulfilment refers to the capacity of intelligent systems to produce the desired results consistently, while privacy relates to the protection of personal information in the highly digitalized environment of service provision.

as a technology-mediated concept. It is shaped by passengers' perceptions of their interactions with automated systems. Such an approach extends current research on airport service quality by recognising that passengers' experiences depend not only on the results of operations but also on the quality of their interactions with intelligent systems.

Trust as the Critical Mechanism Linking AI and Passenger Satisfaction

The other important aspect of the present study is that the authors highlight the role of trust in automation as the major mechanism that connects the quality of service supported by artificial intelligence with passenger satisfaction. Previously, many researchers have discussed the significance of service quality and adoption of technology in airports. Still, there were relatively few studies that examined how passengers form the trust in intelligent systems and how this trust affects their perceptions of airport experience.

The issue of trust becomes especially important due to the fact that passengers begin to rely on technological services that are far from their understanding. In a conventional service encounter, customers have an opportunity to ask staff for the needed information. However, in the case of automated service, the system works using some algorithms that are unknown for the user. Passengers do not understand the way how such technologies as face recognition technology, predictive algorithms or automated screening technologies work, still they need to use them in order to have a smooth experience in airports.

Therefore, trust becomes the mechanism of uncertainty reduction and accepting of automated services. If passengers perceive these technologies as reliable, capable, secure and predictable, they develop the needed confidence in how these services work and what results they can achieve.

The role of trust can be particularly emphasized with regard to uses of biometric screening, automation border control system, self-check in technology, and smart baggage management system. They are vital components whose performance affects passengers directly and meaningfully. When there are any mistakes or failures in their operation, it may cause inconveniences, delays and even security issues for passengers. In contrast to that, consistent reliable work of such systems helps to build and strengthen trust that leads to positive evaluations of airport services.

Therefore, the conceptual model proposed in this paper assumes the role of trust as an intermediary variable whose presence links the level of service quality to passenger satisfaction from airport services. With high quality of service, trust will be higher as well, and, therefore, will contribute to higher level of satisfaction. It expands both E-S-QUAL and Trust in Automation theories as it combines their components into one conceptual model. It gives a deeper understanding of passenger reactions to intelligent technologies in the airport setting than any of those theories independently.

Theoretical Implications

The framework offers several valuable theoretical contributions, and each of them manifests itself in a particular manner. First of all, it expands the scope of application of E-S-QUAL

beyond its traditional areas of e-commerce and digital services by showing that this tool is applicable to the evaluation of AI-enabled airport environments as well. The study shows that the classical dimensions of efficiency, system availability, fulfilment, and privacy retain their relevance and remain key factors when evaluating the quality of intelligent airport services. In other words, these dimensions can still be used as means of assessing the quality of the service provided by automated airport systems.

Secondly, the framework promotes airport service quality research by changing the focus from purely performance-based criteria to passenger-centered criteria of evaluation of automated interactions. The change of focus is justified by the fact that a significant part of the current airport literature has mostly emphasized efficiency-related measures of quality at the expense of experiential measures.

Thirdly, the study brings the concepts of E-S-QUAL and Trust in Automation Theory into one consistent explanatory framework. In much of the previous research, the constructs of service quality and trust were not connected despite being conceptually related to each other. This gap was filled with the help of the proposed framework, according to which trust is considered to be a mediator between service quality and passenger satisfaction.

Finally, the study provides a theoretical base for future empirical studies of passenger experiences within the context of automated airport environments.

Heathrow Airport as an Illustrative Smart Airport Context

In this respect, the case of Heathrow Airport represents a relevant and expanded example of the application of the proposed framework in practice. As one of the largest international aviation centers on the planet, Heathrow has invested significant effort into digital transformation projects aimed at enhancing both efficiency and passenger experience. The introduction of biometric verification technologies, digital identity solutions, predictive analytics platforms, and smart operation management systems is reflective of current tendencies within the global aviation industry.

It is worth noting that Heathrow Airport is not offered as an example of an isolated empirical case study. Instead, the case serves as an illustration of how AI-enabled technologies become a part of the contemporary reality of airport operations. The digital transformation activities at Heathrow demonstrate the practical context of interaction between service quality, trust, and passenger satisfaction.

Specifically, the use of biometric identity verification systems promises increased efficiency by means of shorter processing times and more convenient passage through security and check-in procedures. However, the real-world effectiveness of these technologies depends on the level of trust of passengers in their accuracy, reliability, and safety. At the same time, the implementation of predictive systems for managing passenger flow may promise improved operational efficiency by means of reduction of congestion and optimization of resource allocation. Nevertheless, passenger satisfaction depends on the transparency, convenience, and fairness of the system.

The offered framework helps airport managers to evaluate the described initiatives using a particular lens-based approach. Unlike other frameworks, this approach implies taking into account passenger perception of service quality and trust, in addition to the analysis of efficiency-related indicators. This aspect is crucial for the assessment of the discussed case

since technological success does not guarantee positive customer experience necessarily. In order to receive maximum benefits from AI adoption, the airports should focus on both of these aspects equally.

Managerial Implications

Based on the discussed framework, a number of implications regarding the efficient way of working of airport operators in conditions of utilizing AI systems could be identified. Three main issues could be highlighted in this context.

First of all, airport operators are recommended to consider the necessity of including specific trust indicators in the set of measures for assessing the quality of provided services. The traditional performance indicators, which pay attention to such aspects as efficiency, throughput, and general performance, could fail to measure some relevant passenger experience factors in the environments using artificial intelligence systems.

Secondly, managers should be concerned about providing transparent and informative messages about the introduced technologies. The passengers would tend to trust the system much more if they understand its functionality and benefits. In this regard, providing the explanations about how the data is used, about the security measures employed, and about the procedures of operation of the new technology could be beneficial.

Finally, airport managers should be ready to achieve a certain balance between automation and human support in providing passenger services. Despite the numerous benefits from using AI technologies, there would still be occasions, usually rather complex ones, where people would require human assistance. Thus, the development of hybrid service models combining intelligent technologies and human support could be useful.

In conclusion, the framework implies airport operators to expand trust-oriented indicators, provide transparent information about AI solutions, and combine automation with human support.

Policy Implications

As more AI technologies get incorporated into airports, some policy issues become quite relevant. The need arises to ensure that innovations are matched with effective governance that will secure passenger rights and keep the trust of people in the entire transportation system.

In particular, the issue of privacy protection and data governance needs special attention. With more advanced technologies like facial recognition, there must be certain regulations concerning how the data is collected, stored, accessible and used. It will be important to develop such standards to provide passengers with guarantees concerning their privacy and proper use of automated systems.

International bodies related to aviation industry, like ICAO and IATA, have a good potential to develop certain harmonized guidelines on how AI technologies should be implemented in airports. Establishing global standards on transparency, accountability, cybersecurity, and AI itself would help achieve more harmony in the field and promote innovations.

Implications for Future Airport Development

The future of smart airports is associated with the process of growth and evolution in terms of increased automation, connectivity, and intelligence. In the following years, the arrival of novel technologies, including sophisticated methods of biometrics, digital identity tools, prediction and analysis, generative AI assistants, autonomous operations platforms, and other similar developments will bring substantial changes in the area. However, based on the framework offered by this paper, mere technological advancements will not guarantee better results for customers. Thus, smart airports of the future should adopt the idea of being people-centered during digital transformation. Although AI is known to improve efficiency of operations, design and implementation of artificial intelligence in airports should focus on providing better passenger experience rather than on increasing efficiency. The combination of human and artificial intelligence will become more and more important; smart airports are expected to combine modern technologies with empathy, adaptability, and reassurance provided by human employees.

The ethical dimension will acquire more relevance as smart airports start using intelligent technologies more actively. Thus, issues related to privacy, algorithmic bias, transparency, and accountability will need to be addressed properly. Consequently, in developing strategies for future development of airports, there will be a need to adopt robust governance framework.

As far as future airports will adopt increasing technological solutions, the issue of digital inclusivity becomes relevant. Not all passengers have a high level of technological literacy or feel comfortable with the process of using modern technologies. Future airport strategies should incorporate inclusive technologies or at least offer alternative service channels in order to make sure that the benefits of digital transformation are available for all customers.

Therefore, the competitive advantage of future airports may be associated with the ability to merge efficiency and trust. Those airports that will find the way to combine technological innovations and reliability, security, and customer-oriented service are expected to be satisfied by passengers and achieve higher level of loyalty and competitiveness.

CONCLUSION

The rapid development of artificial intelligence technology has changed the way airports function nowadays and the services they provide. Several technologies, including biometric recognition software, automatic border clearance, intelligent baggage management systems, predictive analysis software, and artificial intelligence customer service, have become part of the passenger experience at airports. Despite the fact that there is plenty of research that describes the positive aspects of the implementation of these technologies, such as a high level of efficiency, better safety, and optimized resource usage, less attention is paid to passenger attitudes toward the AI-enabled airport environment. Thus, the current paper attempts to contribute to the literature by providing a conceptual framework of passengers' perceptions of AI-enabled service quality and trust in automation and their effect on passenger satisfaction in the airport environment.

The study uses E-S-QUAL and Trust in Automation theories as a basis for an integrative framework that considers AI-enabled service quality as a higher-order construct comprised of four dimensions: efficiency, system availability, fulfilment, and privacy. In addition, the study claims that passengers' perception of the mentioned aspects of AI-enabled services influences

their satisfaction because trust in automation works as a psychological mechanism between perceived service quality and passenger satisfaction. Combining these two theories helps to develop a more profound understanding of passenger satisfaction in a digitalized environment.

One of the main contributions of the paper lies in a new definition of airport service quality. The results show that in the case of evaluating AI-enabled services, passengers do not concentrate on the functionality of those technologies; instead, their attention is attracted by their reliability, transparency, security, and trustworthiness. Therefore, the success of airport digitalization initiatives depends not only on the functional performance of technologies but also on passengers' attitudes towards them and readiness to interact with intelligent technologies.

Thus, the contribution of this paper is in expanding the literature on smart airports by putting emphasis on trust as an essential predictor of passenger satisfaction. With the development of automated technologies whose inner workings remain unclear to users, it becomes crucial to have trust as a mediator. In this sense, the suggested framework expands on the research related to airport service quality in that it highlights the significance of trust in how passengers perceive AI-powered services.

From this perspective, Heathrow Airport is used throughout the research as a practical example of how digital transformations take place in the aviation industry. In particular, the use of biometric technologies, predictive passenger management technologies, and initiatives to use digital identities at the airport makes it evident how practical the suggested framework is in terms of assessing technological innovations taking place in the aviation industry and highlighting the need for passenger-based evaluation of such innovations.

However, there are still some weaknesses of the study. Being a conceptual paper, the framework lacks empirical validation. For this reason, future research needs to focus on studying the suggested relationships between variables using either quantitative, qualitative or mixed methods in airport contexts. Among other things, it will be interesting to see how passengers assess AI-enabled service quality, what the process of building trust in AI-powered services looks like, and whether trust actually mediates the relationship between service quality and passengers' satisfaction.

In conclusion, future airport competitiveness will depend on how effectively airports respond to the changing expectations of passengers in increasingly digitalized environments. As AI technologies continue to transform airport services, maintaining a passenger-oriented approach will be essential to ensuring that technological innovation delivers meaningful improvements in the airport experience. The proposed framework provides a basis for further empirical research into AI-enabled service quality, trust and passenger satisfaction in airport environments.

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