

THE TRANSFORMATION OF THE AVIATION AND TOURISM INDUSTRY THROUGH SMART TECHNOLOGIES: INNOVATIONS, CHALLENGES, AND PERSPECTIVES

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Abstract

Smart airports leverage technology, including IoT, AI, and automation, to improve operations and enhance the passenger experience. Advanced solutions such as biometrics and real-time information analytics reduce response times, boost security, and streamline valuable resource management. Remarkable examples are Dubai and Incheon airports. Despite the benefits, challenging situations involving interoperability and information security necessitate revolutionary solutions and appropriate legislation. Responsible use of these technologies can transform airports into models of sustainability and operational excellence.

Keywords: clever airport, technological innovation, automation, passenger experience, sustainability.

JEL Classification: Z30.

Introduction

Smart airports are a significant component of aviation modernization, incorporating advanced technology such as the Internet of Things (IoT), synthetic intelligence, and automation to improve operational performance and enhance passenger experiences. Recent study suggests that combining better technology leads to improved performance and consumer satisfaction (Alansari et al., 2019; Deloitte, 2021).

These innovative centers are intended to improve security procedures, reduce wait times, and provide passengers with a higher level of comfort. According to research shows that IoT-based technology and facial recognition can speed-up check-in and baggage inspection processes, improving airport security and performance (Changi Airport, 2019; Al Nuaimi et al., 2015).

Real-time analytics allows airport operators to better manage passenger flows while reducing the hazards associated with congestion and delays

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(Stewart, 2016). Additionally, AI in security processes allows for speedy and accurate passenger authentication, lowering wait times (Jiang et al., 2023).

Successful implementation of these technologies requires integrated and collaborative management, while challenges such as ensuring interoperability and safeguarding personal data privacy remain significant. This study contributes to the literature with a comprehensive analysis of the benefits and limitations of smart facilities, offering recommendations for future optimization of smart airports to enhance passenger satisfaction (International Airport Review, 2023).

Smart Airports

Smart airports constitute a developing fashion within the aviation industry, wherein superior technology including facial recognition, the Internet of Things (IoT), and artificial intelligence (AI) are used to optimize passenger experiences and streamline airport operations. According to Lu (2020), the implementation of these technologies aims to reduce waiting times and increase passenger security and satisfaction, providing a safer and faster travel experience (Lu, 2020). As safety and efficiency demands increase, the adoption of smart technologies is becoming a priority for major airports worldwide.

Dubai International Airport serves as a global leader in implementing facial recognition and iris scanning solutions for immigration control, enabling passengers to complete procedures without presenting physical documents (Dubai Vibes Magazine, 2021). Dubai Airport also presented the smart tunnel concept, in which passengers pass through control points using a fully contactless biometric system, cutting processing time to a few seconds (Airport Technology, 2021).

Recent research emphasizes the significance of effectively managing these technologies in order to address the real demands of travelers. For example, Zhang and Chen (2022) found that while passengers value enhanced efficiency, they are concerned about the privacy and security risks connected with biometric data utilization. In this regard, airports that focus on integrating smart technologies while following to privacy standards might improve customer satisfaction and operational efficiency (FTE, 2021).

Smart Hospitality

Smart hospitality, a growing sector of the hospitality business, is gaining traction. It is anticipated that by 2031, the global market value of clever hospitality would reach USD 133.7 billion. The concept of "clever hospitality" generally relates to the integration of technology and IoT into the operations of hospitality businesses, with the goal of improving guest experiences and creating a more comfortable and pleasant environment.

Advanced technologies and IoT are also altering the hospitality business, accelerating its transition to a smarter model. Wireless infrastructure is predicted to become the standard in hotel IT applications, resulting in cost savings, increased productivity, and improved customer relationship management (CRM) and property management.

Smart hospitality takes an innovative approach to the sector, leveraging technology to improve guest experiences, operational efficiency, and sustainability. The combination of IoT devices, AI, and data analytics enables tailored and seamless visitor experiences. Hotels and resorts that use smart hospitality solutions have intelligent energy management systems, automated guest services, and individualized room surroundings, such as smart mirrors that show weather information. Furthermore, AI-powered chatbots and virtual concierges are becoming more common, offering immediate support and improving client happiness.

Between 2008 and 2020, research on smart tourism identified eight major trends, most of which focused on ecosystems and smart technologies, highlighting the need for exploring other directions, including responses to the COVID-19 pandemic. Previous studies have shown that the integration of big data and interconnected applications can enhance revenue management performance and competitiveness in the hospitality industry.

Moreover, a framework with ten essential technological skills for hospitality practitioners has been proposed, emphasizing the importance of technological competencies in this era. Hospitality and tourism professionals can utilize smart services to provide personalized and proactive experiences while safeguarding client confidentiality and ensuring accurate service delivery. Adopting smart hospitality, based on customer centrality, personalization, and marketing in interconnected destinations, contributes to the creation of sustainable business ecosystems that benefit all stakeholders involved. Research in smart destinations provides a foundation for identifying themes and future areas of study, offering valuable guidance for academics and professionals.

Smart Airport Systems

As a end result of the Fourth Industrial Revolution, airport operations may be streamlined the use of superior technology, improving passenger experiences. Furthermore, the general performance of airports may be increased. Smart airports enhance aviation security, passenger comfort, operational performance, and useful resource optimization whilst addressing vital demanding situations and studies priorities for the future. Initially, the idea of a clever airport changed into proposed to offer primary statistics to clients in a easier and extra green manner, casting off direct interactions.

By integrating technology which includes IoT, synthetic intelligence (AI), biometrics, and information analytics, airport capabilities which includes

check-in, security, bags handling, and plane preservation are optimized. Passengers gain from shorter ready times, personalised services, and smoother tour experiences. At the identical time, airport operators beautify security, control sources extra efficiently, and make information-pushed decisions.

A preceding study (Lykou, G.; Anagnostopoulou, A.; Gritzalis, D. Smart Airport Cybersecurity: Threat Mitigation and Cyber Resilience Controls. *Sensors* 2018, 19, 19) described a clever airport as a unit that complements infrastructure intelligence and evolves right into a clever facility, helping boom and presenting a pleasing tour enjoy with the aid of using integrating commercial IoT and clever devices. Another study (AlMashari, R.; AlJurbua, G.; AlHoshan, L.; Al Saud, N.S.; BinSaeed, O.; Nasser, N. IoT-Based Smart Airport Solution. In *Proceedings of the 2018 International Conference on Smart Communications and Networking (SmartNets)*, Yasmine Hammamet, Tunisia, 16–Revolutionary Organization terrorist organization 2018; IEEE: New York, NY, USA, 2018; pp. 1–6) defined the clever airport as component of a smart city, being a subsystem that connects urban life with aircraft movements. It was also mentioned that an IoT-based smart airport solution would enhance passenger services, operational efficiency, and security capabilities, providing a safer and more robust airport experience. Regarding smart airport management systems, IoT can improve passenger processing and flight management, enhancing services and facilitating passenger travel.

Aviation is an essential part of Hong Kong's constitutional identity. Article 128 of the Basic Law states that "The Government of Hong Kong shall provide the conditions and take measures to maintain Hong Kong's status as an international and regional aviation center." The key phrase "international and regional aviation center" is frequently interpreted as meaning "international aviation hub." Indeed, Hong Kong has been a successful international aviation hub due to its general laissez-faire economic policy and advanced infrastructure, although several factors have influenced this status over the years. However, the Guangdong-Hong Kong-Macao Greater Bay Area (GBA) Development Plan offers new opportunities for Hong Kong. The GBA initiative defines Hong Kong's role in the overall development of the GBA region and reinforces its importance as a leading international aviation hub. This article suggests that although Hong Kong's status as a connecting airport has weakened, the GBA initiative can strengthen its role as an international and regional aviation center.

The Hong Kong International Airport (HKIA) is a remarkable example of a smart airport, utilizing advanced technology to improve both operational efficiency and passenger experiences. Implemented solutions include facial recognition for check-in and security control, enabling passengers to quickly navigate through various stages of travel without the need for human interaction. The airport also employs automated baggage management systems,

facilitating real-time tracking and reducing delays. Additionally, HKIA uses IoT technologies to monitor and manage airport resources such as passenger flow, lighting, and air conditioning, thereby increasing efficiency and reducing energy consumption. The airport has developed mobile applications that provide passengers with personalized and real-time information about flights, baggage status, and available services. Robots are also used to guide passengers, offering information and additional assistance during their journey. These technologies contribute to improving waiting times, operational efficiency, and safety, consolidating Hong Kong's status as an international aviation hub.

At Hamad International Airport (HIA), passengers and visitors can benefit from smart solutions such as the "Pay-on-Foot" automated parking payment system and the "Web Check-In" online check-in service to avoid waiting times. "Pay-on-Foot" machines allow visitors to make payments via strategically placed terminals within the terminal. This system saves passengers time by helping them avoid additional fees associated with waiting in queues to exit airport parking. Although personnel are available in almost every corner of the airport to assist visitors, users, especially first-time visitors, need to familiarize themselves with the system. HIA has announced parking fees that are already in effect. To use the "Pay-on-Foot" machines, visitors must keep their parking tickets rather than leaving them in their vehicles. One of the challenges passengers face is locating their cars in large (short-term) parking areas, especially for those who do not remember their parking space numbers or levels. Even with numbers assigned to each parking space, some passengers find it difficult to locate their vehicles, and sometimes it can take more than an hour to find their car. Parking is free for the first 30 minutes, and the fee for the first hour is QR5. The "Pay-on-Foot" machines accept payments for parking fees but also return change when large-denomination bills are inserted. They also accept coins, but unfortunately, no coins larger than 50 dirhams, so this option may not be usable. In addition, "Web Check-In" machines allow passengers to obtain boarding passes and select their preferred seats on the plane, offering a faster and more personalized experience at the airport.

Heathrow Airport, placed in London, United Kingdom, is one of the largest and maximum essential airports within the world, recognized for its function as an worldwide aviation hub. Operated through Heathrow Airport Holdings Ltd, the airport gives a extensive variety of offerings for airlines, passengers, and numerous business sectors. Aeronautical offerings encompass centers for take-off, landing, plane parking, and bags handling. The airport additionally gives non-aeronautical offerings, inclusive of retail operations, automobile parking, and marketing and marketing revenue.

Heathrow is likewise recognized for its superior infrastructure, consisting of cutting-edge terminals and an green rail shipping system, inclusive of the

Heathrow Express service, which connects the airport to imperative London. In addition, the airport rentals business areas inclusive of hangars, upkeep centers, and load warehouses. Heathrow is a important departure factor for worldwide flights and performs an critical function within the UK economy, serving many passengers and substantially impacting the tourism and change industries. The airport is owned through FGP Topco Ltd and maintains to put money into innovation and improvement to decorate passenger reports and operational efficiency, strengthening its status.

Incheon International Airport, placed close to Seoul, South Korea, is certainly considered one among the biggest and maximum cutting-edge airports withinside the world, identified for its superior infrastructure and revolutionary offerings. Opened in 2001, the airport serves as an essential worldwide hub, being a first-rate transit factor among Asia and the relaxation of the world.

The airport gives a extensive variety of offerings and centers for each passengers and airlines. These encompass an automatic check-in system, speedy protection through biometric technology, an efficient baggage handling system, and modern parking facilities. In addition, Incheon International Airport is known for its exceptional passenger experience, including relaxation lounges, entertainment areas, as well as a museum and luxury shopping space. The airport places a strong emphasis on innovation, using technologies such as passenger-guiding robots and check-in kiosks.

Incheon is also a leader in utilizing smart airport solutions, implementing IoT and artificial intelligence technologies to enhance operational efficiency and reduce passenger waiting times. The airport has also been recognized for its contributions to environmental sustainability, featuring an extensive energy management system and carbon emissions reduction Initiatives.

Incheon International Airport performs a critical function in South Korea's financial system and its global connections, serving hundreds of thousands of passengers yearly and status for example of excellence within the aviation industry.

Incheon International Airport is an example of ambitious development, having a global, regional, and national impact. Over the past decade, the airport has evolved from an impressive transport complex to essential infrastructure for South Korea. Starting with Incheon International Airport, a modern terminal of 6 million square meters that replaced the old Kimpo Airport, this project was planned by Bechtel Corporation and designed by Fentress Bradburn Architects.

Incheon International is a fundamental component of the infrastructure supporting South Korea's ambition to transform Seoul into a major gateway to Northeast Asia. The airport is connected through an extensive transport complex, including a new Transportation Centre designed by Terry Farrell & Partners from London. This elegant and complex building coordinates multiple modes of transport to link the airport to the capital, located over 30 miles away.

Incheon International and its transportation center are vital to the region's development and consolidating South Korea's status as a global transport hub.

Smart Airport Case Study: Dubai Airport

Dubai Airport continues to evolve and enhance traveler experiences, being recognized for its innovative initiatives in smart technology and serving as a model for other global hubs such as Heathrow and Charles de Gaulle (Future Travel Experience, 2021; Dubai Vibes Magazine, 2021). These technological advancements offer new perspectives for optimizing airport operations worldwide.

In the past decade, the emergence of new technologies has led to the development of smart cities, which aim to provide stakeholders with efficient and effective technological solutions. The primary goal of smart cities is to improve outcomes related to people, systems, and processes in businesses, public administration, and other entities in the public and private sectors, ultimately enhancing the fine of existence for all residents. In this context, clever tourism has emerged in latest years as a subcategory of the clever town concept, aiming to offer tourism answers that meet the particular desires of travelers.

Dubai is a growing traveler vacation spot that has carried out clever town and clever tourism structures to have interaction numerous stakeholders.

Dubai International Airport (DXB) is diagnosed as one of the smartest airports in the world due to its advanced technology integration and innovative vision for passenger experience. It has become a global model of efficiency, comfort, and innovation, completely transforming how travelers perceive airport transit.

Advanced Technologies for a Seamless Experience

One of the reasons DXB stands out is its use of cutting-edge technologies to simplify and speed up processes. From automated check-ins and state-of-the-art security scanners to biometric gates that allow swift passage through passport control, every detail is designed to save time and reduce traveler stress. Artificial intelligence systems and big data play a crucial role in optimizing passenger flows and reducing queues, while dedicated mobile apps provide real-time updates on flights, boarding gates, and amenities.

A Smart Ecosystem for Diverse Passenger Needs

DXB aims to be more than just a transit point. The airport has invested significantly in creating an environment that caters to every type of traveler, from tourists to businesspeople. Relaxation areas are equipped with rest spaces and sleep pods, while free, high-speed Wi-Fi and coworking spaces make DXB a perfect spot for the ones running at the go. Furthermore, the cultural variety of passengers is meditated thru a huge variety of eating places and shops, showcasing global impacts.

Sustainability as a Top Priority

Another factor contributing to its reputation as a savvy airport is its commitment to sustainability. DXB has implemented several green measures, such as LED lighting systems, electric vehicle charging stations, and an extensive recycling program. By reducing its carbon footprint and properly utilizing resources, the airport not only provides a modern experience but also contributes to environmental preservation.

Innovation and Future Orientation

DXB's ongoing enhancement ambitions include implementing futuristic technologies such as augmented reality for passenger steering and companion robots that provide data and directions. Furthermore, the airport is looking into blockchain solutions to improve safety and transparency in dealing with visitor data.

Dubai International Airport is extra than a international hub; it's far a image of development and technological adaptability. By integrating clever, customer-centered answers, DXB is redefining enterprise standards, demonstrating that generation and innovation can remodel any adventure right into a memorable revel in. Thus, DXB keeps to encourage and set tendencies for the destiny of aviation.

Survey on Romanians' Preferences for Smart Airport Technologies: Applicability to Henri Coandă Airport

This study was conducted to identify Romanian inhabitants' opinions and possibilities on the concept of smart airports and the use of advanced technology in Romanian airports, specifically at Henri Coandă Airport. Smart technology is becoming increasingly prevalent in airports throughout the world, with the goal of improving passenger experiences, streamlining operations, and providing faster and more personalized services. High-quality services, including sustainable energy. By completing this poll, we hope to determine how prepared Romanian travelers are to adopt such technology and their expectations of Henri Coandă Airport's application of smart solutions.

The survey is anonymous and involves a sample of 45 individuals from various social classes, age groups, educational backgrounds, and genders. The questions include both identification questions and questions related to airport preferences.

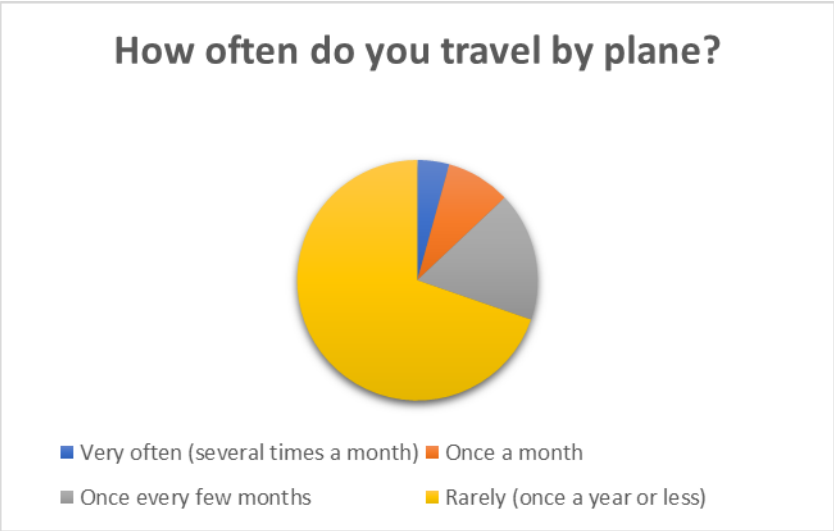


Chart 1. Respondents' Air Travel Habits

The majority of respondents (70.5%) travel by air infrequently, indicating a low usage frequency of this mode of transport, possibly due to financial reasons or a lack of necessity. Regarding familiarity with the concept of a "smart airport," over half of the participants (56.8%) have not heard of it, highlighting a lack of awareness about technological innovations in the airport industry. Additionally, more than half (52.3%) state that they are not at all familiar with the technologies used in smart airports, such as automated check-ins or facial recognition, while only 25% of respondents are very familiar with them.

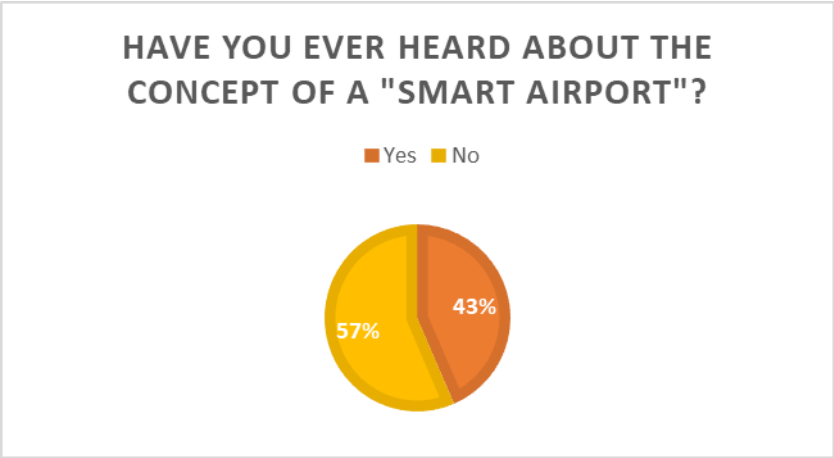


Chart 2. Awareness of the 'Smart Airport' Concept

These findings reflect a low level of adoption and awareness of modern technologies, suggesting the need for educational campaigns and the promotion of the benefits provided by "smart airports." Only 57% of the respondents admit having heard of the concept of "smart airport".

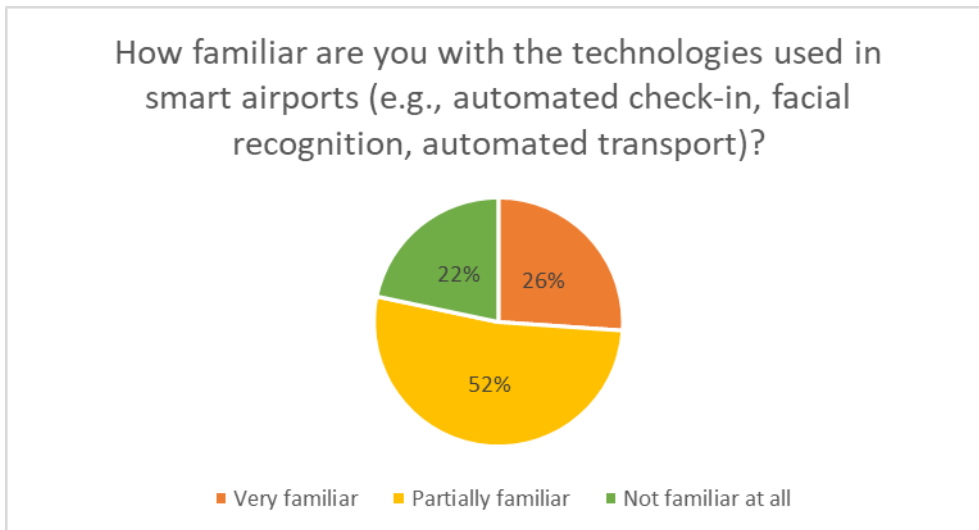


Chart 3. Familiarity with Smart Airport Technologies

Moreover, 22% of the respondents feel they have no familiarity with the technologies used in smart airports, while the majority, 52% admit that they are somewhat familiar. Only 26% consider themselves highly familiar with smart airport technologies.

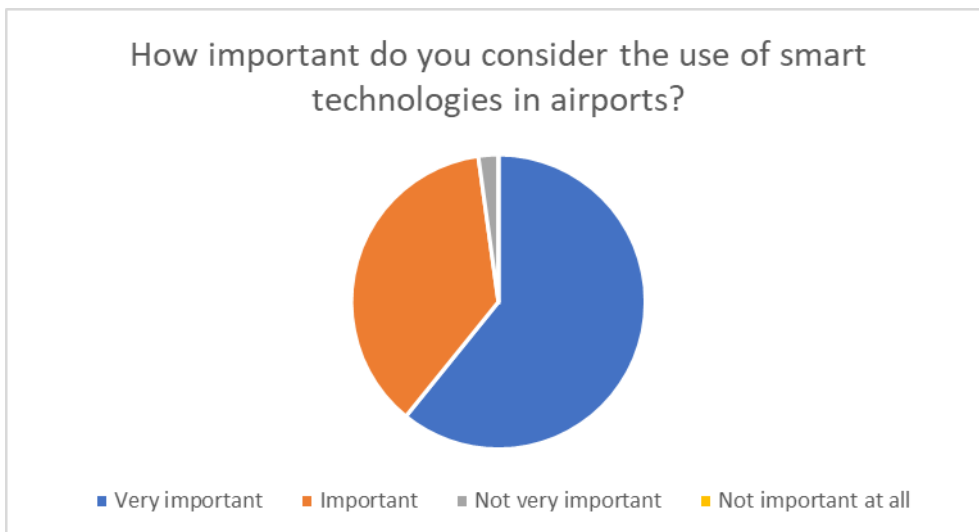


Chart 4. Importance of smart technologies in airports

The survey data reflects a positive attitude among Romanians toward the use of smart technologies in airports. The overwhelming majority of respondents (63.6%) consider these technologies to be very important, while 34.1% regard them as important, demonstrating widespread interest in digitization and innovation in this field.

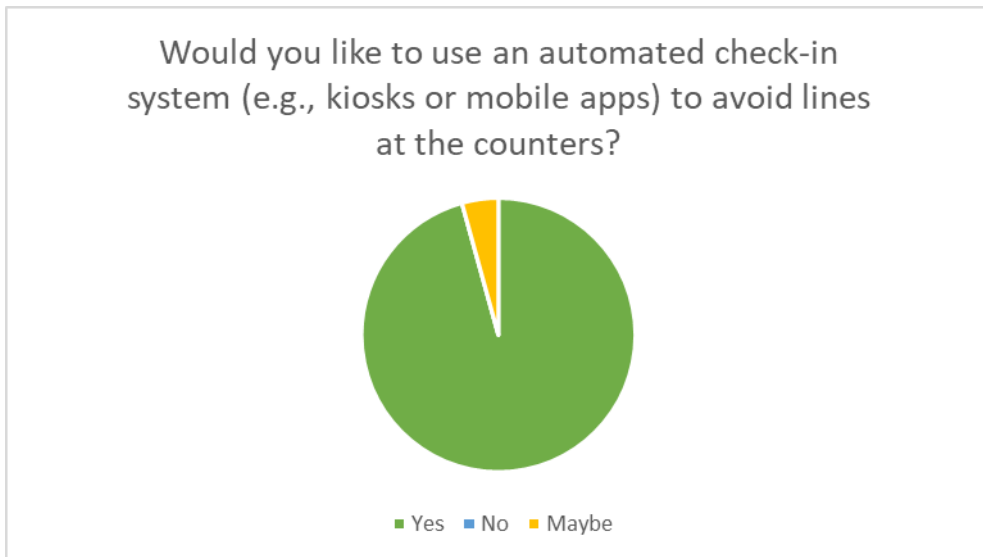


Chart 5. Automated check-in systems

Regarding the implementation of an automated check-in system, almost all participants (95.5%) would prefer this solution to avoid queues at counters, emphasizing the need for faster and more efficient processes.

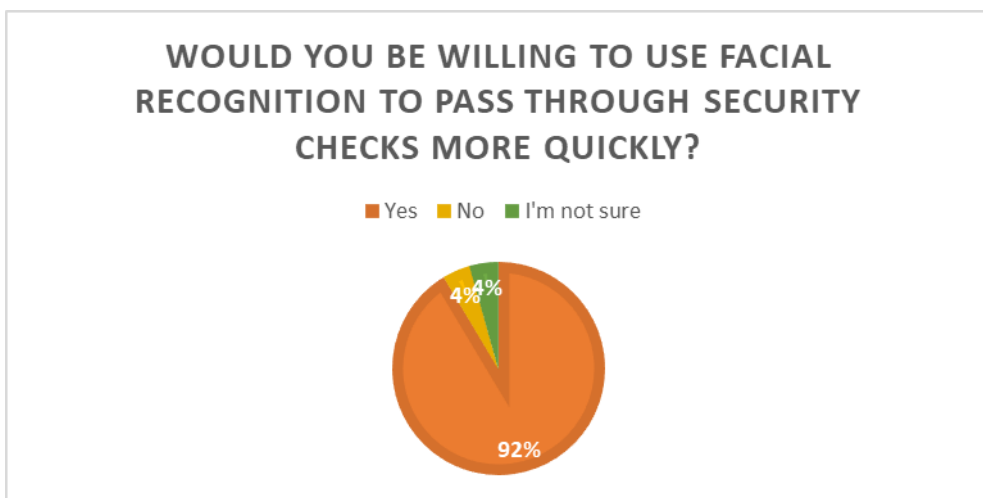


Chart 6. Preferences about facial recognition

Additionally, facial recognition for security control is well received, with 90.9% of respondents stating they would be willing to use this technology to reduce waiting times.

These results indicate a significant openness to adopting smart technologies in airports, aiming to enhance the passenger experience and simplify procedures.

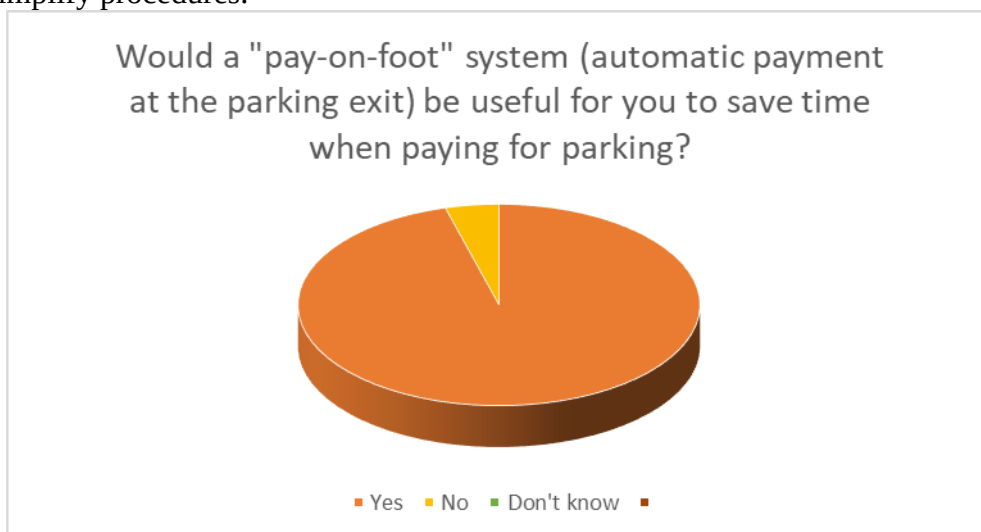


Chart 7. Pay-on-foot system

The overwhelming majority (95.5%) value the usefulness of such a system, suggesting a heightened interest in time-saving technologies that simplify processes.

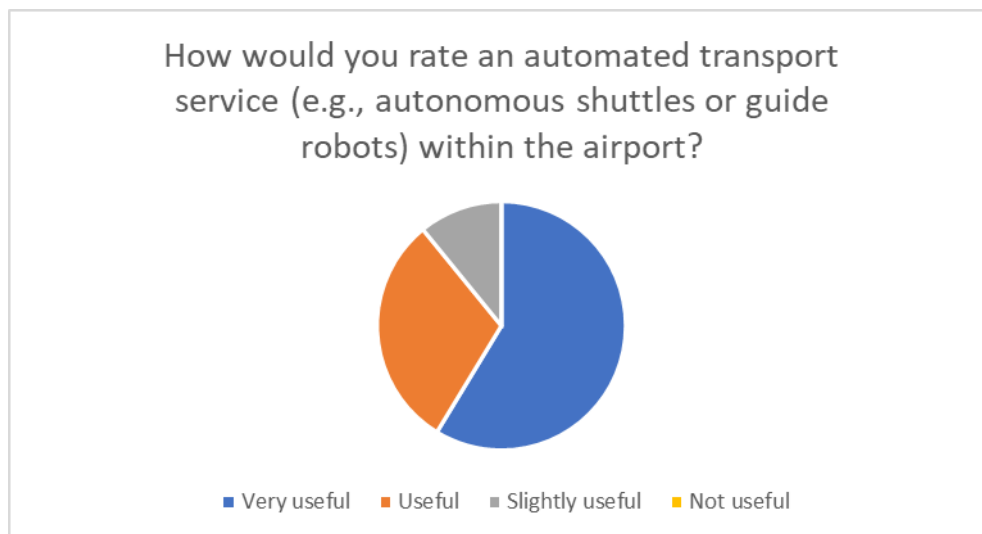


Chart 8. Preferences about automated transport service

Approximately 88.6% of respondents consider this service "useful" or "very useful," reflecting broad openness to modern technological solutions in airports, with a low potential for public resistance.

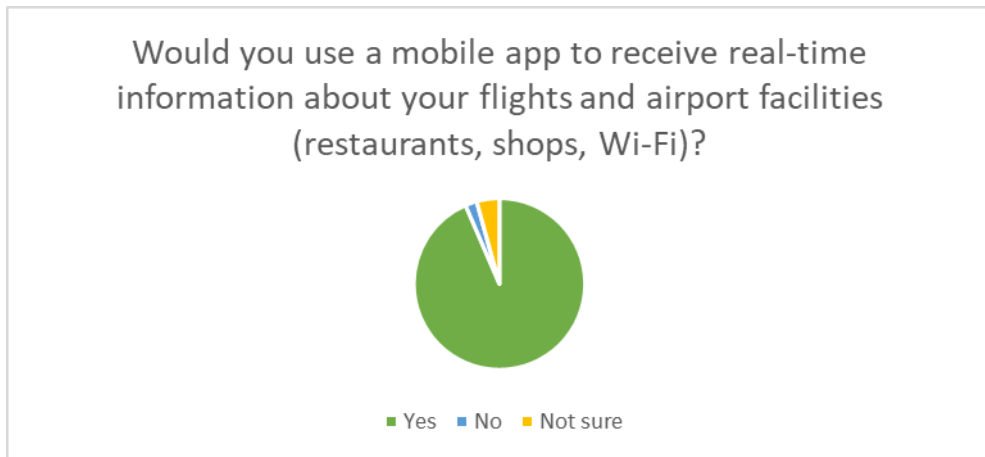


Chart 9. Mobile app for receiving real-time information

With 93.2% of respondents willing to use such an application, it is evident that quick access to updated information is a major priority for users, and such a digital solution would have a high adoption rate.

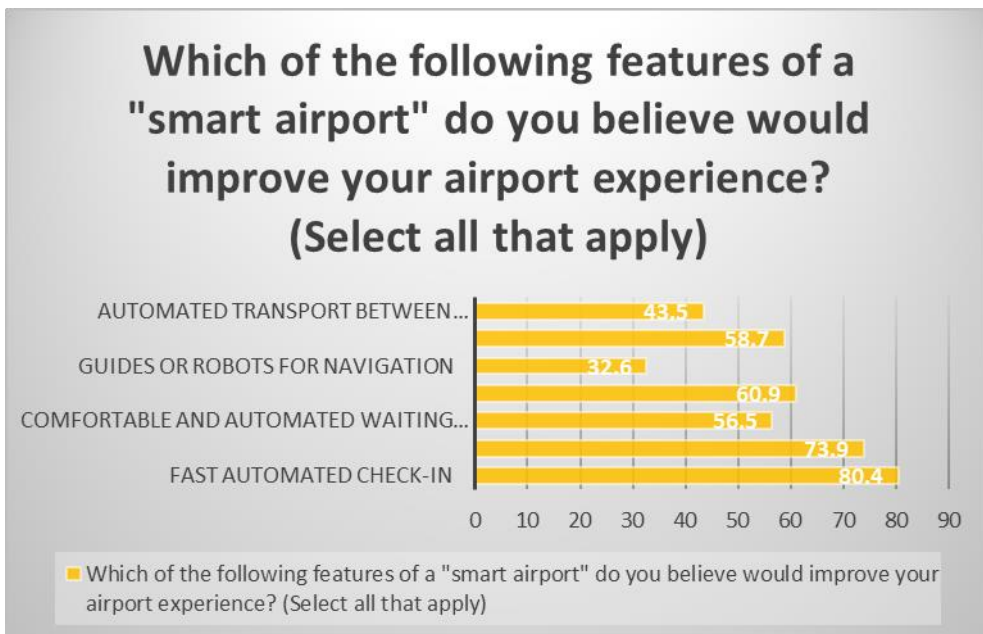


Chart 10. Features of smart airport which improve the airport experience

Most of the respondents (80.4%) consider a fast-automated check-in would improve their airport experience, 73.9% agree that they would like to use facial recognition system for security screenings, whereas 60.9% would like to receive real-time information on mobile apps.

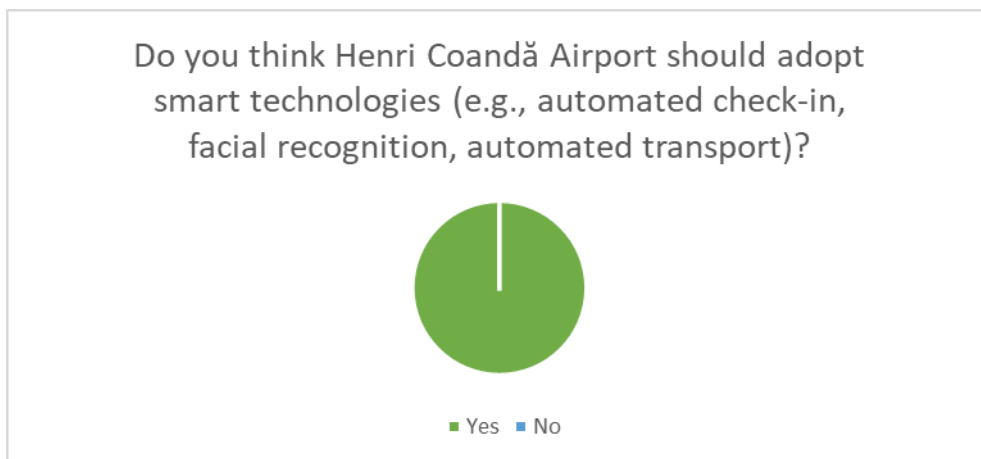


Chart 11. Henri Coanda should adopt smart technologies

The results from the charts indicate a high level of interest and significant openness among respondents toward the implementation of smart technologies at Henri Coandă Airport. All 44 participants (100%) believe the airport should adopt technologies such as automated check-ins, facial recognition, and automated transportation, highlighting a clear consensus in favor of modernization.

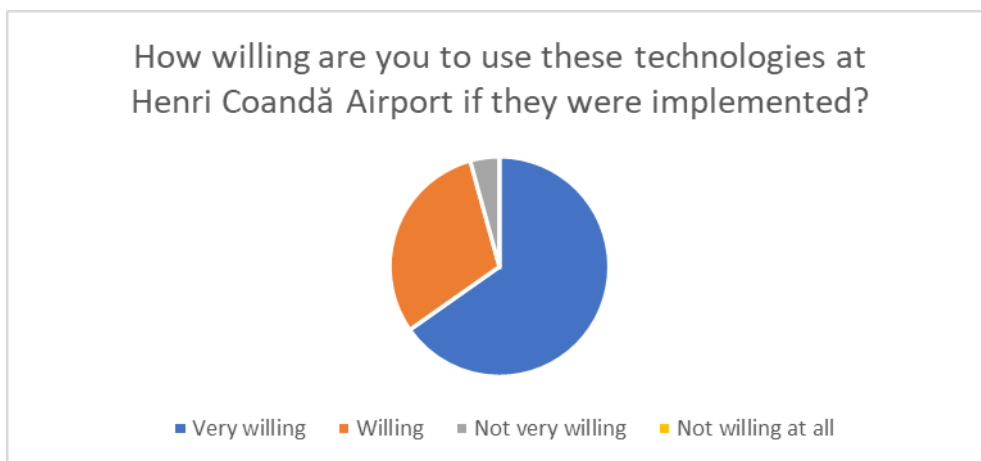


Chart 12. Using these technologies at Henri Coanda Airport

Regarding the willingness to use these technologies, 65.9% of respondents stated they are "very willing," and 29.5% are "willing," demonstrating a positive attitude and a high level of acceptance.



Chart 13. Experience of respondents at Henri Coanda Airport

Among the smart features considered most useful for improving the airport experience, respondents prioritized quick check-ins (79.5%), followed by facial recognition (72.7%), real-time information (59.1%), and smart waiting lounges (56.8%). Options such as smart parking (56.8%) and automated transportation (43.2%) were also well-received, though with slightly lower preferences.

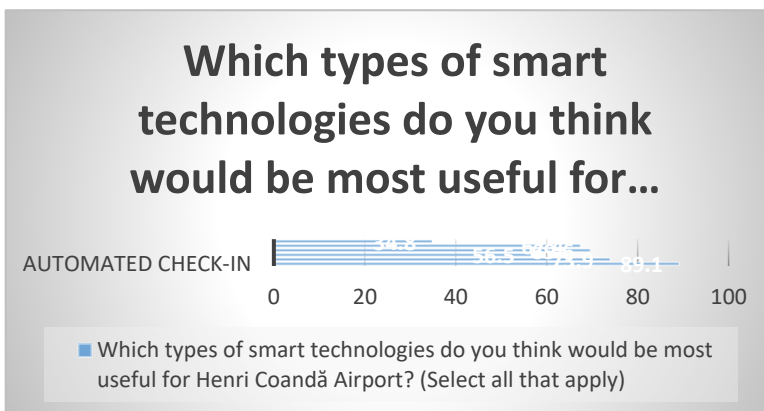


Chart 14. Useful smart technologies for Henri Coanda Airport

According to the survey responses, the main perceived obstacles to adopting a "smart airport" in Romania, particularly at Henri Coandă Airport, are the high implementation costs (63.6%) and the lack of adequate infrastructure (61.4%). Other significant barriers include the lack of user education and information (54.5%) and fear of using advanced technologies (34.1%).

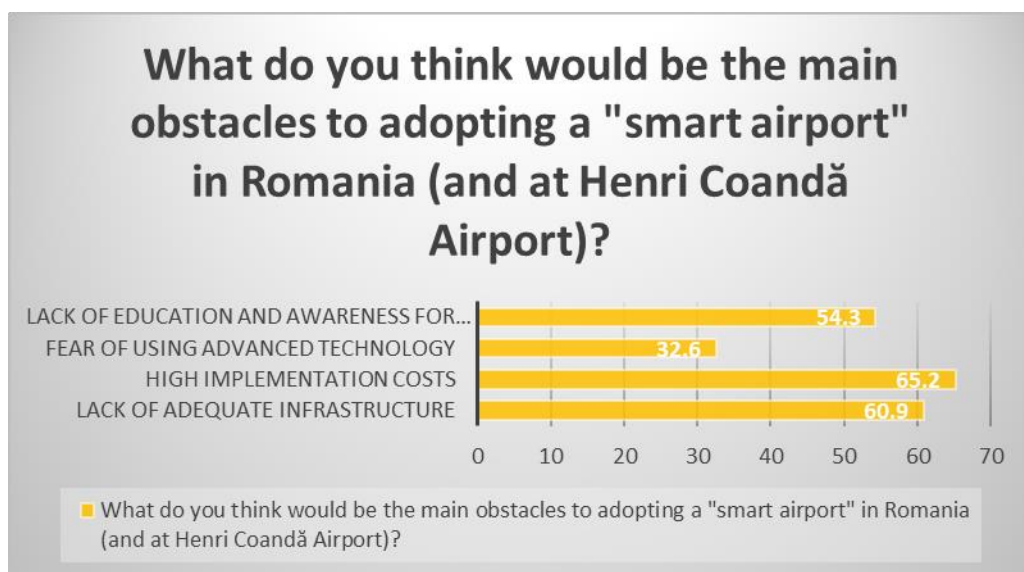


Chart 15. Main obstacles to Henri Coandă becoming a smart airport

However, the majority of respondents (95.5%) believe that implementing smart technologies would significantly improve their airport experience. Among the technologies perceived as most useful are automated check-ins (88.6%), facial recognition for security (72.7%), mobile applications for information (68.2%), and automated parking fee payments (68.2%), while robotic guides are considered useful by 36.4% of participants.

These findings suggest a strong openness toward smart technologies, but they also highlight the need for measures to overcome the identified barriers.

The survey results indicate that the majority of respondents (72.7%) are female, while only 27.3% are male. Regarding education levels, 54.5% of participants hold a university degree (bachelor's), 25% have high school education or less, and 20.5% have postgraduate education (master's or doctorate).

Analyzing the age distribution, most respondents (40.9%) fall into the 25–34 age group, followed by those aged 35–44 (25%) and 18–24 (18.2%). The under-18, 45–54, and over-65 age categories each have equal representation, at 6.8% each.

Most respondents are full-time employees (54.5%), while 40.9% are students. The rest are part-time employees, entrepreneurs, unemployed, or retirees, but in much smaller percentages.

The majority of respondents live in urban areas (86.4%), while a minority of 13.6% come from rural areas. This indicates an urban concentration of the respondents.

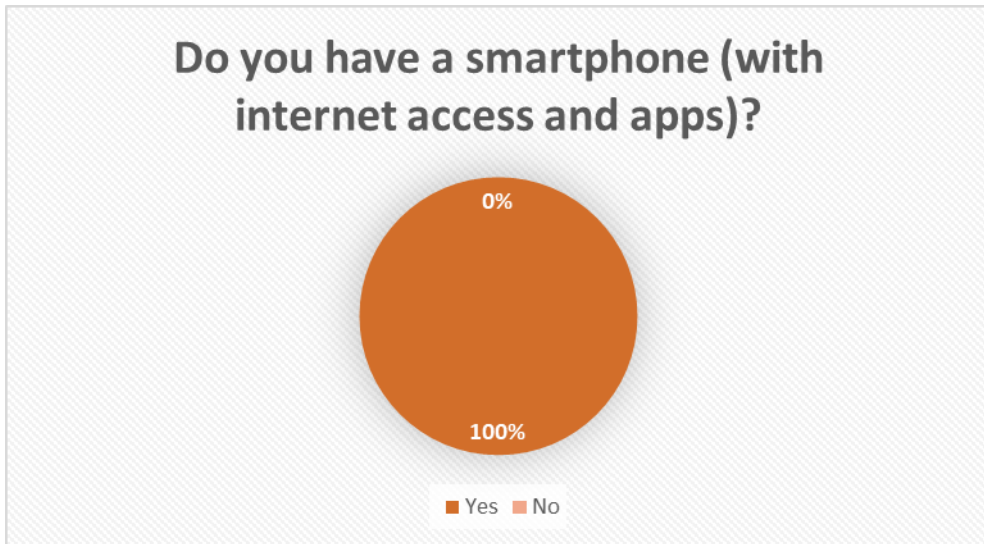


Chart 16. Access of the respondents at a smartphone

All respondents (100%) own a smartphone, suggesting universal access to modern technology among the participants.

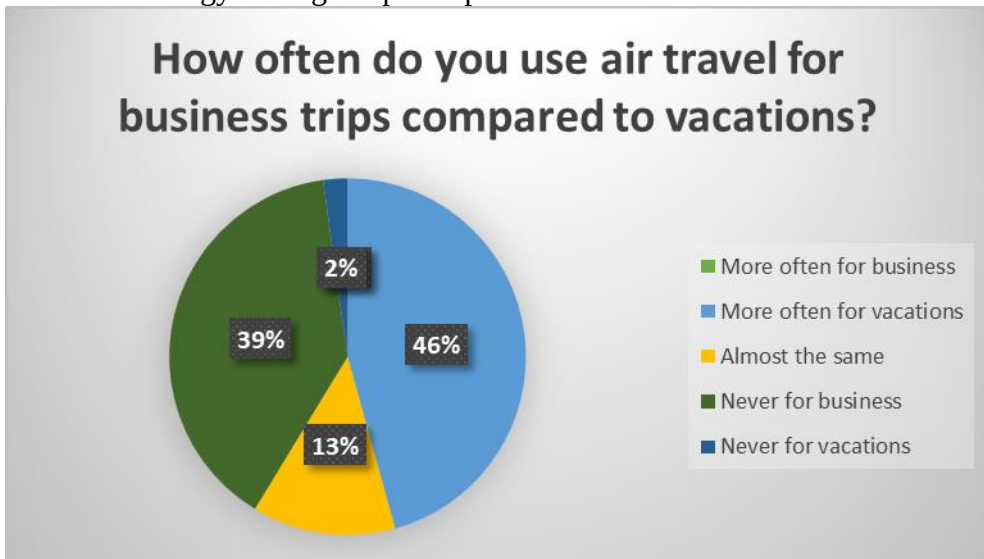


Chart 17. Air travel for business trips vs vacations

The survey results provide an interesting insight into the preferences of Romanians regarding air travel and their monthly income. Regarding flight frequency, the majority of respondents (43.2%) use air transport more often for vacations than for business. Nearly as many (40.9%) report using air travel for both purposes equally, while a smaller percentage (13.6%) state that they never travel for business. These data suggest that vacations are the primary reason Romanians use air transport, with leisure flights being more popular than corporate ones.

In terms of monthly net income distribution, the largest group of respondents (29.5%) falls within the 2,001-4,000 RON range, reflecting a middle-income category. Other significant groups include those with incomes between 1,000-2,000 RON (15.9%) and those earning between 4,001-6,000 RON (15.9%). A smaller percentage (11.4%) indicate incomes below 1,000 RON, with the same percentage opting not to respond. This distribution highlights a predominance of middle-income participants in the survey.

In conclusion, the preference of Romanians for vacation-related flights and their average income provides valuable insights for airlines and tourism operators. They can tailor marketing strategies focused on promoting leisure offers, thus responding to the majority market demand.

Smart airports represent a crucial element of aviation modernization, leveraging advanced technologies which includes the Internet of Things (IoT), synthetic intelligence (AI), and automation to increase Operational performance and enhance passenger experience. These answers lessen ready instances, beautify protection, and customize services, presenting a smoother tour experience. Recent research display that IoT technology and biometric systems, together with facial recognition, boost up check-in and bags coping with processes, optimizing airport resources (Alansari et al., 2019; Deloitte, 2021). Moreover, real-time facts analytics allow green passenger waft control and decrease overcrowding.

Dubai International Airport is a frontrunner in enforcing clever answers, making use of biometric tunnels that permit passengers to by skip via protection factors contactless, decreasing processing time to only a few seconds (Dubai Vibes Magazine, 2021). Hong Kong International Airport (HKIA) employs IoT technology to screen passenger waft and enhance electricity performance. Additionally, robots manual passengers, imparting data and customized assistance. Similarly, Incheon International Airport in South Korea makes use of AI and IoT to lessen ready instances and provide great services, which include sustainable electricity control answers.

In addition to airports, the idea of clever hospitality is gaining traction within the tourism industry. The integration of IoT and AI in motels permits customized services, together with clever rooms that modify settings primarily based totally on guests` possibilities and chatbots presenting on the spontaneous

assistance. These answers beautify purchaser experience, lessen costs, and growth operational performance. The international clever hospitality marketplace is projected to reach \$133.7 billion with the aid of using 2031, highlighting the huge capacity of this industry.

However, enforcing clever technology in airports and hospitality offers demanding situations associated with interoperability and private facts privacy. While passengers admire performance and comfort, they're touchy to the dangers related to the use of biometric data (Zhang & Chen, 2022). To ensure the success of these solutions, it is essential for operators to comply with privacy regulations and adopt an integrated and collaborative approach. At the same time, airports and hotels implementing such technologies can significantly improve customer satisfaction and operational efficiency, contributing to the creation of sustainable business ecosystems.

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