Revolutionizing Aviation:

The Impact of

ARTIFICIAL INTELLIGENCE

on Airports and Passenger Experience

Patrick Su

Airport Authority Hong Kong

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Executive Summary

As Artificial Intelligence (AI) technologies continue to evolve, they promise significant advancements in efficiency, personalization, and operational management within the aviation industry. This research paper then examines the transformative impact of AI on airports and customer experiences.

Undoubtedly, AI presents numerous opportunities to enhance airport services. However, the lack of AI readiness in different dimensions could challenge AI adoption in airports.
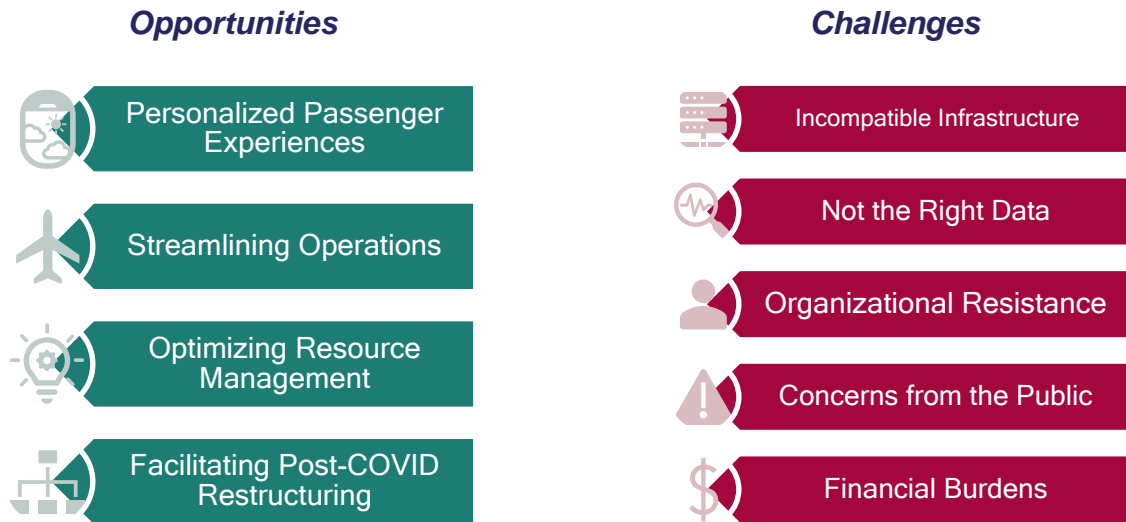
Opportunities

Challenges

Personalized Passenger Experiences

Incompatible Infrastructure

Streamlining Operations

Not the Right Data

Optimizing Resource Management

Organizational Resistance

Facilitating Post-COVID Restructuring

Concerns from the Public

Financial Burdens

Table 1 Opportunities and challenges of AI in airports

Despite these challenges, airports actively explore AI capabilities to improve passenger experiences, streamline operations, and develop innovative management strategies. Some potential AI innovations in airport are summarized (Table 2). While customer-facing enhancements, such as digital identity and recommendation services, are expected to be the most visible transformations by AI, behind-the-scenes improvements also play a crucial role in fostering a positive overall experience.

In fact, to effectively foster AI adoption in the aviation industry, airports must undertake multifaceted roles as initiator, platform provider and facilitator, adapting based on the readiness and collaboration of various stakeholders.

One critical approach to ensuring success in these roles is to establish common goals for AI adoption within the airport community, and foster collaboration among stakeholders.

Initiator of AI Innovation

Platform Provider for AI Solutions

Facilitator of AI Adoption
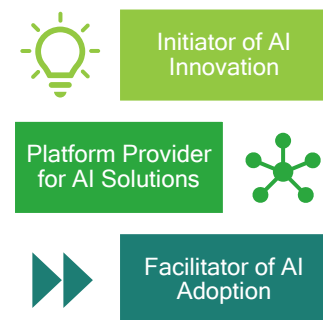
Multifaceted Roles of Airport

Regular reviews of AI strategies are also essential for adapting to evolving needs and technologies, promoting a culture of innovation and continuous improvement.

In summary, while challenges exist, integrating AI in airports presents a critical opportunity to revolutionize passenger experiences and optimize operations. It is never too late for airports to embark on their AI journey; they can enter at any point. By strategically adopting AI technologies, airports can set new standards for efficiency and customer satisfaction in the aviation industry.

Table 2 Some potential AI integrations in Airport

Innovations	Enhancement or enablement by AI	AI tech to be applied
Seamless journey in Airport and beyond		
• Digital Identity and Travel Token	➢ More efficient and accurate facial recognition and verification	🔴🟡🟣
• Recommendation Services	➢ Personalized recommendations on time info and activities	🔴🔵🟢
• Driverless Transport Services	➢ Auto-Transport passenger around the airport	🔴🟡🟣
Efficient airport operation and resource management		
• Apron Management and Airfield Service	➢ Abnormal Apron Event Detection ➢ Flight Delay Prediction	🔴🟡
• Baggage Handling	➢ Predictive Maintenance ➢ Auto-Transport Baggage	🔴🟡🔵🟣
• Security and Safety Checks	➢ More efficient and accurate check on personal belongings	🔴🟡🟣
• Resource Allocation	➢ Intelligent and dynamic Allocation, such as Check-in Counter, Parking Stand, Baggage Reclaimed Belt, etc.	🔴🟡
• Sustainable Operations	➢ Dynamic energy consumption	🔴
Innovative Management Strategy		
• Knowledge Management	➢ Systematic Database for airport domain knowledge	🔴🔵🟢
• Public Relations and Customer Service	➢ Automated Social Listening ➢ Intelligent customer service	🔴🟢🟣
• Corporate Planning	➢ Business insight for potential growth	🔴
…		

AI Technology to be applied
- 🔴 *Big Data & Machine Learning*
- 🟡 *Computer Vision*
- 🔵 *Natural Language Processing*
- 🟢 *Generative AI*
- 🟣 *Intelligent Robot*

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Artificial Intelligence Development: Gateway to Airport Advancements

Artificial Intelligence (AI) has emerged as a transformative force, revolutionizing industries and reshaping our technological landscape. From predictive algorithms to autonomous systems, AI has become integral to our daily lives, offering innovative solutions and driving efficiency and productivity to new heights. This chapter explores the evolving AI landscape and how it presents unique opportunities for reshaping airport operations and enhancing customer experiences.

• Current AI Applications

AI technologies have made remarkable strides in recent years, fueled by advancements in machine learning, natural language processing, and computer vision. Organizations worldwide are increasingly leveraging AI to streamline operations, improve decision-making, and deliver personalized experiences tailored to individual needs.

In the past few years, the rise of Generative AI (Gen AI) has accelerated AI adoption, with a substantial surge in organizations integrating AI into business functions [1]. Common tools like ChatGPT and Copilot have become indispensable in daily tasks. It is crucial to understand that AI encompasses a wide spectrum of technologies with diverse applications across various fields, shaping our interactions with technology and enhancing service efficiency.

> **In essence, AI harnesses the power of computers, data, and machines to mimic human problem-solving and decision-making capabilities [2, 3].**

For industries, including airports, to derive value from AI, there must be behaviors, knowledge, processes, or experiences that AI can learn from. This learning process is fundamental for AI to generate significant business value, especially in complex environments like airports.

• AI Opportunities in Airports

In the realm of airports, AI stands poised to revolutionize traditional practices and introduce cutting-edge solutions tailored to the evolving needs of travelers and the dynamic air travel landscape. AI offers a host of opportunities for airports, including:

- **Personalized Passenger Experiences**: Utilizing recommendation systems to analyze user behavior and deliver personalized information, time reminders, and activity recommendations, enhancing passenger satisfaction and engagement.

- **Streamlining Airport Operations**: Implementing advanced facial recognition and computer vision techniques to enhance security checks, immigration processes, and detect suspicious activity, improving accuracy and efficiency while reducing inconvenience for travelers.

- **Optimizing Resource Management**: Leveraging AI's big data analytics capabilities to identify business insights, provide real-time predictions, and optimize resource utilization for enhanced operational efficiency.

- **Facilitating Post-COVID Restructuring**: Deploying AI-powered robotic automations to streamline labor-intensive tasks, improve manpower efficiency, and meet the challenges of airport expansions with limited resources in the post-COVID era.

By embracing AI-powered innovations, airports can unlock new possibilities for operational optimization, data-driven decision-making, and seamless passenger interactions. In later chapters, we will introduce more AI-Powered innovations to enhance airport experience.
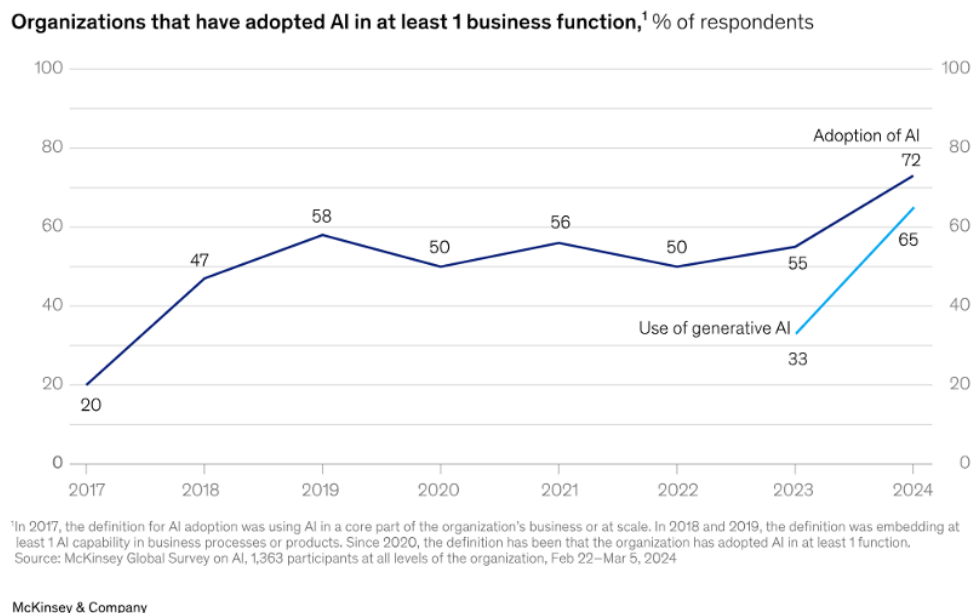

Organizations that have adopted AI in at least 1 business function,[1] % of respondents

[1] In 2017, the definition for AI adoption was using AI in a core part of the organization's business or at scale. In 2018 and 2019, the definition was embedding at least 1 AI capability in business processes or products. Since 2020, the definition has been that the organization has adopted AI in at least 1 function.
Source: McKinsey Global Survey on AI, 1,363 participants at all levels of the organization, Feb 22–Mar 5, 2024

McKinsey & Company

Figure 1 AI adoption surges in 2024 [1]

Navigating Challenges: Roadblocks to AI Integration in Airports

The integration of Artificial Intelligence (AI) in airport operations holds immense promise for revolutionizing the industry, but it is not without its challenges. To fully leverage the benefits of AI technology, airports must navigate significant hurdles that stand in the way of seamless integration.

Assessing an airport's readiness for AI adoption is crucial, with key criteria including Infrastructure readiness, Data Readiness, Organizational readiness, Ethics and Governance Readiness, and Business Value Readiness [4, 5].

In this chapter, we delve into airports' AI readiness across these aspects and identify the major roadblocks hindering their progress.

• Incompatible Infrastructure

Infrastructure readiness poses a primary challenge for many airports looking to integrate AI seamlessly. Operating on legacy systems that may not align with advanced AI technologies, airports often face obstacles in upgrading their infrastructure. Unlike other industries, airports typically operate with systems that are considered fixed assets, making upgrades costly and time-consuming. The integration of AI-compatible infrastructure, such as Internet of Things (IoT) sensors, High Definity (HD) cameras, high-speed communication networks (e.g. 5G), cloud environments, and graphics processing units (GPUs) [6], establishes a solid technical foundation essential for successful AI applications.

Figure 2 Baggage Handling System at HKIA

IoT sensors and HD cameras enable live monitoring of critical components within the airport system, while 5G and cloud environments support real-time data processing and responses. GPUs deliver the processing power needed to run AI workloads, facilitating predictive analytics and proactive decision-making. Although some infrastructure, such as GPUs and cloud services, can be subscribed to from external providers without requiring on-site installation, most essential components still need to be developed at the airport. Without these foundational elements, the potential value of AI applications in airports may be significantly diminished.

Nevertheless, while comprehensive infrastructure upgrades may pose challenges, standalone AI solutions can serve as initial steps for airports to explore the benefits of AI technology before committing to extensive infrastructure modifications.

• Not the Right Data

Inadequate infrastructure readiness often leads to a lack of data readiness, hindering airports from generating the necessary data for practical AI applications. AI relies on large quantities of quality data to mimic human intelligence and execute tasks efficiently. However, existing operational flows and infrastructure limitations in airports impede data collection for AI applications.

For instance, the absence of real-time health data for baggage handling systems hinders predictive maintenance efforts, impacting system reliability and efficiency. Limited access to arrival flight passenger information also restricts airports from leveraging big data techniques for arrival customer analysis and personalized services. Data silos, common in many airports due to historical system implementations, further complicate data accessibility and integration for AI applications.

Addressing data readiness challenges requires airports to invest in infrastructure upgrades, data collection mechanisms, data integration strategies and data governance policies to ensure the availability of high-quality data for AI-driven insights and decision-making.

• Organizational Resistance

Organizational readiness presents a critical challenge for airports seeking to adopt AI technologies.

Firstly, the domain-specific knowledge required in airport operations presents a significant barrier to the seamless integration of AI solutions. Unlike industries with more generalized operational processes, airports demand a deep understanding of aviation intricacies, safety protocols, and regulatory requirements. This specialized domain knowledge complicates the adoption of AI technologies, as it requires a unique blend of expertise in both aviation operations and artificial intelligence.

Secondly, resistance from experienced airport staff contributes to the challenge of organizational acceptance. Established airport personnel, accustomed to traditional operational methods, may resist embracing AI-driven solutions.

Furthermore, the difficulty in recruiting AI talents with specialized knowledge in aviation poses a significant obstacle to organizational acceptance of AI initiatives. The intersection of aviation expertise and AI proficiency is a niche area, making finding individuals with the requisite skills and experience challenging. The scarcity of qualified candidates with expertise in both domains further complicates the adoption of AI technologies in airport operations.

To overcome organizational challenges, airports must prioritize employee training and change management efforts to foster a culture of innovation and continuous learning. Collaboration between technical teams and operational staff is essential for successful AI integration, ensuring alignment with operational goals and objectives.

• Concerns from the Public

Ethical and governance concerns related to AI adoption pose significant roadblocks for airports. While safety and security remain paramount in airport operations, public apprehensions regarding privacy, data accuracy, AI performance, and cybersecurity impact the acceptance of AI technologies. Passenger confidence in AI adoption may waver due to concerns about data privacy, system reliability, and the potential for cyber threats.

Additionally, outdated legislation and regulations surrounding AI adoption create uncertainties and barriers for airports seeking to implement AI solutions. Addressing public concerns and regulatory challenges requires transparent communication, robust data protection measures, ethical AI practices, and a strong focus on cybersecurity to build trust and ensure compliance with evolving legal frameworks.

• Financial burdens

The financial implications of AI integration pose a substantial challenge for airports, particularly in the post-COVID era where financial constraints are prevalent. While the anticipated value of AI in enhancing airport operations is significant, the upfront costs of establishing AI-compatible infrastructure and implementing AI solutions may deter some airport operators from investing in AI technologies [7].

To address cost-effectiveness concerns, airports must conduct thorough cost-benefit analyses, prioritize AI initiatives with clear ROI potential, and explore collaborative partnerships to share implementation costs and risks. Leveraging scalable AI solutions and phased implementation

approaches can help airports manage costs effectively while realizing long-term benefits from AI adoption.

In conclusion, while AI integration in airports presents challenges across infrastructure, data readiness, organizational acceptance, public concerns, and cost-effectiveness, proactive strategies and collaborative efforts can help airports overcome these roadblocks.

Enhancing the Airport Experience:

AI-Powered Innovations

After introducing the opportunities and challenges of AI integration in airports, we will comprehensively explore how AI could integrate into airports' business and operations and revolutionize the airport experience. For each potential innovations, its enhancement and enablement by AI and the AI technology to be applied is further summarized in Table 2. Specifically, the airport experience that air passengers anticipate will be most transformed by AI is identified.

- ## To be most transformed by AI: Seamless journey in Airport and beyond

The airport experiences that passengers interact with most directly—those related to customer service and engagement—are the areas they expect to be most profoundly transformed by AI.

Every day, thousands of travelers engage with various airport services and facilities, from arrival to boarding and baggage reclaim. These interactions reflect individual preferences and behaviors, providing fertile ground for AI to deliver personalized, seamless experiences. By leveraging AI technologies, airports can offer customized services, predictive reminders, and anticipatory assistance, significantly elevating the overall passenger experience [8].

Figure 3 Flight Token at HKIA

> #### *Digital Identity and Travel Token*

One of the most significant innovations in the airport experience is the concept of digital identity, championed by the International Air Transport Association (IATA) through initiatives like One ID [9]. This approach aims to streamline the passenger journey by utilizing biometric information, enabling eligible travelers to move effortlessly through airport touchpoints without the need for physical documents. HKIA has adopted a similar concept with its Flight Token system [10], allowing passengers to enjoy a cohesive departure journey from bag drop to security checks and boarding.

While the concept of digital identity does not inherently rely on AI, the technology is crucial for its implementation. AI plays a vital role in managing and securing digital identities through identity verification, fraud detection, biometric authentication, and access control. By analyzing vast amounts of data in real-time, AI algorithms can authenticate identities more accurately and efficiently, ensuring that the concept of digital identity in air travel is both practical and secure.

> #### *Recommendation Services*

AI-driven recommendation engines are another transformative innovation that enhances the passenger experience. By analyzing passenger behaviors from big data, airports can provide tailored experiences based on individual preferences. Time and activity-related recommendations are particularly valuable for travelers.

Time is critical in air travel; thus, passengers benefit greatly from AI predictions about when to leave home, check in, pass through security, board their flights, and collect their baggage upon arrival. These insights help passengers manage their time more effectively, reducing anxiety and improving overall satisfaction.

Moreover, many passengers find themselves idly waiting at boarding gates. Personalized recommendations for activities within the airport—such as shopping, dining, or relaxation options— allow travelers to make better use of their time. This not only enhances their experience but also increases revenue opportunities for airports through higher conversion rates.

> #### *Driverless Transport Services*

The advent of driverless transport services represents a groundbreaking shift in airport mobility. With their controlled environments and limited public traffic, airports are well-suited for the deployment of autonomous vehicles. AI technologies enable these vehicles to navigate complex traffic scenarios, moving beyond traditional automated systems like people movers.

Figure 4 Future Airport City Link at HKIA

For instance, HKIA has introduced autonomous shuttle buses on airside roads to transport staff, with plans to extend this service to passengers in the future. Additionally, the Airport City Link in Hong Kong will use autonomous driving technology to transport passengers between the airport, SKYCITY, and the Hong Kong Boundary Crossing Facilities [10]. Such innovations not only enhance passenger mobility but also align with the futuristic expectations of travelers.

AI innovations are poised to transform the airport experience significantly, particularly in areas directly related to passenger interactions. From digital identities and personalized recommendations to driverless transport services, these customer-facing solutions represent the experiences that travelers anticipate will be most enhanced by AI. As airports continue to integrate these technologies, they will meet the evolving expectations of modern travelers and set new standards for efficiency and customer satisfaction in air travel. Embracing AI is essential for airports aiming to provide a seamless journey that resonates with passengers at every touchpoint.

• **Efficient airport operation and resource management**

While the spotlight often shines on customer-facing AI innovations in airports, it is crucial to recognize that non-customer-facing operations are equally essential, and AI can revolutionize various aspects of airport operations, addressing resource-intensive tasks and optimizing limited resources. From baggage handling to security checks, AI-driven solutions can streamline operational processes, automate routine tasks, and enhance decision-making capabilities. This increases operational efficiency and creates a more pleasant experience for passengers who may not see the behind-the-scenes improvements. [11]

➤ *Apron Management and Airfield Service*

Effective apron management is essential for optimizing air traffic control and airport operations. At HKIA, the Digital Apron and Tower Management System (DATMS) has been introduced to enhance these processes. Featuring over 200 ultra-high-definition cameras, DATMS delivers a comprehensive, real-time view of air and ground activities. This system not only digitizes traditional manual monitoring but also leverages AI to revolutionize apron management.

In addition, by leveraging AI and digitalization, airports can track the complex multi-step aircraft turnaround more effectively. For instance, HKIA employs an augmented airfield service system (AS2) that gathers data from various sources and utilizes AI to create meaningful forecasts [12].

Airport can also power the Airport Collaborative Decision-Making System (ACDM) with AI predictions [13] and alert ground handlers to potential delays, allowing for better deployment of manpower and resources. By predicting a reliable Actual Off Block Time (AOBT), airports can enhance planning for slot and stand allocation. These optimizations ultimately improve on-time performance and ensure that passengers experience minimal delays [14].

Figure 5 Digital Apron and Tower Management System

➢ *Baggage Handling*

Baggage handling systems are among airport operations' most intricate and critical components, often comprising thousands of elements, including conveyors and sorters. AI can play a transformative role in this area through video analytics and predictive maintenance. By monitoring baggage handling systems in real time via IoT sensors or cameras, AI can facilitate predictive maintenance, ensuring that components operate smoothly and efficiently.[15]

Moreover, autonomous vehicles have been implemented for baggage delivery. HKIA uses autonomous tractors to transport passenger luggage. This innovation not only reduces the labor intensity of baggage handling but also enhances reliability and efficiency. Additionally, AI-driven baggage trolley management systems, which utilize video analytics to monitor trolley availability, ensure that trolleys are replenished and maintained, improving the overall passenger experience.

➢ *Security and Safety Checks*

Airport security and safety is paramount, and AI can enhance the efficiency and accuracy of security and safety checks [16]. By applying AI to screen and interpret images from X-ray machines, airports can significantly reduce processing times and minimize human error. For example, Singapore Changi has begun trials of an AI-powered system that performs as well as, or even better than, human security screeners in identifying prohibited items [17]. This improves safety and streamlines the security process, reducing wait times for passengers.

Figure 6 Smart Security Screening System at HKIA

➢ *Resource Allocation*

Efficient resource allocation is crucial in busy airports, where limited resources must be managed effectively. Traditional methods often lead to congestion at check-in counters, parking stands, and

baggage reclaim areas. AI can optimize these allocations by analyzing passenger types, flight schedules, and real-time resource usage.

For example, AI-driven systems can dynamically allocate check-in counters based on passenger flow, ensuring no such case that some aisles are overcrowded while others remain underutilized. Regarding parking stands, AI can enhance the transfer experience for passengers by strategically locating gates for arrival and departure legs to minimize walking distances. For baggage reclaim, AI-powered allocations can optimally assign carousels based on historical baggage pick-up patterns, ensuring more even distribution of carousel usage.

These thoughtful resource management strategies enhance passenger satisfaction by alleviating crowds, reducing waiting times, and improving overall flow through the airport. Additionally, the integration of AI allows airports to establish dynamic pricing based on resource usage. This capability incentivizes stakeholders to optimize their resource allocation.

Figure 7 Crowds at Baggage Reclaim Hall

➤ *Sustainable Operations*

Sustainable operations are increasingly becoming a priority for airports, and AI can play a significant role in achieving these goals. For instance, HKIA has implemented a Weather Forecast for Air-conditioning Control System [10] that predicts terminal cooling demand over the next 24 hours. This predictive model adjusts chiller operations based on forecasted needs, leading to energy savings and reduced environmental impact. By utilizing AI to optimize energy consumption and improve operational sustainability, airports can contribute to their ESG goals while maintaining a comfortable environment for passengers.

By focusing on operational efficiency, resource management, and sustainability, AI-powered airports can create a smoother travel experience that begins long before passengers enter the terminal. As airports continue to embrace these innovations, they will set new standards for operational excellence and passenger service.

Ultimately, efficient airport operations form the backbone of a positive travel experience, ensuring that passengers enjoy a seamless journey from start to finish.

• Innovative management strategy

As airports navigate the evolving landscape shaped by technological advancements and changing passenger expectations, AI's role in innovative management strategies becomes increasingly important. Beyond enhancing passenger journeys and operational efficiencies, airports can harness AI applications to drive corporate development, optimize staff training, elevate public relations and customer service, and enhance corporate planning processes. These AI-driven initiatives position airports as agile and customer-centric organizations in a post-pandemic world.

➤ *Knowledge Management*

The aftermath of the COVID-19 pandemic has underscored the necessity for effective knowledge management and training methodologies in airports grappling with a shortage of experienced staff. AI, notably Gen AI, stands out as a valuable resource for knowledge dissemination and talent enhancement, especially in environments rich in specialized domain expertise, like airports. By leveraging AI technologies, airports can streamline training processes, facilitate knowledge management, and adapt operations to meet the evolving demands of a post-pandemic environment.

➤ *Public Relations and Customer Service*

In terms of public relations and customer service, AI-powered chatbots driven by Gen AI capabilities offer a sophisticated means of interpreting customer feedback and delivering personalized and efficient solutions. These chatbots can provide consistent responses, adapt to individual preferences, and seamlessly handle a high volume of inquiries. Additionally, large language model tools enable airports to engage in social listening, monitoring passenger feedback across various online platforms to proactively address concerns and enhance the overall customer experience.

➤ *Corporate Planning*

Analytic AI tools also serve as invaluable resources for airport development by acting as virtual business consultants. By analyzing global data from diverse sources, airports can gain valuable insights to inform strategic decision-making and long-term planning. Analytic AI empowers airports to anticipate future travel trends, identify opportunities for destination expansion, and strengthen their position as key aviation hubs in their regions. By leveraging AI-driven analytics, airports can make informed decisions that drive sustainable growth and competitive advantage in the dynamic aviation industry.

By embracing AI as a transformative force in airport management, airports can adapt to the challenges of the digital age and emerge as leaders in the future of aviation.

Airport Evolution:

Initiator, Platform Provider, and

Facilitator in the AI

Era

As airports embark on their journey to integrate AI technologies, they are uniquely positioned to play pivotal roles as initiators, platform providers, and facilitators within the aviation industry.

The rapidly evolving landscape of airport operations necessitates a strategic approach to AI adoption, where airport operators adapt their roles based on the readiness and collaboration of various stakeholders.

This multifaceted approach not only enhances operational efficiency but also significantly improves the overall passenger experience.

• Multifaceted Roles of Airports in AI Adoption

➤ *Initiator of AI Innovation*

Airports must take the initiative to lead AI innovations, especially in resource-intensive areas such as baggage handling and apron operation. These sectors, while crucial, are often less visible to passengers and dominated by a few service providers who may be hesitant to adopt new technologies. As such, airports need to step forward as pioneers in these domains.

By investing in AI-powered assets and infrastructure, airports can provide stakeholders with access to state-of-the-art technologies. Furthermore, airports should establish service standards within their contractual agreements with service providers to promote AI adoption throughout the airport community. Such proactive approach not only positions airports as leaders in the digital transformation of aviation but also encourages stakeholders to embrace AI technologies, ultimately benefiting the entire airport ecosystem. A prime example is HKIA's implementation of autonomous vehicle systems, showcasing how airports can spearhead AI initiatives.

Figure 8 Autonomous Vehicle System at HKIA

> ### *Platform Provider for AI Solutions*

In their role as platform providers, airports can act as central hubs for deploying AI solutions that cater to diverse operational needs and stakeholder requirements. By offering robust technological infrastructure and data-sharing platforms, airports facilitate the integration of AI applications that streamline processes, optimize resource allocation, and enhance real-time decision-making.

For example, HKIA has developed a cargo data platform that allows various stakeholders—including airlines, security agencies, and ground transportation services—to share cargo data efficiently. This collaborative platform sets the groundwork for future AI applications. Similar data platform has been developed in ACI for the aviation community to access airport traffic data [18].

By promoting seamless collaboration and information exchange among stakeholders, airports can drive synergy and efficiency across the aviation value chain.

> ### *Facilitator of AI Adoption*

As more companies within the airport community begin to adopt AI technologies, airports can transition into facilitators, supporting stakeholders on their AI journeys. Some stakeholders, such as airlines, may already be advanced in their AI applications due to their profit-driven nature and customer-facing services. Some airlines already leverage Gen AI for customer service, dynamic pricing, flight delay predictions, and more [19].

While airports may not have as many AI use cases, they can still play an essential role in facilitating the effective utilization of AI among stakeholders. This includes sharing data and offering technical support to ensure stakeholders can successfully implement AI solutions. By enhancing the AI capabilities of their partners, airports can indirectly benefit from improved operational efficiencies, attracting more passenger and cargo flows.

- ## **Best Approach for Role Positioning and Change Management**

To ensure the successful execution of AI initiatives across the airport community, airport operators must adopt a unified approach establishing common goals for AI adoption with regular review.

➢ *Set Common Goals*

Establishing shared goals for AI adoption is critical for fostering a cohesive airport community. All members from top management to frontline staff should align with the vision of transforming airport operations through AI. At HKIA, for example, top management has spearheaded the establishment of a technovation and data management board that designs the airport's AI roadmap and guides its strategic direction. Regular information sessions communicate this vision throughout the organization and the broader airport community.

By cultivating a culture where everyone is encouraged to incorporate AI into their daily roles, airports can create an environment that promotes innovation and collaboration. This unified approach ensures that all stakeholders work towards common objectives, facilitating smoother transitions during AI adoption.

➢ *Regular Reviews and Adaptation*

Regular reviews of the AI strategy and stakeholder roles are essential for sustaining long-term success. HKIA, for instance, holds senior management meetings twice a year to assess the existing AI strategy and make necessary adjustments. This adaptability is crucial as the airport community's needs evolve and new AI technologies emerge.

Airports should also consider adjusting their organizational structures to align with the community's different stages of AI development. In the early stages of AI adoption, when stakeholders may have limited familiarity with AI innovations, airports can establish dedicated innovation departments to concentrate resources on showcasing AI applications. As acceptance and understanding of AI grow,

airports can shift to a more decentralized approach, empowering various departments to explore and implement their own AI solutions.

The evolution of airports as initiators, platform providers, and facilitators in the AI era underscores their crucial role in driving innovation and excellence within the aviation industry. Airports must establish common goals for AI adoption and conduct regular reviews of their roles and strategies, ensuring that all stakeholders are equipped to navigate the AI landscape successfully. Through these efforts, airports can drive innovation, enhance operational excellence, and set new benchmarks for success in the digital age.

Charting the Flight Path:

Future of AI in

Airports and

Customer Experience

Imagine a future where AI transforms the airport experience for travelers. Before arriving, passengers receive personalized travel recommendations that enhance their journeys from the very start. Upon arrival, autonomous terminal movers eliminate long queues for check-in and baggage drop, making the process seamless. AI-enhanced security checks expedite the experience, allowing travelers to enjoy shopping at suggested stores—all before reaching their optimally assigned boarding gates.

Behind the scenes, non-customer-facing operations are also upgraded to be AI-compatible, resulting in faster, safer, and more accurate services with minimal disruptions. Initially, the changes in passenger experience might seem subtle, but the impact on efficiency and cost savings will be substantial. As these operational improvements take hold, their benefits will increasingly enhance customer interactions, creating a smoother and more enjoyable airport experience.

Three stages of AI applications in airport

Task-Based Solutions:

With **minimal** effort, airports can implement task-focused AI solutions. Examples include the deployment of robots for terminal and apron patrolling or the use of autonomous tractors for luggage transport. These standalone AI applications enhance safety and efficiency without requiring extensive infrastructure changes.

Process-Focused Applications:

With **moderate** effort, airports can adopt AI to address specific processes or problems. Innovations such as smart parking stand allocation systems or intelligent baggage reclaim belt management exemplify how AI can streamline operations and improve the passenger experience.

Transformative Change:

With **broad and continuous** efforts, AI can drive transformative changes throughout the airport and the wider aviation industry. This could include fully autonomous vehicle systems within airport grounds or real-time monitoring and predictive maintenance for airport infrastructure, leading to safer and more efficient operations.

In fact, the potential of AI to revolutionize airports is immense, influencing customer experience, operational efficiency, and corporate management strategies. AI will permeate nearly every aspect of airport operations, driving significant enhancements across the board.

Airports can initiate AI projects at any point, regardless of their current level of readiness.

However, airports need not wait for complete readiness before embarking on their AI journey. They can assess their unique strengths and needs to prioritize resource allocation effectively. Deloitte's AI ambition curve illustrates three stages of AI application, showing airports can initiate AI projects at any point, regardless of their current level of readiness [20]. By focusing on gradual implementation and prioritizing AI adoption, airports can lead a technological revolution that reshapes air travel, setting new industry standards for excellence.
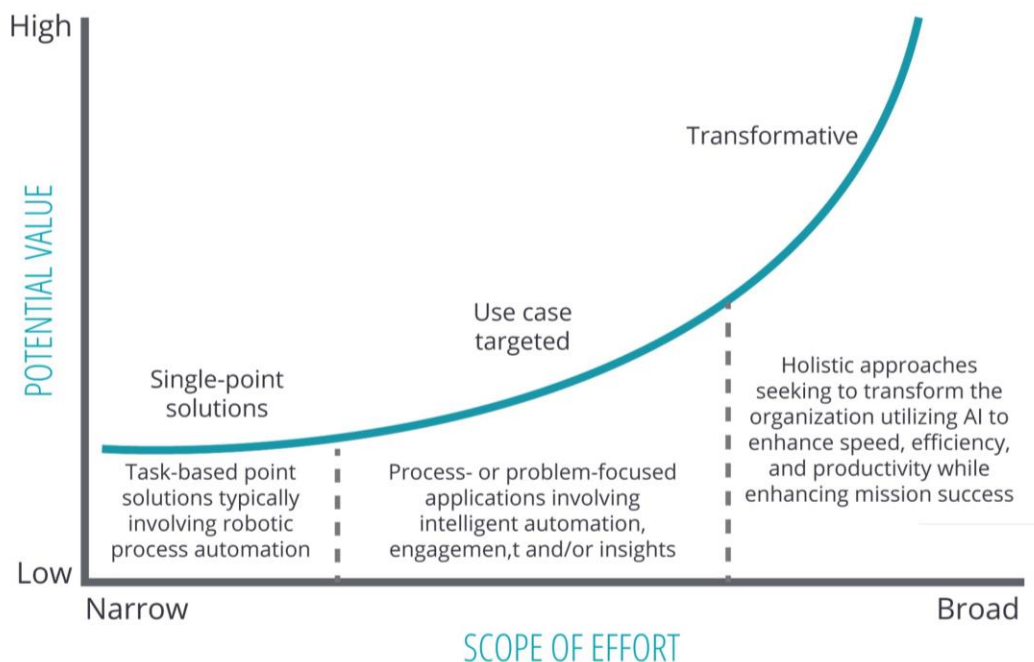

Figure 9 AI ambition curve [20]

Concluding remarks

In conclusion, integrating AI in airports presents a transformative opportunity to enhance operational efficiency and passenger experiences. By adopting AI technologies, airports can improve personalized services, streamline operations, and better adapt to evolving traveler expectations. While customer-facing services often take the spotlight in AI integration, behind-the-scenes enhancements also significantly benefit both the airport and the passenger experience.

Despite challenges such as infrastructure readiness, data management, and public concerns, airports that position themselves as leaders in the aviation industry can play multifaceted roles as initiators, platform providers, and facilitators throughout the AI journey. By establishing proactive and adaptive strategies and aligning their shared AI vision, airports can foster collaboration among stakeholders and pave the way for successful AI adoption, ensuring a seamless and enjoyable travel experience that meets the demands of the modern aviation landscape.

Reference

1.   Singla A, Sukharevsky A, Yee L, Chui M, Hall B. The state of AI in early 2024: Gen AI adoption spikes and starts to generate value 2024 [Available from: https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai#/.

2.   Ertel W. Introduction to artificial intelligence: Springer Nature; 2024.

3.   Xu Y, Liu X, Cao X, Huang C, Liu E, Qian S, et al. Artificial intelligence: A powerful paradigm for scientific research. The Innovation. 2021;2(4):100179.

4.   Cisco. Cisco 2024 AI Readiness Index: Cisco; 2024 [Available from: https://www.cisco.com/c/m/en_us/solutions/ai/readiness-index.html.

5.   Singapore A. AI Readiness Index [Available from: https://aisingapore.org/innovation/airi/.

6.   IBM. What is AI infrastructure [Available from: https://www.ibm.com/topics/ai-infrastructure.

7.   Kizilca I. Airport Infrastructure—Facing Delays but Can Recover: Asian Infrastructure Investment Bank; 2020 [Available from: https://www.aiib.org/en/news-events/media-center/blog/2020/Airport-Infrastructure-Facing-Delays-but-Can-Recover.html#:~:text=The%20vast%20majority%20of%20airports%20in%20developing%20economies,complicate%20access%20to%20finance%20for%20airport%20infrastructure%20projects.

8.   Vaamonde A. Understanding how AI will impact Passenger Support and the Overall Traveling Experience: ACI; 2024 [Available from: https://airportscouncil.org/2024/03/13/understanding-how-ai-will-impact-passenger-support-and-the-overall-traveling-experience/.

9.   One ID: IATA; [Available from: https://www.iata.org/en/programs/passenger/one-id/.

10.   Hong Kong International Airport [Available from: https://www.hongkongairport.com/.

11.   Malaviya A. Revolutionizing Airport Operations: The Impact of Artificial Intelligence and Machine Learning in Aviation ACI2024 [Available from: https://airportscouncil.org/2024/09/03/revolutionizing-airport-operations-the-impact-of-artificial-intelligence-and-machine-learning-in-aviation/.

12.   CUHK's "IoT-Augmented Airfield Service System" Piloted at Hong Kong International Airport to Assist in Building a Smart Airport 2019 [Available from: https://www.bschool.cuhk.edu.hk/press-releases/cuhks-iot-augmented-airfield-service-system-piloted-at-hong-kong-international-airport-to-assist-in-building-a-smart-airport/.

13.   Can AI make A-CDM even better? [Available from: https://www.assaia.com/resources/can-ai-make-a-cdm-even-better.

14.   Brooker A. Predicting Flight Delays: How Airlines Are Harnessing AI to Minimize Disruptions: Cirium; 2024 [Available from: https://www.cirium.com/thoughtcloud/predicting-flight-delays-how-airlines-are-harnessing-ai-to-minimize-disruptions/.

15.   Company RA. Riyadh Airports Records a New Achievement by Adding Artificial Intelligence (AI) Technologies to Enhance Baggage Handling Systems at King Khalid International Airport in Cooperation With Amazon AWS and AIRIS. 2022.

16.   The Implementation of Artificial Intelligence and Machine Learning in the Security Checkpoint White Paper. ACI: ACI; 2022.

17.   Yufeng K. Changi Airport trialling AI to improve security screening for carry-on luggage. 2023.

18.   ACI INTELLIGENCE HUB: ACI; [Available from: https://aci.aero/programs-and-services/aci-intelligence-hub/.

19.   IATA. AI in Aviation White Paper 2018 [Available from: https://www.iata.org/contentassets/2d997082f3c84c7cba001f506edd2c2e/ai-white-paper.pdf.

20.   Van Buren E, Chew B, Egger W. AI readiness for government are you ready for AI 2020 [Available from: https://www2.deloitte.com/us/en/insights/industry/public-sector/ai-readiness-in-government.html.