



Next Generation Airports: Building Intelligent, Agile and Future Ready Airports in Asia

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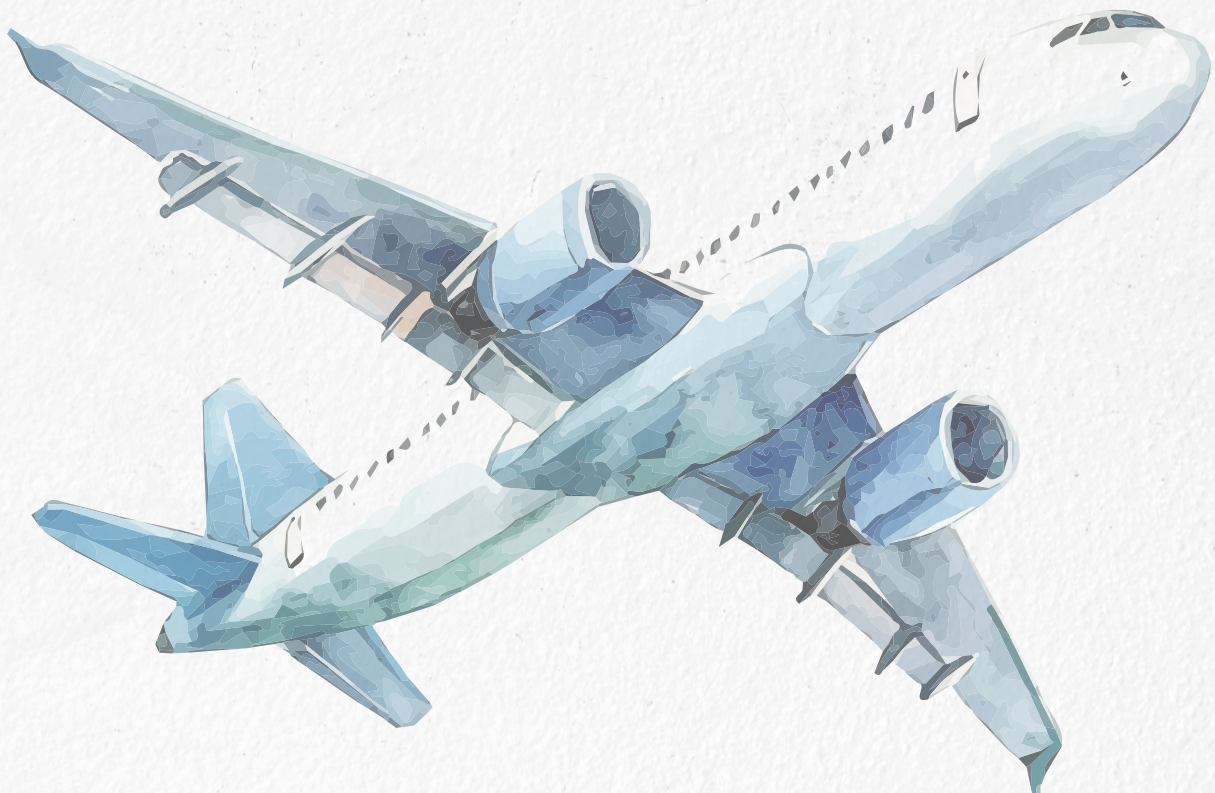
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Introduction

Airports are undergoing enormous transformation as air travel demand is soaring, airspace is more congested than ever, and the combined pressures of rising costs, labour shortages, and the growing expectations of passengers and airlines are pushing airport operations to their limits. To meet these challenges and to keep pace with both current and future demand and changing industry dynamics, all while offering increased passenger experience, maintaining strong operational performance and revenue budget. Airports must embrace innovative technologies to create safer, smarter, more immersive, and highly efficient hubs. Innovation is no longer optional it is the imperative that will determine an airport's growth, competitiveness, and ability to become future proof.

Imperatives for Airport in Asia to Future-Proof

Rapid Passenger Growth Across Asia - Asia is forecasted to continue to remain one of the fastest growing aviation markets globally supported by growing middle class, increased demand for leisure and business travel and expanding regional connectivity. Airports need to prepare for increases in passenger demand while maintaining high passenger experience and operational efficiency.

Capacity Constraints - Many major airports across Asia are already operating close to capacity, particularly during peak periods. Although new terminals, runways and airports are being developed across the region. However, infrastructure expansion is not always the solution especially in short to medium term but must be supported by smarter passenger processing, better resource utilisation and more flexible operating models to support enhanced operations with current infrastructure.





Increasing Passenger Expectations – Passenger expectations with airport journeys is constantly increasing to be fast, seamless, personalised and digitally enabled. Real time insights, self-service processing, biometrics and intuitive wayfinding are becoming standard expectations rather than premium services.

Climate Risks and Operational Disruptions - Airports across Asia are increasingly exposed to extreme heat, flooding, heavy rainfall, tropical storms and other climate-related events. Airports must strengthen both infrastructure resilience and disruption response capabilities.

Workforce Shortages and Cost Pressures - Airports, airlines and ground handlers face growing difficulty in recruiting and retaining workforce resulting in rising labour costs are outing pressure on airport economics. Automation and digital tools can support optimization workforce allocation and productivity.





Innovating and Redefining the Passenger Journey

Airside

- ▶ **Predictive Stand, Gate, and Apron Management** - Advanced airport operations integrate numerous data points to dynamically adjust gate/ stand allocation based on real-time conditions such as early or delayed arrivals, aircraft changes, and operational constraints.
- ▶ **Digital Twin** - Digital twin solutions provide a comprehensive view of airport processes, including passenger flow, aircraft and vehicle movement, gate operations, and workforce deployment while offering the ability for operators to test/ try out process changes to evaluate impacts before deployment and reduce any potential disruption.
- ▶ **Autonomous and Robotic Ground Operations** - Autonomous GSE are increasingly catching airport operators' attention, especially when operators face workforce scarcity while aircraft movement continues to increase. Autonomous GSE aim to reduce reliance on manual processes and improve operational continuity with minimal impact from factors such as adverse weather, overall resulting in efficient operations and enhanced passenger experience.

Landside

The landside area of airports in the past few years has begun experiencing significant technological innovations as airports recognize the value of delivering a seamless, end-to-end passenger journey. Innovations at the landside focus on having a robust multimodal transport connectivity, implementing smart parking solutions, and setting up advanced last mile connectivity such as integration of AAM/UAMs.

- ▶ **Efficient Intermodal Connectivity** - Integrating multiple transportation modes into a single facility. for easy transitions within a unified terminal and facilitate smooth connections between different modes, including rail, metro, bus,, ferry, taxi, ride-hailing and parking operators.
- ▶ **Off-Airport Processing** – Offering option for passengers to carry out check-in, bag drop and identity verification, at locations such as railway stations, hotels, convention centres. This reports in reducing terminal congestion, improve passenger experience & convenience and create a more seamless journey.



- ▶ **Smart/ Automated Parking** – Solution such as automated parking systems that use robotics to park and retrieve vehicles are being developed/deployed to ensure enhanced passenger convenience, efficiency. Airport operators can use data to adjust pickup areas, redirect vehicles and prioritise public or high-occupancy transport during periods of high demand.

Terminal

Over the past decade, airport terminals have evolved into a focal point for technological innovations, with the aim of delivering a seamless passenger journey with reduced processing times and eliminating inefficiencies while making the whole experience more intuitive. This not only benefits operators increase throughput but passengers who now spend less time at immigration and security, and more time at the gate, an extremely valuable opportunity for non-aero revenue streams.

- ▶ **AI for Passenger Processing** – Solutions leveraging AI coupled with big data to optimizing touchpoints across passengers' journeys while also elevating the passenger experience by offering dynamic queue management, deployment of resources based on traffic and offering predictive insights to minimize friction across touchpoints and reduce processing time.
- ▶ **Robotics for Passenger Assistance** – As airports deal with increasing passenger demand and workforce shortage, robotic solutions are being deployed to fill in operational gaps especially for tasks such as cleaning, passenger service, security monitoring and are being experimented to carry out maintenance in the future.
- ▶ **Non-intrusive security screening** - Enhanced security solutions that are able to detect threats without interrupting passenger flow or causing any inconvenience are becoming a critical requirement as passenger volumes continue to grow and airports aim to adherer to required security standards while maintaining seamless and efficient passenger movement.
- ▶ **Personalised Services** - Tools are being developed to analyse passenger behaviour and evaluate certain trends based on route, seasonality to provide personalized recommendations, such as food and beverage, retail, and lounge services without invading privacy.
- ▶ **Personalised Service Offerings** – Airports are increasingly working with stakeholders across the airport to provide more relevant and personalised services. These may include customised retail and dining recommendations, lounge access, accessibility support, wayfinding assistance and real-time connection guidance. Offering, personalised services can improve convenience, reduce uncertainty and create new opportunities for non-aeronautical revenue.



- ▶ **Digital Solutions** – Passengers increasingly expect airport experience extending beyond the physical terminal. Passengers require mobile applications, digital platforms and connected/digital services that offer real-time flight updates, queue information, indoor navigation, baggage status and disruption alerts throughout the journey even before arriving and after departing the airport. Having continuous engagement with passengers, supports airports in managing passenger's expectation much better while having a direct connect with them.

Future ready airports are not defined only by the number of technologies they have deployed but more about how multiple technologies are well integrated across the airport ecosystem to offer a much more enhanced, efficient and intuitive experience. Airports to become future proof will need to not only increase throughput but become sustainable, efficient, resilient and adaptable to demand and technological changes.





Key Components of Future Ready Airports



Seamless Multimodal connectivity that offers passenger's easy access to various modes of transport by making airport more of a transport hub. Offering services like through baggage for cruise/ferry while working with operators to offer end-to-end travel management of the passenger experience will drive growth in passenger demand.



Unified Passenger Centric Digital Solutions The airport's digital services should operate as a connected platform rather than multiple independent applications. This should integrate real-time flight information, wayfinding, digital identity, baggage visibility, accessibility support, airport services, payments and disruption communication.



Intuitive and Immersive F&B/ Retail that combines online and offline sales channels that aid improve non-aero revenue and passenger experience are expected to attract higher spending.



Advanced A-CDM/ TAM solutions that integrate multiple stakeholders across the airport ecosystem into a single nodal point supporting predictive and collaborative decision making offering holistic and dynamic airport management will enable increased throughput and processing times.



Flexible and modular infrastructure Airport buildings and systems must be capable of adapting to changing demand, technologies and requirements. Having reconfigurable processing areas, scalable networks and modular facilities can allow airports to change scale of operations based on any rapid changes in passenger demand as well as have the ability evolve as passenger dynamics changes over time without requiring high investment infrastructure changes.



Automation, artificial intelligence and robotics will form an important part of future-ready airports. Solutions such as automated baggage handling, intelligent passenger management and autonomous GSE will aid in improving capacity, safety and experience and create a differentiating factor in terms of cost optimization and efficiency.



Sustainable, Resilient and Agile Future ready airports will need to be actively involved in supporting reducing of emissions across Scope 1, Scope 2 and Scope 3 as going forward this will be a key criterion that airline and passengers alike will consider while choosing airport/destination. Airport also need to have robust crisis management and alternate operations plan to address any situations with minimum disruption and cost.



Strategic Recommendations and Future Outlook

Airports in Asia are at different stages of development and technology maturity ranging from large international hubs to smaller regional airports but the one thing common amongst them is that these airports act as a gateway to one of the world's fastest-growing aviation markets. Regardless of budgets, size or maturity, adopting a few key strategic principles can enable airport operators and stakeholders make airports future-proof through technology adoption, process optimization, sustainable initiatives, resource optimization and effective use of existing infrastructure.

Delivering this vision will require collaboration across the entire airport ecosystem. Airport operators must define transformation priorities and create scalable foundations. Airlines, ground handlers and government agencies must participate in shared processes. Technology providers must develop flexible solutions that address real operational requirements. Airports should focus on high-value use cases, establish clear performance metrics, define priorities and create guidelines for successful pilots and deployment. Airports and technology suppliers need to work together collaboratively develop & deploy innovative technology by leveraging airports as test bed. Airports should explore adopting solutions not only from large organisations but also explore solutions from newly established specialised organizations and explore new business models, revenue sharing models that supports adoption & deployment.

The region will continue to build new airports, terminals and runways but the airports that will be able to create the greatest long-term value will be those that make their infrastructure more adaptable, their operations more efficient and offer enhanced passenger journeys.



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