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The Modern Airport
Conquering Complexity in an Era of Increasing Expectations

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THE COMPLEXITY OF THE MODERN AIRPORT

It was Friday afternoon. The traveler stepped out of the taxi at the airport after a week of business meetings. She entered the terminal and thought of all the things she needed to do before she actually got on the aircraft to fly home. The queues at the check-in counters were long, and the line at security looked even longer. She wanted to pick up something quickly at one of the shops and then spend some time unwinding in the lounge, but she wondered what the situation at the boarding gate would be like. She had to check a bag and wondered if the wait for her baggage would mean that she got home at midnight.

While the traveler was entering the terminal, the airport manager was looking at the Friday afternoon rush splashed across two dozen computer screens. There was a thunderstorm over the central part of the country, and he knew that flight departures would start backing up any minute now. The integrity of the security perimeters and checkpoints looked good, but this situation was never a sure thing. It was hot in the city, and he knew that his facility was drawing a lot more power off the grid than normal. With the heat and the looming delays, the airport staff of 400 people, their equipment and all of the airport's systems would be challenged to keep the airport running smoothly. He hoped that the travelers in his airport would not get frustrated with the situation.

CHALLENGES, CHANGES AND COMPLEXITY

This vignette illustrates the daily complexity facing airports each day as passengers traverse their facilities. Today, airport managers are challenged to increase operational efficiency and reduce operational costs, while improving airport capacity and strengthening the security and safety of travelers and cargo.[1] At the same time, airports need to find ways to grow revenue from commercial (non-aeronautical) sources, as they lower or maintain aeronautical fees in an effort to keep and attract airlines and paying customers. Perhaps the most pressing challenge is enhancing the quality of the passenger experience. Most travelers want short wait times, easy navigation through the airport and their baggage to arrive quickly.[2] Yet increasing passenger volume—growing at five percent annually according to the International Air Transport Association[3]—frustrates passengers with long lines at check-in, security checkpoints and baggage collection. Strong customer focus is a competitive advantage in the air travel industry[4], and because airports are the gateway to air travel, they can have a large impact on improving the customer experience[5], helping to increase non-aeronautical revenue.

As they strive to provide positive customer experiences, as well as growth, efficiency, safety and security, the responsibilities on airport management are expanding. Airports are complex enterprises made up of different domains and systems of systems. In addition to aviation operations, there are safety and security, energy, physical asset and human resource, real estate and space domains, all of which intersect with the passenger experience. Managing all of this complexity requires not only understanding what happens in these domains, but also controlling them and directing them for continual improvement. Airports and their management infrastructures should therefore be designed to handle complexity and support change. Current airport management systems are insufficient to cope with the complexity of today, and without anticipating and initiating change, will be unable to support future demands as airports evolve.

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OUTLOOK 2025: MANAGING A SPECTRUM OF AIRPORTS

Airports are evolving to play different roles in the wider ecosystem of the communities they serve.[6] Driven by the complexity of shifting needs, the airport industry is adapting by developing different models, each meeting a different combination of needs. Some travelers wish to experience the airport almost as a destination unto itself, with many options for leisure and entertainment, dining, fitness and shopping. Others want a more minimalist experience, moving as quickly as possible through the airport before and after their flight. Still others may need extra assistance to navigate through an airport. The challenge for the airport is to deliver the experience that each type of passenger wants, consistently and cost-effectively, despite the inherent complexity in meeting a wide variety of needs. The magnitude of this challenge will increase over time as passenger volumes continue to rise.

We believe that airports will evolve along the lines of three models that will all have to meet the passenger experience needs. The **airport city** is a fully-featured international gateway and destination catering to the needs of both travelers and visitors from the local community. The **regional travel and transportation hub** is an arm of the local economy focused on moving passengers and freight efficiently. The **local, self-service terminal** is a streamlined entity where most of a traveler's airport processes are conducted through self-service, focusing on speeding passengers efficiently from curb to aircraft with minimal human assistance.

Regardless of the type of facility, airport executives face a common set of management challenges. These challenges stem from the amount, variety and speed of information flowing from the major management domains in any airport, as depicted in Figure 1. The six domains shown in the figure are linked to management outcomes, which enable the business outcomes central to the airport as an enterprise.

Figure 1: Airport Management Domains and their Business Outcomes

Airport Management Domains

| Passenger Experience | Aviation Operations | Safety & Security | Energy | Physical Assets & Human Resources | Real Estate & Space |

Source: Frost & Sullivan

Underlying the management domains and their associated outcomes, efficient data processing is critical to ensuring that managers can understand, predict and direct events, processes and assets to achieve the outcomes. Business intelligence and analysis has taken hold in airports and the airline industry, focusing primarily on analyzing specific, single domain issues.[7] For instance, most airports today can determine if a flight arrived on time or was delayed and often know why, but most cannot analyze and respond in real time to the root cause (e.g., delayed catering truck, slow fueling, etc.). For airports to be able to meet their challenges and imperatives while remaining agile enough to accommodate evolutions in the industry, they must move beyond using analytics to simply producing reports in single domains to using them

to produce instant insights across all domains. This means that airport executives and CIOs must elevate the strategic importance of the digital infrastructure to manage informational complexity and produce successful outcomes.

MANAGING INFORMATION COMPLEXITY IN AIRPORTS

As airports evolve, the amount of information and data generated will increase, driven by increasing numbers of subsystems, people, technology platforms and the interconnections between them, creating massive complexity for airport managers. Typical airport management systems using information technology (IT) are designed around discrete, single-purpose systems, such as passenger management, which sit within organizational silos. This results in a complicated and inflexible system that is difficult to administer and expensive to maintain and power. Worse still, these legacy systems segregate information that should be shared between domains and cannot easily adapt to changing requirements placed on them. Moreover, as the volume and complexity of information increases, these legacy systems can be overwhelmed, degrading managers' ability to run the facility.

A better approach to managing information complexity is to implement an overarching system integrating all of the domain subsystems and enabling cooperation between them. Under this approach, aviation operations, security, energy and physical assets would all coordinate during a snowstorm, for instance, to accommodate sudden changes in air traffic patterns while ensuring positive passenger experiences. Using current management systems, this level of coordinated activity is difficult and costly, as managers manually abstract relevant information from multiple sources and then try to combine it in the moment. The integrated management system approach builds business value by reducing administration costs, improving process efficiencies and generating higher, supervisory-level insight. Moreover, an integrated management system extends managers' visibility across all domains, increases control and balances between them, promoting continuous improvement holistically, as illustrated in Figure 2.

Figure 2: An Integrated Airport Management Framework
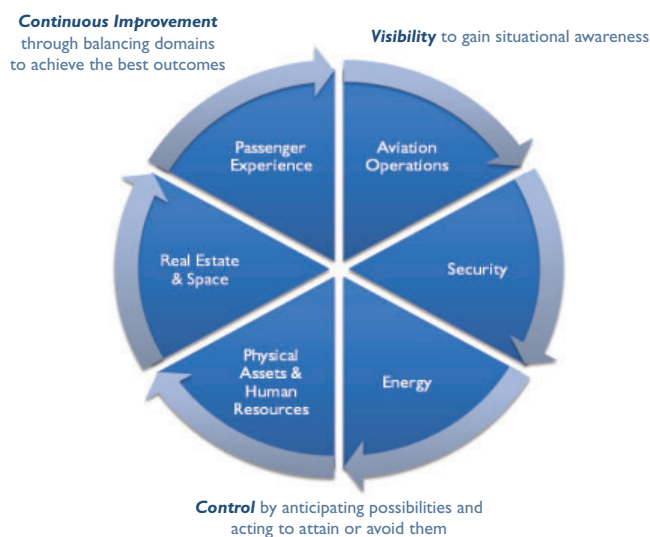
Source: Frost & Sullivan

SMARTER AIRPORT MANAGEMENT

The digital infrastructure for an integrated airport management framework is based on ingesting, processing and sharing data from the many subsystems throughout the airport domains. This supports a method of smarter airport management through visibility, control and continuous improvement capabilities.

Holistic Management Systems

The heart of smarter airport management is a holistic management system that integrates an airport's stand-alone systems. Because many airports will have substantial investments in these legacy systems, the holistic application is able to incorporate the stand-alone systems without having to replace them. The holistic system works by obtaining operational data from each separate system and then creating a single view of all the data. This also allows interconnection between the separate systems and promotes collaboration between domains through shared sources of information.

Holistic management systems support smarter airport management by:

- Giving security officers the ability to detect a threat, such as an unauthorized intrusion into a secure area, evaluate its implications and direct the appropriate personnel and resources to neutralize the threat without disrupting airport operations or inconveniencing passengers

- Enabling maintenance managers to schedule work during low traffic periods while retaining the flexibility to rapidly reschedule physical assets and personnel in the event of a weather emergency to accommodate the unexpected surge of passengers

- Allowing airport real estate managers to use consumer forecasting to evaluate the impact of a new entertainment center on energy consumption, security needs and terminal traffic patterns to drive increased passenger spending

The Uses of Analytic Software

Analytic software is valuable to airport managers because they can help turn siloed, inefficient organizations that react into collaborative organizations that anticipate and act. Airport managers can use analytics as part of an integrated management approach to produce insight from large amounts of data collated from different domains and then generate user-specific reports to disperse the resulting insight throughout the organization.

Analytic software supports smarter airport management by:

- Describing the current situation of the airport or any part of it, in detail, with real-time indications of changes, giving supervisors complete situational awareness

- Predicting system-wide patterns in passenger and aircraft traffic, in various regular and irregular operating scenarios, and developing contingency plans that can be enacted or changed as events unfold

- Prescribing ways to manage resources and assets to optimize passenger satisfaction and revenue growth

The vision of smarter airport management is compelling because it brings new levels of control in a complex environment. Using holistic management and analytic applications within an integrated airport framework, airport executives can improve their capabilities to grow revenue; provide a consistent, enjoyable experience for passengers; improve efficiency to lower costs and enhance collaboration; and ensure safety and security for customers and employees with minimal disruption to operations. However, traditional airport management systems are unable to scale to support holistic management and will not allow analytic software to create airport-wide insight. IBM has created a set of offerings to enable an integrated airport management approach, applicable to any type of airport facility.

THE IBM APPROACH TO ENABLING THE MODERN AIRPORT

IBM's approach to enabling integrated airport management is based on a suite of information technology solutions, services and consulting for the air travel industry. The solutions are designed to leverage data and information to meet airport capacity demands, increase operational efficiency, help control costs and promote airport service differentiation. The approach addresses key aspects of integrated airport management systems:

- An airport operations management system to abstract the interfaces from separate domain management systems to allow collaboration between business functions, reducing cost and improving operational efficiency

- Common-use, multi-channel, self-service systems such as check-in kiosks, smartphone support, baggage drop and Web- and voice-activated response and call centers, which can help reduce congestion and waiting times in airports and support programs to increase non-aeronautical revenue

- Operations, planning, and optimization solutions that use analytics to support equipment, facility and labor planning operations delivery and schedule recovery in the event of irregular operational conditions

- Baggage management solutions that use analytics and process management software for baggage track-and-trace to reduce mishandled baggage, shorten bag transfer times and lower baggage operations expenses

- Asset management and maintenance solutions that use analytics to raise utilization rates and decrease operating expenses, while helping to coordinate maintenance with airport operations, which increases airport operational capacity

- Safety and security solutions that use analytics to monitor operations in real time, identify security risks and generate alerts, enabling commanders to gain situational awareness of unfolding events and coordinate the response to them

Working with IBM, a major Canadian airport authority developed an innovative business model that has saved 19% of IT costs; an international airport in India is creating a holistic, real-time management system; and an Australian airline has created a next-generation check-in process.

IBM has used its approach with a number of airports and airlines around the world to help them enhance passenger experiences, grow revenue, become more efficient and increase safety and security.

A major Canadian airport authority worked with IBM to improve the passenger experience with self-service check-in and boarding solutions. This authority also engaged IBM to provide all technology support and billing for its 160-plus carriers and tenants allowing the authority to focus on what it does best—running Canada's largest airport and focusing on positive passenger experience. This innovative business model has saved 19 percent of IT costs for all of the authority's stakeholders—airlines, airport tenants, and the airport authority.

An international airport in India is working with IBM to modernize, expand and establish a best-in-class airport with the best possible facilities and infrastructure to deliver a superior experience for passengers. The airport and IBM are implementing a holistic airport management system that integrates more than 30 separate airport systems into an airport-wide business process model. Scalable to accommodate new systems, the holistic management system will enable management to have a group-wide view in near real time while measuring key performance indicators for partners and passengers.

An Australian low-fare airline needed to support an aggressive growth strategy by driving higher levels of efficiency, cost control and speed into its terminal operations. The airline's strategy is to enable its customers to bypass long check-in lines, giving them more time to enjoy their time in the airport. Working with IBM, the airline deployed a solution to outsource the entire inbound process to the passenger by using advanced self-service kiosks and cutting-edge traffic flow designs. The airline's customers can now check themselves in, obtain seating and tickets and process their baggage, which increases capacity and check-in speed without adding any staff. This is helping the airline keep costs—and airfares—low without sacrificing customer satisfaction.

ENABLING THE AIRPORT EXPERIENCE

Airports are complicated, and the volume, velocity and variety of information that airport managers deal with every day is daunting. The IBM approach and its suite of solutions can give managers visibility and improved situational awareness, while giving them new tools to maintain control, and support continual improvement across management domains. Leading airports in Canada and India, and a growth-oriented airline, are demonstrating that the approach can help an airport's travelers, employees, tenants and airline customers all enjoy the experience that they want at the airport.

Back at the terminal entrance, the traveler smiled as she looked at her smartphone. The boarding pass she downloaded when she checked in on the way to the airport directed her to the self-serve baggage drop area. After leaving her bag, she walked over to the biometric security station. Less than a minute later, she entered the main concourse and her smartphone updated her that her flight would be departing on time, despite the thunderstorm back home. She realized that she had enough time to do a little shopping and relax in the departure lounge. Now her only concern was whether she could fit in a quick visit to the airport's new butterfly garden as well.

The airport manager also smiled as he turned away from the bank of computer screens and looked at the situational dashboard on his tablet. The airport's new management system took the critical information from those two dozen screens and gave him what he needed to know in the palm of his hand. The system's analytics predicted how the situation would unfold over the next hour and gave him suggested actions to ensure that airport operations would run smoothly, and that travelers would enjoy a positive experience. One of these days, he thought, he'd have to take a vacation and fly somewhere to experience things from the traveler's perspective. After all, he thought, we've helped make travel fun again.

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