



Does airport ownership / operating model impact the level of digital transformation?

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ABSTRACT

This paper examines how airport ownership and operating models influence digital investment and digital maturity. It first outlines different ownership structures, ranging from fully government-owned airports (such as Dubai Airport and Doha Airport) to partially privatised airports (including Bengaluru Airport and Manchester Airport), and fully private airports (such as Heathrow Airport and Gatwick Airport). It then reviews key operating models, including direct government administration, corporatised structures, concession arrangements, not-for-profit entities, and the distinction between single-airport operators and multi-airport groups. This study is among the first to examine potential links between airport ownership, governance, operating structures, and digitalisation and innovation outcomes.

Building on this foundation, the paper analyses how these ownership and governance arrangements shape approaches to airport digital transformation, particularly in terms of investment capacity and digital maturity. This analysis is situated within broader global trends in baggage handling systems, passenger service technologies, airline–airport IT integration, emerging digital innovations, passenger experience performance indicators, and IT spending patterns. The study is further supported by a qualitative thematic analysis of interviews conducted with digital leaders from selected airports worldwide.

The findings indicate that while ownership structures (public, private, or hybrid) and operating models (single-airport or group-based) significantly influence governance frameworks, funding capacity, and the scalability of digital initiatives, they do not independently determine the extent of digital transformation achieved. Instead, digital maturity is shaped by broader strategic leadership, the degree of autonomy over IT investment decisions, regulatory processes and timelines, and the strength of an organisation's digital culture.

1. Introduction

Over the last decade, the role of 'digitalisation' has grown phenomenally in all areas of business, specifically more so since the launch of the Digital Transformation of Industries (DTI) initiative, a project launched by the World Economic Forum in 2015, which serves as the focal point for examining new opportunities and challenges that digitalisation is creating for business and society.

Since its inception, the initiative has analysed the impact of digital transformation across 13 industries (i.e., Aviation, Travel and Tourism, Chemistry and Advanced Materials, Mining and Metals, Oil and Gas, Professional Services, Retail, Telecom, Automotive, Consumer,

Electricity, Healthcare, Logistics and Media) and five cross-industry topics (i.e., Maximising Return on Digital, Digital Consumption, Digital Enterprise, Platform Economy, Societal Implications), to identify the key themes that enable the value generated by digitalisation.

The initiative has further developed a distinctive economic framework which quantifies the impact of digitalisation on industry and society, estimated at USD 100 trillion value created by the end of the decade (World Economic Forum, 2016). Fig. 1 shows the historical and predicted capabilities of the world's industries to leverage various technological advancements from 1950 to 2020 and beyond. Specifically, from 1990, the graph shows the growing capabilities of the Internet of Things (IoT), Big Data analysis and prediction, and

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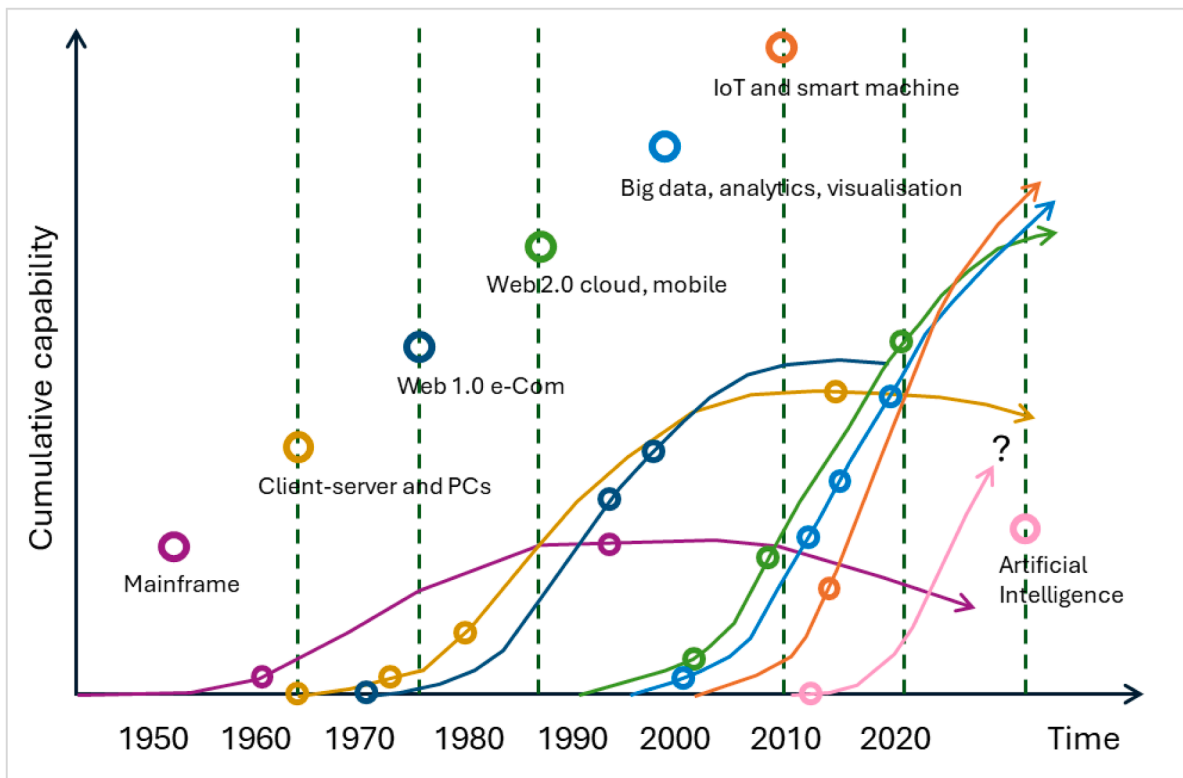


Fig. 1. Historic and predicted capability of world industries to leverage various technologies over time (reproduced from World Economic Forum / Accenture analysis 2020).

cloud-based and mobile-based technology. Although aviation overall has been at the forefront of digital transformation, airports as infrastructural resources within the air transport system have always followed the strategic direction imposed on them by the operating airlines.

To mitigate the overwhelming pressures within the industry due to the growing demand for air travel, limitations of the available infrastructure, financial constraints and increasing traveller expectations, airports have had to incessantly develop new solutions to maximise the potential of their existing assets, satisfy the interests of their customers through enhanced experience, and optimise resources to break even. Ownership and operating models have also played a crucial role in how airports have navigated traffic volatilities and financial pressures. However, one critical yet under-researched issue is the extent to which these models shape the pace and depth of digital transformation across airports globally. This study intends to examine whether private ownership leads to greater technological investment and consequently higher levels of digital maturity, as suggested by several airport organisations (AirportGurus, 2023; ACI, 2025), or whether ownership structures have no material impact on airport digitalisation.

Therefore, the aims of this paper are:

1. To explore if and how airport ownership and operating models impact airport investment in digital technology, digital strategy/leadership and innovation.
2. To further investigate if there exists a relationship between ownership and operating structure and the digital maturity of an airport.

To achieve the above, the paper first explores the existing literature on airport ownership and operating models and delves further into global digital transformation to identify links and knowledge gaps that warrant further research in Section 2. Gaps in the secondary data were addressed through primary data collection, the methodological framework for which is outlined in Section 3. Interviews of digital leaders

helped gather first-hand expert insights on the factors affecting airport digital maturity and investment. The transcripts were thematically analysed, with the findings presented in Section 4. Section 5 discusses the study's findings, aligning with the research aims set out at the beginning. Section 6 provides concluding remarks and the study's contribution to knowledge, additionally identifying areas of further research.

2. Literature review

This section draws on key publications on airport ownership and operating models, as well as on the industry's digital transformation, thereby identifying relevant secondary data and potential research gaps to be addressed.

2.1. Ownership models

There are several different airport ownership models, with Airports Council International (ACI) having a simple classification of *government-owned* (100% government-owned), *partially privatised* airports (<100% equity), and *fully private-owned* airports (100% equity).

2.1.1. Government-owned airports, e.g. DXB¹, YVR², DOH³, SEA⁴

These are airports owned 100% by the local, regional or central government.

¹ DXB: Dubai Airport

² YVR: Vancouver Airport

³ DOH: Doha Airport

⁴ SEA: Seattle Tacoma Airport

2.1.2. Partially privatised airports, e.g. BLR⁵, MAN⁶

These airports are structured as public-private partnerships (PPP), with partial government ownership and partial private ownership for a defined concession period, under a concession agreement, such as Build-Transfer-Operate (BTO), Build-Own-Operate (BOO), Design-Build-Finance-Operate (DBFO), Rehabilitate-Operate-Transfer (ROT), Build-Own-Lease-Transfer (BOLT), Build-Operate-Train-Transfer (BOTT) and Modernise-Own-Operate-Transfer (MOOT), Build-Operate-Transfer (BOT), Build-Own-Operate-Transfer (BOOT), etc. In some countries, there are limits on the percentage of ownership that can be held by private entities.

In India, for instance, the legal title to land and core airport assets at many privatised airports remains with the Airports Authority of India or the respective state governments. Private operators develop additional airfield or terminal infrastructure under the BOT framework, manage and operate the facilities under long-term lease agreements, and transfer the assets back to the government at the end of the concession period.

2.1.3. Fully private airports, e.g. LHR⁷, LGW⁸

These are airports that are 100% privately owned.

The operating models for each of the above ownership categories may differ, and some of these models are explained further below. The ACI World Inventory of private airports stated that approximately 45% of the world's passenger traffic in 2019 was handled at airports with private capital, including fully private and partially privatised, i.e., underscoring their significant contribution to the sector (see Fig. 2).

Several scholars have emphasised the importance of ownership models for airport efficiency (Oum et al., 2008), financial performance (Chen et al., 2017), airport market power (Choo et al., 2018) and profitability (Augustyniak, 2009). Graham (2020) examines the evolution of airport ownership and privatisation, seeking to identify its relationship with airport economic performance. The study also considers additional drivers of privatisation, including competitive pressures and regulatory frameworks.

2.2. Operating models

Airport operating models can be broadly categorised into the following six types, with further differences observed between single and group structures.

2.2.1. Direct central government operator

In this model, the government operates the airport, usually through a ministry (for example, transport or infrastructure) or a specific agency that oversees planning and operations, thereby retaining control of a strategic asset. This means that political cycles, more than technical or financial needs, are more likely to dictate investments. Some African airports (e.g. Entebbe airport owned and operated by Uganda Civil Aviation Authority) are operated through this model.

2.2.2. Corporatised government operator

This is where the State creates an independent, corporatised company or entity responsible for planning and operating the airport. The entity is also responsible for continued investment and profitability and can therefore hire people and sign contracts while maintaining its public ownership status. Changi Airport in Singapore is an example of this corporatisation model.

2.2.3. Private company operator

Airports can be privatised for a limited or unlimited timeframe.

Dependent on the time period, the airport is operated either by a private company indefinitely or by a concession contractor for a specified number of years. A private company operator, therefore, operates an airport privatised through an equity transfer, where ownership (full or majority) is held by private investors, either indefinitely or for a long term (i.e., not fixed by a concession term), with the government predominantly maintaining only regulatory oversight.

Examples of privately owned operators (Ison et al., 2011; Graham, 2008) include London Heathrow and London Gatwick airports.

2.2.4. Concession model operator

A concession model operator refers to a private entity that operates an airport for a fixed period under a contractual agreement with the government. Concession model airports are more complex (Deloitte, 2018), with the ultimate ownership of the airport retained by the State, e.g., in the case of the Build-Operate-Transfer (BOT) concession model (Cruz & Marques, 2011), the airport is leased to the concessionaire / private entity for a specified timeframe and the private company (or concessionaire) has operational control only during the concession period. Mumbai airport, for example, is operated under the concessions model by Adani Airports. Many Latin American and Asian airports also use this model.

Another concession model mentioned earlier, applicable mainly to greenfield airport projects, is the BOOT model, in which the private entity also owns the new infrastructure for the specified concession period, after which ownership is transferred to the State.

2.2.5. Not-for-profit operator

The operator is a not-for-profit company with no shareholders, allowing profits to be reinvested in the airport. Many Canadian airports, including Vancouver Airport, fall into this category.

2.2.6. Contracted operator (short-term or long-term)

In this model, the airport's day-to-day operations are subcontracted under a management contract to a private company. Such management contracts are observed mainly in US airports; however, more recent examples include some French Airports managed by Vinci Airports (Vinci Airports, 2025). Another such private operator group is the Vantage Airport Group, which invests, develops, and manages a network of several airports across North America, the Caribbean, and Europe.

2.3. Single versus multi-airport operators

Single airport operators have a single ownership and control structure. Some examples include LHR and BLR.

Multi-airport operators, however, can be further classified into Airport system, Airport network and Airport groups. The International Civil Aviation Organisation (ICAO, 2020) provides the following definitions:

2.3.1. Airport system

Two or more airports serving the same metropolitan area and operated under a single ownership, management and control structure (ICAO Doc 9562, 4th ed, 2020a). E.g. Port Authority of New York and New Jersey (PANYNJ) airports. Although John F. Kennedy International Airport (JFK) and LaGuardia Airport (LGA) are owned by the City of New York, and Newark Liberty International Airport (EWR) is owned by the cities of Elizabeth and Newark, they are managed and operated by the Port Authority under long-term leases.

Another example is Group ADP, a single business entity, which manages Paris Charles De Gaulle (for long-haul intercontinental traffic) and Paris Orly (for point-to-point traffic between Paris and European/North African cities) airports, thereby pooling costs and revenues at the system level (ACI, 2019a).

⁵ BLR: Bengaluru Airport

⁶ MAN: Manchester Airport

⁷ LHR: London Heathrow Airport

⁸ LGW: London Gatwick Airport

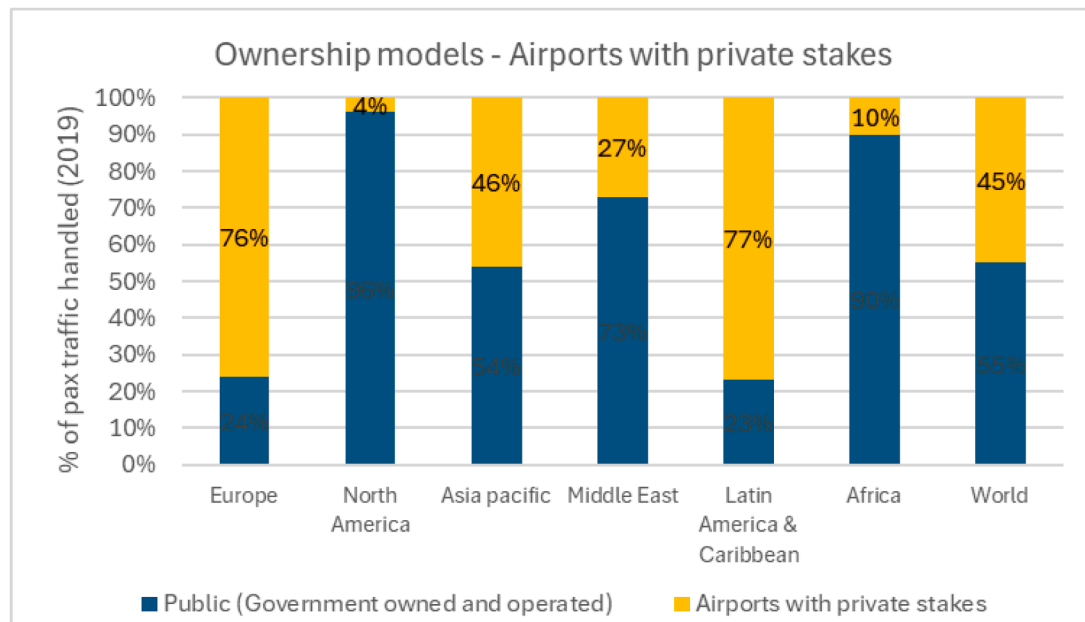


Fig. 2. Percentage of passenger traffic at privatised airports (Adapted from various citations of ACI World Inventory of Private Airports, 2020).

2.3.2. Airport network

An airport network, which could be an airport system as defined previously (ICAO Doc 9562, 4th ed, 2020b), is a group of airports within the State operated under a single ownership, management, and control structure; it may include all airports serving the territory of this State or only some of them. E.g. Swedavia (Swedavia Airports, n.d.), Finavia (Bloch & Lassen, 2016).

Airport networks could have one of the following operating models: National airport networks, which are either state-operated airport networks through a civil aviation authority or a ministerial department (quite common in Sub-Saharan Africa and the Pacific Islands), or corporatised national airport networks, where the network operator is publicly or privately owned (e.g., Israel Airports Authority) (ACI, 2019a).

Sub-national airport networks, where corporatised entities (publicly or privately owned) manage several airports at the regional level within a single country. E.g., PT Angkasa Pura 1 and PT Angkasa Pura 2, which operate airports in Central and Eastern, and Western Indonesia, respectively (ACI, 2019a).

ACI's Policy Brief claims that 78% of ICAO's Member States (i.e. 55% of the world's airports) are part of airport networks, contributing to 42% of global passenger traffic in 2019. Also, it reports that more than half of the world's small airports are operated by airport networks (ACI, 2019b).

Fig. 3 shows the proportion of ICAO Member States with some form of airport network arrangement.

As the ultimate responsibility for safe/secure airport operations lies with the State, airport systems and airport networks are required to exercise extra care in their cost/revenue accounting to ensure that airport charges accurately reflect the cost of providing the service.

In most cases, the smaller airports benefit from economies of scale and costs (collective purchasing and unified administrative structure across the system/network), and in turn could serve as a reliever airport into which some air traffic could be diverted to reduce congestion and operating costs at the larger airport. In other cases, the smaller airports could serve as traffic feeders to the larger/hub airports, improving connectivity and the route network. Therefore, grouping airports in a system or network could be an effective management strategy for airports that, taken individually, would not be viable.

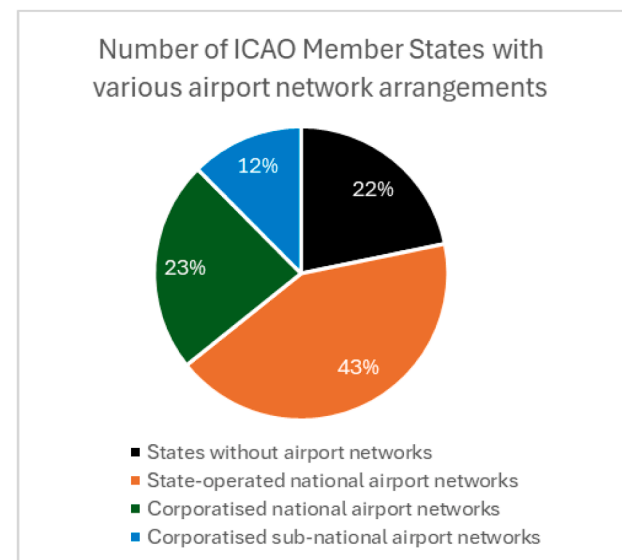


Fig. 3. Proportion of ICAO Member States with/without airport networks (Adapted from ACI Inventory of Airport Networks, 2019).

2.3.3. Airport groups

Two or more airports are operated at the international or multinational level under a single ownership and control structure, in this model. Airports within groups are often a patchwork of different limited companies with varying ownership arrangements and separate financing and management structures. This limits the extent to which airports within Airport Groups can benefit from some of the cost/scale efficiencies enjoyed by airport networks.

Some examples of airport groups are AENA (a majority state-owned company listed on the Spanish Stock Exchange, operating Spanish and other airports), Vinci (a private company with concessions and management contracts), MAG (a partially private owner and operator of three UK airports), SEA Milano (a partially private company that manages two Milan airports), Adani and GMR Airport groups (both private companies with airport operator concession contracts). Over 10% of the

world's airports (~425 airports) are operated by Airport groups (ACI, 2022a). These figures include airport groups operating solely domestic airports (e.g. MAG) and/or operating airports worldwide (e.g. Vinci, Vantage).

In 2019, airport groups collectively contributed USD 74 billion to the global GDP,⁹ supporting 2.7 million jobs worldwide (ACI, 2025).

Fig. 4 shows the total proportion of passengers travelling globally through airports that are part of a group in various regions, with the largest percentage (53%) in Europe, followed by Asia-Pacific (28%) and Latin America and the Caribbean (14%) in 2022 (ACI, 2022b).

As stated by ACI, airport groups benefit from centralised functions and sharing of resources, standardisation and compliance and continuous benchmarking and improvement (ACI, 2019c). Centralised functions provide access to specialised expertise and deliver economies of scale through established lender relationships and expert support, which are often unavailable to smaller airports. Zaharia et al. (2021) explore how airport groups enhance competitiveness, operational efficiency, and regional economic development through centralised management and shared expertise. Even if functions are not centralised, group membership facilitates knowledge exchange, sharing of best practices, networking and innovations that may otherwise not be tested at smaller airports. This can be achieved through leadership meetings, colleague forums and/or staff rotations. New solutions piloted at one airport could be rolled out more widely if successful.

As regards standardisation and compliance, airport groups set overarching goals and translate them into specific targets for individual airports, focusing on safety, passenger experience, environmental performance, and operational efficiency. They also establish systems to track progress and align leadership incentives with these goals. Airport groups develop and enforce group-wide policies and procedures, particularly in Environmental, Social and Governance (ESG) areas like occupational safety, gender equality, non-discrimination, and anti-bribery - see IATA Toolkit on Airport governance in compliance with ICAO and ESG policies (IATA, 2025.) or Eurocontrol standardisation portal for aviation operations standards aligned with EU regulations (Eurocontrol, n.d.). Using standard tools and metrics in airport groups enables more meaningful benchmarking across airports. Encouraging participation in standardised performance programs, such as ACI's Airport Carbon Accreditation (ACA) and Airport Service Quality (ASQ), further supports consistent monitoring and performance improvement across the group.

On the other hand, being part of a group could pose disadvantages, such as improper assessment or failure to recognise the local and regional demands and needs of smaller airports, and inadequate representation of smaller airports' concerns in centralised decisions on financial investments, technological innovations, and environmental implications.

Even though all these forms of airport management could be beneficial (or otherwise as the case may be) to airport operators, passengers and the communities they serve, the main focus of this study is on the single versus airport group management model, which has been further researched in the later sections.

It is widely recognised that an airport's ownership structure, although quite distinct from its operating structure, is closely connected to its day-to-day operating arrangements, to the extent that airport leaders often use the two terms interchangeably. This is evidenced in IATA's Guidance Booklet (IATA, 2018) where the terms ownership and operating models are grouped together due to the overlapping nature of these concepts. This was also evident during the primary data collection phase of this study, where digital leaders alternated between the two terms when discussing their influence on digital transformation. For this reason, the 'ownership-operating' model is used as a proxy to capture both of these distinct yet closely related concepts in the primary

analysis.

2.4. Airport digital transformation

The Airports Council International (ACI) states that airport leaders globally should embrace digital transformation, which is about evolving processes and services to deliver a better customer experience (Barich et al., 2015), by adopting and implementing new technologies and integrating them with existing ones (ACI, 2017). Digital Transformation encompasses holistic business transformation (Straub et al., 2021; Evans et al., 2022), rather than mere technological improvements within a business. From a passenger's perspective, a better experience would mean a seamless, personalised journey from the booking stage, through their departure process and until they board the aircraft and reach their destination. Technology has the crucial role of alleviating stress (Straker & Wrigley, 2016) throughout the passenger journey, be it baggage, passenger processing or airfield operations.

Airports are constantly having to keep up with changing technology and provide better, seamless and personalised service to passengers. Nau and Benoit (2017) proposed their four waves of airport digitalisation, ranging from Airport 1.0 to Airport 4.0, and similarly, Pell and Blondel (2018) outlined different stages of digital maturity in their models. The ACI has listed various technologies that enable airports to become Digital Ready (see Fig. 5). It starts with basic IT infrastructure and cyber security protection, easy/free Wi-Fi, cloud services and charging spots in the *foundational stage*, followed by privacy management, location-based services, dedicated innovation team, processes and labs in the *emerging stage*, flow management, passenger profiling, context-aware offerings, digital distribution channels, IoT and smart buildings, open data platforms in the *proficient stage*, omnichannel experience, hackathons and start-up joint ventures, AI chatbots, virtual assistants, virtual AOC¹⁰ and biometric systems being implemented in the *advanced and smart airport stages*.

The usage of technology for various airport operations has grown steadily over the last decade, mainly for the following reasons: (1) to optimise baggage operations and reduce mishandling, (2) to enhance passenger satisfaction and increase revenues, and (3) to facilitate smoother, more reliable infrastructure for the operating airlines.

Airport baggage performance improvements include end-to-end real-time tracking, optimised baggage conveyor systems, automated screening and data analytics, with the most crucial cost-saving initiative being reducing mishandled baggage (delayed, damaged, lost or stolen bags) (Jayaraman & O'Connell, 2011). The average number of checked bags per passenger has been steadily increasing from 1.22 in 2015 to a peak of 1.49 in 2020 (around Covid) and has stabilised at 1.33 bags in 2023 (SITA, 2024b).

However, the reduction in mishandling from over 18 bags per 1000 passengers in 2007 to just under 7 bags per 1000 passengers in 2023 due to digital initiatives such as IATA Resolution 753,¹¹ SITA's World-Tracer¹² and Auto-Reflight¹³ systems has decreased the annual cost to the industry spent in baggage reconciliation, from USD 4.22 billion in 2007 to USD 2.4 billion in 2018 (SITA, 2025). The global passenger traffic during this period (2007–2023) has grown from 2.48 billion to 5.2 billion annual passengers.

When considered by region, the mishandled baggage rate shows a

¹⁰ AOC is the abbreviation for Airport Operations Centre.

¹¹ IATA Resolution 753 (mandated in June 2018) requires the airlines to track baggage at four mandatory points (upon acquisition from the passenger, delivery to the aircraft, during custody transfers between carriers, and upon final delivery to the passenger) and share the tracking data with their partners.

¹² WorldTracer by SITA is the global automated baggage management solution to quickly track, locate and recover lost baggage.

¹³ AutoReflight by SITA allows the airline to re-flight bags without (or with minimal) manual intervention.

⁹ GDP: Gross Domestic Product

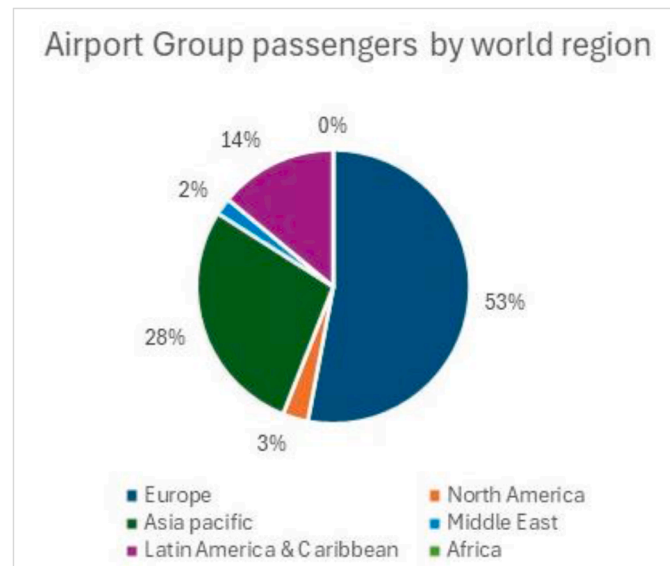


Fig. 4. Airport group passengers by region (Reproduced from [ACI 2022b](#)).

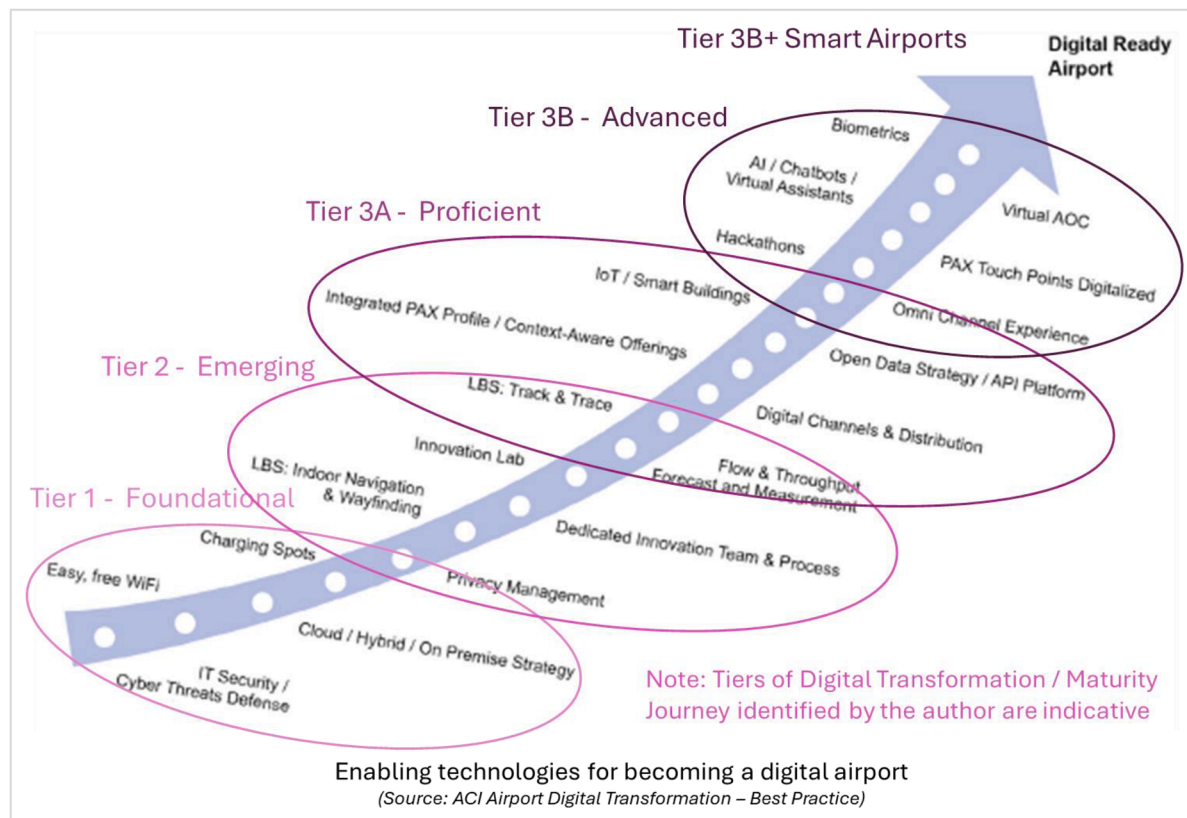


Fig. 5. ACI technology roadmap to digital readiness (Source: [ACI, 2017](#)).

decline overall in the longer term; however, the relative decline varies by region. The slowest improvement in mishandling is in Europe (see [Fig. 6](#)), followed by North America, with Asian airports and airlines performing very well in reducing mishandling rates and maintaining lower figures (merely 3.04 mishandled bags per 1000 passengers in 2023). The reasons for these regional differences and whether they may be linked to ownership-operating models have been examined further in [Sections 4 and 5](#).

Tracking (e.g., with Resolution753, WorldTracer, etc.) leads to a

decrease in mishandling rate by ensuring reconciliation at loading, a key driver of better baggage handling performance ([SITA, 2019](#)).

Aligned with advancements in baggage technology and improvements in tracking and real-time baggage status information, IATA surveyed passengers globally to ask whether they would check an additional bag if real-time baggage status were provided; 87% responded positively ([IATA, 2023](#)), underscoring the importance of real-time alerts.

Regarding passenger-facing technologies, [Fig. 7](#) shows various self-

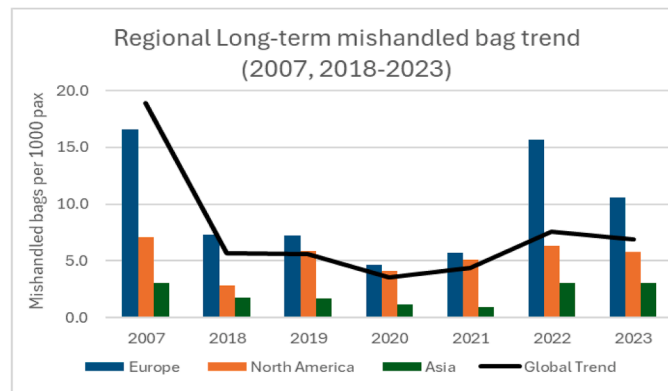


Fig. 6. Long-term mishandled bag trend by region (2007, 2018–2023) (Produced from SITA Baggage IT Insights 2018–2024).



Fig. 7. Emerging technology trends at airports – implemented and planned (Produced from SITA, 2024a).

service and other emerging technologies at airports from 2016 to 2027 (SITA, 2024d). It is worth noting that self-service check-in kiosks, bag drops (printing tags, assisted/unassisted), and self-assisted border and boarding were the norm until 2022. However, since 2023, newer technologies such as biometric-enabled systems and touchless and single-token technologies have been gaining prominence for passenger processing.

Globally, passengers' adoption of technology throughout their journey is increasing every year; however, the uptake is not uniform across all journey processes. As seen in Fig. 8, technology usage is the highest at booking (over 85%) for all years, followed by dwell time (~60%) and on-board (~50%). The lowest tech usage is at boarding (average 20%), followed by bag drop (average 23%), bag collection (average 27%), border control (average 30%) and identity control (average 38%). The complexities of changing technologies across the airport have led to passengers experiencing a range of emotions as they pass through, with security reported as the most stressful part of the journey.

As passenger expectations evolve and new technologies enable more

seamless journeys, airports are increasingly creating and using 'passenger personas' to better understand travellers and tailor services to their needs.

For example, lounge operator [Airport Dimensions \(2022\)](#) has identified six passenger personas, or 'tribes', in its recent research, detailing how individuals engage with airports. Grouped as Premiers, Affluents, Streamliners, Wayfinders, Aspiring and Explorers. Premiers account for 21% of the airport community, and 87% of them say that they are happy with their airport experiences globally. Explorers, on the other hand, account for 29% of the airport community and 62% of them report being satisfied with their airport experiences. Each persona has reported different needs and satisfaction levels regarding airport experiences ([Airport Dimensions, 2022](#)). More importantly, the six tribes have different relationships to airport spending (see Fig. 9), with Premiers and Affluents demanding more retail offers, automated kiosks, vending machines, and product experiences. At the same time, Wayfinders express the least interest in airport retail, automated kiosks, and personalised experiences and account for 11% of the airport community, with 47% of them reporting satisfaction with their airport experiences.

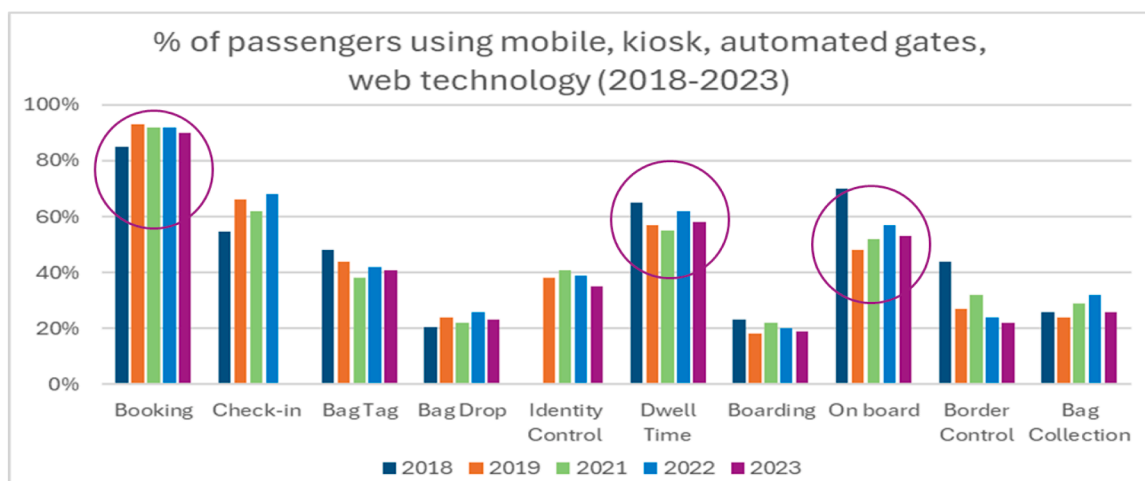


Fig. 8. Passenger tech usage trends (Produced from SITA air transport IT insights 2018–2023).

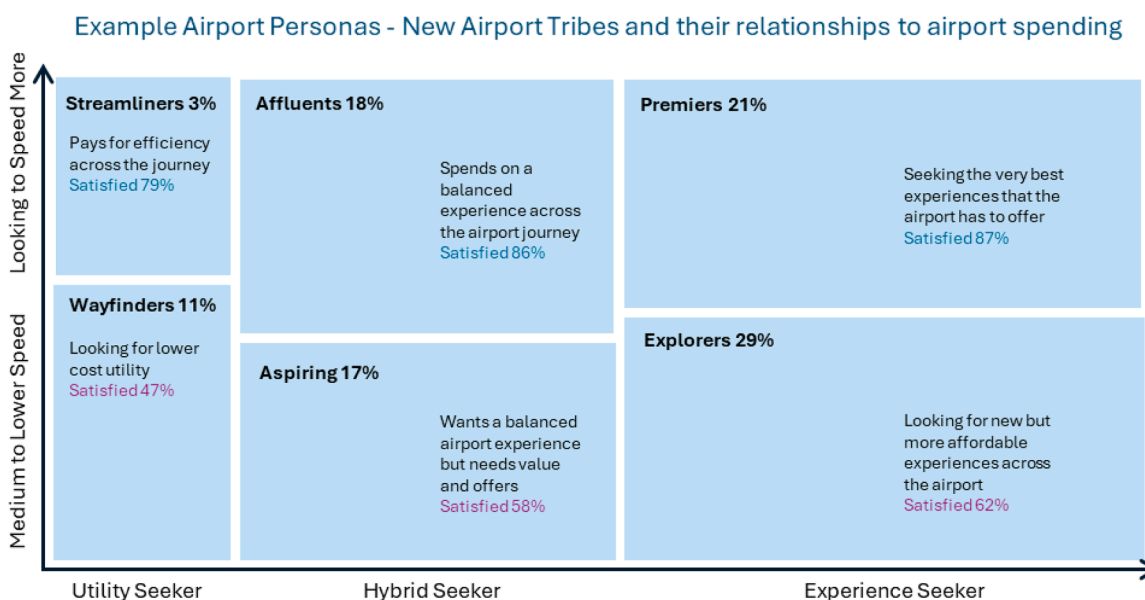


Fig. 9. New airport tribes (personas) identified by lounge operator – adapted from *Airport Dimensions*, 2022.

Airports, therefore, have started analysing their passenger data to tailor services appropriately to their customers.

Reinforcing passengers' growing digital confidence, in another survey by *ACI Europe* (2024), about 73% passengers reported confidence in using digital or online products (particularly passengers over 65 years old). However, the younger the passenger, the more confident they were in using digital products. The open comments on the survey, however, were contradictory, highlighting a lack of trust in technology, privacy concerns about data sharing and accessibility, particularly among older people and those unfamiliar with digital tools (*ACI Europe*, 2024).

Overall, airport digital initiatives aimed at improving baggage handling and passenger processing also demonstrate significant downstream effects on airline operations. Technologies such as biometric identification, automated baggage systems, IoT, and real-time data analytics streamline passenger and baggage flows, reduce terminal congestion, optimise the use of ground service equipment and airline staff, enable faster boarding, and support more consistent on-time performance. In addition, improved data integration and coordination with airport and air traffic control operations help minimise delays and mitigate disruptions, leading to cost efficiencies. Furthermore, airlines operating within networks can facilitate the transfer of advanced

technologies and their associated benefits from larger hub airports to smaller or regional airports within the same network.

Historically, travel culture has been significantly different across geographies. Similarly, passenger expectations of their airports and satisfaction also vary considerably by country (*Airport Dimensions*, 2025). As seen in Fig. 10, developing markets in Asia outperform mature markets such as the US, the UK, and Australia in passenger satisfaction. Testament to this, Singapore airport (SIN) ranks first (94% travellers satisfied) due to continued improvements and innovation, followed by Indian airports at 86% and UK airports at 66% passengers reporting that they are 'satisfied' with their airport experience. About 6–28% across the sample provided no comment.

ACI produces the ASQ Barometer, which considers overall passenger satisfaction by region. The graph (Fig. 11) shows how well airports are servicing their passengers. The satisfaction metrics are grouped into eight primary categories, namely, airport access, check-in, security, passport/ID control, wayfinding, airport facilities, commercial offerings, and airport ambience. Between 2024 and 2025, border and passport control saw the largest satisfaction gains globally, due to the deployment of frontline staff and new self-service technologies (*Aerospace Global News*, 2026). Digital service is seen as the primary driver behind high

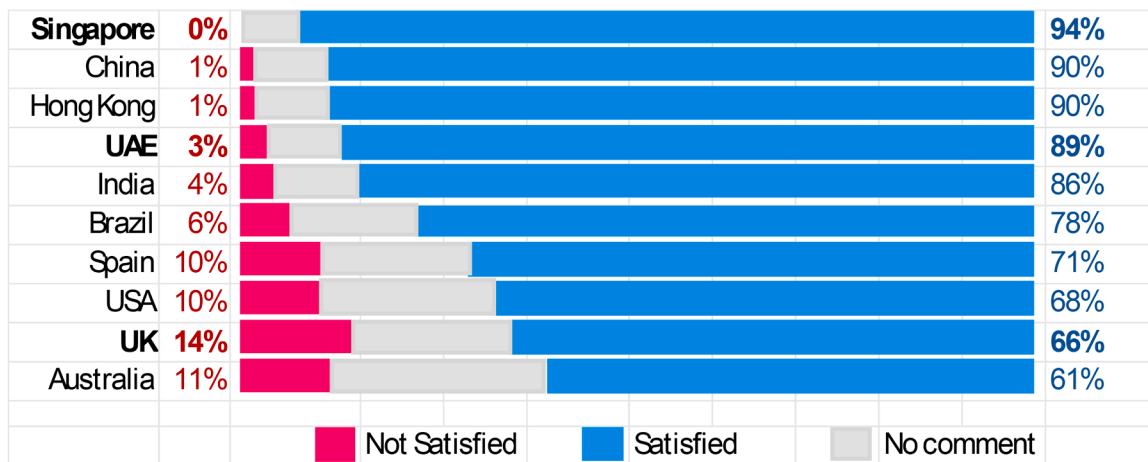


Fig. 10. Passenger satisfaction growth by country (Source: [Airport Dimensions 2025](#)).

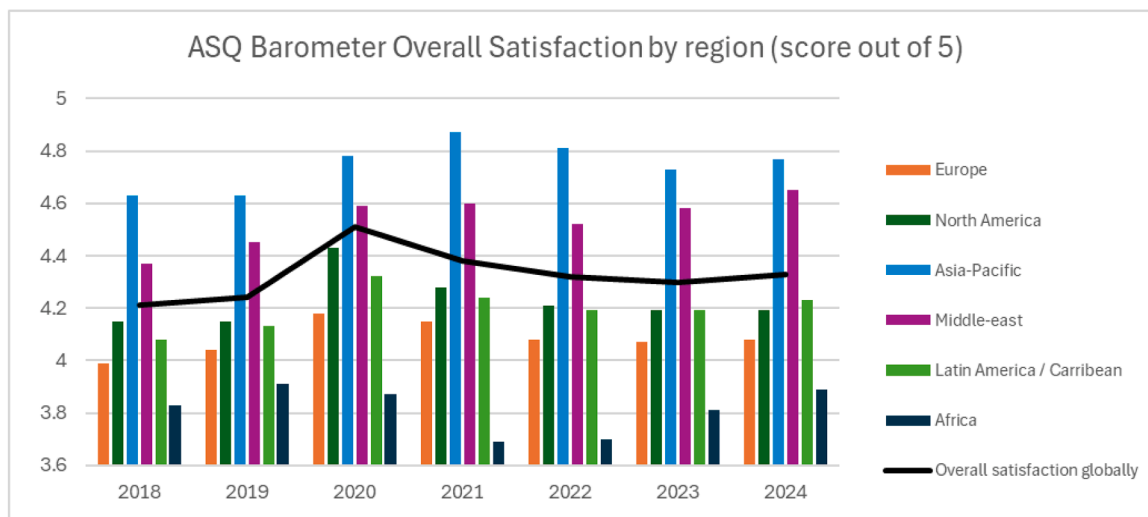


Fig. 11. Overall passenger satisfaction by region - ASQ barometer (ACI, 2018–2024).

scores in check-in, security and passport control with the widespread deployment of biometric and self-service technologies. ACI's global traveller survey (2025) further supports this statement with 72% of its (4000+) respondents expressing willingness to use biometric solutions in 2025 ([World Aviation Festival, 2025](#)). Overall satisfaction has remained above 4.2 (out of 5) from 2018 to 2024, peaking at 4.5 in 2020. When examined by region, however, Asia-Pacific (over 4.6 for the period) and the Middle East (over 4.3 for the period) excel by far, followed by Latin America and North America. European airports show the lowest satisfaction levels in mature markets. This could be due to a variety of reasons, which are explored in [Sections 4 and 5](#).

Improving technology adoption among passengers is essential for newer initiatives such as digital wallets (e.g., the EU Digital ID Wallet), digital travel credentials (DTC), and digital passports/visas to become more widely used globally in the future. However, it is essential to understand the reasons for varied technology usage and passenger satisfaction across regions and whether any of these are attributable to the airport ownership-operating structures prevalent in these regions.

The perceived usefulness and interest in paying for a DTC is particularly high in the Asia-Pacific and Middle East / Africa regions, perhaps due to greater familiarity, as this technology is more widespread in these regions ([SITA, 2024c](#)) and/or they have a higher proportion of younger travellers who are keen to use the latest technologies.

2.4.1. Airport digital transformation investment

The recent evolution of airports from 'firefighting' or Covid-recovery mode, to considering longer-term priorities such as investing more in digitalisation to improve efficiency, resilience, sustainability, and business continuity, is worth exploring. The IT company, Amadeus examined travel technology investment trends in 2024 (survey concluded in Q4 2023), by collecting and analysing individual responses from about 50 airport technology leaders, across 10 markets (Brazil, China, France, Germany, India, Mexico, South Korea, UAE, UK and USA), which suggested that 58% of these airports were planning to spend more on technology in 2024. The short-term objectives for investment in technology were to enhance the customer experience, improve operational efficiency, become more sustainable operationally and move to cloud computing to enhance IT efficiency ([Amadeus Insights, 2024](#)).

The global Aviation IT company SITA states that global Airport IT spend has been increasing steadily since the pandemic, with estimated investments of USD 8.9 billion planned for 2024, which accounts for nearly 6% of overall annual revenue.

As demonstrated throughout this section, existing literature thoroughly examines both the evolution of airport ownership-operating models and the accelerating trend of airport digitalisation. However, there is limited research connecting these two streams of inquiry. This disconnect represents the central knowledge gap that underpins the present study. The rationale for exploring a potential relationship lies in

the increasing global emphasis on digitalisation, with technological infrastructure becoming a core component of critical airport infrastructure worldwide.

The methodological framework underpinning this study has been explained in the following section.

3. Methodology

The study uses a 'mixed methods' approach. Desk-based research was conducted to collect and review secondary data from annual reports, airport websites and other key industry publications such as SITA IT Insights 2016–2024 (Baggage IT Insights, Passenger IT Insights, Air Transport IT Insights) and ACI ASQ Barometers (Global) (2018–2024). These were descriptively analysed and compared globally and by region, supported by primary interviews at several airports/airport groups.

Fig. 12 shows the airports and airport groups chosen for primary data collection, representing some of the diverse ownership-operating models discussed previously across different geographical regions. To avoid confusion arising from the involvement of multiple airport operators, this analysis focuses on the corporate ownership structures of the operating companies rather than the ownership of the individual airports. Within a single corporate group, the ownership of specific airports may be public, private, or mixed, and operating models can vary by location.

The airports for this study were selected using a 'convenience sample' intended to represent a range of ownership and operating models from across the world. While YVR, DOH, SEA, some airports under the Vantage Group, airports under the SEA Milano Group, and Dubai Airports are 100% state-owned, the operating companies such as SEA Milano Group, Bangalore International Airport Limited (BIAL) and Manchester Airports Group (MAG) are partly privatised. LHR is 100%

privately-owned airport operated by Heathrow Airport Holdings Limited, Adani Airport Holdings Limited (AAHL) is 100% private company operating several airports in India and Vantage Group is 100% private company operating airports mainly in USA and Canada.

Operating models also differ. Dubai airports are operated directly by the government, whereas Seattle-Tacoma is operated by the Port of Seattle. In contrast, BLR, LHR, DOH, MAG, SEA Milano, and Adani airports are operated by corporate entities.

Airports in the United States are predominantly publicly owned, although specific terminals or infrastructure components may be owned and operated by private companies. Many US airports also engage private operators through management or service contracts. In Canada, airports such as YVR, operate under a distinct governance model in which operational responsibilities are delegated to 'not-for-profit' airport authorities.

As illustrated in Fig. 12 and highlighted earlier, the presence of multiple airport operators can make the ownership structure appear complex. This is because the discussion refers to corporate/ company ownership rather than the ownership of individual airports. Within a single corporate group, some airports may be publicly owned while others may be privately owned. Similarly, the operating models applied by these groups can vary depending on the specific airport being considered.

To clarify further, an overview of each airport's ownership and operating structure is set out below. Please note that Heathrow Airport Holdings, AENA, and VINCI Group were contacted; however, interviews with representatives from these organisations were not secured before publication.

- Bengaluru Airport (BLR) is operated by BIAL, a partially private company (74%), that holds a concession contract to develop, own

Airport Operator - Ownership Models

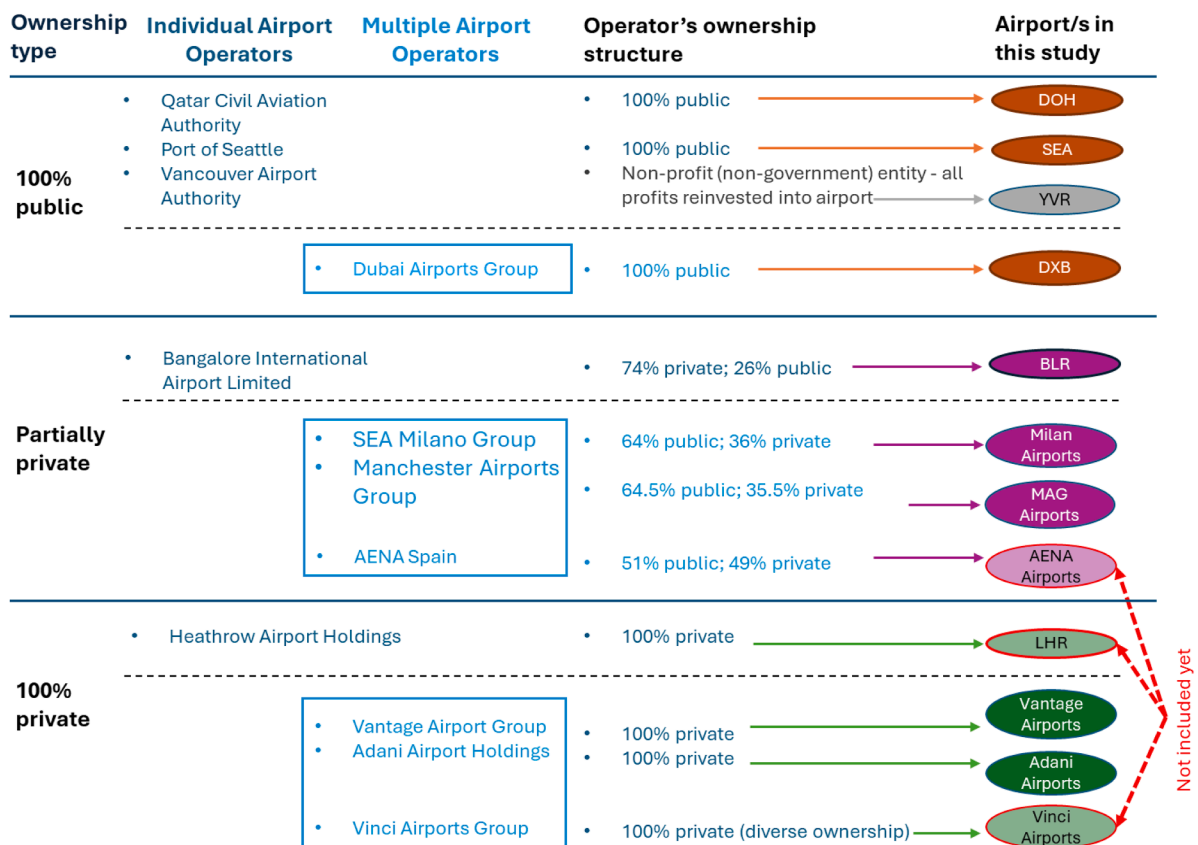


Fig. 12. An illustration of airport operator's ownership structure (with airport examples included in this study).

and operate the airport for a period of 30 years (2008–2038), which can be extended 30 years to 2068, after which the airport ownership reverts to the government i.e. Airports Authority of India (AAI) and Karnataka State Industrial and Infrastructure Development Corporation (KSIIIDC).

- Heathrow Airport (LHR) is 100% owned and operated as a private company by Heathrow Airport Holdings Limited (owned by Ardian, Qatar Investment Authority, Public Investment Fund, GIC, Australian Retirement Trust, China Investment Corporation, Ferrovial S.A., Caisse de dépôt et placement du Québec (CDPQ), and the Universities Superannuation Scheme (USS).
- Seattle Tacoma Airport (SEA) is owned and operated by the Port of Seattle, which is a special-purpose municipal corporation (a form of local government) authorised by the State of Washington to manage regional assets. Alaska and Delta Airlines are the main airlines based at the airport in various concourses.
- Vancouver Airport (YVR) is managed and operated by a community-based, not-for-profit organisation, namely, Vancouver Airport Authority.
- Hamad International Airport (DOH) is owned by the state and operated by Qatar Airways Group and Qatar Civil Aviation Authority.
- Manchester Airports Group (MAG) is 64.5% local government-owned and 35.5% private, so this is also the ownership structure of Manchester Airport. MAG also operates East Midlands Airport and Stansted Airport, which were 100% sold off/ privatised by their previous government.
- Vantage Airports Group is 100% privately owned and operates and manages the following US airports under management contracts.
 - LaGuardia Airport Terminal B (New York City)
 - John F. Kennedy International Airport Terminals 6 and 7 (New York City)
 - Chicago Midway International Airport (Illinois)
 - Kansas City International Airport (Missouri)
 - Albuquerque International Sunport (New Mexico)
 - William H. Gray III 30th Street Station (Philadelphia)
- SEA Milano Group manages the Milan airports for the national government under a 40-year agreement until 2041, so the ownership remains long-term with the Italian government. SEA S.P.A has a mixed ownership (55% being the municipality of Milan) and so can be defined as a *partially private company operator* (45% private stakes).
- Adani Airport Holdings Limited (AAHL) is a 100% private company with concession contracts to develop, own, and operate several Indian airports, including Mumbai, Navi Mumbai, Jaipur, Ahmedabad, Lucknow, Guwahati, Mangalore and Trivandrum airports. As of 2024, AAHL airports handle 23% of India's total passenger traffic (Aviation A2Z, 2024).
- Dubai Airport (DXB) is owned and managed by Dubai Airports Company, a 100% state-owned airport authority that also took control of Al Maktoum Airport and Dubai Cargo Village in 2008.

The data collected from the two sources (secondary and primary) were descriptively analysed to understand trends, and the primary qualitative data were thematically analysed (Terry et al., 2017) using NVivo 14¹⁴ to extract emerging themes regarding ownership and operating models that impact digital investment and maturity.

4. Findings

This section presents the key findings of the study. As outlined in the literature review, the main objectives of airport digitalisation are to

improve efficiency across baggage and passenger processing, aircraft on-time performance, and security monitoring, while enabling predictive planning and optimised resource utilisation. These improvements help reduce congestion and delays, while increasing throughput, revenues, and overall profitability.

Passengers increasingly prefer to remain in control of their journey and expect greater visibility over the status of their baggage. Advances in bag-tracking technology have significantly reduced the costliest aspect of baggage mishandling. Airlines have also become more willing to share baggage status data with airports, with 58% reporting such data sharing in 2023. In addition, around 32% of passengers globally use mobile devices to receive baggage collection updates upon arrival (SITA, 2023).

From a passenger-facing perspective, digitalisation, particularly through touchless technologies, facilitates seamless movement from kerb to gate. This includes reducing security-related stress through pre-registered biometric systems, enabling passport-less border control via facial recognition, and delivering personalised, real-time updates on flight departures and baggage status through mobile applications.

Airports worldwide are at varying stages of digital maturity, and obtaining consistent regional data to assess digitalisation by specific ownership and operating models remains challenging. Consequently, the following sections compare ownership-operating structures (single versus multi-airport operators) with outcomes such as mishandled baggage and passenger satisfaction, while recognising that these metrics capture only part of the broader impact of airport digitalisation. The findings from the interviews touch on some of these other metrics, such as national aviation frameworks, organisational culture, regulatory conditions, funding freedom and DT leadership as influencers of DT, in addition to ownership-operating arrangements.

4.1. Secondary research

Secondary data relating to airport private ownership, group operators, passenger satisfaction, and reductions in mishandled baggage were further analysed by region to identify any discernible relationships among these variables. The intention was to explore whether the existence, direction, and strength of such relationships would help identify meaningful metrics that could explain broader airport digitalisation trends.

Prior research examining passenger satisfaction across countries suggests that airports in Singapore, for instance, consistently rank among the highest performers. This performance has frequently been associated with sustained investment in innovation (see Fig. 10) and advanced technologies that enhance service quality, operational efficiency, and the overall passenger experience. These insights reinforce the relevance of examining ownership and operating models alongside performance outcomes.

However, given the limitations of available secondary data (predominantly very aggregated data), this secondary analysis focuses solely on the distinction between group-operated and individually operated airports, as comparable data were readily available for these two models. More complex ownership and governance structures discussed in the literature review, such as government-operated models, concession-based arrangements, and hybrid frameworks, are therefore not examined in this secondary dataset.

It is also important to acknowledge that the aggregated nature of the data limits the ability to link specific ownership structures to service quality outcomes at a more granular level.

The secondary data was therefore examined to understand the following relationships, based on available data:

1. Airport private ownership and passenger satisfaction by region
2. Airport group operators and passenger satisfaction by region
3. Airport private ownership and mishandled baggage trends by region
4. Airport group operators and mishandled baggage trends by region

¹⁴ NVivo is a qualitative analysis tool that allows the user to code interview transcripts and group them into themes / sub-themes.



Fig. 13. Passenger satisfaction level and airport private ownership (Created from ACI / ASQ data 2019).

4.1.1. Private ownership and passenger satisfaction

As seen in Fig. 13, in the Asia-Pacific region, where about 45% of passengers travelled through privatised airports, the average passenger satisfaction score was 4.63 (out of 5). Similarly, in the Middle East, where private-sector participation is approximately 25%, the satisfaction score was also around 4.45.

By contrast, in Europe and Latin America, where the share of privatised airports was high (exceeding 75% in both regions), passenger satisfaction levels were relatively lower (4.04 and 4.13, respectively) than those reported in Asia and the Middle East.

Most North American airports and African airports are still publicly owned, with satisfaction scores just above and under 4 (out of 5), respectively.

4.1.2. Group operators and passenger satisfaction

Mapping the proportion of passengers using airports in a group against passenger satisfaction ratings by region (see Fig. 14), showed that Europe had the highest proportion of airport groups (over 50% of passengers travelling through airports operated by a group), compared to Asia-Pacific (under 30%) and Latin America (over 10%). However, the satisfaction scores in 2022 were still highest in Asia-Pacific (4.81/5), the Middle East (4.58/5), and Latin America (4.19/5), with Europe's score lagging at 4.08. In North America, the Middle East and Africa, there were negligible to no airport groups operating in 2022.

4.1.3. Private ownership and mishandled baggage

Fig. 15 shows the number of mishandled bags and airports with private stakes by region. Europe (with 76% passengers travelling through privatised airports) had higher mishandling rates (~7 bags per 1000 pax), while Asia (with 45% privatised airport traffic) had a lower number of mishandled bags (~2 bags per 1000 pax). Latin America (with 77% privatised airport passenger traffic), on the other hand, had lower mishandled bag rates than Europe, but higher than Asia.

4.1.4. Group operators and mishandled baggage

As seen in Fig. 16, Europe, with the largest proportion of airport groups (over 50% of passengers), had higher mishandled baggage rates than Asia (a region dominated by individual airport operations). The figures for the Middle East and African regions were unavailable, and therefore, proxies based on global averages were used. The figures for Latin America also use proxies based on their historical similarity in mishandled bag numbers with the North American region (SITA, 2025).

These patterns indicate that no clear relationship can be observed between the level of private-sector participation (measured as the

percentage of passengers travelling through privatised airports in a region) and overall passenger satisfaction or baggage performance, contradicting claims by ACI (2025) and ICAO (2025), that privatised airports are better at capital investments focused on operational efficiency (Starkie, 2016).

Similarly, no particular trend was observed between the level of group operations and passenger satisfaction or baggage performance, despite theoretical advantages of group operators such as centralised technologies/automation and scale economies, often regarded as efficiencies of group operations.

The analysis using aggregate ownership and group-operator data against passenger satisfaction and baggage outcomes can therefore provide only a very basic visual indication of potential relationships or the absence thereof. Numerous other explanatory factors likely influence these outcomes, but they cannot be isolated using the current secondary dataset. The limitations of the data also prevent more rigorous statistical testing of associations or the exploration of causal relationships. As a result, the findings presented in this section should be regarded as indicative, thereby calling for more in-depth primary research with digital leaders, presented in the following sections.

4.2. Primary research: findings from interviews

Slightly broadening the scope beyond baggage mishandling and passenger satisfaction in relation to digitalisation, the interviews were designed with a wider remit to gather insights on various emerging and current technologies, as well as the impact of different ownership and operating models on digital transformation.

The primary data collected through online interviews with digital leaders between May 2025 and June 2025 at airports and global aviation IT companies was analysed thematically (Braun et al., 2014) using NVivo,¹⁵ generating 162 codes from the interview transcripts. Table 2 lists the airport digital leaders interviewed: ten digital leaders across four regions (Asia, the Middle East, North America, and Europe). Fig. 17 provides a snapshot of the coding hierarchies and the themes generated from interviews with the leaders (Table 1).

As shown in Fig. 17, dominant themes included *digital transformation (DT) risks*, *strategic priorities*, and *the digital future*. However, to address the focal research question, the codes concerning how ownership-

¹⁵ NVivo is a qualitative data analysis (QDA) software widely used in research to organise, code, analyse, and visualise qualitative and mixed-methods data, mainly using thematic analysis.

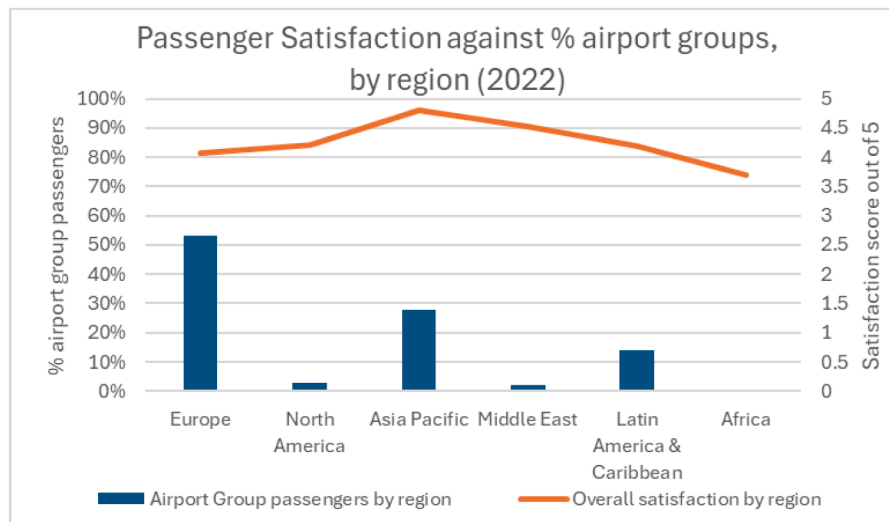


Fig. 14. Passenger satisfaction level and airport group operating model (Created from ACI / ASQ data 2022).

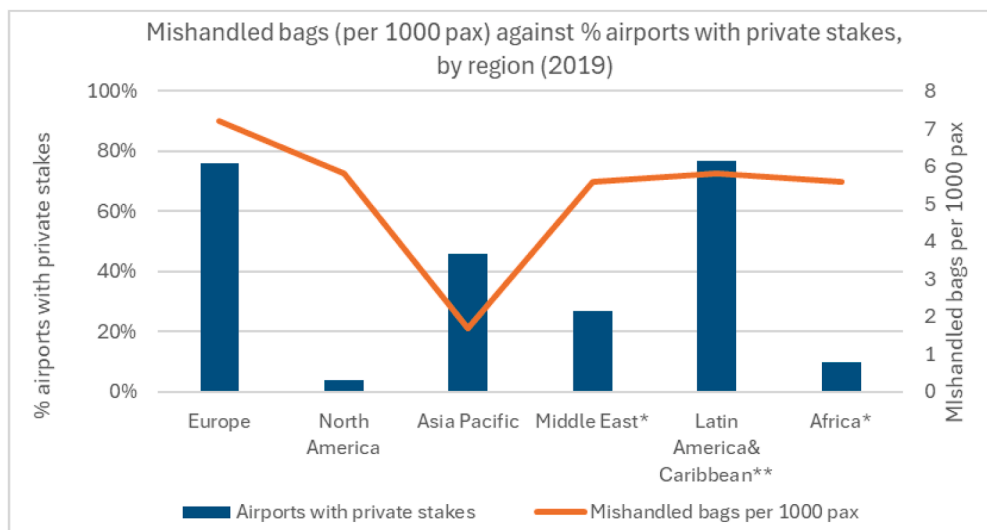


Fig. 15. Mishandled bags and airport private ownership (Created from ACI / ASQ / SITA data 2019).
(Note: * Proxy based on global average. ** Proxy based on historic similarity with the North American region)

operating models shape DT investment and DT maturity were isolated for further investigation. Please see [Appendix 1](#) for the interview guide. As mentioned previously, the terminologies ‘ownership model’ and ‘operating model’ were used interchangeably by digital leaders during the interview process. Questions related to the operating model encompassed ‘individual’ versus ‘group’ operator as well as ‘government’ versus ‘concession’ operator models.

The first interview question was a simple yes/no prompt, with validation, that determined whether airport ownership-operating models influence digital transformation (DT). Once that was established, interviewees were asked follow-up questions to explore the specifics. As illustrated in [Figs. 18-20](#), the questions directed at digital leaders were:

- Q1. Does the airport’s ownership-operating model affect DT?
 Q2A. In what ways does the ownership-operating model influence DT investment?
 Q2B. How does the model impact DT maturity?

The codes derived from these responses and the key themes that emerged from the analysis have been presented in the following

sections.

On Q1 regarding airport ownership-operating models having an impact on DT, the most important theme that emerged was ‘Other factors (besides ownership-operating model) highly impact DT’. It is important to recognise that some of these factors are exogenous and lie outside the airport’s control; as such, they must be treated as given conditions by the airport. The codes supporting this theme were: *The airport and airlines’ vision and motivation drive DT*; *The country, leadership, autonomy and authority drive DT decisions*; and *Collaboration and integration are key drivers of DT*.

The second theme that emerged was ‘Yes, Ownership-Operating Model impacts DT’. The codes supporting this theme were: *Private investors bring in more funds, make faster decisions, focus on profitability, and secure shareholder support*; *Airport groups have higher volumes, access to a shared resource pool, and benefit from scale and price economies*.

The third theme was ‘No direct impact of Ownership-Operating Model’, supported by codes such as *Profitable airports invest in DT*; *Humans are reluctant to do certain tasks, driving the need for more technology*; *Airports invest in DT due to their fear of missing out on the digitalisation trend*.

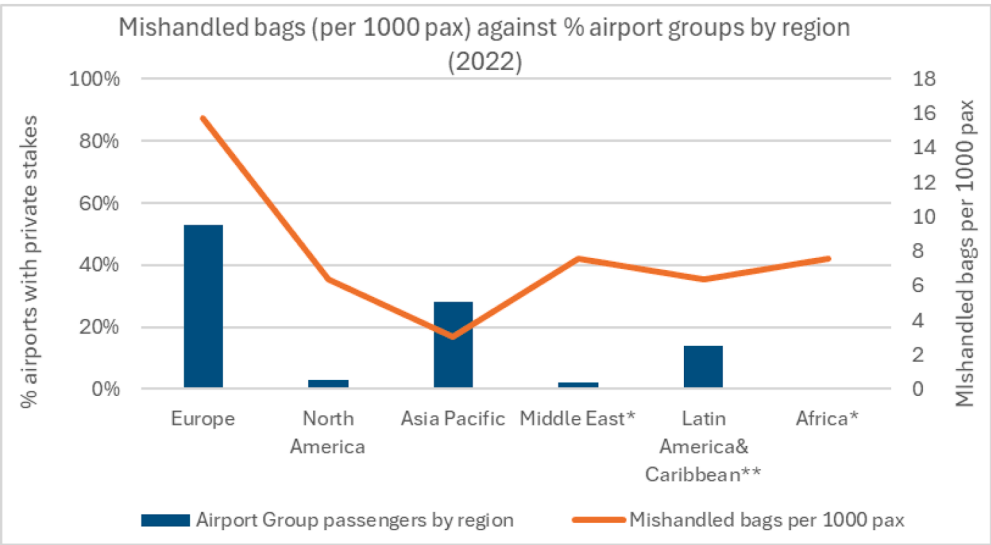


Fig. 16. Mishandled bags and airport groups (Created from ACI / ASQ / SITA data 2022).
(Note: * Proxy based on global average. ** Proxy based on historic similarity with the North American region)

Thematic Analysis using NVivo 14 (Total 162 codes generated from interview transcripts)



Fig. 17. Snapshot of coding hierarchies from digital leader interviews (using NVivo v14).

Summarising the above themes for Q1, key drivers of digital transformation include organisational vision and leadership, national aviation framework (governance, autonomy, authority) and stakeholder collaboration, many of which are exogenous factors that the airport

needs to operate within. That said, ownership-operating models could still influence DT: private ownership and airport groups enable greater access to funds, faster decision making, and economies of scale, which support proactive DT strategies. However, there is also a

Table 1
List of Airports whose digital leaders were interviewed.

Total 10 interviews of Digital Leaders (CXO level) across Asia, Middle-East, N. America, Europe	
- India (1 Individual Airport + 1 Airport Group) - Canada (Individual Airport) - Qatar (Individual Airport) - Global Airport IT Company (SITA)	- UK (Airport Group) - UAE (Airport Group) - USA (1 Individual Airport + 1 Airport Group) - Italy (Airport Group)

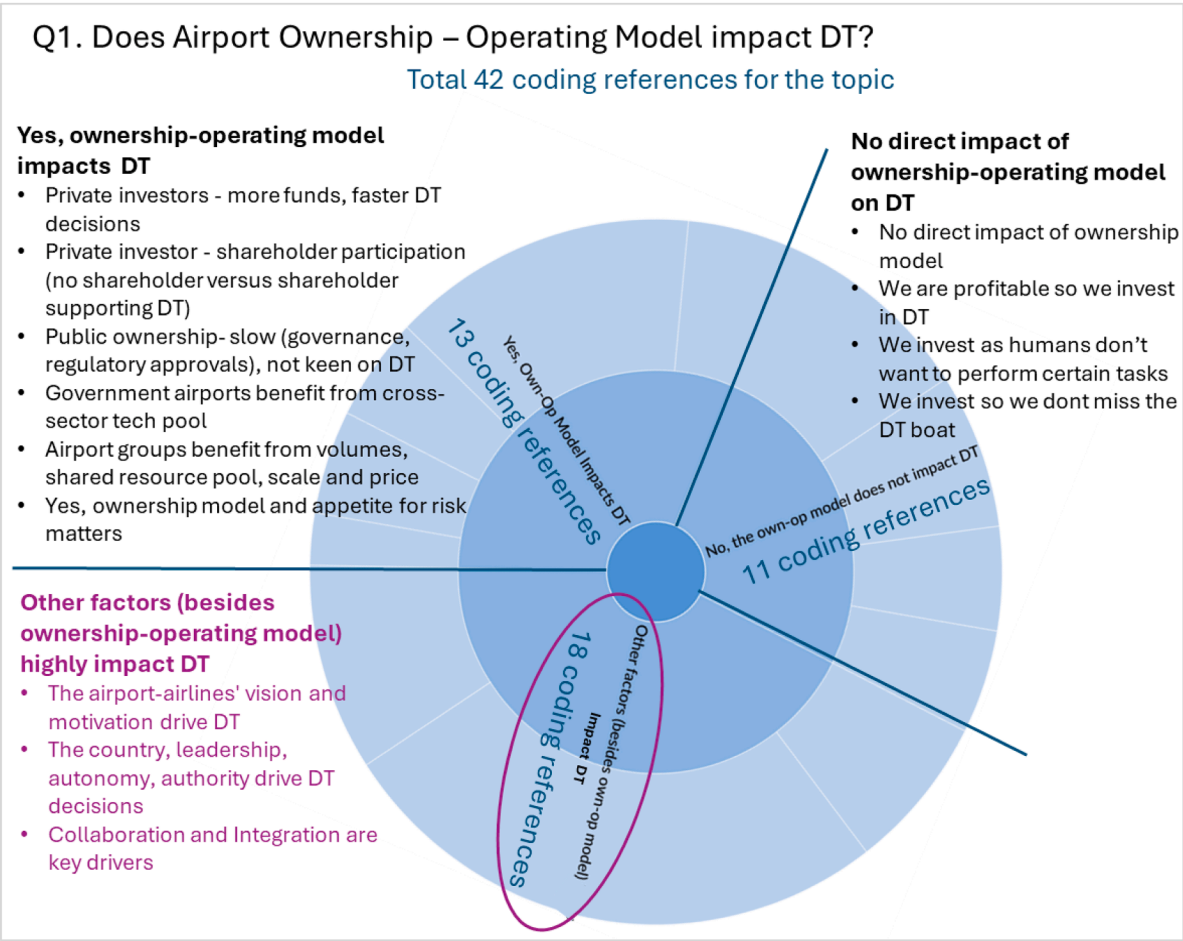


Fig. 18. Themes emerging from the interview responses to ‘whether airport ownership and operating model has an impact on digital transformation’.

counterargument that there is no direct evidence of ownership-operating models on DT, as it is often driven by profitability, operational needs and external pressures such as labour constraints and fear of falling behind in digitalisation, regardless of airport ownership arrangement.

Q2A on how airport ownership models impact DT investment, the most important theme that emerged was ‘Ownership without funding constraints promotes DT’. The main codes supporting this theme were: *Globally, all airports invest to keep up; Privatisation brings in funds, so it encourages more DT spend; Profitable airports (private or government-owned) invest in DT.*

The second theme that emerged was ‘Government-owned airports have their own ways of staying ahead in the DT game’. The codes supporting this theme were: *In these government-owned airports, airlines drive DT investments; DT is subcontracted to the private sector / IT concessions; A private operator without shareholders ensures that profits are reinvested for DT; DT is carried out on a piecemeal basis and in some cases, e.g. the Middle*

East, government airports are in favour of DT.

The third theme was ‘Other drivers (besides ownership model) impact DT’, supported by codes such as: *Airports (specifically in EU, US) are perceived as transactional spaces with flat growth where DT focusses purely on efficiency; Open API and inhouse data lakes allow airports to approach DT incrementally, regardless of ownership; and Having hands-off shareholder enables early adoption of DT.*

A fourth theme that emerged for this topic was ‘Formalisation-standardisation of DT investment will promote investment’ through codes such as: *Airport IT-becoming Critical Infrastructure, thereby regulating and encouraging spend on DT; DT currently not being accounted for within the regulated asset base (RAB) calculation being a deterrent which could be resolved in the future; by including DT that is non-commercial as part of RAB.*

Synthesising the above themes for Q2A, the key driver for digital investment is funding availability rather than the ownership-operating model. Airports with fewer financial constraints (whether public or

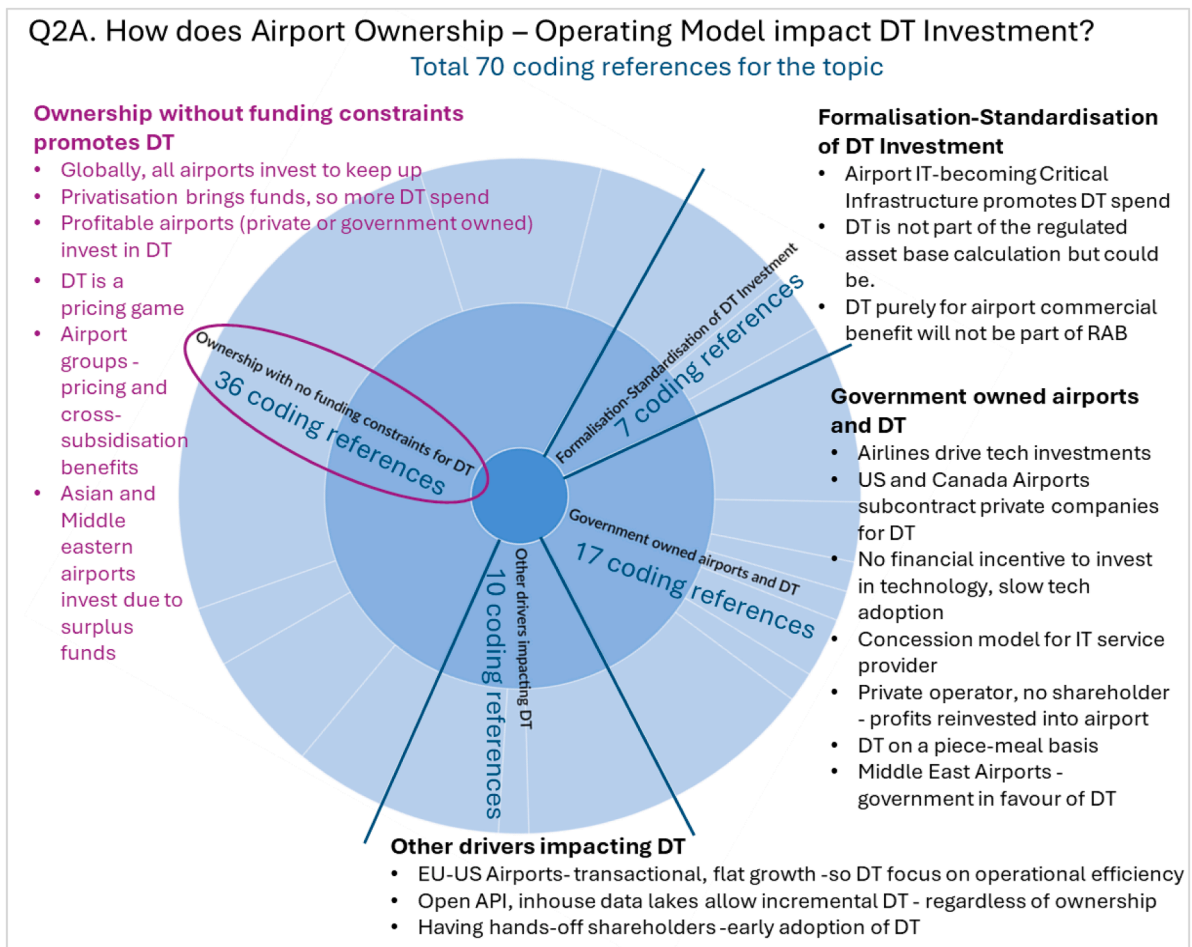


Fig. 19. Themes emerging from the interview responses to 'whether airport ownership and operating model has an impact on digital transformation'.

private) consistently invest in DT, with privatisation often enabling greater access to capital and higher spending. Government-owned airports remain competitive technologically through alternative approaches (i.e., outsourcing to private IT providers). However, their DT efforts are often more incremental and subject to budget cycles. Exceptions to the rule are the Middle Eastern airports with strong State support for digitalisation. Beyond ownership, factors like market maturity, technological capability and governance influence DT. In mature markets, DT tends to focus on efficiency rather than transformation. Stronger regulatory frameworks, potentially including DT/IT as part of the airport's critical infrastructure, could further incentivise DT investments.

Q2B on how airport ownership models impact DT maturity, the most important theme that emerged was 'Innovating, resource pooling, business-IT integration, and strategic leadership are key to DT maturity'. The main codes supporting this theme were: *All airports in 'group ownership' are at the same maturity level as they share skills and technology; Airports that are keen on innovation and partnering with risk takers are ahead in DT; Airports need to view Business and IT together rather than separately; DT comes from leadership; and Innovation is not an existential crisis for airports as they are not tech companies.*

The second theme that emerged was 'State-owned airports have several DT challenges, but some regions try to stay ahead'. The codes supporting this theme were: *Government airports are risk-averse, slow governance procedures, slow procurement approval, and have no incentive*

for digitalisation; Public sector pays less and does not attract talent; Some public airports in Asia and the Middle East are still technologically advanced; and Data sharing across sectors is easier within a state-owned airport group.

The third theme was 'Privatisation opens possibilities and promotes DT', supported by codes such as: *Privatised airports try fast, fail fast and learn from technology; PPP model allows faster DT growth; Privatised airports provide better passenger service; and Privatisation induces improvement in other competing public airports.*

The themes for Q2B suggest that DT maturity is driven less by ownership-operating model and more by organisational initiatives such as innovation, resource pooling, business-IT integration and strong leadership. Airports within group structures often reach similar maturity levels by sharing expertise and technology, while those actively partnering with innovators and IT-business integrators tend to advance further. State-owned airports could face structural barriers such as risk aversion, slower governance and procurement, but regional exceptions (i.e., smart airports in Asia and the Middle East benefitting from easier data sharing within state systems) do exist. Privatisation enables faster experimentation, quicker access to resources and improved service and revenue focus, thereby pushing public airports to improve services as well to remain competitive.

In addition to the qualitative responses above, interviewees also provided an estimate of DT Spend anticipated at their airport in the short term (see Fig. 21). As shown in the figure, most interviews confirmed that airport DT/IT spend is increasing and will continue to grow over the

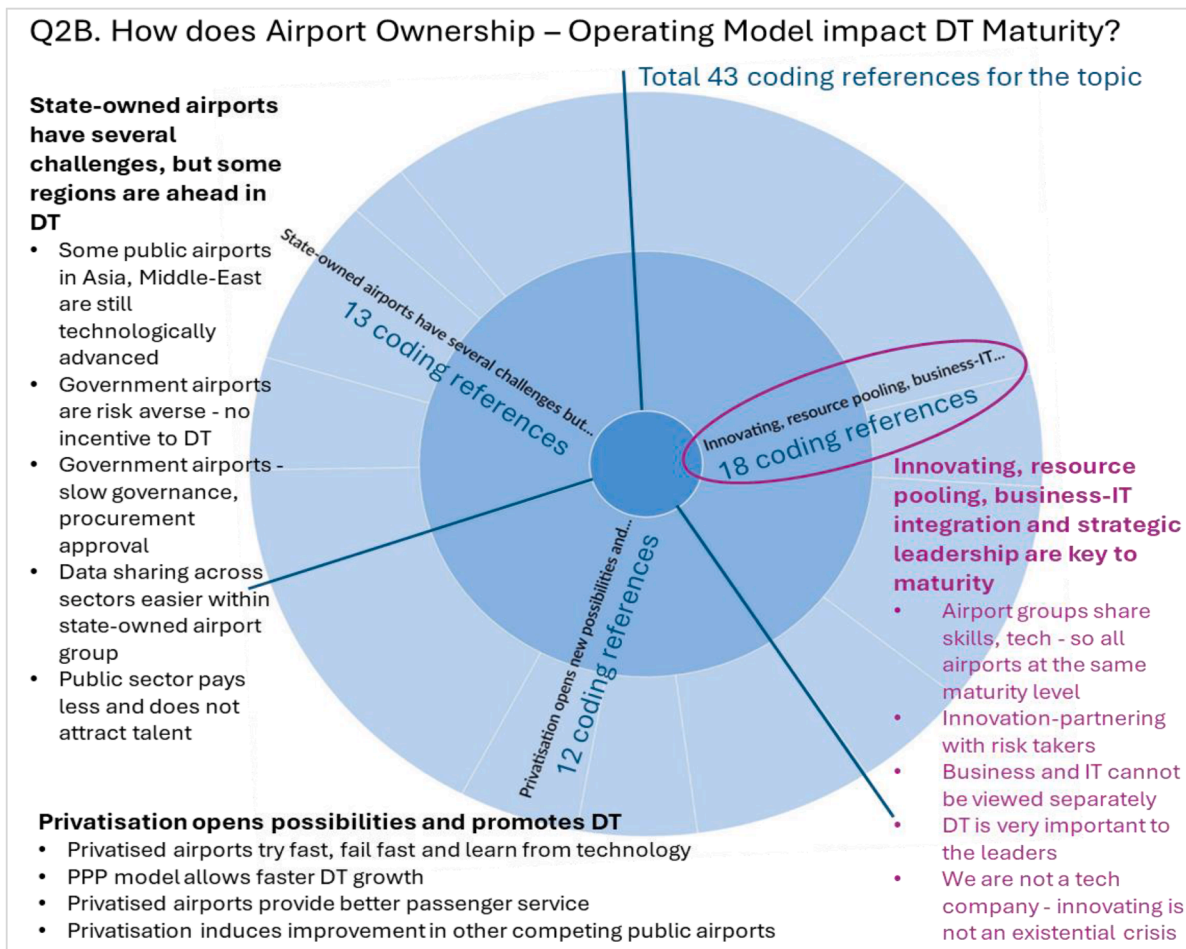


Fig. 20. Themes emerging from the interview responses to 'whether airport ownership and operating model has an impact on digital transformation'.

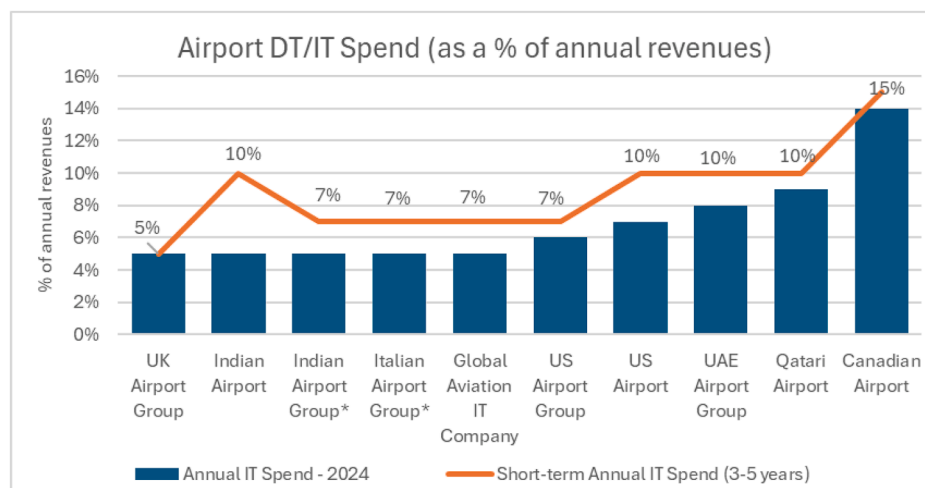


Fig. 21. Interviewees' responses to DT / IT Spend (as a % of annual revenues) now and in the next 3–5 years.

next 3–5 years. The current spend is estimated at 5% to 15% of annual revenues, according to digital leaders interviewed. Additionally, the codes generated also confirmed that airport groups are twice as likely to explore new technologies compared to individual airports (as reported within the 'Digital Futures' interview questions) (see [Appendix 1](#) for interview questions).

The findings have been discussed further in the following section.

5. Discussion

This section discusses and interprets the findings from the secondary and primary research.

5.1. Secondary research interpretations

5.1.1. Ownership-operating model is not the sole predictor of performance

The secondary research did not demonstrate any clear visual relationship between the level of private sector participation and passenger experience outcomes across global regions. Regions with lower levels of privatisation, such as Asia-Pacific and the Middle East (~25%), recorded higher passenger satisfaction scores than Europe and Latin America, despite the latter reporting privatisation levels above 75%. Likewise, publicly owned airport systems in North America and Africa reported satisfaction scores comparable to or only slightly lower than their more privatised counterparts.

The effect of privatisation is, in fact, context-dependent: it can be positive when privatised airports prioritise customer needs and operational efficiency, but negative when the focus is primarily on profit maximisation at the expense of service quality.

A similar absence of visual association was observed when comparing airport group operators with individually operated airports. Europe, with the highest number of airport groups, underperformed compared to other regions; satisfaction remained highest in Asia, the Middle East and Latin America despite their lower levels of group operation. Thus, group governance structures alone do not account for regional disparities in satisfaction.

The analysis of baggage performance revealed the same pattern. Higher privatisation levels and group operating structures did not correlate with lower mishandled-baggage rates.

Overall, these findings from secondary data reinforce that ownership and operating models, in isolation, cannot explain regional variation in airport performance. Broader structural and contextual factors must also be considered, linking us back into the interviews and expert insights from digital leaders, elaborated further in the following sections.

5.2. Primary research interpretations

5.2.1. DT outcomes rely on vision, governance autonomy, strategic leadership and collaboration

A dominant theme across interviews was that the airport's vision, leadership, national aviation framework (governance, autonomy, authority), and cross-sector collaboration often override ownership-operating structure in determining digital direction. Airports with strong strategic leadership, empowered digital teams, and supportive relationships with airlines and regulators were described as progressing more rapidly, regardless of whether they were publicly or privately owned.

Nevertheless, interviewees also recognised that the ownership-operating structure can shape the enablers and constraints that influence digital investment. Private operators were perceived to benefit from greater funding flexibility, faster decision-making, and clear commercial incentives, all of which facilitate more ambitious and timely digital initiatives. Airport groups similarly benefited from resource pooling, standardisation, and scale efficiencies, making them more likely to pilot emerging technologies.

However, this influence is not absolute. Interviewees noted that profitable airports, irrespective of ownership, tend to invest more heavily in DT. Additionally, some state-owned airports, particularly in Asia and the Middle East, were described as technologically advanced due to sustained government commitment, national-scale digital agendas, and strong policy alignment. In these contexts, central coordination and long-term planning were perceived to yield outcomes comparable to those of leading privately-owned airports.

5.2.2. DT investment: funding freedom and regulatory alignment matter more than ownership-operating model

The interviews revealed that "ownership without funding constraints" is the most important facilitator of digital investment. While privatisation often improves funding capacity, several leaders emphasised that government-owned airports can still excel where airlines drive innovation, profits are reinvested, or IT is outsourced through concession models, as observed at some US airports.

In mature markets, where DT is driven mainly by efficiency and capacity gains, the investment tends to be incremental and fragmented, often with competing digital priorities.

A recurring view was that digital investment could be significantly strengthened through formalised frameworks, such as recognising airport IT as critical infrastructure or adjusting regulated asset base (RAB) rules to include non-commercial DT investments. Current slow-paced regulatory arrangements in some regions, especially in mature markets, however, were cited as limiting long-term digital investment irrespective of ownership.

Looking ahead, digital and IT investment across airports is expected to increase significantly as confirmed by digital leaders, potentially reaching up to 15% of annual revenues within the next three to five years, with airport groups twice as likely to invest in advanced technologies.

5.2.3. DT maturity: innovation culture, business-IT integration and leadership are decisive

When considering digital maturity, interviewees placed greater emphasis on "innovation culture, business-IT integration, and strategic leadership" than on ownership structure. Airports that actively partner with innovators, encourage risk-taking and integrate IT within business operations were consistently described as more digitally mature. Group-owned airports reported advantages from shared systems and knowledge exchange, but this did not guarantee uniform maturity across contexts.

By contrast, interviewees commonly described state-owned airports, particularly in Western markets, as facing slow governance processes, risk aversion and talent-attraction challenges, which can impede digital progress. Yet the strong digital performance of major public airports in Asia and the Middle East illustrates that ownership does not preclude high maturity if governance autonomy, policy alignment and investment commitment are present.

5.2.4. Integrating findings: ownership and operating model shape the pathway to DT, but do not determine its trajectory

Synthesising the secondary and primary findings highlights that airport ownership-operating models shape the governance environment for digital transformation, but they do not directly dictate digital outcomes. Instead, a plethora of factors such as airport strategic leadership, governance autonomy, availability and flexibility of funding, collaboration across airport-airline-government ecosystems, innovation culture, the ability to pool or share resources and alignment with national or regional digital agendas, play a far more important role in determining an airport's digital maturity.

This explains why publicly owned airports in digitally progressive regions can outperform heavily privatised airports in mature markets, and why group operators may not always yield better passenger or baggage outcomes. Ultimately, the ownership model determines the structure, but leadership and strategy determine the success of digital transformation.

Finally, airport leaders also mentioned that their investments in digital technologies are growing annually, with most of them

considering advanced technologies such as cloud platforms, data lakes, AI, digital twins, integrated operations centres, and robotics.

The study has identified potential factors (in addition to the trajectories laid out by ownership-operating models) that could influence airport digitalisation, such as governance structure, regulatory framework, funding flexibility, digital leadership, sector-wide collaboration, and digital culture. A comprehensive synopsis of the findings follows.

6. Conclusions

This study set out to examine whether airport ownership and operating models influence digital investment and digital maturity. The findings demonstrate that although airport ownership structures (i.e., public, private or hybrid) and operating arrangements (i.e., single-airport or group-based operations) shape governance models, funding flexibility, and scalability of digital initiatives, they do not solely or independently determine the level of digital transformation achieved. Instead, digital maturity depends on a broader set of factors, including strategic leadership, decision-making autonomy, regulatory context, and organisational culture, as elaborated below.

Globally, airports are accelerating digital transformation in response to rising passenger expectations and operational complexities. Capacity constraints and revenue pressures (especially in mature markets) necessitate revenue diversification, alongside rapid technological change. Secondary research revealed no consistent link between ownership type and performance outcomes, i.e., passenger satisfaction or baggage performance. Although privatised and corporatised airport groups benefit from scaling digital systems, publicly owned airports in regions such as Asia and the Middle East prove that central coordination, long-term planning, and operational autonomy can be equally effective, and in some cases outperform airports operating under more restrictive/fragmented regulatory conditions, as witnessed in some mature markets.

A similar pattern appeared in technology deployment. Private operators and airport groups often adopt innovations like biometrics and touchless systems more quickly, yet publicly owned airports with clear mandates and supportive policies can achieve comparable results. Where public funding constraints and fragmented oversight persist, implementation tends to be slower. Across all models, increasing digital complexity has also heightened passenger stress at key touchpoints, particularly security, highlighting the need for more integrated, passenger-focused strategies.

Airports with greater commercial flexibility (typically privatised or concession-based) are better positioned to monetise passenger data through personalised services and increased non-aeronautical revenues. Publicly owned airports, by contrast, often prioritise service equity, resilience, and compliance, which can temper the pace of experimentation. At the same time, passenger trust in digital systems varies by demographic and region. Stricter data governance in public models may limit the adoption of emerging tools such as Digital Travel Credentials, while private operators often benefit from more flexible data strategies and partnerships, enabling faster deployment in regions with higher acceptance of digital identity solutions.

Interviews confirmed that ownership alone does not guarantee digital leadership. Government-owned airports that treat digital systems as core infrastructure can match or exceed private-sector performance, while some privatised airports face regulatory disincentives to invest. Airport groups, regardless of ownership, benefit from economies of scale

and shared expertise, whereas single-airport operators depend more on local leadership and partnerships.

Looking ahead, digital and IT investment is expected to grow significantly, potentially reaching up to 15% of annual revenues within the next three to five years. Airports with effective governance (whether public or private) will be best placed to scale technologies such as cloud platforms, data lakes, AI, digital twins, integrated operations centres, and robotics.

Overall, ownership and operating models shape the context for digital transformation, but outcomes are driven by leadership, regulation, organisational readiness, and the ability to integrate technology into coherent, resilient, and passenger-focused systems.

6.1. Research gaps and limitations

Although this study provides insight into how ownership and operating models influence airport digital transformation, several areas require further research. Quantitative analysis comparing IT expenditure across fully private, fully public, and partially privatised airports, normalised by passenger throughput, would help clarify the financial determinants of digital investment. Additionally, a comparative assessment of digital maturity between single-airport operators and airport groups would highlight the role of scale, governance standardisation, and shared services in shaping digital capability.

Despite efforts to minimise bias, it must be acknowledged that portions of the secondary data were sourced from technology providers and system developers, which may introduce inherent partiality and should therefore be interpreted with caution. Furthermore, several large airports and airport groups anticipated to contribute to the primary research did not ultimately participate, limiting the diversity of ownership-operating models represented in the interview sample. Finally, the impact of the COVID-19 pandemic on data trends (related to digital investment and maturity) should be considered, as this period reflects both structural disruption and accelerated digital adoption that may not represent long-term trajectories.

CRedit authorship contribution statement

Sugandhi Jayaraman: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Anne Graham:** Validation, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendices

Appendix 1. Interview questions

Appendix 1.

Airport Ownership/ Operating model and Digital Transformation (DT) How does Airport ownership/operating model impact Digital investment and Digital maturity?
Strategic Priorities Strategic direction for digitalisation - what does the leadership want technology to do? Improving efficiency, passenger experience, sustainability, predictive maintenance... anything else? Which processes are you considering for digitalisation? At which airports (if you're in a group)? Which digital technologies are you considering? Which technologies are good value for money? Technological Innovation - what trials are you investing in?
Access to funds Do you get any government aids / subsidies annually? How much of it is specifically for technological improvement? Airport group question: How much of your digital services successful in one airport is implemented at your other airports? What percentage of your annual revenue is allocated to digital services / technology investment? What is your planned investment into digital technology over the next 3-5 years (as a % of overall revenues)?
Regulatory environment How are data protection / cybersecurity regulations affecting digitalisation at your airport?
Risk tolerance - any examples of how you faced and mitigated challenges? Financial risk of unsuccessful tech Uncertain pay-back period Ability to manage tech failures
Adoption / Training of new technology Challenges related to pace of adoption, organisation's willingness to change? Cost of Training of users / staff - is it high / low in your opinion?
Digital Future Where do you want your airport to be in 3-5 years technologically?

Appendix 2. Summary – key themes from the thematic analysis

Appendix 2.

Q1 – Does Airport Ownership-Operating model impact DT?

- **Other factors:** The airport-airlines' vision, motivation; The country, leadership, autonomy/ authority; Cross-sector synergies.
- **Yes, Own-Op Model impacts DT:** Private investors - more funds, faster decisions, profitability, shareholder support; Airport groups – more volumes, shared resource pool, scale and price.
- **No direct impact of Own-Op Model:** Profitable airports invest in DT; Humans reluctant to do certain tasks; Fear of missing out.

Q2A – How does Airport Ownership-Operating model impact DT Investment?

- **Government ownership and DT:** Airlines drive tech investments; US-Canada Airports subcontract private companies; No financial incentive to invest, slow adoption.
- **Ownership with no funding constraints:** Globally, all airports invest, Privatisation brings funds; Profitable airports (private or government owned) invest in DT.
- **Institutionalisation of DT spend:** Airport IT-becoming Critical Infrastructure promotes DT spend; DT not within regulated asset base calculation but could be formalised.
- **Other drivers for DT:** EU-US Airports- transactional, flat growth -so DT for operational efficiency; Open API, inhouse data lakes, incremental DT.

Q2B – How does Airport Ownership-Operating model impact DT Maturity?

- **Innovating, resource pooling, business-IT integration, strategic leadership - key to maturity:** Airport groups, Innovation labs, etc.
- **State-owned airports have several challenges, but some regions are ahead in DT:** Government – risk averse, slow procurement, approval; Some public airports in Asia, Middle-East are still technologically advanced.
- **Privatisation opens possibilities and promotes DT:** Try fast, fail fast and learn from tech; Focus on growth, optimisation and better passenger service to drive revenues.

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