Smart asset management:
The future of airports

Passenger traffic is growing, but airport infrastructure is not meeting demand.

Capgemini

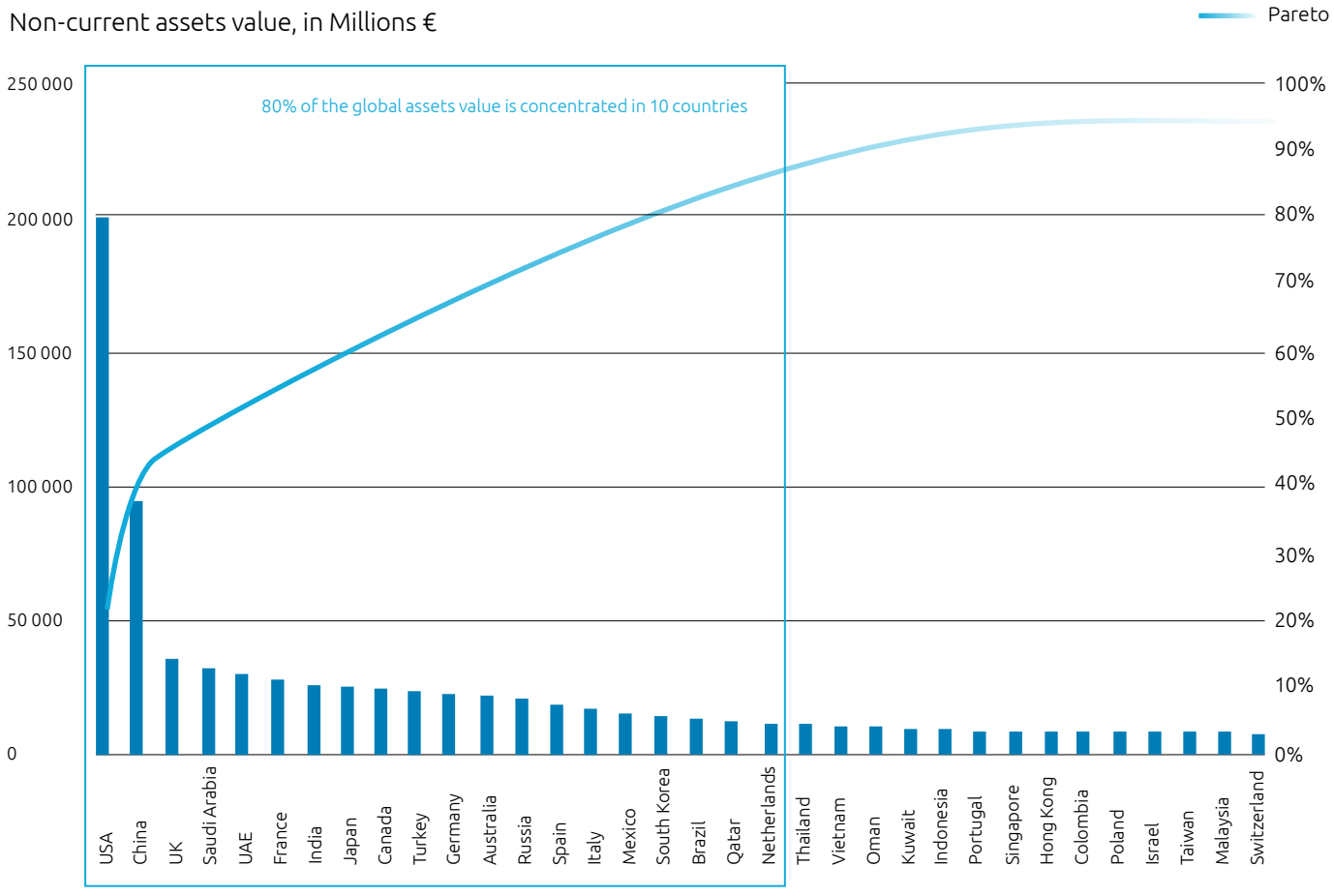
Modernization and management

As Covid-19's impact on air travel has steadily faded, passenger traffic has been increasing. According to Airports Council International (ACI)[1], global passenger traffic is forecast to reach 9.9 billion in 2025. To meet demand, airports must invest in smart asset management and infrastructure.

While the surge in growth is a positive sign for the industry, airport infrastructure is being outpaced by demand. The ACI notes that there will be a **104% increase in passenger travel** as compared to the 2019 levels and reflects a **10% year-on-year growth** from 2023 onwards. Airports are looking to bring modern innovations into their infrastructure, while carefully balancing this with health, environmental, and safety regulations.

As investment numbers grow, understanding the current value of airport assets is paramount for strategic decision-making. The current total asset value of airports globally is €739 billion, with the US, China, and the UK topping the list.

Worldwide distribution of airports assets value

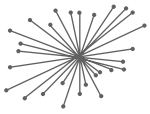
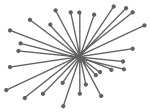
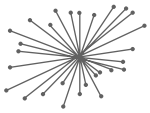


Source: Capgemini Analysis, 2024

Regionally, North America, led by the US, holds the highest non-current asset value at €211 billion, followed by Europe at €206 billion and APAC at €200 billion. Both Europe and APAC in particular present significant opportunities for strategic investment, as each have higher shares of private ownership compared to the US, which is 98% publicly owned.

As airport infrastructure grows, CAPEX and OPEX projects must navigate sector-specific challenges to achieve efficient infrastructure management. In the US alone, around **$115.4 billion[2] will be needed for modernization** over the next 5 years. To add to this, **more than 20 major European airports[3]** will be at or near capacity by 2035, compared to just 3 in 2012. Air traffic management, vital not only for smooth operations but also safety, would be put under additional stress.

Overview of assets value market structure on main geographies

Region	Non-current asset value	Top 5 countries	Market structure	AOO Segmentation
 NA	€211B	• USA: €191B • Canada: €12B • Mexico: €7B	PUBLIC 98% / PRIVATE 2%	 Very segmented
 Europe	€206B	• UK: €36B • France: €26B • Germany: €19B • Spain: €14B	PUBLIC 65% / PRIVATE 35%	 Concentrated
 APAC	€200B	• China: €79B • India: €21B • Japan: €21B	PUBLIC 70% / PRIVATE 30%	 Very segmented
 MEA	€96B	• Saudi Arabia: € 29B • UAE: €27B • Qatar: €10B	PUBLIC 90% / PRIVATE 10%	 Very Concentrated
 LATAM	€23B	• Brazil: €11B • Colombia: €3.5B • Argentina: €2.8B	PUBLIC 40% / PRIVATE 60%	 Concentrated

Source: Capgemini Analysis, 2024

However, meeting this demand is only one piece of the puzzle. There's a series of critical business drivers that are also driving airport modernization. These include:

> **Maintaining and increasing the efficiency of a variety of assets and infrastructure, from baggage systems to terminal facilities**
>
> **Developing long-term investment forecasts, particularly with deeper understanding of asset lifecycles, maintenance requirements, and performance trends**
>
> **Sustainability targets, particularly the drive towards net-zero emissions and balancing this with continued growth**

Additionally, traditional airport infrastructure is also undergoing a transformation. There is a series of new trends that are impacting both the design and functionality of these facilities.

Among the most significant, the concept of the **Aerotropolis** best represents the evolving role of airports. This shifts airports from being solely a transportation hub to the heart of a beating, self-sustaining economic ecosystem. An **Aerotropolis** will connect an airport's facilities directly with business districts, industrial centers, and other economic infrastructure.

Airports are also looking to incorporate **hydrogen and solar** energy assets. While this can help airports align with net-zero goals, it's also a way to develop a wealth of new economic activity. From storing and distributing hydrogen energy to the production, storage, and distribution of solar energy, airports are increasingly managing a much wider array of assets. In fact, already in June 2023, Air Liquide and Groupe ADP[4] launched their Hydrogen Airport – a joint venture to help airports integrate hydrogen projects into their infrastructure.

Other trends, like **Urban Air Mobility (UAM),** which will harness vertical take-off and landing (eVTOL) aircraft, need completely new infrastructure to implement. UAM will provide an additional mode of urban transportation, allowing for the transport of people and goods directly from an airport to urban areas.

These trends demonstrate the need for renewed infrastructure for airports and, above all, the necessity to harness the right technologies.

Opportunities

While new trends and practices are the basis for change, it is technology that drives it. Here, the aviation sector shines brightest.

Real-time operation supervision

The increase in passenger traffic means airports need to be more responsive than ever.

Computer vision augmented by AI can help supervise highly complex processes, such as aircraft turnaround operations and passenger flow. Real-time monitoring ensures smoother loading and unloading times, provides bottleneck detection within airports, and even helps supervise airplane parking. These factors contribute to greater levels of customer satisfaction, airport efficiency, and safety.

Additionally, Internet of Things (IoT) devices can also help with flow management. By providing real-time data, airports can better control resource allocation. They also support continuous monitoring of critical assets, such as gate traffic.

Digital twins and flow simulators

Digital twins can be broadly broken up into two larger categories: project twins and operation and maintenance twins. Each of these categories contains a wealth of data to support use cases that can match a desired process by an asset owner.

For example, a digital twin could be used to record data about a particular piece of equipment and help operators keep up with maintenance checks. The various types of digital twins and how they record and share information allows for different insights and simulation capabilities for different asset owner/operator business disciplines.

Here are some examples of different digital twins:

> **Requirement twin:** contracts, technical specifications, budget/milestones, regulatory requirements, quality standards, materials and equipment standards
>
> **Design twin:** design basis and drawings (2D/3D), process flow diagrams, technical specifications, material requisitions and equipment list, safety and environmental reports, engineering calculations, supply chain simulation
>
> **Construction twin:** updated drawings (2D/3D), material certificates, assets, connected worker, safety and environmental reports, construction control tower
>
> **Operations twin:** operation records, asset performance monitoring, service optimization, energy monitoring, productivity optimization, operations control tower, remote training and simulation, process enhancements
>
> **Maintenance twin:** maintenance records, predictive maintenance, condition monitoring, warranty management, maintenance forecasting and planning, supplier management

Digital twins can also help analyze passenger flow. Airport operators can run complex simulations with real-time feedback. For example, a digital twin "as operated" can give insights on potential infrastructure changes, such as gate allocations or security staffing shifts, and how all of this may impact overall airport efficiency, organization, and traveler satisfaction.

Biometric technologies

The use of biometric technologies is an ongoing process, with advances in this technology being balanced with concerns over privacy and civil liberties.

For airports, biometrics such as digital identities paired with facial recognition software can improve operational efficiency with faster boarding times. They can also ensure better levels of security thanks to digital IDs being more secure than physical credentials.

Airport operators will need to work closely with governmental agencies[5] to ensure that traveler data is protected and respected.

Compliance and trust

Government agencies, like the American Transportation Security Administration (TSA), can play an active role in ensuring the safe and responsible use of passenger biometric data.

Challenges

Airports are capital and asset intensive and balancing this with new technologies and practices is often complex.

This blends into a variety of unique challenges that must be taken into consideration while implementing any transformation.

Airport traffic congestion

Growth in travel is outpacing the capacity of today's airport infrastructure. This translates into delays for passengers, lost luggage, and air traffic congestion. In fact, unless action is taken, **20 of the main European airports will be at or near capacity by 2035.** This is a remarkable increase from 2012, where that number was only 3.

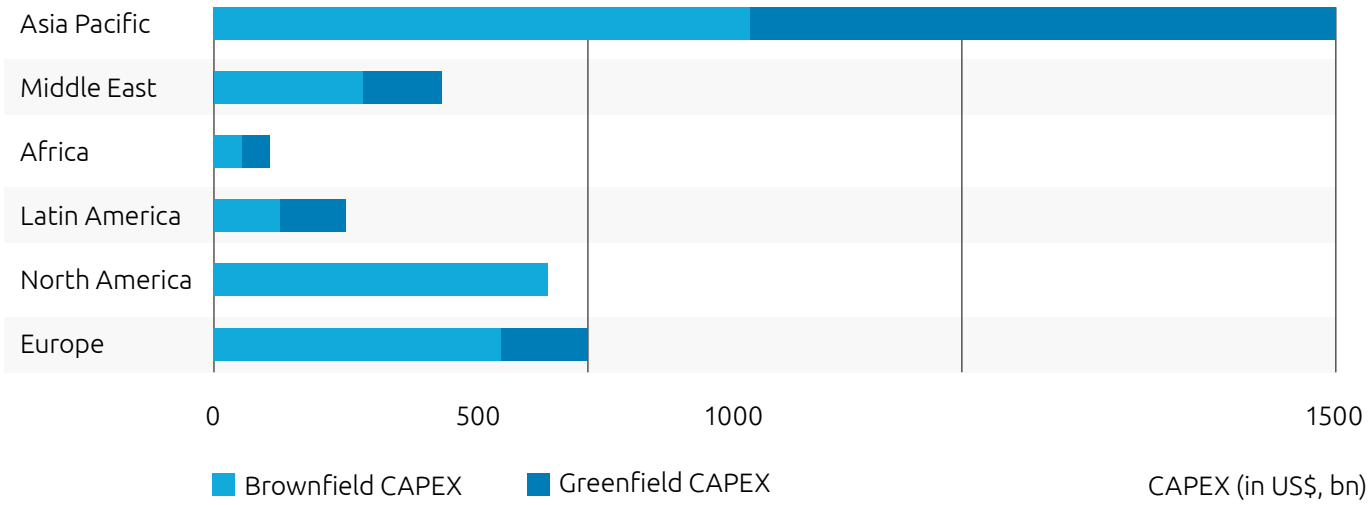
While airports need more capacity for infrastructure, traditional investments in greenfield expansion may be problematic due to limited space. This may lead airports to consider how to take advantage of pre-existing infrastructure and more investment in brownfield development is well worth considering. Asset Lifecycle Management (ISO 55000) is a strategic framework that can guide these investment decisions, helping airports prioritize initiatives that deliver long-term value while minimizing risk and cost.

Aging infrastructure

Many airports operate on outdated systems and infrastructure that was built decades ago. Modernizing these legacy systems is complicated and costly, and like any transformation, may negatively impact the experience of passengers in the short-term. For example, the 2021 Report Card by the American Society of Civil Engineers noted that around $115.4 billion would need to be spent to address infrastructure problems in the US.

Additionally, by 2040, around 70% of capital expenditure (CAPEX) in the aviation sector will come from expanding infrastructure through brownfield developments. The US and Europe will make up about half of these investments alone, while in Asia and emerging markets, greenfield projects are more common.

Capital Expenditure Needs of Airports by 2040



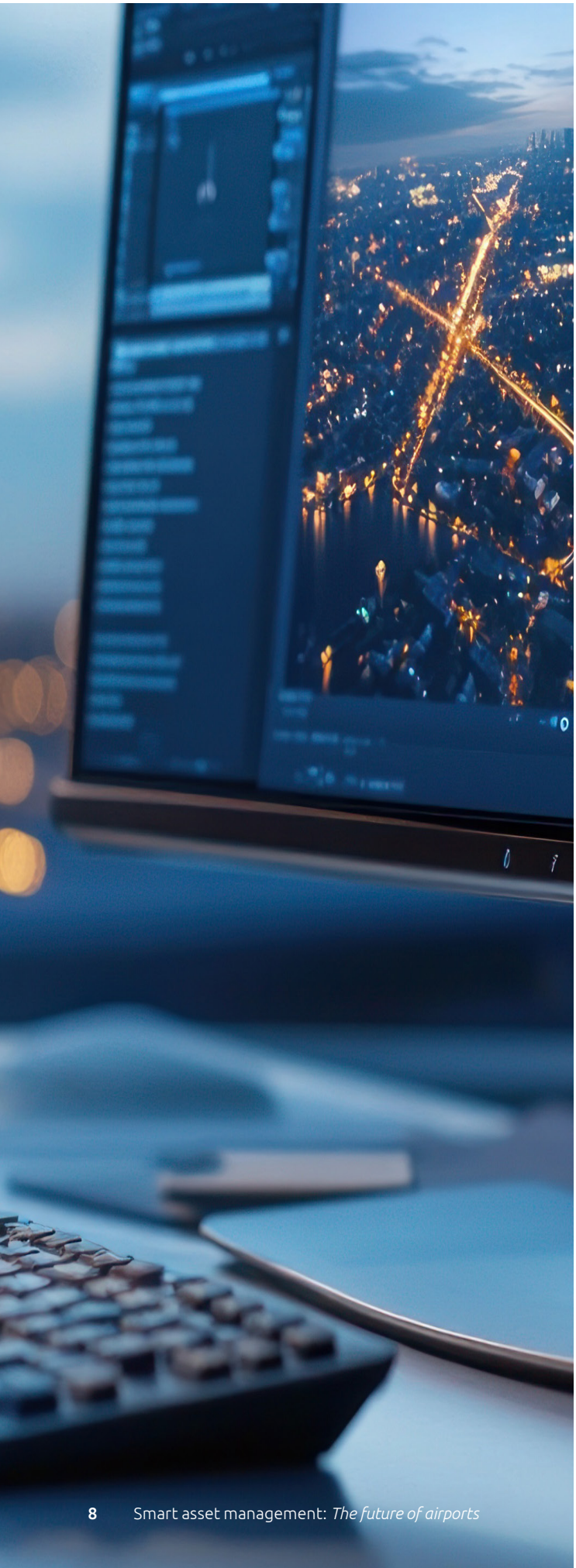
Climate change

Rising sea levels, extreme weather events, rising temperatures, and other climatic shifts can damage infrastructure and disrupt services.

When designing new infrastructure, it's vital to consider the climate impact and evolution in an area.

According to the World Bank[6], an estimated increase in the climate resiliency of airports could cost between $4.2 billion to $6.8 billion per year globally.

To mitigate the effects of climate change, some airports are already building infrastructure with this in mind. For example, the San Francisco International Airport is investing $587 million to raise its runways and strengthen its perimeter to withstand rising sea levels. Additionally, the Hague Airport has implemented sophisticated water management systems to reduce flood risks.



Data integration and connectivity

A typical large airport manages a tremendous number of assets, ranging from terminal buildings and runways to baggage handling systems and security tools. These generate a wealth of data daily. This means that data continuity must be ensured from project planning and construction into the operations and maintenance phases, and to do that, airports need a strong data management strategy right from the very start and all along an asset's lifecycle.

However, airports are unable to tap into the full potential of this data due to fragmented systems and incompatibility.

Some key data challenges are:

> **Data siloes and system incompatibility:**
> Numerous systems and data formats create isolation and prevent the smooth transfer of data.
>
> **Data security and privacy:**
> Airports handle sensitive data related to passengers, airlines, security, and operations. Strong cybersecurity measures must be used to prevent unauthorized breaches and comply with data protection regulations.
>
> **Data quality and reliability:**
> Effective decision-making depends on accurate, consistent, and reliable data. Incomplete or erroneous data can negatively impact operations.

Additionally, airports have a continual concern over security and customer satisfaction.

While these challenges may seem daunting, they also provide clarity in how airports must evolve to overcome them, and with a trusted partner, they can be more assured in a successful transformation.

Conclusion
Our end-to-end Capgemini approach

Capgemini's Smart Asset Framework

Our Smart Asset Framework is designed to support airports in overcoming today's challenges and modernizing their infrastructure. Whether it is managing a single airport or a fleet of airports, our value proposition empowers visibility and improvement of the entire asset lifecycle, from the project to the operation and maintenance phases.

Asset information management is crucial to master to have asset oversight along its entire lifecycle. This is supported by efficient data taxonomy and ontology, which ensures elevated data organization and structure from a variety of sources and leverages best technology practices in tools like generative AI.

Other key elements include:

Asset development projects portfolio efficiency:

Strategic planning, resource allocation, and adapting to evolving technologies and regulations are critical, as is harnessing smart asset management solutions to assist in identifying key projects, making risk assessments, and building budget-compliant developments.

Leveraging data for asset operations and maintenance:

Making use of the abundance of data that airports generate is a critical task, which can help forecast demand, identify peak periods, and adjust capacity planning in real-time.

Digital twins:

This technology allows for a collaborative ecosystem, which can open communication between stakeholders, EPC companies, subcontractors, and OEM vendors via 3D models and 2D drawings which promotes better understanding and coordination between a wealth of disciplines. It also helps in maintaining and extending the lifespan of assets.

Enterprise Asset Management (EAM):

This system centralizes data, enhancing asset lifecycle management, speeding up decision-making, and automating workflows. It uses advanced analytics to optimize maintenance and forecast demand.

Connected workers:

Advancements in mobility tech, industrial IoT, and 5G/6G have revolutionized how field workers interact with critical assets and command centers, enabling real-time data access and improved safety through connected devices. These technologies enhance asset data, documentation (as per digital twins), and efficiency, especially in remote areas. In airports, AR headsets and drone-assisted maintenance powered by 5G provide real-time support, significantly boosting operational capabilities.

Connected assets:

This approach enables real-time monitoring of critical airport assets, improving efficiency and reducing downtime. By integrating live data from machinery and equipment, airport owners/operators can optimize maintenance, cut costs, and increase uptime. Technologies like RFID, IoT, sensors, and 5G-enhanced geolocation improve asset visibility and tracking, particularly for ground support equipment (GSE), though system integration remains a challenge.

Our Smart Assets Framework is designed to help airport asset owners make informed decisions, risk assessments, and guidance for future investments.

It's time for airports to craft a smart asset driven transformation. Let's build smarter, together.

Authors

Thierry Jourdan
VP & CTO, Intelligent Industry,
Capgemini Invent

Henri Brasseur
Director, Intelligent Industry,
Capgemini Invent France

Joma VJ
Manager, Intelligent Industry,
Capgemini Invent

Yassine Bouzine
Senior Consultant, Intelligent Industry,
Capgemini Invent France

Credits

1 Airports Council International. P. (2025). The trusted authority on air travel demand insights. ACI World. https://aci.aero/2025/02/26/the-trusted-authority-on-air-travel-demand-insights/

2 Airports Council International – North America. P. (2023). 2023 ACI-NA infrastructure needs report. https://airportscouncil.org/wp-content/uploads/2023/03/2023ACI-NAInfrastructureNeedsReportFINAL.pdf

3 European Commission. P. (2015). Airport capacity and quality. Mobility and Transport. https://transport.ec.europa.eu/transport-modes/air/airports/airport-capacity-and-quality_en

4 Air Liquide. P. (2023). Air Liquide and Groupe ADP announce the creation of Hydrogen Airport, the first joint venture to support hydrogen development at airports. https://www.airliquide.com/group/press-releases-news/2023-06-16/air-liquide-and-groupe-adp-announce-creation-hydrogen-airport-first-joint-venture-support

5 Transportation Security Administration. P. (2025). Biometrics technology. U.S. Department of Homeland Security. https://www.tsa.gov/biometrics-technology

6 Murugan, S. P. (2024). The influence of climate change on airport infrastructure. LinkedIn. https://www.linkedin.com/pulse/influence-climate-change-airport-infrastructure-murugan-4ifrc/

About Capgemini

Capgemini is a global business and technology transformation partner, helping organizations to accelerate their dual transition to a digital and sustainable world, while creating tangible impact for enterprises and society. It is a responsible and diverse group of 350,000 team members in more than 50 countries. With its strong over 55-year heritage, Capgemini is trusted by its clients to unlock the value of technology to address the entire breadth of their business needs. It delivers end-to-end services and solutions leveraging strengths from strategy and design to engineering, all fueled by its market-leading capabilities in AI, generative AI, cloud, and data, combined with its deep industry expertise and partner ecosystem. The Group reported 2024 global revenues of €22.1 billion.

Get the future you want | www.capgemini.com

Capgemini