

7. A Review of Digital Technologies in Aviation Industry

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Due to the fierce competition caused by the economic downturn, rising fuel costs and growing customer demand, airfreight companies are forced to look for new ways to improve their performance and client base. The future of air transport will be driven by a digital transformation in the industry. Digitization is seen as the key lever for the development of new innovative services and solutions, and as the factor that will drive efficiency in the air cargo ecosystem and deliver incremental value to the end customers.

Aviation industry is facing a whole complexity of new challenges. Airports are going through an era of hyper-competition which means an increasing number of airports are competing for a diminishing number of resources. The bigger hub airports face competition both from rival domestic hubs, but also from the global 'mega hubs'. At the same time smaller airports are engaged in pitched battles with other regional airports in a bid to attract and retain carriers.

In our today's life, digital technology surrounds us from all sides. Broadly speaking, **digital technologies** are those technologies that use information in digitally encoded form. This code is called binary code. A binary code represents text, computer processor instructions, or any other data using a two-symbol system. The two-symbol system used is often "0" and "1" from the binary number system. The binary code assigns a pattern of binary digits, also known as bits, to each character, instruction, etc.

American engineers began developing digital technology in the mid-twentieth century. Their techniques were based on mathematical concepts suggested by the seventeenth-century German mathematician, Gottfried Wilhelm Leibniz, who proposed a binary computing system. His innovation inspired such numerical codes as American Standard Code for Information Interchange (ASCII) that described objects with digits.

Digital technology enables immense amounts of information to be compressed on small storage devices that can be easily preserved and transported. Digitization also quickens data transmission speeds. Digital technology has transformed how people communicate, learn, and work. [1]

The digital capability of a business is fundamental to remaining competitive on today's market. Digital technologies are rapidly changing and evolving, which in turn increases competition and the need for companies to innovate quickly. It has never been more dangerous for companies to neglect the importance of digital technologies.

The digital strategy a company pursues can make or break an organization. Today's business landscape is becoming increasingly complex. For a company to be successful now, it is vital to adopt digital innovations that can help them to achieve their objectives and stay ahead of their competitors. Adopting digital technology can have a number of benefits for the company that chooses to do so. [2]

To achieve business success, efficiency and productivity are vital. Digital technology can help improve communication, collaboration, content management, access to analytics data and social networking as well as staff and customer experience.

Digital is often used as a synonym of computing, information technology or technology. The following are common types of digital things.

Digital electronics. Devices that contain computers or that process binary data.

Digital media. Media such as photo, music and video that is captured, stored and delivered as binary data.

Digital content. Content such as documents, news and books that are delivered as binary data, For example, e-book is digital content.

Digital economy. A term for industries that are based on information technologies and use digital technologies in their activities.

Digital data. Data stored in binary. Generally speaking, all computerized data.

Digital technologies touch us almost in each sphere of our life. Examples of digital technology may be as follows: Websites, Buying and Selling Online, Smartphones, Digital Televisions, Video Streaming, eBooks, Digital Music, Geolocation, Blogs, Social Media, Computers, Printers, Self-Scan Machines, ATM's, Digital Cameras, Cars and Other Vehicles, Clocks, Robotics, Drones and Guided Missiles, Banking and Finances

Digital technology has transformed nearly every aspect of modern life. Travel, work, shopping, entertainment, and communications are just some of the areas that have been revolutionized in recent decades. It's now rare to find an electronic device or piece of machinery that doesn't incorporate digital technology in some way. Let's consider some advantages of using digital technologies (Fig. 1). [3]

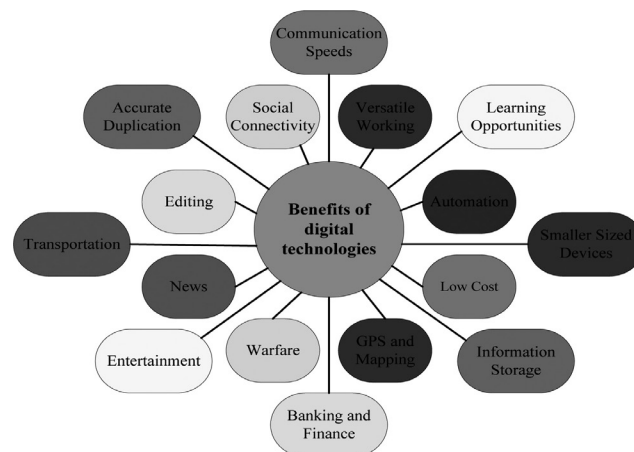


Fig. 1. Advantages of digital technologies [Source: 3]

Aviation transport has a positive impact on the development of tourism business and international trade. Today, more than 52% of international travel is by air. The developed aviation industry helps to increase the investment attractiveness of the country and increase the opportunities for international companies to operate in its territory.

Aviation transport also provides extremely fast delivery of valuable and perishable goods to the destination, which necessitates its widespread use by major leading international logistics companies.

Air transport today has the following global trends:

- high technological complexity of vehicles and ergonomics, development of intelligent transport systems, application of information and electronic technologies, satellite navigation means;
- improving the level of safety of aviation transport, enhancing measures to protect aviation against acts of unlawful interference;
- development of multimodal transport technologies and infrastructure complexes for different modes of transport, interoperability;
- globalization of transcontinental aviation transportation within powerful world alliances;
- increasing the role of low cost (low cost) air services for direct inter-regional services;
- increase of accessibility of air transportation for the population, development of international aviation tourism, migration of labor resources to more remote regions of the world.

The development of digital technology has largely affected all fields of our modern life. In the aviation area today, an efficient digital strategy is crucial for long-term benefit. The ever-faster flow of information has made our everyday Internet-dependent. Digital technologies can personalize our everyday activities, from the tailored newsfeeds we get on our smartphones to personalized diet plans we get from numerous applications. The aviation industry is fully aware of the possibilities such technologies include and is practicing them to personalize their customers' flying experience. [4]

Key opportunity will be utilizing digital technology to meet consumer expectations. The rise of 'the digital consumer' is notable in the aviation sector, where a significant proportion of clients have an online presence. Companies are concentrating on engaging with clients through compelling online purchasing campaigns, social listening, feedback apps and links with other performers in the aviation, travel and tourism industry.

Digital technologies are being used today to increase consumer satisfaction with the use of aviation services, and therefore to increase customer loyalty.

For airports, it is possible to create a simpler process for passengers to get from the airport entrance to the aircraft, as well as to increase their capabilities in terms of operational safety.

With the increase of passenger traffic through the airport, the use of digital technologies allows to optimize work and ensure its continuity. It also allows airports to perform virtual simulation and simulation activities during peak hours for better allocation of resources and optimal use of the runway.

Let's take a look at the main emerging technologies which are revolutionising the flying experiences and digitally transforming it to a tech-savvy and customer centric industry (Fig. 2).

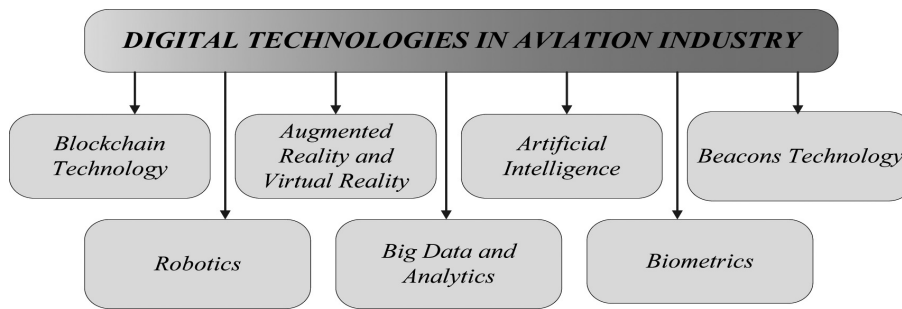


Fig. 2. The main digital technologies in aviation industry

1. Blockchain Technology.

Given the popularity gained by the blockchain technology in the financial sector it is seeing a wide range of applications in other industries as well. Airline industry has just started realising the potential of blockchain in various aspects. Recently, Air France talked about how they are looking at blockchain technology in improving business process and improving workflows.

Blockchain is a rule-built, continuous series of blocks containing information. In other words, it is a distributed database in which storage devices are not connected to a single server. This database stores an ever-growing list of ordered records called blocks. Each block contains a timestamp and a link to the previous block. By allowing digital information to be distributed but not copied, blockchain technology has formed the basis for a new kind of Internet. The concept of block chains was proposed in 2008 by Satoshi Nakamoto. It was first implemented in 2009 as a component of digital currency - bitcoin, where blockchain plays the role of a common registry for all bitcoin transactions.

According to SITA's 2018 Air Transport IT Insights, 34% of airports are planning blockchain research and development programmes by 2021. One area in which airports see blockchain's potential is the ability to help improve passenger identification processes, in part by reducing the need for multiple ID checks. [5]

Here is how airlines can use blockchain technology to improve operational efficiencies, security systems and even customer experiences:

- by implementing blockchain technology airlines can do away with the need to rely on physical ID proofs by saving passengers' data maintained in a virtual de-centralised database, which can be accessed by relevant people.
- it can help in turning flying miles into a more valuable asset which can be used to give added benefits to the customers, by tokenising these points and offering them a chance to accrue these points through a community of partners.
- blockchain can be extremely useful in building a robust security system for managing customer data. [6]

2. Augmented Reality and Virtual Reality.

Industries like retail, healthcare etc. can see a lot of uses of the AR/VR revolution. Airlines industry is also following suit. Right now, one of the most obvious applications of these technologies can be expected to be seen in the airport space where the airport experience can be enhanced with the help of AR/VR based apps.

The Gatwick airport uses AR to help passengers navigate the complex layout of the airport, and London City Airport has installed AR tech to help air traffic controllers with the vital job of keeping planes safe.

3. Artificial Intelligence (AI).

With AI gaining traction industries are using it to upgrade customer experience at every touch point. From chat bots to voice-based AI tools there are umpteen use cases of AI being utilised.

The airline industry understands the power of AI in helping them step up their technology game. A lot of forward thinking airlines understand the impact AI can have in multiple areas of the industry and are already investing in the same.

UK-based EasyJet uses AI for predictive analysis. The airline uses a combination of these technologies to make sense of all the available data and use these insights to create offers and services personalised for individual travellers. The airline also has a recognition tool that reads passports and fills out all the information for flyers — easing out the data entry and data management tasks more manageable.

Easyjet, Korean Air is also exploring how voice-activated digital assistant can help in offering a seamless travel experience.

4. Beacons technology.

Beacons technology has seen a lot of success when it comes to retail and there is a huge potential for the airline industry to use Beacons in making navigation easy for travellers between different terminals at the airport. Further, Beacons can help airports and vendors at the airport premises to know where passengers are and then send them personalised and relevant information accordingly. These updates can be about boarding gate number, baggage carousel, flight status or also about the shops and eateries around the customer.

MIAMI International airport is already leveraging Beacons in its premises to create a personalised experience for the travellers. The app provides information about the entire airport as travellers navigate through various places at the premises. Further, they are also updated with relevant information depending on their individual journey, e.g. gate numbers, flight updates, baggage collection details, etc.

5. Robotics.

The airline industry also uses robotics in assisting with various tasks like customer management, baggage handling, car parking, etc.

The introduction of KLM's socially-aware "Spencer Robot" last year created a lot of buzz. This robot has been equipped with the capability to deal with social situations between people and can "see" and analyse people nearby with his sensors. Spencer can also distinguish between individuals, families and larger groups, and also learns about and then complies with social rules, ultimately acting in a human-friendly way.

6. Biometrics.

The airlines industry is consistently working towards making travel experience delightful and comfortable for their customers. Adopting the Biometrics Technology at airlines and airport touch points is one such attempt by the industry. Back in 2015, the biometrics trial was launched with the "Happy Flow" project. Aptly named, this project aimed at creating a seamless and secure air travel process.

In just two years, today, a lot of biometric-enabled single token platforms have been introduced, and airlines and airports are leveraging them to revolutionise passenger experiences. Air New Zealand has launched a biometric-enabled bag drop to speed-up the check-in process.

Recently Delta Airlines went a step ahead and launched the world's first self-service biometric-enabled baggage drop to free up "free up more Delta people" to deal with customers.

7. *Big Data and Analytics.*

Airlines can drive valuable insights by analysing the vast amount of data available to them to create delightful experiences for travellers, understand customer preferences in real-time based on data of their purchase history, travel itineraries etc. and provide them customised offers etc.

United Airlines uses a smart "collect, detect, act" system to analyse around 150 variables in the customer profile including their previous purchases, preferences etc. and provide tailor-made offers to them. United Airlines has seen a year over year revenue increase of 15% after implementation of this system.

Further, this data can also help in increasing the operational efficiencies through predictive analytics.

Southwest Airlines has partnered with NASA to indicate potential safety issues. By using machine-learning algorithms, they have built an automated system capable of crunching vast data sets to warn about anomalies and to prevent potential accidents.

Technologies in logistics industry, such as artificial intelligence (AI), machine learning (ML) and Internet of Things (IoT) help to create a digital enterprise in which data collected from physical systems drives intelligent action back in the physical world. Such feedback loops lead to the production of smaller, customized batches and product improvements in real time, often based on customers' feedback. Satisfying a B2B (business-to-business) customer today demands a smart, networked supply chain of which delivery is the last, but integral, link. [7]

In accordance with Wikipedia, the Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. [8]

The IoT is revolutionizing the logistics industry. By connecting nearly everything from parcels to people, the IoT is enabling supply chain and logistics companies to track and trace freight in real time, make data-driven decisions that improve operational efficiency, perform predictive maintenance on assets and infrastructure, and much more.

Operating on three levels — i.e., connected hardware, infrastructure which facilitates data exchange and processing and the software tier, — IoT blurs the line between the digital and physical, as virtually any object such as a delivery vehicle, picking cart or inventory items can potentially become trackable. [9]

Equipped with IoT solutions, manufacturing, retail and transportation companies can monitor goods' whereabouts in real time and ensure they arrive at the right time and place and in appropriate condition. Furthermore, IoT solutions enable businesses to assess demand based on historical data and automate inventory replenishment [10].

Besides RFID- and barcode-based asset tracking, the applications of the Internet of Things technologies in logistics include:

- *connected & autonomous delivery vehicles.* While on-board GPS trackers, driver drowsiness detection technology and fuel level sensors have become a reality in modern logistics, further advances in electronic engineering and computer vision are expected to give rise to unmanned delivery solutions including

drones and driverless trucks aimed at automating short-haul delivery services and facilitating same-day delivery to remote areas.

- *smart warehouse*. Unlike traditional warehouse management systems (WMSs), IoT solutions allow warehouse managers to monitor goods down to the item level, streamline order processing with the aid of picking robots and improve inventory accuracy by up to 95%.
- *wearables*. The applications of the wearable technology in logistics, supply chain management and transportation encompass hand-worn, head-mounted and fabric-contained devices which expedite picking operations in the warehouse, monitor employees' well-being and provide hands-free guidance to industrial workers.

Smart sensors transform the physical world into digital insights that are used to create new value across the supply chain. By arming managers with real-time information about their inventory, machinery, and purchased materials, smart sensors create visibility across the supply chain and fuel analytics that can be used to understand and anticipate demand, optimize sourcing, and drive highvalue manufacturing decisions [11].

The ability to provide relevant, timely data regarding both products and conditions can be used to generate a more holistic, accurate perception of the operating environment. Smart sensors create the “digital last mile” of a fully connected, always-on supply chain—a digital supply network—that brings the company end-to-end visibility into its suppliers, distributors, and customers [11].

Could improve your supply chain by: increasing operational efficiency, lowering production costs, and providing critical insights into customer behavior. Smart sensors introduce automated monitoring processes, such as inventory counts or predictive maintenance, improving both labor productivity and performance accuracy. By embedding smart sensors into products, companies generate awareness of usage trends that can be used to inform future product development and improve after-sale service offerings.

Investment in supporting technology, limited internal functional expertise, or an unwillingness to redesign processes may deter some companies from adopting smart sensors in their supply chain. A number of enabling technologies—in-house data aggregation platforms, plant bandwidth, data encryption, and several others—are required to create value through a smart sensor strategy. Having the technical skill sets for interoperability is also a prerequisite to smart sensor integration. Moreover, companies need to possess the willingness and flexibility to implement or replace processes in their supply network to unlock the benefits of smart sensors.

A sensor is a device that provides feedback on a physical process or substance in a predictable, consistent, and measurable way. Smart sensors are different from sensors in that smart sensors are advanced platforms with onboard technologies such as microprocessors, storage, diagnostics, and connectivity tools that transform traditional feedback signals into true digital insights. These smart sensors can provide the timely and valuable data underpinnings to power analytical insights that can in turn drive improvements in cost, performance, or customer experience.

A differentiator of the smart sensor is its role in the broader information and analytics ecosystem. The accelerated exchange of physical-turned-digital information can exponentially increase the range of opportunities for increased performance, higher capacity, greater reliability, and advanced innovation. Five primary interface methods—digital, logic, voltage, current, frequency, and phase— convert observed inputs into digital form. Transmission standards such as Wi-Fi, Bluetooth, NFC, RFID, and others are then used to communicate this data to other sensors, controller devices, centralized management platforms, or distributed computing platforms for data aggregation and analysis (see fig. 3).

Smart sensor computing capabilities have strengthened substantially, thereby enabling data processing and analysis at or near the source (“edge computing”) and reducing the amount of data that moves between the device and platform. Additionally, the introduction of microelectro-mechanical systems (MEMS) technology has allowed for more compact, higher functioning smart sensors by effectively incorporating microelectronic functions in minimal space [11].

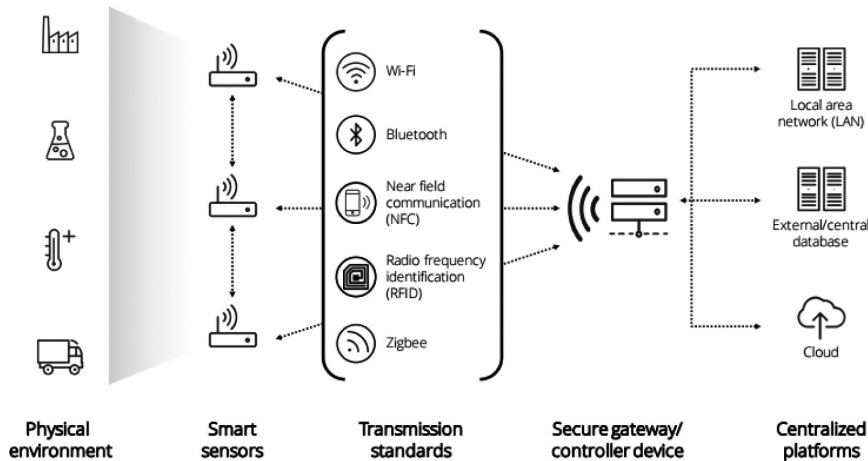


Fig. 3. The smart sensor ecosystem

Source: Deloitte. Using smart sensors to drive supply chain innovation [11]

Technologies used in air cargo tracking.

There has been a massive surge in use of instant access technology in the air cargo industry in the recent years. The airline business has made it possible to access business information and track air freight shipments in real time. Let us check out a few technologies that are being used for air cargo tracking:

GPS: The GPS systems make it possible to gather information about the direction, coordinates, speed as well as altitude of the aircraft transporting the shipment. GPS gives not only the shippers but also the customers a chance to track their air cargo directly and on a real-time basis.

RFID: Radio frequency identification or RFID stores data and retrieves it via radio waves. This technology is increasingly being used in air cargo tracking to ensure constant surveillance on the movement of the shipment. Since most of the airborne shipment is usually expensive in value, RFID ensures negligible to no losses due to theft or misplacement.

Sensors: Advanced sensor technologies have revolutionized air cargo tracking and provide more accurate, timely and diverse data. Sensors have longer battery life, greater range, higher data storage capacity and can capture entirely new kinds of the data type.

Satellite Tracking: Satellite tracking has pushed the standards of real-time air cargo tracking to new levels. Through means of satellite tracking, it becomes possible to track an aircraft over each inch of the globe, from the take off point to its landing destination.

Air cargo tracking has made it possible to not only follow the trail of the shipped cargo but for being prepared for all situations as and when they arise. People can now ascertain the temperature, packing status etc. of sensitive shipments to ensure safety as well as keep prepared with a further plan of action.

Companies should consider their supply chain goals and identify the appropriate level of investment required to get started. Many organizations can and should start small, using their business objectives to prioritize and pursue smart sensor pilots from which they can quickly learn. Organizations capable of larger implementations should deeply investigate and detail their goals to create clear priorities and a well-defined road map.

The impact of mobile and digital technologies has a lot to do with this and airports and air companies will have to embrace digital technologies quickly if they are to meet rising customer demands.

In order to keep up with a rapidly changing consumer marketplace, the logistics industry has work to do to make sure it's prepared for the technologies that will come to define it. The rise of the digitally discerning consumer and business customer has brought the sector to an important moment, where an appreciation of this new landscape is the key to remaining relevant.

By keeping in mind the digital technologies that are set to play an important role in facilitating this shift, logistics companies can be confident that they are on the right track, and are ultimately operating in a way that makes them fit for the future.

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