

DIGITALIZATION IN AVIATION INDUSTRY MANAGEMENT DURING A PANDEMIC

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***Abstract.** Digital initiatives are explored that relate not only to the technological and organizational aspects of airlines and their processes, but also those that affect all participants in aviation activities. The driving forces for adaptation to the standards set by the industry for all participants have been identified, namely the introduction of the latest information technologies and digital tools to position themselves in the competition for customers. A thorough examination of current aviation industry practices has demonstrated that digital development will remain key to restoring aircraft and flight operations to safer and more efficient operations. It was concluded that the development of digital operations through an integrated application ecosystem and connectivity tools will provide airlines with the necessary responsiveness to meet the new challenges and demands of the COVID-19 pandemic.*

***Keywords:** digitalization; aviation management; digital technologies; airline; operational efficiency; pandemic.*

Digital initiatives concern not only the technological and organizational aspects of the activities of airlines and their processes, but affect all subjects of aviation activity. Forced to adapt to the standards set by the industry, all aviation industry participants are adopting the latest information technology and digital tools to position themselves to compete for customers. In this regard, airports, airlines, ground handlers, air navigation service providers and new market players are positioned differently in digital competition. Aviation management requires the use of various tools to support the work, which also requires close cooperation of all entities for the optimal allocation of resources using digital means [9].

Despite extensive research activities on individual concepts such as digitalization, digital transformation in the aviation industry, emerging technologies and applications, etc., not all relevant dimensions between them have been analyzed in depth. In particular, society is interested in understanding whether digitalization can restore the institutional position of aviation companies, helping to improve their economic performance. Due to the limited research in this area, it is believed that this can be achieved through continuous development of knowledge and sustainable development, but the current challenges of a global pandemic confirm that the main goal of the measures taken is not only about sustainability. Therefore, the focus should be on exploring the potential of digitalization in ensuring the organizational resilience of the aviation industry.

Analysis of the latest research and publications.

The importance of data and technology for improving management in companies has been assessed in many studies linking them to productivity, innovation and workforce development or engagement [3].

Current research [2, 5, 6] shows that airlines investing in digital technology can potentially improve their customer satisfaction as well as their operational efficiency. Specific digital trends driving customer satisfaction are the Internet and Internet of Things (IoT), big data and blockchain,

while augmented reality (AR), automation and 3D printing are impacting flight performance. Successful adaptation of these technologies could potentially lead to improvements in overall airline efficiency, cost, flexibility and safety. However, before focusing on individual trends, it is vital to recognize the airline's current capabilities. Additionally, the airline needs to develop a robust digital strategy and implement it successfully.

Purpose of the article. The purpose of this article was to study the concept of digitalization in the context of its impact on the management of the aviation industry in the context of the global COVID-19 pandemic.

As has been researched, digital initiatives not only affect the technological and organizational aspects of airlines and their processes, but also affect all participants in aviation activities. At the same time, aviation management requires the use of various tools to support the work, which also requires close collaboration of all participants to optimally allocate resources through digital means.

Digitalization and the many developments that flow from it represent a complex framework that is important for any industry, and for the aviation industry in particular. This relevance itself stems, first of all, from the defining characteristics of the aviation industry - the ability to develop rapidly, in addition, it is supported by such important management components as cost structure, flight safety and intensity of competition, which play an equally important role.

Specific digital trends are highlighted that are driving customer satisfaction in the aviation industry and impacting performance, such as the Internet and Internet of Things (IoT), big data, blockchain, augmented reality (AR), automation and 3D printing, which have the potential to be successfully adopted can improve the quality of service.

Digitalization and the numerous developments resulting from it constitute an overarching framework that is important for any industry, and for the aviation industry in particular. This particular relevance stems primarily from the defining characteristic of the airline industry - the ability to develop rapidly, further supported by important management components such as cost structure, safety and intensity of competition, which play an equally important role.

In the era of large-scale digitalization, the aviation IT development industry faces a number of challenges associated with the combination of new distribution channels, social networks, Big data, cloud technologies, and the like. One of the main challenges of the time is the need to solve the security problem when software components are distributed and operated in hybrid clouds, the providers of which may be independent of each other. The challenge lies not only in defining and expressing the desired level of security in software, but also in how cloud services impact security assurance in the aviation industry.

However, effective digitalization does not begin with the adoption of the latest technologies, but with the transformation of organizations to harness the potential of digital solutions. This approach includes developing new business models, redefining business boundaries using digital technologies and rethinking the entire airline management system. In addition, education and training are an important aspect for implementing the digitalization process. It is essential that every employee understands the goals and benefits of digitalization while creating an appropriate organizational culture. Therefore, it is necessary to provide for the acquisition of certain knowledge and skills necessary to improve this process and provide new interdisciplinary qualifications.

In today's hyper-competitive environment, new sources of product and process innovation are constantly being sought to enhance airlines' competitive advantages. In the recent past, the digital revolution has inspired new management programs to strengthen their market position. For airlines,

the first web applications came in the form of asynchronous sites where customers could access more detailed schedule and fare information provided by travel agencies, albeit in new formats. Later, carriers began selling tickets online to take advantage of a cheaper distribution channel than standard computer reservation systems (CRS). Today, the Internet potentially allows operators to gain significant economic and competitive advantages beyond those simply coming from e-commerce. A broader e-business perspective can provide personalized relationships with target consumers and then refine the airline's system offering. At the same time, carriers can leverage significant cost savings in the procurement process.

We see digitalization as a radical rethinking of how an organization uses technology, people and processes to fundamentally change the effectiveness of its activities. That is why airline digitalization is not just about upgrading software or moving internal software systems to cloud services. Instead, it's about reinterpreting how an airline can incorporate the latest hardware and software into its processes to better serve its customers, add value and become more efficient.

Thus, digitalization in aviation management is mainly about the use of technologies to automate processes and attract passengers, including mobile applications, cloud technologies, blockchain technologies, big data, Internet of Things (IoT) and robotics. Another important aspect of modern aviation management is flow monitoring, which uses predictive and preventative measures, airport geolocation, identity management, flow control or radio frequency identification (RFID).

In general, the most important performance indicators were identified, the assessment of which can be based on the management and management of airlines within the framework of digitalization. These indicators were grouped according to the subjects of such influence (Table 1).

Table 1. Results of airline digitalization

Customer-focused results	Airline performance-oriented results
Improving the quality of passenger service (personalization and individual services)	Easier integration of a new partner or channel
Increase in additional services	More informative business analytics
Lifelong commitment to customer service	Protecting brand value
Improved customer support	Creating a Virtuous Innovation Cycle
Effectively manage crises and ensure flight regularity	Protection against disruptions in company activities

It is impossible not to note certain barriers that make it difficult for airlines to digitalize. First of all, the point is that the process of such digital transformation for airlines is very complex and poses huge challenges for management. Since there is a significant risk of losing relevance and competitiveness, airlines with a long-term development strategy must include digitalization planning in the very first stages. The challenge is that airlines have large, complex operations, and their systems are typically already embedded in legacy IT architectures (with data housed in databases throughout the organization), meaning that an airline's ability to quickly adopt an industry-leading commercial strategy is greatly reduced. limited). At the same time, modernizing the IT infrastructure requires large investments, which will allow combining databases and obtaining the ability to analyze in real time.

The period from 2014 to 2019 in the world history of the airline industry is determined by the relatively high profitability of airlines, despite numerous cases of bankruptcies (which were most likely associated with the action of market mechanisms of competition). Overall, airlines generated US\$175 billion in revenue from 2014 to 2019. But, undoubtedly, this period has undergone drastic changes due to the outbreak of the COVID-19 pandemic. Along with increasing revenues and profits, airline spending on technology and digital initiatives reached record levels year after year from 2014 to 2019 [7].

Airlines have actively embraced the concept of digitalization and begun to transform their operations. Numerous airlines (especially carriers and airline groups) have created new departments and incubators to develop innovative digital solutions. Some airlines have developed a strategy to evolve into a technology company that runs aircraft operations as a complement.

It should be emphasized that there are certain areas that can lead to the most rapid changes in the airline as a result of digitalization. For example, Lufthansa is recognized as a leader in the use of artificial intelligence, Air New Zealand is a pioneer in the use of augmented reality, while AirAsia has made significant strides in using facial recognition to improve customer service [1].

However, the 2020 pandemic has had a devastating impact on airlines' digitalization journey and their ability to develop modern digital solutions and offerings. That is why, during the recovery period (1-2 years), it is likely that airlines will again concentrate on their core business - air travel, while simultaneously suspending a significant number of their own technology projects and developments. Thus, the use of ready-made digital products will increase, and accordingly, dependence on the software and solution provider will increase.

The above trend will be coupled with the undeniable continuation and intensification of the digital revolution as the COVID-19 pandemic only accelerates digital developments around the world.

In daily flight operations, strategic digital improvements delivered through a suite of intuitive airline programs and services enable airlines to gain both current and future benefits. By supporting the tasks performed at each stage of flight, they can in turn help airlines optimize their overall operations.

Digitalization has increasingly transformed work processes. Yes, pilots gain access to a connected ecosystem of apps, services and documents that will shape future flights. Targeted apps offer pilots access to vital information using a handheld device. This will improve operational efficiency, situational awareness, collaboration processes and safety as part of the airline's overall digital profile. For pilots, the use of digital technology is a means of minimizing workload (for example, the ability to download briefings or send reports digitally using a handheld device).

The influence of organizational culture in modern aviation organizations can be decisive in the direction of digitalization. It is important to develop a new way of working and managing processes by developing a digital culture in the organization. A digital culture will promote transparency, encourage decision-making and improve collaboration among all market participants, encouraging them to survive and take risks. Thus, digital culture will significantly impact the operational efficiency and development of the aviation industry by changing the perception of social responsibility, which includes sustainable development as an important goal. In this regard, airline management must convey to employees the idea that the digitalization of the company depends on the entire team creating and maintaining an organizational culture that is conducive to work and development. For example, at Munich Airport, a vice president for digitalization was appointed to strengthen the digitalization process [4].

Conclusion. New information technologies have improved the possibilities for optimal resource allocation and qualitatively increased the level of risk management of flight operations of large airlines, and also posed new challenges to the airline's operational control system. Focusing on the basic requirements for digitalization and operational management of airlines, the overall architecture of such a system in airlines should be based on the pre-processing of flight risks and the architecture of the underlying risk management system. Key breakthrough technologies in the field of aviation management are, accordingly, based on service-oriented architecture, the use of new information technologies, data science and information security.

Digitalization was central to the management of the airline industry until the shock of the COVID - 19 pandemic. Airlines around the world have made progress in implementing their digital transformation strategies, investing in cloud services, data centers, wireless cabin crew services and automated data management are key components to achieve digitalization of airline operations.

At the same time, faced with the current challenges of the operating environment during the pandemic, many airlines are offering affordable smart solutions to operate more efficiently and economically during the crisis. This can also lead to airlines improving and rebuilding their operations for the long term and proactively supporting and adapting digital strategies.

Modern aviation practice shows that the development of digital technologies will remain a key factor in restoring the operation of aircraft and flights, making them safer and more efficient. Evolving digital operations with an integrated ecosystem of apps and tools that support connectivity will give operators the speed they need to address new challenges and demands post-COVID-19.

For flight digitalization to fulfill its role in improving profitability and efficiency, airlines must be able to cover different areas of expertise and comply with best practices.

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