УДК 330.341

JEL classification: M31, L86

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Отримано: 23.10.2021 р.
Прорецензовано: 03.11.2021 р.
Рекомендовано до друку: 16.11.2021 р.
Опубліковано: 16.11.2021 р.

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ТЕХНОЛОГІЧНІ РІШЕННЯ РОЗВИТКУ АЕРОПОРТІВ В ПЕРІОД ЦИФРОВОЇ ТРАНСФОРМАЦІЇ

АНОТАЦІЯ

Вступ. Цифрова трансформація вплинула на різноманітність ІТ-проектів, що активно впроваджуються в діяльність аеропортів. Нові технологічні рішення та інформаційні системи використовується в аеропортах у різних напрямків: відстеження пасажиро- та вантажопотоку, обслуговування повітряних суден, завантаження рейсів, фінансові операції, документообіг, контрактна логістика та інші процеси. Незалежно від того, які транспортні потоки обслуговує аеропорт, міжнародні або регіональні, які авіакомпанії забезпечують сполучення, інфраструктура, при цьому, повинна задовольняти сучасним вимогам з безпеки та технічної оснащеності.

Мета. Дослідження основних технологічних рішень розвитку аеропортів в період цифрової трансформації та їх вплив на підвищення безпеки та пропускної здатності аеропортів, а також ефективну та безперебійну роботу, наданого клієнт-сервісу у ланцюзі авіаційної послуги.

Метод (методологія). Теоретичною та науково-методологічною основою дослідження стали положення концепції цифрової та інформаційної економіки. У процесі дослідження використано такі методи та підходи як логічного узагальнення і синтезу для формування основних висновків і пропозицій дослідження; графічний – візуалізації результатів ідентифікації основних технологічних тррішеньендів розвитку аеропортів.

Результати. У статті визначено, що застосування сучасних технологій в аеропортах є наслідком динамічного розвитку авіаційної галузі та зростаючого попиту на обробку великої кількості інформації, забезпечення безпеки. Представлені фактори, як COVID-19, призводять до більш швидких змін, що стосуються останніх інновацій в авіації, автоматизації та цифровізації, на роки прискоривши процеси цифровізації галузі. Багато рішень, які спочатку сприймалися як революційні в індустрії авіації, ще не реалізували свій потенціал. Представлена класифікація основних технологічних рішень розвитку аеропортів, з описом технологічних рішень у період цифрової трансформації, може стати динамічним і стратегічним інструментарієм прогнозування та впровадження майбутніх проектів у розвиток інфраструктури аеропорту.

Катерна О., Молчанова К. Технологічні рішення розвитку аеропортів в період цифрової трансформації. *Економічний аналіз*. 2021. Том 31. № 3. С. 143-149.

DOI: https://doi.org/10.35774/econa2021.03.143

Ключові слова: аеропорт; інформаційні системи і технології; модернізація інфраструктури; технологічні рішення; технології Big Data; цифрова трансформація; штучний інтелект.

UDC 330.341

JEL classification: M31, L86

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Received: 23.10.2021
Revised: 03.11.2021
Accepted: 16.11.2021
Online publication date: 16.11.2021

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TECHNOLOGICAL SOLUTIONS FOR AIRPORTS DEVELOPMENT DURING THE DIGITAL TRANSFORMATION PERIOD

ABSTRACT

Introduction

Digital transformation has influenced the variety of IT projects and is being actively implemented in airport operations. New technological solutions and information systems are used at airports in different directions: tracking passenger and cargo traffic, aircraft maintenance, flight loading, financial transactions, document flow, contract logistics and other processes. Regardless of which traffic flows are served by the airport, international or regional, which airlines provide communication, the infrastructure must meet modern safety and technical requirements.

Purpose. Research of technological solutions for airports development during the digital transformation period and their impact on improving the security and capacity of airports, as well as the efficient and smooth operation of the provided customer service in the aviation service chain.

Method (methodology). The theoretical and scientific-methodological basis of the research is the provisions of the concept of digital and information economy. In the process of research, the following methods and approaches were used as a logical generalization and synthesis to form the main conclusions and proposals of the research; graphic – visualization of the results of identification of the main technological trends of the airports development.

Results. The article determines that the use of modern technologies at airports is a consequence of the dynamic development of the aviation industry and the growing demand for processing a large amount of information and ensuring security. Factors such as COVID-19 are presented, leading to faster changes regarding the latest innovations in aviation, automation and digitalization, accelerating the digitalization of the region for years. Many solutions that were initially perceived as revolutionary in the aviation industry have yet to reach their full potential. A classification of the main trends in the airports development has been formed with a description of technological solutions in the period of digital transformation, which can become a dynamic and strategic tool for forecasting and implementing future projects in the development of airport infrastructure.

Katerna, O. and Molchanova, K. (2021). Technological solutions for airports development during the digital transformation period. *Economic analysis*, 31 (3), 143-149.

DOI: https://doi.org/10.35774/econa2021.03.143

Keywords: airport; information systems and technologies; infrastructure modernization; technological solutions; Big Data technologies; digital transformation; artificial intelligence.

Introduction

The aviation industry is one of the main levers of economic development in any country. A modern aviation hub and its infrastructure in servicing international and domestic flows must meet modern safety and technical requirements. The use of modern technology at airports is a result of the dynamic development of the aviation industry and the growing demand for information processing and security. Thus, the use of modern technologies in servicing passenger and cargo flows, aircraft traffic control, while processing a large amount of information, is growing from a national to a global scale. The scale and variety of projects in the civil aviation market is evidence that the industry is actively undergoing digital transformation processes.

The development and implementation of information systems and technologies in the aviation industry have been considered by many scientists. Ya. M. Dalinger [1] in his work considered the problem of creating the information environment of the airport, as an enterprise focused on the production of services. Overlook according to his opinion, the requirements for the information environment must be invariant [1, P.84].

Other authors Gnatyuk S., Vasyliev D. [2] in their work managed to classify modern aviation information systems with three main categories: information systems of air navigation services, on-board information systems of aircraft, information systems of airlines and airports.

Romanian scientists Zaharia S. and Pietreanu C. [3], using the example of Henri Coanda International Airport, analyze the technological problems caused by the necessary equipment for the digital transformation of the airport. Their work offers solutions for check-in, security, customs control, departure control and passenger assistance services.

A lot of research related to the development and implementation of smart technologies in the aviation industry and an integrated support system belongs to Chinese scientists, in particular Xiangsheng Dou [4] and Rui Qiu, Shuhua Hou, Xin Chen, Zhiyi Meng [5].

Pereira B., Lohmann G., and Houghton, L. (from Australia) in their research highlighted best practice examples of leading aviation companies such as the International Airlines Group (IAG), Emirates Airline Singapore, Boeing and Jet Blue to provide insight into existing collaboration that has led to innovation and value creation in the aviation sector [6]. The model they propose includes factors such as strategic decision making, networking and partner selection, cultural context, values, behavior and interoperability, collaboration configuration, integrated information technology, and the like.

Iranian scientists Khosropour H., Feizi K., Tabaeean K., and Taheri, Z. ([7] investigated the impact of open innovation on technological intelligence in the aviation industry.

A considerable number of scientists have been involved in the study of the implementation of energy efficient (green) IT and IS in the aviation industry and their subsequent impact on the environment [5; 9].

However, during the global crisis that triggered the COVID-19 pandemic, air transport provided the most relief in the hardest hit regions. In this regard, attention to digital transformation in airport operations is now more important than ever, especially in the context of increasing the comfort and safety of air carrier services and reducing prices.

Purpose and objectives of the article

The purpose of the article is to analyze the main technological solutions that affect the development of airports during the period of digital transformation and investigate their impact on improving the safety and capacity of airports, as well as the efficient and smooth operation of the provided customer service in the aviation service chain.

The theoretical and scientific-methodological basis of the study was the concept of the digital and information economy. In the process of research, the following methods and approaches were used as a logical generalization and synthesis to form the main conclusions and proposals of the research; graphic – visualization of the results of identification of the main technological trends of airports development.

The main material of the research. According to the experience of introducing new digital technologies at the world's leading airports, they can reduce flight delays, improve and speed up the procedures for servicing passengers, cargo clientele, airlines and other aviation entities, and ensure the safety of air transportation.

Innovation is key to the development of the aviation industry. Digitization is driving significant change, and the shaping of major trends affecting airport operations can provide a roadmap for innovation and help structure and revitalize flagship projects and research in the field. The introduction of new technologies in the activities of airports caused by digital transformation concerns the following areas:

- unmanned transport control and automated control means of mechanization at airports,
- electronic document management,
- transition to the simulation of traffic flows in real time,
- the use of Big Data technology and artificial intelligence (AI), in particular, to optimize the operation of the transport infrastructure and its expansion.

All these technologies are being actively implemented today in the activities of airports, various software are being developed by IT companies and new technological solutions. For example, artificial intelligence technologies are already actively used both on board (in the aircraft avionics complex) and in the airport terminal itself.

Giving examples of the introduction of innovative technologies, it is worth noting Changi Airport in Singapore, where self-service terminals with biometrics were introduced in 2017. Also, the airport's automatic checkpoint uses face recognition technology. In 2018, Dubai Airport, which is considered the busiest in the world, opened a biometric tunnel for passport control. Biometric Tunnel helps you save time and control in 15 seconds. Delta has developed a technology recognition device at a terminal at Hartsfield-Jackson Atlanta International Airport (ATL). Thus, the air carrier decided to offer its customers passport control. In 2019, recognition terminals were also installed at Los Angeles International Airport (LAX), Bangalore (India), Gatwick and Heathrow (UK), Hong Kong International Airport and Dallas Fort Worth Airport [12].

In 2018, Korea's Incheon Airport began using modern smart technology. In addition to biometric identification, passengers can use delivery services to send their luggage to and from the airport. Chatbots based on artificial intelligence provide round-the-clock service at the airport through the "KakaoTalk" application, and from 2023 they will provide parking services. In 2018, Munich Airport and Lufthansa presented the work of Josie Pepper, developed by SoftBank Robotics. Its mission is to provide passengers with information using cloud-based artificial intelligence technologies IBM Watson Internet of Things (IoT). In the same year, Haneda Robotics laboratory tested a series of tests of several robots at Tokyo International Airport. The first Reborg-X, equipped with a touch panel and intrusion detection technology, is planned to be used for security (acting as a security guard) and escorting passengers. Also in Tokyo, they tested the compact robots Cinnamon and Robocot, whose task is to communicate and advise passengers. To this end, both robots were equipped with artificial intelligence technology [12].

Robotics and automation technologies maintain zero defects in all airport processes and bring new levels of productivity. A new generation of robots and automated solutions, the use of artificial intelligence is becoming a real alternative to manual processing.

An analysis of the study of the main technological solutions revealed that they are dynamically appearing in all modern airports, making it possible to distinguish among them biometric identification, the use of artificial intelligence and robots, blockchain, and technologies for baggage tracking.

For aviation hubs, the introduction of biometric technologies is not only a tool to improve the provision of airport services, security, but also the ability to avoid queues and reduce the load on the airport infrastructure.

Airports, as a strategic object, always fight against crime, terrorism and illegal migration. Biometric identification helps not only to protect airport passengers, but also to improve the level of international security in general.

Another effective way to improve airport security is video surveillance systems with face recognition technology. In 2020, RecFaces, together with Pelco, implemented a project to implement biometric identification at Nairobi International Airport (Kenya). The VxFaces face recognition module, integrated with the Pelco VideoXpert video surveillance system, allows you to quickly identify an unwanted person in the passenger flow. For example, a wanted criminal or potential terrorist [12].

When it comes to safety, it is worth noting that the airport is not only about serving passengers and airlines, but also thousands of employees and service personnel. The use of face recognition technology makes it possible to effectively delimit access to office premises and prevent illegal entry into secure facilities by persons who do not have the right to do so.

Note that the introduction of technological solutions also affects the additional income that the airport can receive from non-aeronautical activities by minimizing the passenger's time at the pre-flight stage. This, in turn, will allow the passenger to stay longer in duty free, restaurants and the like. Thus, experts from the Airports Council International (ACI) found that an increase in passenger satisfaction with pre-flight procedures by 1% increases the income of shops and cafes at airports by 1.5% [13].

The largest developers of biometric solutions are the following companies: ASSA Abloy; Aware; Bio-Key International; Cognitec Systems; Daon; Facebanx; Fujitsu; Fulcrum Biometrics; NEC; Precise Biometrics; Safran; Secunet Security Networks; Securiport; Stanley Black & Decker; Thales.

The main factors affecting the demand for the introduction of biometric technologies at airports are the threat of terrorist attacks and the demand for surveillance systems. The only thing holding back this trend is the high cost of these technologies.

The basis for efficient and smooth operation of the airport is the presence of artificial intelligence in it. The use of Digital Twin technologies for real-time operation allows for a computer simulation that uses data from the entire airport and airlines for further interaction and prediction, improving the quality of passenger service. This data is then used to optimize operations and maximize automation.

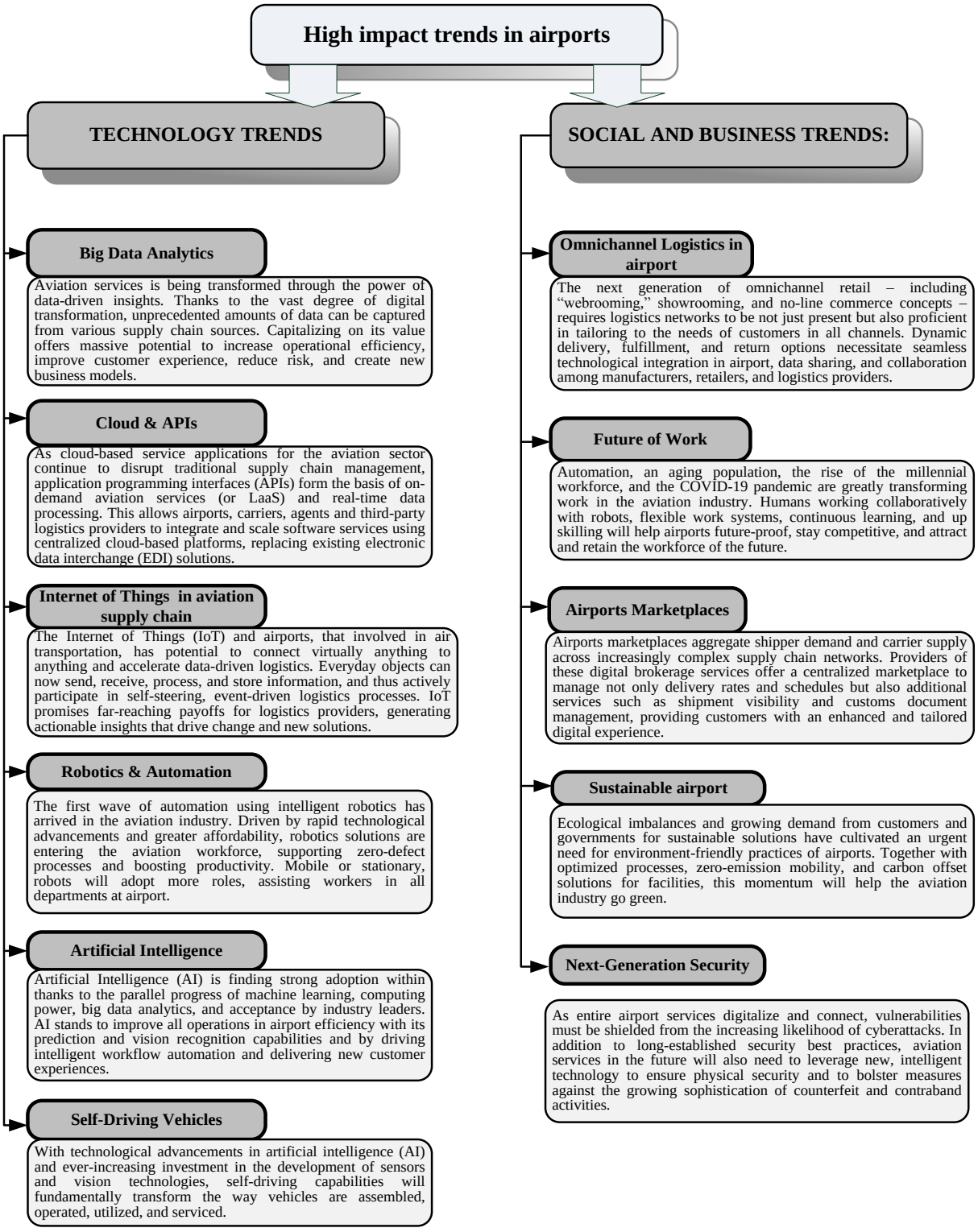

Fig. 1. Main trends of influence on the development of technological solutions at airports

Source: compiled by authors.

Thus, it is possible to send voice messages to employees of various airport services – from immigration to cleaning.

Thus, technological solutions for the airports development are a dynamic and strategic tool for forecasting operational tasks, generate additional revenues, optimize flows, and make airport operations more efficient.

In fig. 1 shows the Main trends of influence on the development of technological solutions at airports.

The classification of the main trends presented by us demonstrates the fact of fast process of transformation of technological decisions of airports development. The global pandemic has led to more rapid change in the latest innovations in aviation, automation and digitalization, accelerating the industry's digitization process for years.

Conversely, many trends that were initially perceived as revolutionary in the aviation industry have not yet realized their potential. From cloud computing to general robotics, big data analytics, to artificial intelligence and the Internet of Things, aviation professionals need to understand the importance of the huge market for emerging technologies. In order to optimize the management and use of energy resources, the life support systems of a modern airport should be integrated with each other.

This makes it possible to centrally manage all operations at the airport, including all climatic parameters, reducing the load on each of the systems separately. The high degree of automation available with this approach can significantly reduce the workload on maintenance personnel and the number of errors associated with the influence of the human factor. The integration into the common information space not only of life support systems, but also of integrated security systems also yields excellent results. A single approach allows for a higher level of redundancy for all connected subsystems.

Thus, airport modernization is the new imperative for long-term success. Those airports that are most likely to introduce and scale up new technologies, as well as improve the skills of their employees, will gain a significant competitive advantage in the market.

Conclusions and prospects for further research

The conducted research of the influence of technological solutions on the development of the world's airports during the period of digital transformation show the feasibility of introducing various latest technologies into their activities in order to timely predict future passenger and cargo flows and predict possible solutions. Trends in simplifying airport operations, saving passengers time and ensuring security at the same time, affect the receipt of additional financial revenues and the use of infrastructure facilities. The megatrends that will continue to be relevant are the development of new technologies, the growth of e-commerce. It should be noted that some areas of the economy will grow faster than others, so it is important to understand the underlying trends and their impact on airports – not least because of the impact of COVID-19 on global trade and workforce.

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