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The impact of Covid-19 on the digital transformation of the airports

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Abstract

The smart airport concept has become the future of airport operations and it can completely change the industry towards adapting to modern technologies. The paper is focused on the digital transformation of the airports and the impact of Covid-19 on the digital transformation of the airports. The paper contains qualitative primary research in the form of structured interviews with competent persons working in executive functions in the field of operation, safety and maintenance at the airports that were the subject of the research. Qualitative primary research is focused on airports in Slovak republic and Czech Republic. The data that are obtained via structured interviews create a comprehensive picture of the issue of digital maturity of Czech and Slovak international airports as well as the impact of Covid-19 on digital transformation of the observed airports.

1. Introduction

The modern aviation industry is currently developing very fast and the airports have undoubtedly become a gateway to all parts of the world. The rapid growth of the aviation industry and the growing number of passengers pose an important challenge for international airports in ensuring the maximum efficiency of airport processes in order to reduce operating costs, improve passenger comfort and ensure maximum safety (Sekera and Novak, 2021). To meet the above requirements, airports are resorting to the implementation of digital solutions and thus become advanced.

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The process of digitization began as in the 1980s, when airlines and ground-handling companies expressed an interest in sharing IT equipment to reduce the cost of setting up new airlines. Today's aviation industry is in the aviation development phase - Aviation 4.0, thanks to technological advances and all the technologies developed in the digital revolution (Nau and Benoit, 2017). Digital Transformation seeks to integrate Industry 4.0 technologies into all areas of business to fundamentally change the way it works and delivers value (Mrna et al., 2021). Therefore, it is a process based on continuous improvement in order to achieve digital maturity - a time when intelligent systems are fully deployed and integrated (Janoskova et al., 2021).

The level of technological adaptation of the airport can be considered as digital maturity. The adaptation of airport technology can be divided into four phases - Airports 1.0, 2.0, 3.0 and 4.0 (Halpern et al., 2021). These phases form the airport's digital model of maturity. Traditional airports with manual processes and basic IT solutions are called Airports 1.0. At the next level, Airport 2.0, where some processes are automated to reduce costs and place more emphasis on the passenger experience. Therefore, self-service check-in facilities and Wi-Fi technology are provided.

The phase in which all levels of airport passenger service are equipped to provide full self-service is called Airport 3.0. Airport 3.0 has implemented fully automated processes. The digital transformation involves phase four, referred to as Airport 4.0, which is a synonym to the smart airport. This is a shift in the way digital technologies are received and used (Atzori et al., 2010). Values are created from data that is captured and shared with a number of key parties in real time using intelligent data features (Rajapaksha and Jayasuriya, 2020). Airport systems and processes are integrated within a wider digital ecosystem that brings together key stakeholders.

The latest technologies are pushing the aviation industry towards smart airports (Nau and Benoit, 2017). The latest technologies in airport solutions use, for example, smart gateways, smart check-in, smart baggage tracking, face recognition, biometric recognition, navigation at airport terminals using mobile devices, security IP cameras, data analysis, monitoring of anomalous passenger behaviour (Rajapaksha and Jayasuriya, 2020).

Airport 4.0 also known as smart airport manages, captures and processes all airport operations, including passenger experience and traffic management within the aviation ecosystem. Airports are truly digitally interconnected through a variety of intelligent systems and technologies, including IoT and big data analysis (Narongou and Zhaohao, 2021).

The Covid-19 pandemics significantly affected air traffic in 2020 and 2021 (Rostas et al., 2021). At present (2022), air traffic has gradually begun to revitalize from the huge negative impact of the pandemic. However, the Covid-19 pandemic has also created many opportunities for digital transformation at airports. One of the advantages of smart solutions is the possibility of contactless services, which helps to increase security at airports.

In response to Covid-19, Hamad International Airport has invested in Smart Screening Helmets, which are wearable smart helmets that allow contactless temperature measurement of passengers. It is a supplement to fully autonomous UV disinfection robots, which emit concentrated UV-C light eliminating most infectious microorganisms. The robots are strategically placed in the busiest passenger areas to reduce the spread of pathogens (Doha Hamad Airport, 2021).

Changi International Airport has integrated autonomous cleaning robots equipped with spray technology and UV-C LED technology in the terminals to safely disinfect surfaces against the spread of pathogens (Changi Airport, 2021).

In 2020, Vancouver International Airport incorporated an ultraviolet cleaning lamp and a contactless screen protector into the kiosks. UV cleaning technology performs a three-minute cleaning cycle that eliminates surface bacteria. The protective glass captures light and transforms it into a source that removes germs (Scribd, 2021).

Houston International Airport uses autonomous robots to ensure a clean airport environment. The robots autonomously clean and disinfect terminal floors and surfaces. The SC50 works on the principle of using UV technology, which focuses on viruses and pathogens, and LIDAR remote sensing technology, which measures the distance to objects and targets using a combination of laser lights and cameras, so that the robot can independently disinfect (Fly2Houston, 2022).

Due to the pandemic situation, Munich International Airport has introduced a contactless check-in solution. However, the device is not equipped with any other advanced technology to remove bacteria. The airport tried to eliminate bacteria by dispensers with disinfectants, which were provided to passengers to a sufficient extent, and regular disinfection of surfaces by airport staff. (Munich Airport, 2021).

In 2020, a new generation of thermal scanners was installed at Rome Fiumicino International Airport to monitor the body temperature of passengers. Smart helmets are equipped with an infrared temperature sensor that continuously monitors the body temperature of passengers (Li et al., 2021).

2. Methodology

The aim of this scientific paper is to find out what the impact of the Covid-19 pandemic was on the digital transformation of airports. To achieve the desired result, it is necessary to use methods of excerpting, analysis of the current state, statistical methods, primary research, induction and deduction. To achieve the main goal, qualitative primary research is carried out at Slovak and Czech airports.

Qualitative primary research is carried out through structured interviews with competent persons working in executive functions in the field of operation, safety and maintenance at the airports that are the subject of the research. Qualitative primary research is taking place at 4 Slovak airports (Zilina, Piestany, Bratislava and Poprad-Tatry) and at 4 Czech airports (Prague, Pardubice, Karlovy Vary and Brno-Turany). All these airports are international and are the most frequently used airports in Slovakia and the Czech Republic.

The structured interview plan took place in the following phases:
1. delimitation of the sample of international airports of the Czech Republic and Slovak Republic to be addressed,
2. addressing airports,
3. elaboration of interview questions,
4. conducting interviews,
5. summarizing the answers in a table,
6. analysis of interviews.

When evaluating qualitative primary research, responses from 8 respondents who provided a structured interview are processed and evaluated.

3. Results

In this section are provided results from the qualitative primary research and answers from respondents to three selected questions from the research that are concerning the paper. Question 1 is aimed at determining the current state of airports in terms of the use of technology. The responses of the individual airports are given in Table 1.

Table 1. Respondents' answers to Question 1

Airport	Answers to Question 1
Zilina	*"Due to the volume capacity of Zilina Airport, which represents hundreds of passengers a year, the airport is still equipped with basic (traditional) mechanisms for passenger and cargo handling. "*
Piestany	*"Piestany Airport is currently at the level of a traditional airport using manual airport processes. "*
Bratislava	*"Bratislava Airport uses the digitized Altea system to review and manage passenger boarding pass reservations, including additional services such as extra luggage, overweight or seat, and this system works remotely with other various reservation systems of specific airlines operating at BTS airport so that all information in the Altea system is up-to-date at the time of airport passenger check-in. The airport also uses state-of-the-art 3D baggage scanners that scan inserted items in a fully rotatable display on the operator's screen, which are also connected to an automatic box carrier for more convenient handling. It is also worth mentioning the digital border control system for verifying travel documents during the entry / exit of passengers from / to Schengen. "*
Poprad-Tatry	*"LZTT Airport is currently technologically at the level of a traditional airport with a minimum of modern technologies implemented in the check-in process. The process of handling passengers and luggage still takes place manually without the use of self-service kiosks or automatic baggage marking. "*
Prague	*"In addition to the conventional method of check-in at check-in counters, passengers at Prague Airport also have facilities available for self-service check-in – CUSS kiosks, Self-Service Bag Drop. Automatic boarding pass validators are used to control the entry of passengers into the non-public area of the airport. Passengers over the age of 15 who hold a biometric passport issued by an EU, EEA or Switzerland can use the Easy-Go-Gates automatic biometric gates during departure and arrival border checks at Terminal 1. Baggage sorting at Terminals 1 and 2 is fully automated. "*
Pardubice	*"Pardubice Airport uses traditional passenger and baggage handling services in the Amadeus Altea and GO-NOW systems. "*
Karlovy Vary	*"LKKV Airport uses only the traditional PAX / BAG check-in procedure. No smart devices available. "*

Brno-Turany	*"BRQ uses a more traditional technology solution – a classic check-in system for passenger check-in, including boarding, a semi-automated security baggage sorting system, manual baggage sorting before loading onto the aircraft, web interfaces for FIDS control and an internal information system (intranet)."*

Currently, the traditional processes of internal operations and airport services predominate at most of the evaluated airports. The airports surveyed still use manual check-in of passengers or cargo, manual baggage sorting or physical search of passengers at security checks. An exception between airports with traditional processes are Prague and Bratislava airports. They use automatic solutions to increase passenger comfort, efficiency and reduce costs.

The digital maturity of the assessed Czech and Slovak airports is at the level of Airports 1.0, 2.0 and 3.0, which is graphically shown in Fig. 1. Bratislava Airport uses control with partial automatic processes, and therefore belongs to the Airport 2.0 category. Prague Airport falls under category 3.0 and partly under 4.0, as it also offers the use of biometric control via EGG.
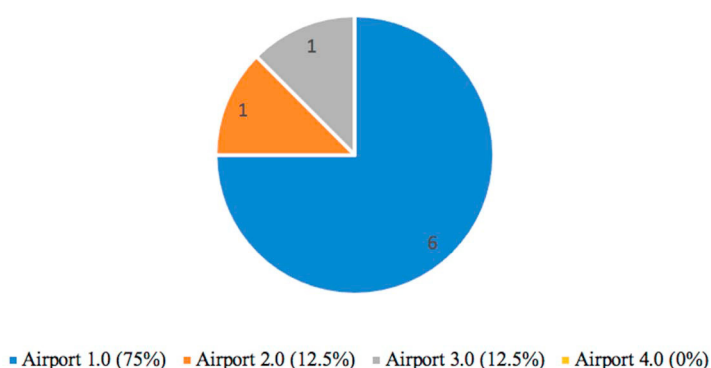

Fig. 1. The digital maturity of the assessed airports

Only two airports answered "yes" to Question 2, which examined whether airports have smart solutions. The smart solutions they have are listed in Table 2.

Table 2. Respondents' answers to Question 2

Airport	Answers to Question 2
Bratislava	*"Bratislava Airport has two self-service entrance gates before entering the Security Check. The gates will open to passengers after scanning the BAR / QR code on their boarding passes for the day. At the same time, each scan of the code is marked in the Altea system, thus creating a better overview of the passenger's movement at the airport in real time. Any other smart device requires a large amount of funds, which in the case of Bratislava Airport are often unavailable due to the extraordinary financial loss in the last pandemic period, including long-term debts in the form of the last decades. Bratislava Airport has the i720 SkyLane Single Lane self-service gateway from Amadeus IT Group, S.A."*
Prague	*"Prague Airport has self-service check-in of passengers and luggage, technology for fully automated baggage sorting and biometric check-in of passengers at border checks. The number of installed devices covers the current demand for their use. With the gradual development of self-service technologies, an increase in the number of available devices is expected. Prague Airport has at its disposal: CUSS kiosks (32 pcs, SITA Smart Path TS6 Kiosk), self-service bag drop (12 pcs, SITA Scan & Fly), boarding pass validators (18 pcs) and Easy-Go-Gates (17 pcs). "*

Bratislava and Prague airports are the only airports surveyed to use smart solutions. Currently, Bratislava has self-service gateways that scan bar codes or QR codes for boarding passes. At the same time, the airport collects passenger data to improve the operational efficiency of airport processes. Prague has facilities for self-service check-in of passengers and luggage, for fully automatic baggage sorting and biometric border control.

With regards to Question 3, which asks whether airports plan to implement smart solutions, five of the eight airports surveyed respond that they plan to introduce smart devices in the near future (Fig. 2). Zilina Airport states that the

introduction of smart solutions may take place in 2023 with the renewal of regular routes, Bratislava Airport plans to increase the number of self-service gates during 2022. Prague is currently working on a pilot project to introduce smart solutions and Poprad–Tatry and Brno–Turany airports implementation is predicted until 2025. The other airports surveyed do not intend to innovate airport processes in the form of smart solutions, mainly due to low traffic intensity.
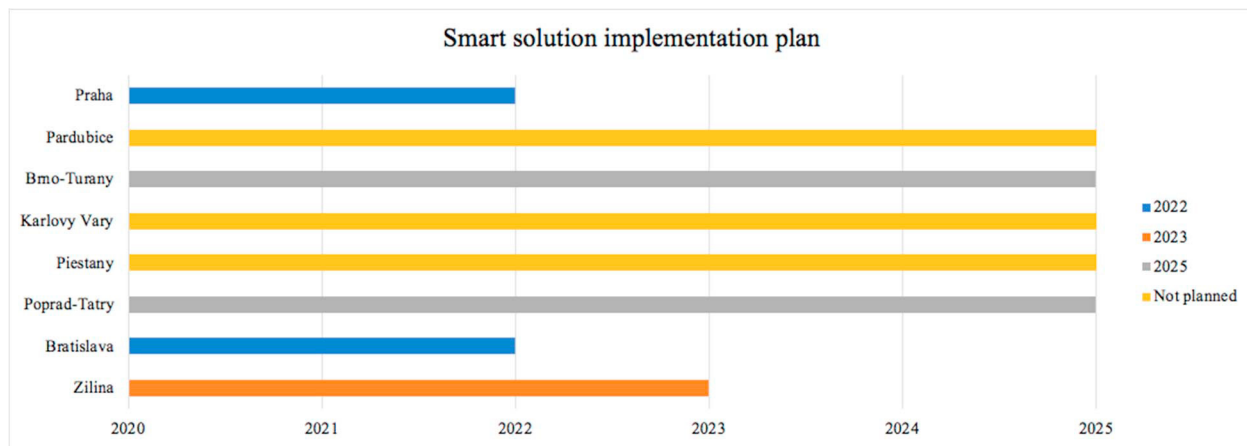

Fig. 2. Smart solution implementation plan of the assessed airports

A common attribute of most of the surveyed airports in the disposition of smart solutions is low traffic intensity and financial deficit. These shortcomings are also affected by the Covid-19 pandemic situation, which significantly affected the aviation industry in 2020 and 2021.

4. Conclusion

The data provided in the structured interviews create a comprehensive picture on the issue of digital maturity of Czech and Slovak international airports. Most of the airports surveyed agree on the formulation of responses concerning the current state of the airport in terms of the use of technology and in assigning an appropriate level of digital maturity.

The digital maturity of most of the examined airports is at the level of Airport 1.0 and only in the case of Prague Airport it exceeds the level of Airport 2.0. The populations of the Czech and Slovak Republics are not comparable to the populations of countries whose airports are at level 4.0, which also largely indicates that the digital level of most Czech and Slovak airports will not be equal to the current digital level of the mentioned world airports.

The introduction of new technologies facilitates and accelerates the digital transformation of airports. Today, digital transformation is moving rapidly, pushing the boundaries by offering new solutions to the airport problems. Many airports around the world have undergone a digital transformation, benefiting from positive operational efficiency.

On the other hand, many airports are in the early stages of this challenge, which includes understanding the use of large amounts of data, the ability to respond to new smart solutions and, last but not least, the development of new security solutions. Being a smart airport may end up seeming much more complicated than just being digitized or innovative. In addition, the smart airport must be prepared to make the most of the technological potential of the smart solution, to set strategic priorities according to its strengths and weaknesses, and to give the company a competitive advantage.

Like all areas of transport, the aviation industry will always try to adapt to current trends or emergencies. After all, this was the case in connection with the Covid-19 pandemic situation. Air transport worldwide has suffered a significant loss, representing, among other things, a rapid decline in profits and the number of passengers carried. Given the pandemic situation, many smart airports have adapted to the introduction of internal traffic technologies in order to reduce human contact at checkpoints and create safer and more efficient processes for airport staff and passengers.

While large international airports, with high numbers of passengers carried per year, were able to find ways to keep airports open during the Covid-19 pandemic, smaller international airports, such as those in Slovakia and the Czech Republic, had to significantly reduce their activities in certain areas. Large international airports, which even before the pandemic implemented smart solutions, were able to find solutions that made it easier and smoother to operate during the pandemic. On the contrary, smaller airports, which have little or no experience in deploying smart solutions, have not been able to start or continue to deploy smart solutions during the Covid-19 pandemic, mainly due to the lack of funding, reduced passenger traffic and airport closures.

Airports in the Slovak Republic and Czech Republic are aware of the possibilities for digital transformation in the future. Airports are also aware that without digital transformation, they will not be able to compete with smart airports in the future.

Acknowledgements

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