

UDC 005.334:656.7; 616.98:578.834]:656.7

CERIF: T 310

DOI: 10.51204/Anali_PFBU_22405A

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***IMPACT OF COVID-19 ON THE AVIATION INDUSTRY:
AN OVERVIEW OF GLOBAL AND SOME LOCAL EFFECTS***

The COVID-19 pandemic temporarily paralysed demand for air travel causing long-term implications for all industry stakeholders involved. Nobody was spared, and without government support, many airlines, airports and air

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navigation service providers (ANSP), would have gone out of business already in the first year of the pandemic. In order to assess the global impact of COVID-19 on the aviation industry, this paper reviewed data from publications by various international aviation organizations, academic papers, and annual reports by airlines, airports and ANSPs, etc. The findings show that the global aviation industry was severely hit by the pandemic, pushing all stakeholders to adopt countermeasures, with the most common response by airlines being the reconfiguring their networks and capacity or switching to cargo operations, airports and other operators reacted by reducing staff numbers, while passengers had to adapt to the new travel rules and the new normality.

Key words: *Aviation industry. – COVID-19. – Government support. – Passenger experience. – Response to crisis.*

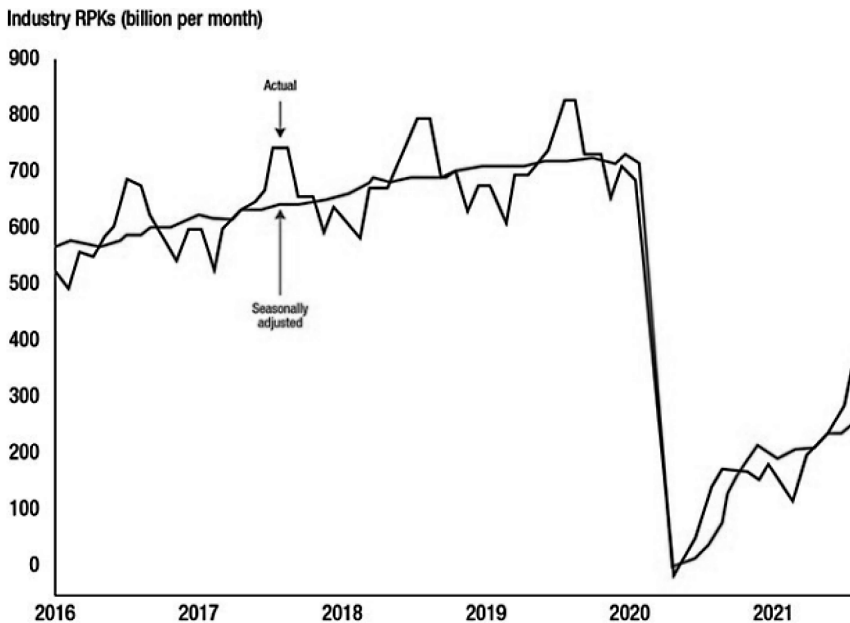
1. INTRODUCTION

The pandemic caused by the COVID-19 disease has had a very negative impact on air travel demand, driving the aviation industry in 2020 to perform the worst results in the recent history of civil aviation, both in term of the transport of passengers and the transport of goods, Figure 1 (IATA 2021). The pandemic caused financial harm to all aviation stakeholders, most notably to airlines. They all reported massive net losses in 2020 in their income statements, with the exception for cargo airlines, which benefited from the rise in demand for air cargo (Bouwer *et al.* 2022). Although it was anticipated that in 2021 the aviation industry might recover from the impacts of the pandemic in 2020, only a moderate recovery in domestic travel was recorded, while international travel remained stagnant.

As of 24 March 2020, many airlines had temporally suspended (or ceased) their operations, and to make matters worse, the recovery of the operations pattern for COVID-19 turned out to be highly uncertain and substantially different than the short-sharp V-shaped pattern observed after the SARS outbreak (Suau-Sanchez *et al.* 2020). IATA (2021a) reported that the COVID-19 pandemic caused global passenger demand (revenue passenger kilometres or RPKs) to drop by 65.9% in 2020 compared to 2019, consequently leading to a decrease of airline passenger revenue by USD 418 billion – a 68.9% drop compared to 2019. According to IATA Outlook (2021b), in 2020 airlines posted the largest ever collective net loss – USD 126.4 billion. At the peak of the crisis, in April 2020, 66% of the world's commercial air transport fleet was grounded as governments closed borders or imposed strict quarantines (IATA 2021). The impact of COVID-19 on

global scheduled passenger traffic in 2021 (compared to 2019 levels), was slightly better; resulting in an overall 40% reduction in seats offered by airlines, a 49% reduction in passengers carried, and approximately USD 324 billion in net loss of gross passenger operating revenues of airlines (ICAO 2022). The effects of this crisis significantly outweighed the effect of the 2008 economic downturn, during which the airline industry reported USD 30 billion in net losses – an abrupt end to a 10-year profit run. In the long term, the impact of COVID-19 on the global air transport system appears to be more profound on the international market, in which airlines typically generate a large amount of their revenues.

Figure 1.
Global air passenger traffic (in revenue passenger kilometres – RPKs)



Source: IATA, 2021

The aviation industry in every region of the world has been strongly affected by the pandemic, and this significant drop in air traffic has given rise to public policy concern for the survival of many stakeholders in this sector, but most notably for flag carriers and international hub airports. Given the vital contribution of aviation to global trade, as well as to the overall labour market, many governments across the world have provided financial and other means of support. This, in turn, has given rise to concerns about competition and the maintenance of a level playing field in the air transport sector.

Taking all this into account, the aim of this paper is to explore the overall implications of the COVID-19 pandemic on the global aviation industry, identifying problems and highlighting different policy responses to the ongoing crisis. We examine the impact on aviation industry in the following areas: airline business and operations, airport business and operations, air navigation service providers (ANSP), aircraft manufacturers and leasing companies, general aviation, and passenger experience. The structure of the paper is as follows. Section 2 reviews the related studies on the impact of COVID-19 on aviation. Section 3 provides an overview on how the demand drop and flight suspensions affected the global air transport market. Sections 4, 5, 6, 7 and 8 discuss the impact on different stakeholders in aviation industry. Section 9 provides an overview of the aviation industry in Serbia during pandemic. Finally, the paper concludes by discussing future considerations for operators in the aviation industry who are still seeking how to restructure their operations and adapt to the new reality, and what lessons have been learned from the past two years.

2. LITERATURE REVIEW

The impact of COVID-19 on aviation has been the subject of many research papers due to its importance to society and the economy as a whole, especially during 2020 and 2021. All these papers used currently available data with the aim of determining the relationship between the state of reduced air travel demand and the pace of recovery, predicting the direction in which air transport will develop further, and anticipating recovery patterns from one of the strongest crisis that has ever hit the aviation sector. With regard to the research areas, the recent literature which investigates the impact of the COVID-19 pandemic on the aviation industry was thoroughly analysed, and the main findings are summarized in Table 1.

Table 1.
Selected papers on the impact of the COVID-19 pandemic
on the aviation industry

Author, year	Research area	Region	Main findings
Kim, Sohn 2022	Passenger, airline, and government policy	South Korea	<u>Passenger responses</u> : int. air passenger demand declined by more than 90%; domestic passenger demand recovered to 2019 levels in August 2020.

Author, year	Research area	Region	Main findings
Kim, Sohn 2022	Passenger, airline, and government policy	South Korea	<p><u>Airline responses</u>: domestic route transitions, cargo transport, and mergers and acquisitions; full service carriers (FSC): operations on indispensable int. routes; labour strategies (retirement, rotational unpaid leave, working from home, wage cutbacks, layoffs), loans, asset sales (real estate, company housing); low cost carriers (LCC): new domestic flights and increase of proportion of routes; exits from the market.</p> <p><u>The government responses</u>: established an airport quarantine system at Incheon International Airport; subsidies to airlines and airports.</p>
Beck, Hensher 2020	Passengers	Australia	<p><u>Survey results</u>: 37% of passengers experienced some kind of disruption to their planned travel; interrupted travel was primarily international (63%) as opposed to domestic (55%); almost half of respondents cancelled travel (49%), a large number returned tickets for vouchers or credit with the airline, with 11% having rebooked their flights for a later date.</p>
Schultz <i>et al.</i> 2020	Aircraft ground operations	General	<p>The passenger boarding process was prolonged due to physical distances between passengers, expansion of standard cleaning, and the disinfection after each flight. A significant extension of boarding times if the physical distance rule was applied.</p>
Sun <i>et al.</i> 2020	Global air transport; air transportation networks	Worldwide	<p>The Southern Hemisphere was more affected than the Northern Hemisphere regarding the drop in connectivity; the impacts of the COVID-19 pandemic on international flights were much greater than on domestic flights; each airport lost 50% of its connections on average; Europe has undergone probably the most significant changes regarding network connectivity.</p>
Bauer <i>et al.</i> 2020	Airline business models	General	<p>Strong reason and evidence to believe that the implications of the COVID-19 pandemic will accelerate the acceptance and use of point-to-point, ultra-long-haul services.</p>
Warnock-Smith <i>et al.</i> 2021	Airline, airports	China	<p>Less well-financed carriers whose networks are focused on international markets, premium traffic and discretionary leisure travel have been found to be impacted the most by the pandemic and are those that are likely to take the longest to recover. Better financed airlines with greater focus on domestic markets, non-discretionary traffic, and standard economy class fares have been found to be less severely impacted</p>

Author, year	Research area	Region	Main findings
Warnock-Smith <i>et al.</i> 2021	Airline, airports	China	by the pandemic. Reductions in traffic caused very significant decreases in airport revenues and profits, especially for airports with large international traffic volumes (Beijing, Shanghai, and Hong Kong). However, airport construction and capacity expansion have returned, indicating the government's optimism about the future.
Garaus, Hudakova 2022	Airline, passengers	General	The aviation industry reacted to travellers' rising concerns about becoming infected with the disease by introducing several safety measures to ensure a safe trip. Employing an experimental design, the current research demonstrates that during the COVID-19 pandemic, consumers reacted more favourably to safety as compared to emotional advertising appeals.
Nhamo <i>et al.</i> 2020	Airports	Global network of airports	In the 10 days following the declaration of the pandemic in March 2020, departures plummeted to less than 10,000 aircraft globally. By the end of April 2020, there were fewer than 2,000 departures on average. Flying hours declined by 56% in North America and by 76% in Asia, with other regions recording much higher declines, totalling as high as 90%. Airlines grounded their fleets, which was an opportunity for airports to generate revenue from parking fees. Several airports across the world closed some runways to accommodate the aircraft. The bulk of employees were furloughed or laid off due to reduced operations or the closure of airports across the world. Also, airports responded by closing sections of the airport as cost containment measures.
Amankwah-Amoah 2021	Airlines, airports, passengers	Global airline industry	Development of the 'CoviNovation' including inflight social distancing, utilizing touchless technologies at airports, disinfecting aircraft with UV light, open-middle-seat policy, accelerated use of biometrics during check-in, and COVID-19 insurance, to point out some of the COVID-inspired processes and product innovations that were implemented in an attempt to respond to the crisis.
Arora <i>et al.</i> 2021	Airports	Global airline industry	Overview of the effects of the pandemic and categorization of the response mechanisms. The authors proposed a framework for a coordinated global response to future disease outbreaks.

Author, year	Research area	Region	Main findings
Choi 2021	Airports	Incheon International Airport, South Korea	After COVID-19 pandemic, safety and hygiene will be the top priority. Dwell time increase may be a by-product. Results suggested that dwell time increase has a more significant impact on increasing the existing purchasers' spending than creating new buyers. Airport operators may introduce a service differentiation perspective, such as a dedicated service, to utilize the current buyers' dwell time more faithfully.
Zhang, A. <i>et al.</i> 2021;	Air transport network	ASEAN+5: 10 ASEAN Member States, plus Japan, Korea, China, Australia, and New Zealand	The impacts of the COVID-19 pandemic on air transport connectivity in the 'ASEAN+5' and the region's international trade are investigated and quantitatively examined as a critical, emerging region in both aviation and overall economic/trade activities. The authors provide an in-depth description of the interactions from a complex system perspective, using network science tools.
Fontanet-Perez <i>et al.</i> 2022	Airlines	United States: 10 main passenger airlines	The impact of the COVID-19 pandemic on the US airlines market, including the benefits and limitations of current business models in the context of increasing socio-economic uncertainty and stringent environmental regulations.
Cheong <i>et al.</i> 2021	Airlines	Singapore	The impact of the COVID-19 pandemic on Singapore Airline's profit recovery and aircraft allocation (the number of aircrafts to be allocated to serve passengers & cargo, and the number of aircraft that will go into storage) are examined.
Sobieralski 2020	Airlines	United States	Employees at major airlines will be the most impacted during the pandemic. LCC and regional airlines' business models afford the ability to weather uncertain times without the large employment reductions seen by the major carriers. Recovery following uncertainty shocks is estimated to take between 4 and 6 years.
Sun <i>et al.</i> 2021	Air transport network	United States, Europe-27 and China	The impact on the air transport system was explored from unique perspectives: the international country network, domestic subnetworks, and the heterogeneous effect on airports. Three regions/countries have different strategies for the COVID-19 pandemic. It is difficult to assess which of these strategies should be chosen and at which point, in order to expedite recovery.

Author, year	Research area	Region	Main findings
Sun <i>et al.</i> 2021	Liter. over. on COVID-19 and air transport	-	110 selected papers published in 2020 grouped into following categories: analyses of the global air transport system during the COVID-19 pandemic, impacts on the passenger-centric flight experience, and long-term impacts on aviation overall. Further, papers from each category are classified into several sub-categories.
Thep-chalerm, Ho 2021	Liter. over. and reports on COVID-19 and airline business	-	In response to the COVID-19 pandemic, airlines have updated their operational procedures and explored alternative revenue streams. Airlines need to focus on infection prevention, update their procedures according to the guidelines provided by health care organizations, aviation associations and state governments, as well as adjust their routes and network.

Source: Authors

Although some studies have discussed the impact of the COVID-19 pandemic on the aviation industry, there is still a gap in the relevant literature regarding in-depth analysis of the impact on different stakeholders. As already pointed out, this paper endeavours to close this gap by providing an extensive overview of how the aviation industry reacted to the COVID-19 crisis, together with industry performance in 2020 and 2021. Moreover, the typical crisis response strategies of different stakeholders in aviation across the world will be also examined as one of the important aspects that ensure their business survival. First, we provide an analysis of the reactions to the COVID-19 crisis worldwide and, where applicable, by region. Then, we point out the European stakeholders' strategic responses and outline some implications for the competitive environment in the industry. Finally, we provide a brief overview of the state of the aviation industry in Serbia and how the aviation stakeholders, in such a small market, responded to crisis.

3. AIR TRANSPORT OVERVIEW: THE PERIOD 2010–2022

Despite downturns caused by economic crises, recessions, fluctuations in jet fuel prices, and other crisis situations, world air traffic showed stable long-term growth prior to 2019. The COVID-19 pandemic, which hit the whole world in early 2020, is the first crisis that caused long-term disruption in the air transport market. The return to the 2019 level of air traffic and the continuation of the growing trend is uncertain. According to the current forecasts, made in early 2021, the air traffic full recovery cannot be expected

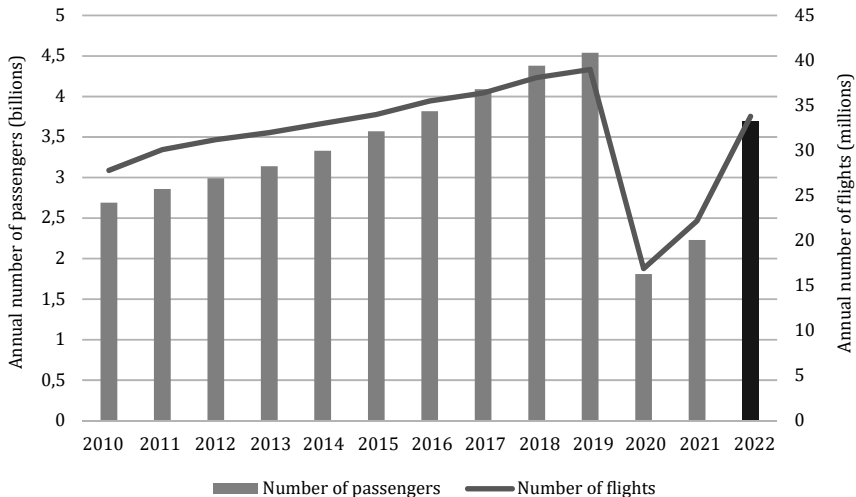
before 2024 (IATA 2020a). Until the beginning of 2020, the number of flights and the number of passengers in air transport had increased year after year. The development of passenger air transport worldwide (number of passengers and number of flights) in the period from 2010 to 2022¹ is shown in Figure 2. The number of passengers in 2022 is a projection based on results recorded for first ten months.

The total number of passengers in air transport in 2019 was 4.54 billion. Due to the crisis caused by the COVID-19 pandemic, the number of air passengers in 2020 decreased drastically and, according to ICAO estimates, amounted to 1.79 billion, which is 60.6% less than in 2019. It can be expected that the number of passengers in 2022 will almost double compared to 2020, but that number will also be significantly lower than in 2019 (app. 25% less).

Figure 3 shows the annual number of passengers per year (in million) in Europe, encompassing the EU, Iceland, Norway, Switzerland, Turkey, Serbia, Montenegro, Bosnia and Herzegovina, North Macedonia, and Albania. It is very important to emphasize that statistical data for EU-27 exclude the UK as of 2020. Thus, in 2020 and 2021, UK data is taken into account separately. The total number of air passengers in Europe in 2019 was 1.49 billion.

Figure 2.

Annual number of passengers in the world (in billions) and annual number of flights in the world (in millions), in commercial scheduled air transport.

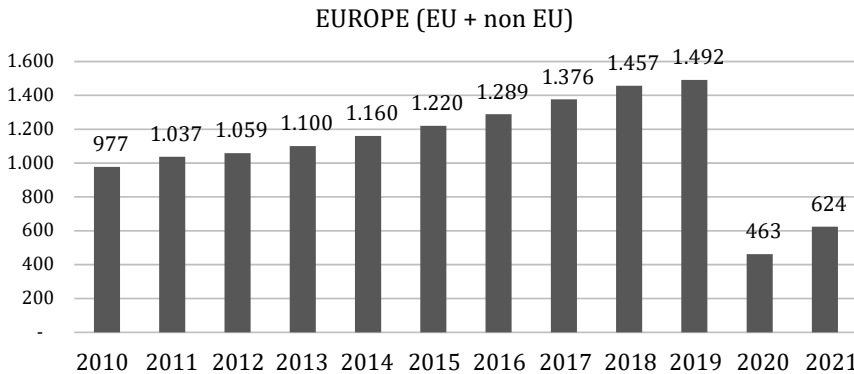


Source: Authors; Data source: Statista 2022a.

¹ Data for 2022 in Figure 2 is estimated.

Due to the impact of the COVID-19 pandemic, the number of passengers decreased drastically in 2020, by more than three times comparing to 2019. Air passenger transport in the European Union (EU-27) amounted to only 276.5 million passengers in 2020. This is a 76% decrease compared to 2019.

Figure 3.
Annual number of passengers in Europe (in millions)



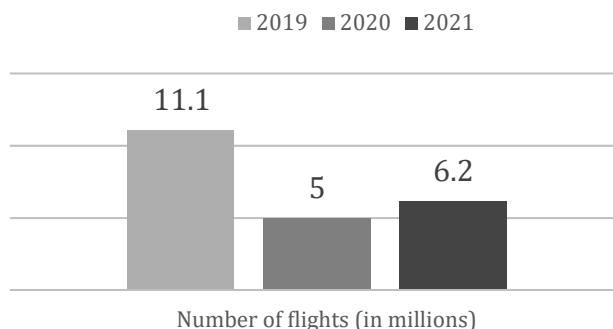
Source: Authors; Data source: Statista, national statistical agencies, airport websites, reports.

Around 30% of air passengers in the world use the LCC services, while in Europe the share of passengers who use low-cost airlines is even greater (36%). The LCC share on intra-European routes in the first half of 2022 year was 47%, compared with just short of 42% in the equivalent period of 2019 and also for 2019 as a whole (CAPA 2022).

In Europe, the number of flights decreased by 55.2% in 2020 and resulted in 6.1 million fewer flights compared to 2019 (see Figure 4, EUROCONTROL, FAA 2021). Even though the region saw significant improvement in the third and fourth quarters of 2021, Europe ended the year at 43.5% of its 2019 level. According EUROCONTROL,² 9.3 million flights operated throughout Europe are expected in 2022 (entire year), representing 84% of the 2019 traffic level.

² EUROCONTROL. 2022b. EUROCONTROL expects 9.3M flights in 2022. <https://www.eurocontrol.int/press-release/eurocontrol-expects-9-3m-flights-2022> (last visited 27 November, 2022).

Figure 4.
Annual number of flights in Europe (in millions)



Source: Authors; Data source: EUROCONTROL 2022a.

The 7-day average number of flights in Europe in 2019 varied between 23 thousand to 35 thousand flights. From March 2020 to December 2020, the 7-day average number of flights between 3 thousand and 17 thousand flights, while in 2021 the daily number of flights was between 10 thousand and 25 thousand. Peak daily flights were on 27 Aug 2021 (26,773), -28% compared to the 2019 peak of 37,228 (28 Jun 2019) (see Table 2).

Table 2.
Average number of flights in Europe variation, by country

Countries	Differences in flights (%), 2021 vs. 2019
United Kingdom, Ireland, Finland	- 62%
Sweden, Denmark, Latvia, Czech Republic, Hungary, Austria, Slovakia, Germany	between - 56% and - 50%
Switzerland, Lithuania, Estonia, Slovenia, Italy, Poland	between - 48% and - 46%
France, Portugal, Netherlands, Spain, Malta, Bulgaria	between - 44% and - 40%
Croatia, Norway, Romania, Luxembourg, Belgium, Moldavia	between - 39% and - 36%
Turkey, North Macedonia, Cyprus, Serbia, Montenegro	between - 35% and - 30%
Ukraine, Greece, Bosnia & Herzegovina, Albania	-27% and less

Source: Authors; Data source: EUROCONTROL 2022a.

4. AIRLINES

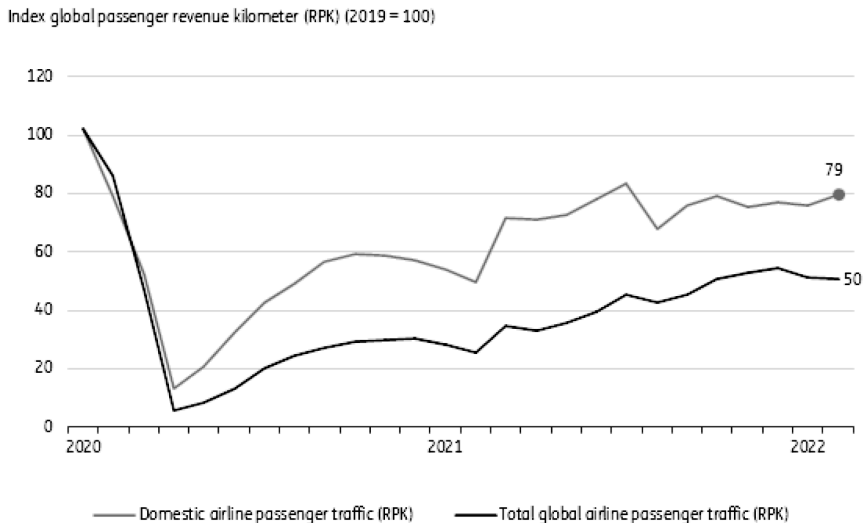
4.1. Worldwide

The airline industry is very sensitive to major external events such as terrorism, political instability, natural disaster, energy crisis, and major public health risk. Each of these events may severely affect both their operations and passenger demand. The same effect occurred this time when the COVID-19 pandemic began in early 2020 – the airline industry experienced a sharp decline in traffic operations. The final global economic impact of COVID-19 on civil aviation in 2020 and 2021 can be summarised as follow (ICAO 2022b):

- *2020 vs 2019: seats offered –50%; passengers flown –2.703 million; airline revenue loss USD 372 billion.*
- *2021 vs 2019: seats offered –40%; passengers flown –2.2031 million; airline revenue loss USD 324 billion.*

The COVID-19 pandemic has greatly reduced travel demand, affected investor expectations, and caused a negative impact on airline stock prices (Atems, Yimga 2021). The impact of the COVID-19 pandemic on international

Figure 5.
Global airline passenger traffic 2020–2022.

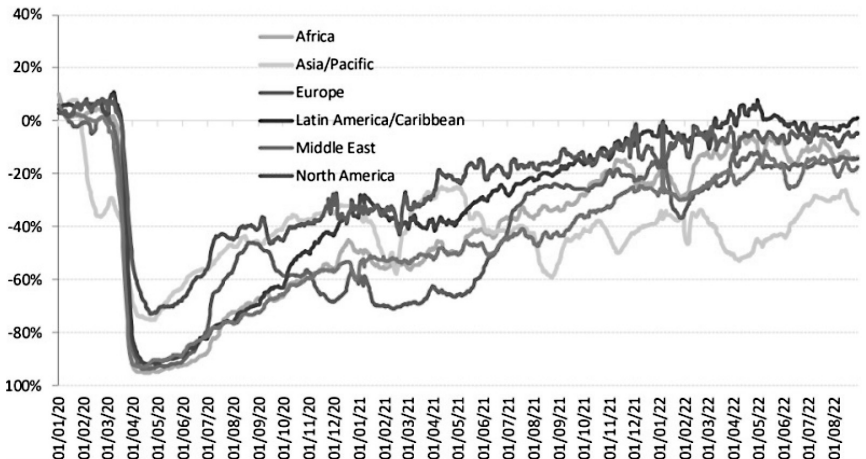


Source: IATA 2022b.

flights appeared to be much greater than on domestic flights (Sun *et al.* 2020), causing more financial damage to FSC than to LCC (Zhang *et al.* 2022). Accelerated recovery of the airline industry started in mid-2020, following the summer season, at a pace of around 4 percentage points/month, compared to 2019 (IATA 2022a). However, at the beginning of 2021, the recovery of airline industry was slowed down again by the impact of a new COVID-19 variant, Omicron. Countries around the world started to reimpose travel restrictions in order to slow the spread of the infection (Fig. 5). Despite all the restrictive measures, overall travel demand strengthened in 2021 due to passenger desire to travel – particularly for VFR (visiting-friends-and family) purposes and holidays – and an increased number of vaccinated people.

Undoubtedly different and uncoordinated restrictive measures, as well as the speed of their abolition, influenced the number of flights and total seat capacity by regions to recover at different pace (see Figure 6). While all regions were impacted by the crisis, regional difference in resilience and speed of recovery depended on operations of the domestic airlines. Airlines with larger domestic markets or with large cargo operations were certainly in better positions, and with their operations, led the industry on an upward trend.

Figure 6.
Comparison of total seat capacity by region
(7-day average, compared to 2019).



Source: ICAO 2022a.

Due to the fact that the airline industry traditionally has a highly cyclical business, with extremely high working capital turnovers, contrasted by very low profit margins (Doganis 2005), with so sharp decline in demand, it is not surprising that it was one of the global industries affected the most by the COVID-19 pandemic. The pandemic hit the airline industry when it had very low cash reserves, with most airlines having only two months' worth of cash or less available (Dube *et al.* 2021). In order to mitigate the effects of the COVID-19-induced crisis and protect themselves from bankruptcy, the airlines desperately struggled to obtain financial government/state aid. This presented a large shift in the regulatory policies of many countries, including that of the European Commission (EC), which strictly prohibited such practice in the decades prior to COVID-19. On 19 March 2020, the EC adopted a Temporary Framework for State Aid measures³ to remedy serious disturbances in the economies of the Member States. Moreover, in early April 2020 the 41 Member States of EUROCONTROL approved the temporary deferment of route charges billed through the EUROCONTROL Multilateral Route Charges System, due in April, May, June and July 2020, with payments beginning in November 2020 (EUROCONTROL 2021a). In the US, the Coronavirus Aid, Relief, and Economic Security (CARES) Act entered into force in March 2020 (116th U.S. Congress 2020), to provide direct economic assistance for impacted industries. Around USD 58 billion was allocated to airlines that agreed to operate a minimum level of service for communities served pre-COVID-19, and to help cover employee wages, salaries and benefits until the end of September 2020 (NPR 2020). Starting in March 2020, various countries provided different types of financial support to airlines, which can be broadly split into the following categories (OECD 2021):

- a) hybrid debt,⁴ including convertible bonds and warrants (e.g. Garuda Indonesia, Korean Air, Singapore Airlines, etc.);
- b) loans and loans guarantees (e.g. Austrian Airlines, SAS, Air France-KLM, Air New Zealand, IAG, EasyJet, Ryanair, etc.);
- c) fiscal transfers (e.g. Intercargo);
- d) equity acquisition (e.g. Finnair, Lufthansa Group, Cathay Pacific, El Al, Singapore Airlines, etc.);

³ Communication from the Commission on the Amendment to the Temporary Framework for State aid measures to support the economy in the current COVID-19 outbreak (2020/C 112 I/01). 2020–04–03.

⁴ Hybrid debt instruments have a combination of debt and equity component (OECD, 2021).

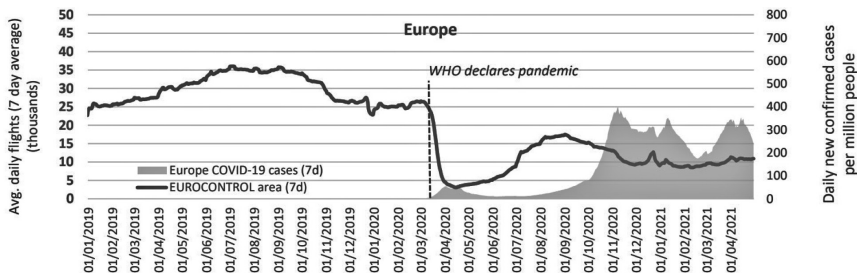
- e) others – wage subsidies, flight subsidies, etc. (e.g. Danish Air Transport and other airlines holding Danish air operator certificates, multiple airlines with employment in Hong Kong, etc.).

Due to the too long duration of the crisis and the uncertainty regarding the recovery of traffic, many airlines worldwide have cancelled aircraft orders or postpone their delivery from the manufacturers. For example, EasyJet postponed the delivery of 22 Airbus aircrafts from 2022–2024 to 2027–2028 (Reuters 2020). However, among the different regions of the world, Europe was certainly one of the most severely affected regions by COVID-19. The particular impact of COVID-19 crisis on European airlines will be explained in detail in the Subsection 4.2.

4.2. Europe

After the first European COVID-19 case was reported in January 2020, major European airlines reduced and eventually ceased their operations to China by the end of that month. In the following few months all European airlines grounded their fleets more or less completely due to the imposed travel restrictions (Albers, Rundshagen 2020). During the summer, intra-European flights and domestic flights within countries recovered quicker than intercontinental ones, but dropped again starting in September with airlines adjusting their schedules as a result of the second wave of the COVID-19 pandemic hitting Europe (EUROCONTROL, FAA 2021). The major obstacle for passengers to fly in Europe was the large number of different

Figure 7.
Number of flights and COVID-19 cases in Europe (7-day average)



Source: Authors; Data source: EUROCONTROL, FAA 2021

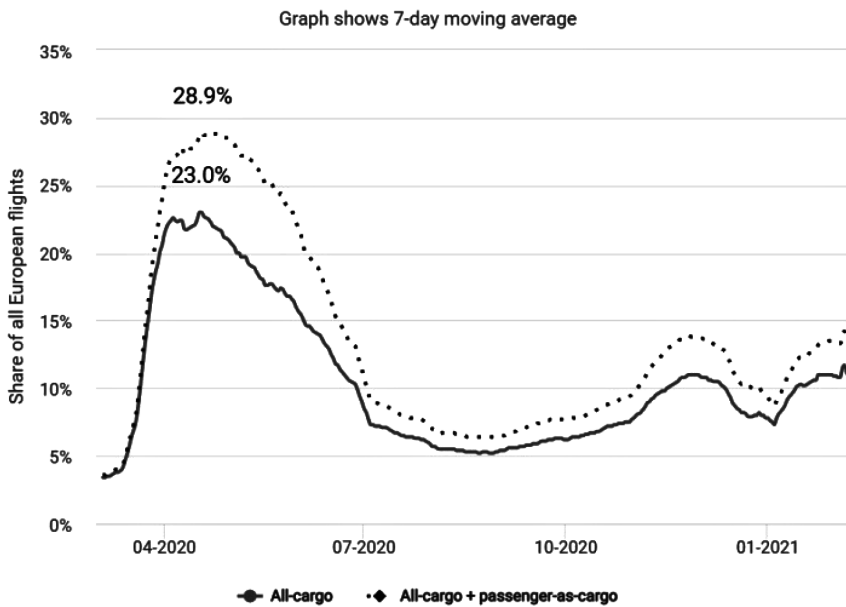
national rules in terms of quarantine and testing requirements. Figure 7 shows the 7-day moving average of daily flights in Europe, including the reported new COVID-19 cases per million people during 2020 and the first quarter of 2021.

During 2021 airlines in Europe started to increase the number of flights but this trend was not followed by an increase in the number of passengers, which resulted in an average global passenger load factors of around 70%, lower than the pre-pandemic levels of >80% (ING 2022). This increase in the number of flights (despite demand showing no signs of recovery) was possibly driven by the need to retain slot rights. Other European airline strategic responses to the COVID-19 pandemic, aimed at mitigating the severe effect of the COVID-19 pandemic, fall within one of the following category (Albers, Rundshagen 2020):

- retrenchment – refers to measures aimed at substantial cost/overhead and/or asset reduction. Airlines that applied it: almost all airlines announced job cuts and/or reduced work patterns; Air France (brought forward A380 retirement; restructured domestic network with fewer flights and more LCC Transavia flight); Austrian Airlines (reduced fleet by 25%, management by 30%); EasyJet (cancelled aircraft orders, slimmed fleet); Brussels Airlines (reduced fleet by 30%); Lufthansa (deep cuts into future fleet, grounded A380s, seven A340–600s and five B747–400s permanently); British Airways (withdrew B747 aircrafts from its fleet), etc.
- persevering – refers to measures aimed at preserving the ‘status quo’ of the companies, including debt financing or the consumption of slack resources (e.g. deployment of excess capacity) to get through the crises with no or minor changes in the organizations’ strategy, structures, and assets. Airlines that applied it: Most European airlines sought government support through grants, preferential loans/government guarantees, and subsidies; Ryanair (committed to drive price competition after crisis).
- innovating – refers to a variety of actions adopted by airlines to improve their strategic position in the short or long term, such as preparations for joint ventures and entering new markets. Airlines that applied it: Austrian, Icelandair, Sun Express, Swiss (reconfigured aircraft for cargo); Air France-KLM (transatlantic joint-venture with Delta Air Lines and Virgin Atlantic); British Airways (UK-Australia joint venture with Qatar Airways); Wizz Air (planned to enter new markets in Europe, increased scale of Abu Dhabi venture, intended to grow ancillary business).

- exit strategies – refers to the discontinuation of an organization’s activities. Airlines that applied it: Air Italy (ceased operations); AtlasGlobal Airlines (filed for bankruptcy); Braathens (filed for court administration); CityJet (entered local equivalent of Chapter 11); Flybe (went into administration); Norwegian Air Shuttle (pilot and cabin crew subsidiaries filed for bankruptcy in Denmark and Sweden); LOT (gave up bid for Condor); Lufthansa (closed Germanwings subsidiary); Virgin Atlantic (abandoned the base at London’s Gatwick Airport).

Figure 8.
Cargo share of all European flights.



Source: EUROCONTROL 2021b.

To minimize huge losses, most airlines offered vouchers/coupons to passengers whose flights had been cancelled, as opposed to refunds (Collinson 2020). The offered vouchers were also restricted in terms of their use, with a limited duration, usually up to 12 months. Irish airline, Aer Lingus also offered vouchers to its passengers with a 10% bonus if they signed up for the voucher; the value of the ticket they paid for was increased by 10%. As a result, 16 major European airlines have reimbursed more than 500,000 flight vouchers they imposed on consumers for cancelled flights during the COVID-19 pandemic (European Commission 2022).

Unlike passenger traffic, cargo traffic in Europe resulted in a +1.9% increase of all-cargo flights in 2020, thanks to the need for goods and medical equipment to fight the pandemic. Previously, all-cargo flights constituted 3% to 4% of total European flights, but in 2020 their market share increased to between 10% and 11% (EUROCONTROL 2021b). Figure 8 shows the all-cargo flights market share during the 2020. In the first wave the share of all-cargo flights raised significantly, but that was because the other market segments declined by nearly 90% for total flights.

4.3. Business aviation

The COVID-19 crisis has had a profound impact on every aspect of airline industry, and business aviation is no exception. Compared to 2019, business aviation in Europe decreased by 24.4% in 2020, however this was much less than scheduled traffic (EUROCONTROL, FAA 2021). As airlines cancelled flights and governments imposed strict rules on international travel, many of those who could afford to fly turned to private jets. Also, clients could be driven up to the steps of aircraft that departed when they wished, flying in isolated cabins, etc., avoiding being in contact with other passengers. Private jet operators have reported that there has been an increase in first-time users of private aviation looking to reduce touch points at airports and minimize contact with the traveling public (French 2020; Georgiadis, Hancock 2020; Powley, Bushey 2020). Some of the demand for private flights is also reported to come from passengers who were looking to fly non-stop on routes that have been dropped by commercial airlines that reduced their networks during the pandemic (Powley, Bushey 2020).

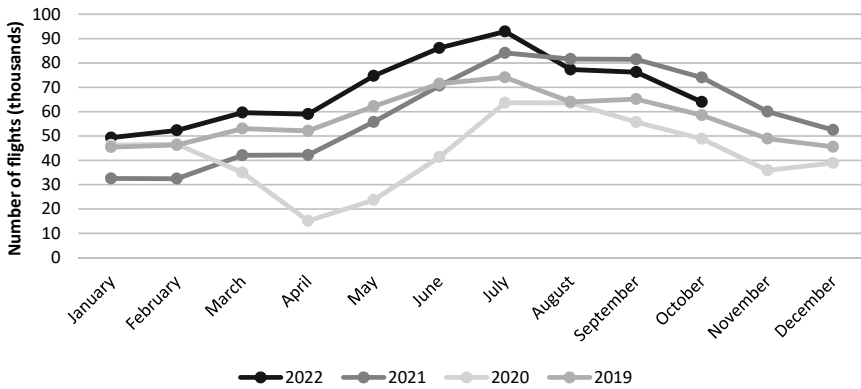
Despite the severe disruption caused by COVID-19, business aviation continued to operate during the pandemic, setting the fundamentals of further growth in the post-pandemic business environment. Figures 9 and 10 depict the number of business aviation flights in the European and US market, respectively. Even though April was marked by a 71% decrease in activity in Europe and a 75% decrease in the USA, compared to normal levels, the European business aviation segment briefly matched 2019 volumes in August 2020 and then experienced a relapse in the autumn and winter (around -20%). The business aviation segment in the USA remained at -15.2% in Jun 2020.

The US business aviation segment recovery started in March 2021, when 2019 levels were reached, stabilising at 17%–30% above 2019 since June 2021. The European market recovery restarted in April 2021, passing 2019 levels in July and stabilising at 20%–30% above 2019 since August 2021.

In 2021, leisure contributed strongly to the growth of business aviation in Europe as Mediterranean destinations recorded more movements compared to the 2019 levels.

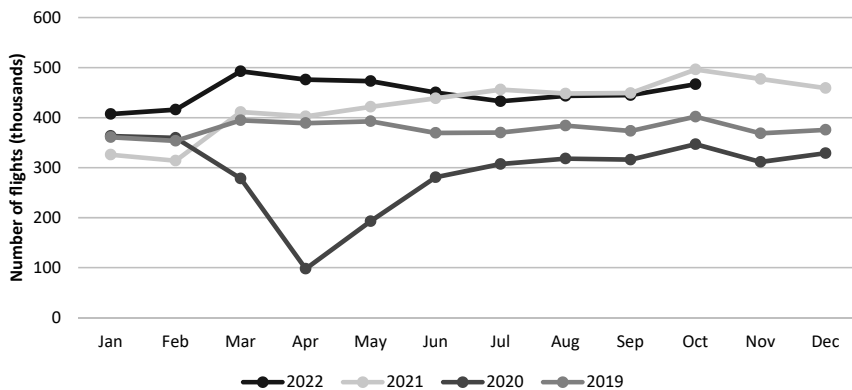
Growth in the business aviation sector has come from a combination of operators finding new ways to reach customers, and new services to offer, such as shared flights, as well as new passengers turning to business aviation flights.

Figure 9.
Number of flights in the European business aviation segment



Source: Authors

Figure 10.
Number of flights in the US business aviation segment



Source: Authors

5. AIRPORTS

5.1. Worldwide

Prior to 2020 airports were considered powerful economic engines, essential to the economic development of cities, countries, and regions, by providing direct, indirect and induced employment. They contribute to national economies as well as overall world economy by providing services to airlines in moving passengers and cargo. However, the COVID-19 pandemic severely hit airports worldwide in terms of traffic and revenues during 2020 and 2021, with flights being cut by airlines, closed borders, travel restrictions, quarantine rules, and associated demand loss. Many of them were closed by governments to contain the spread of the virus.

During the first two years of the pandemic, the COVID-19 outbreak reduced the number of passengers at the world's airports by 11.3 billion (ACI 2022). Despite increasing vaccination rates and some international travel restrictions gradually being revoked, the total number of passengers⁵ did not show the signs of recovery in 2021, at 4.4 billion (48.3% compared to 2019). International passenger traffic was weak in the first half of 2021, with a slight upturn by the end of the year due to the increasing number of people getting vaccinated. Domestic passenger traffic recovered faster than international traffic in 2021, and this was especially noted in the main markets such as the USA, which started to recover in 2020 and accelerated in 2021 (ACI 2021). Globally, airports lost more than USD 83.1 billion in revenue in 2021 (ACI 2022), although the magnitude of the COVID-19 pandemic effects differed by region. The impact of COVID-19 pandemic on airports is shown on Table 3.

The Middle East and Asia-Pacific were the regions most affected in relative terms (69.7% and 60.9% declines in 2021, respectively) compared to the projected baseline (-66.3% and -57.5% compared to 2019 levels). Europe was the most impacted region in absolute terms, losing more than USD 32.3 billion in revenues by the end of 2021, compared to the projected baseline (USD 29.4 billion compared to 2019).

⁵ The main difference between the number of passengers at the airports and the airlines is in the methodology of counting passengers who use their services. Airport counts each passenger enplaned and deplaned individually, so a connecting (transfer) passenger is technically counted twice. Airlines count passengers on a flight segment basis.

Table 3.
Impact of the COVID-19 crisis on revenues* by region
(2020, 2021, 2022, rounded to nearest million USD)

Region	2020	2021
	Estimated revenue loss	
Africa	-2,726	-2,586
Asia-Pacific	-32,686	-34,491
Europe	-43,762	-39,712
Latin America Caribbean	-7,044	-5,599
Middle East	-10,458	-11,111
North America	-25,178	-17,887
Worldwide	-121,853	-111,386
	Estimated revenue loss (%)	
Africa	-68.7	-60.1
Asia-Pacific	-55.3	-55.9
Europe	-69.5	61.5
Latin America Caribbean	-61.0	-46.7
Middle East	-68.5	-69.3
North America	-71.3	-49.2
Worldwide	-64.8	-57.2

Source: Authors; *Revenues are estimated assuming constant quarterly airport revenues on a per-passenger basis and are based on ACI's 2020 Airport Key Performance Indicators, as well as input from ACI Regional Offices.

North America and Latin America-Caribbean recovered quicker than the other regions in 2021, and recorded decreases of 18.9% and 34.8% in 2021 respectively, compared to the projected baseline (down 14.2% and 30.2% compared to 2019). Africa's revenue performance was slightly better

than the global situation in 2021, recording a decline of 46.1% in revenues compared to the projected baseline (down 37.3% from the 2019 level), or an absolute loss of close to USD 2 billion (ACI 2022).

After the turbulent 2020, in 2021 airports all around the world adapted many changes to overcome obstacles imposed by the COVID-19 pandemic, through the introduction of new technologies, cleaning protocols, and passenger processing. Numerous changes were implemented in airport daily operations with respect to passenger processing regulations, sanitisation within airport buildings, the introduction of new biometric technology, etc. The main task for all airports was to enable passengers and airport staff to maintain physical distance. To help alleviate operational challenges and reduce risk of disease transmission between passengers and personnel, where possible, no-touch options have been introduced (e.g. touchless self-service check-in machines, touchless elevator buttons, touchless biometric passport check lanes) (Changi Airport 2020). Other actions that airports have taken in response to the crisis include: government support (e.g. financial assistance, airport taxes relief); reducing variable costs (e.g. closing portions of infrastructure, layoffs or salary reductions, reductions in contract services); cooperating with airlines (e.g. adjusting payment terms and releasing airlines and retail partners from some contractual obligations) (IFC 2020).

In order to support the measures against the pandemic, the International Civil Aviation Organization (ICAO) published guidelines for addressing the impact of the COVID-19 pandemic on the global aviation transportation system, including mitigation measures necessary for the reduction of public health risk to air passengers and aviation workers. The Council Aviation Recovery Taskforce (CART) Take-Off guidance includes four sections related to airports, aircraft, crew and cargo, together with recommendations for countries to evaluate passenger medical testing solutions. The module on airports contains specific guidance addressing elements for: the airport terminal building, cleaning, disinfecting, and hygiene, physical distancing, staff protection, access, check-in area, security screening, airside areas, gate installations, passenger transfer, disembarking, baggage claim and arrival areas.

The COVID-19 pandemic led to the adopting of rules on physical distancing, which in turn resulted in reorganizing the work of airport personnel. There was a decrease in demand for airport personnel, along with a reduction of operations at the airport and changes in airport procedures. A similar situation happened with ground handling agents in the area of passenger traffic organization (Okulicz, Rutkowska 2021). This situation put strong pressure on the income statements in the airport industry, leading them to

lay off excess workers, which involved thousands of aviation professionals. These aviation professionals (including handling, catering, airport, security and others) are necessary to provide airport infrastructure and services in a safe, secure, efficient and sustainable manner and their professional development (creating and enhancing their specific human capital) is a long-term process typically measured in years. Many of them who lost their jobs during the toughest period of pandemic did not stay in the aviation industry. Without efficient and skilled ground operations, flights cannot resume, and airports cannot deal with forthcoming operations. This was confirmed at many airports around the world, and particularly at European airports, in the summer of 2022, with major disruptions in the air transport system due to the insufficient number of workers on ground operations, generating high costs for both passengers and all other stakeholders.

Social distancing measures made it even more difficult to carry out operations at airports. Following this measure, passengers kept physical distance in queues for check-in, security control, boarding and baggage claim, so it was necessary to provide additional space inside the airport, which put more pressure on these systems to maintain seamless and safe processes. The addition of health documents prolonged waiting times at check-in due to the health-related questions and extra paperwork, so passengers started to arrive at the airport earlier and to spend more time at the airport (ARC 2022).

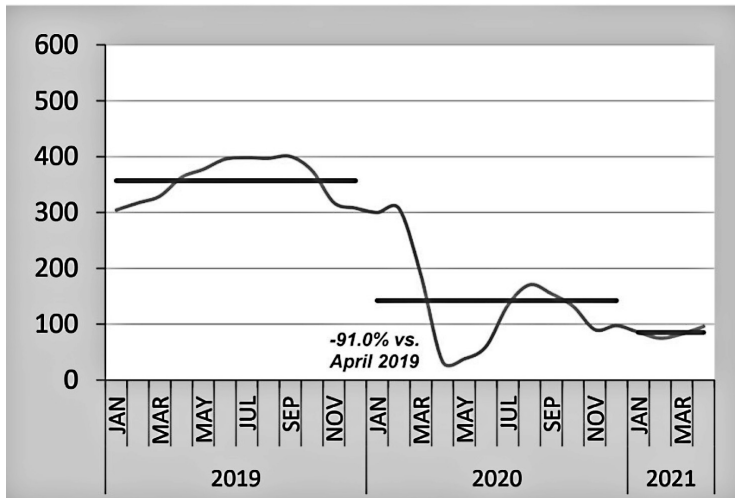
5.2. Europe

Flights in Europe took off during 2020 and 2021, though at the slower pace and far below the level in 2019 (see Section 3, Figure 4). In 2021, aircraft movements were up by 23.3% compared to 2020 but down by 48% against pre-pandemic (2019) levels throughout the European airport network (ACI, January 2022). The COVID-19 pandemic had a particularly profound impact on smaller regional airports in the EU, which mainly depend on tourism and experienced an even sharper traffic drop (Niestadt 2021).

Countries with more severe COVID outbreaks, including Spain, Italy, the UK, and Austria, enforced strict lockdowns and domestic aviation capacity restrictions, which affected operations and recovery. Air traffic recovery in Europe was significantly impeded due to a general fear of more waves and a significant increase in COVID cases during 2020 (especially during the summer months), causing the very low airport operations until end of the year (Hodcroft *et al.* 2020).

Figure 11 shows the evolution of the average number of daily IFR departures at the 34 main European airports during the period from 2019 to 2021. Fortunately, cargo traffic at EU airports doubled its market share from 3% to 6%, due to increased demand for medical supplies, food and other goods (EUROCONTROL 2021b). For example, Liège Airport (Belgium), experienced a 10.7 % increase in cargo flights (34,264 flights in 2020 compared to 30,934 flights in 2019) (Liege Airport 2021).

Figure 11.
Average daily IFR departures at the 34 main airports in Europe



Source: Authors; Data source: EUROCONTROL 2021b

At the end of 2020, ACI-Europe warned that nearly 200 European airports could possibly face insolvency in the short term if sufficient government support was not provided (ACI 2020). In terms of government support related to COVID-19, there were several measures applied to airport operators in Europe, which can be grouped into the following categories: deferral of payments and taxes and wage support schemes, grants and fiscal transfers, state loans and loan guarantees, and equity injections (OECD 2021). The governments of Croatia and France both supported the airport sector in the form of loan guarantees and repayable advances. In Croatia the aid was limited to international airports. In Germany, Berlin Brandenburg Airport received low-interest loans; Munich International Airport received a direct subsidy; and the Cologne Bonn Airport was recapitalised by the regional government. The government of Iceland recapitalised the wholly

state-owned airports in Reykjavik. In Iceland the transaction included a commitment to a second, larger recapitalisation in 2021. The government of Lithuania supported its state-owned airports with three schemes including a reimbursement for salary expenses, reimbursement for directly COVID-19 related expenses, and a delay of profit distribution from the airports to the state shareholder. The government of Norway supported its state-owned national airport operator through three different channels: a grace period on state loans, exemption from paying dividends to the state owner for the financial year 2019, an operating subsidy of NOK 3.6 billion. In Sweden the government recapitalised its national airport operator to the amount of SEK 2.5 billion.

In regular times, the problem with congested airports and scarce capacity in Europe is solved through capacity control implemented in the form of slots (Babic, Kalic 2011). An airport slot is defined as permission given by a coordinator to use the full range of airport infrastructure necessary to operate an air service at a coordinated airport, on a specific date and time, for the purpose of landing or take-off, as allocated by a coordinator (Council Regulation No 95/93, 1993⁶). Slots in Europe are subject to Regulation 95/93 on common rules for the allocation of slots at Community airports and according to one rule airlines are required to use slots at least 80% of the time over the scheduling season for which they have been allocated. In the event that the airline uses it less than 80%, they will lose their slot. Due to the pandemic crisis, which forced airlines to suspend flights, IATA requested on their behalf that aviation regulators worldwide temporarily suspend the implementation of rules governing the use of airport slots for the 2020 season. The request was soon approved by the EC, granting the temporary suspension until June 2020 of the 80–20 ‘use it or lose it’ rule for airport slots (IATA 2020b).

COVID-19 affected airport industry very seriously, without exception. However, the path to recovery will depend on the airport type and the country’s response to the pandemic. It is expected that airport hubs serving large urban centres and financially strong airlines are more likely to recover quicker than regional airports.

⁶ Council Regulation (EEC) No 95/93 on common rules for the allocation of slots at Community airports.

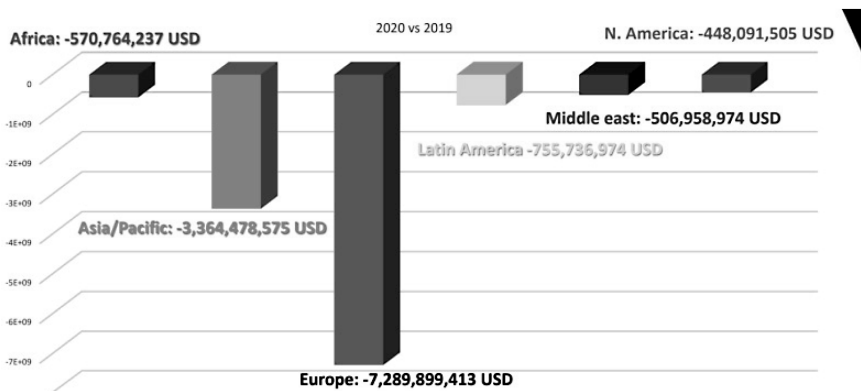
6. AIR NAVIGATION SERVICE PROVIDERS (ANSP)

6.1. Worldwide

Like airports and airlines, the COVID-19 pandemic has also impacted air navigation service providers (ANSP). These service providers are mostly government-owned entities with high and fixed overheads, i.e. fixed costs due to significant infrastructure costs and the highly skilled labour that is engaged. As worldwide scheduled passenger traffic decreased by 60 % in 2020, ANSPs suffered revenue losses of almost USD 13 billion (Figure 12). It should certainly be kept in mind that the regional difference in lost revenue stemmed as a consequence of the large differences in the unit rates that individual states specify for calculating user charges, rather than a reduced number of operations. Some countries impose a fixed charge, while others base it on the distance flown. Also, in the USA there are only two charges, for overflying the state and for flying over the ocean monitored by their ANSP. Generally, navigation user charges are highest in Europe. Although all regions experienced more or less the same reduction in traffic in 2020, certain regions, like North America and Europe, experienced a faster rebound in demand towards the end of the year.

Despite all restrictions and the closure of international borders during 2020–2021, ANSPs all over the world provided services for all aircraft permitted to fly, including military, emergency and repatriation flights, domestic travel, general cargo, and medical supplies.

Figure 12.
Air Navigation charges losses 2020 vs 2019.



Source: ICAO 2021.

6.2. Europe

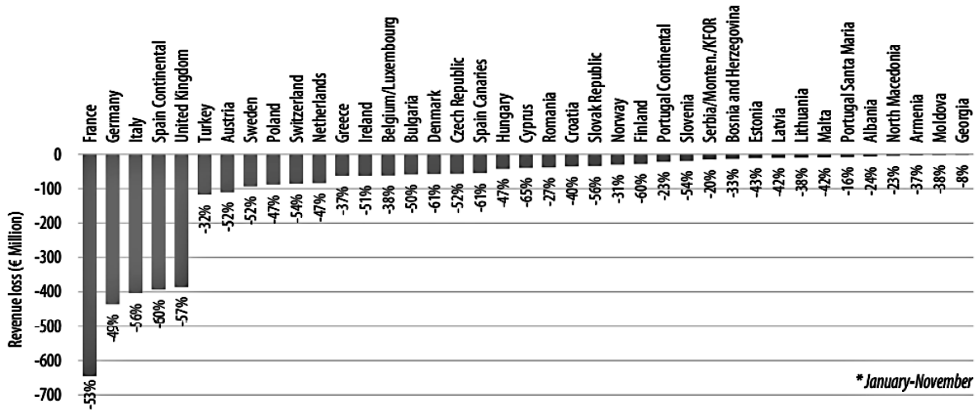
The European ANSP market refers to the European Common Aviation Area (ECAA⁷), including Switzerland, where each individual member state collaborates to ensure a harmonized air navigation region. Today most European ANSPs are independent enterprises, albeit government owned (Buyle *et al.* 2021). In such a constellation, ANSPs are authorized to collect revenues and manage their budgets independently from the government's budget. During the COVID-19 pandemic, many countries imposed travel restrictions, which affected heavily both the intercontinental and the intra-European share in the total number of flights (domestic and international). In 2019, 71.6% of traffic in Europe was international. International flights and domestic flights recovered quicker in the summer 2020, but dropped again in September due to airlines schedules adjustments triggered by the second wave of the COVID-19 in Europe, as well as by difficult travel conditions in terms of quarantine and testing requirements (EUROCONTROL, FAA 2021).

The significantly reduced air traffic failed to cover the fixed costs of ANS provision in Europe, causing a €4.7 billion in-year revenue losses in 2020 and €3.7 billion in-year revenue losses in 2021. Service charges collected by ANSPs in 2020 covered only 65% of ANSP costs (Klikac, Bishop 2022). Figure 13 depicts the en-route revenue losses change in comparison to 2019, showing that four Member States (France, Germany, Italy, and Spain) and the UK were the most affected by this pandemic.

Most of these losses are assumed to be recovered via increases in unit rates (which are paid by aircraft operators for services provided) over a period of five to seven years based on Commission Implementing Regulation (EU) 2019/317 (EUROCONTROL 2022a). These measures were designed to ensure both that ANSPs adjust their operations to the new realities and that aircraft operators are shielded from a sudden increase of ANS charges during recovery from the COVID-19 pandemic. The ANSPs in the eight European States, which are part of the EUROCONTROL Multilateral Route Charges System and are not bound by Single European Sky (SES) regulations, apply different national cost recovery schemes, which, for the majority of these States, are based on a 'full cost recovery' regime (EUROCONTROL, FAA 2021).

⁷ The European Common Aviation Area agreement is an ambitious agreement between the partners from South-Eastern Europe: Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, Serbia, Kosovo (This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence) on the one side and the European Union, United Kingdom, Norway and Iceland on the other side (Directorate-General for Mobility and Transport, European Commission 2022).

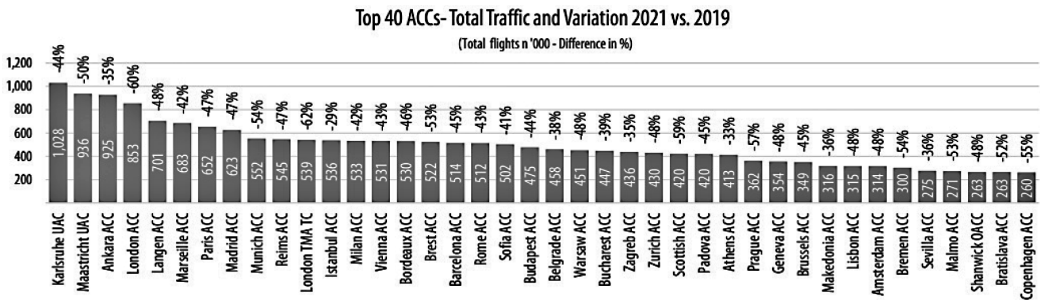
Figure 13.
En-route revenue losses per charging zone (2021 vs. 2019)*.



Source: EUROCONTROL 2022a.

Figure 14 charts the impact on Area Control Centres (ACC) comparing total traffic handled in 2021 and in 2019. The busiest one was Karlsruhe Upper Area Control (UAC), with 1,028 thousand flights and -44% on 2019 levels, followed by EUROCONTROL's Maastricht UAC (936K, -50%) and Ankara ACC (925K, -35%).

Figure 14.
Top 40 ACC comparison.



Source: EUROCONTROL 2022a.

Measures implemented by most ANSPs to reduce cost included staff reductions, salary and benefits reductions, early retirements, postponement of investments, etc. Around the world, salary freeze strategy was implemented in 2020, together with abolishment of additional payments for overtime work (imposed due to staff shortage on account of illness) and bonuses on

various grounds. Specifically, the Irish Aviation Authority (IAA), for example, implemented a three-phase cost containment programme, starting in March 2020, with a moratorium on recruitment, suspension of training for twenty-four recruits, the suspension of all non-essential training and pay increases, and a review of all capital expenditure to determine whether any investments could be deferred. In the United Kingdom, the National Air Traffic Services (NATS) reduced the number of contractors and reassigned the company's own employees. At the peak of the pandemic, NATS temporarily laid off more than 3,000 staff, while it received more than GBP 37 million in grants, under the government's job retention scheme. Generally, the state financial support in Europe was predominantly aimed at safeguarding ANSPs liquidity and alleviating payroll costs when furlough schemes were introduced. The most common mitigating measures implemented by European ANSPs in response to the pandemic in 2020–2021 were: aids from national governments and loans and cost containment measures (related to staff, capital expenditure, etc) (Turnbull *et al.* 2022).

7. AIRCRAFT MANUFACTURERS AND LEASING COMPANIES

Since aircraft manufacturing and aircraft leasing companies provide global products and services, the impact of COVID-19 pandemic will be considered only at the global level. As mentioned previously, the crisis caused great uncertainty regarding the recovery of traffic, therefore, many airlines worldwide have cancelled aircraft orders or deferred their delivery. For example, in 2020 Airbus received only 383 aircraft gross orders, compared to 1,131 in 2019. In the same year, Airbus delivered a total of 566 commercial aircraft, which is 34% less than in 2019 (Airbus 2022). At the same time Boeing reported a 59% reduction in aircraft deliveries with only 157 commercial aircraft delivered in 2020, compared to 380 in 2019 and 806 in 2018 (Boeing 2021). The recorded decline in deliveries is partially due to the grounding of the Boeing 737 MAX. However, in this case it is difficult if not impossible to separate the impacts of these two factors.

The five-year revenues of Airbus and Boeing are given in Table 5. It can be noted that Airbus' revenue was affected by COVID-19 pandemic, since a significant reduction is apparent in 2020. Concerning Boeing's revenue, the decrease is recorded in 2019, which is consequence of Boeing 737 MAX accidents and grounding of all these aircraft. Additional reduction was caused by the COVID-19 pandemic in 2020 and 2021.

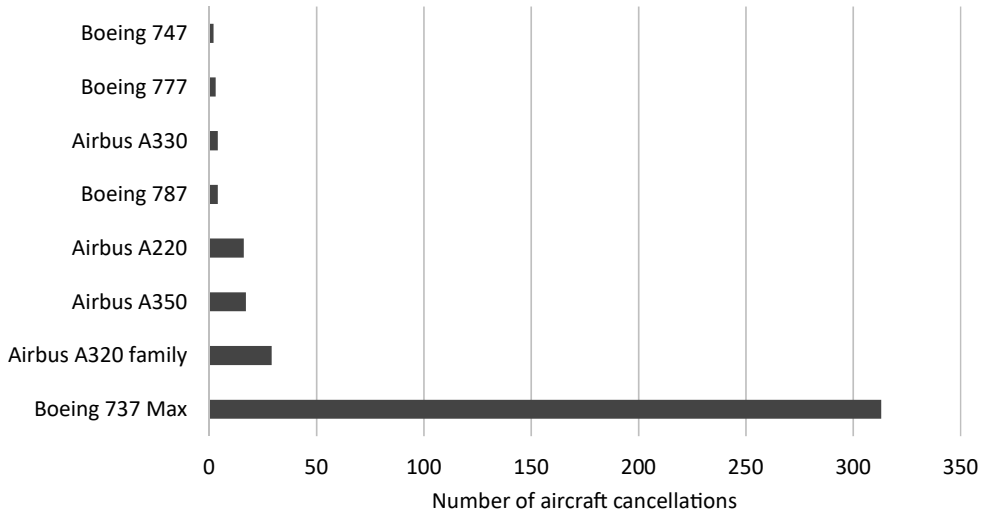
Table 5.
Revenues for Airbus and Boeing in 2017–2021 (millions of EUR)

	2017	2018	2019	2020	2021
Airbus	59,022	63,707	70,478	49,912	52,149
Boeing	83,335	85,705	68,375	51,005	52,681

Data source: Boeing 2021; Airbus 2019; 2020; 2022.

Regarding the cancellation of aircraft orders, by aircraft type, the top ranked aircraft type is Boeing 737 MAX (a result of the grounding of the B737MAX), and it is followed by Airbus A320 aircraft family (Figure 15).

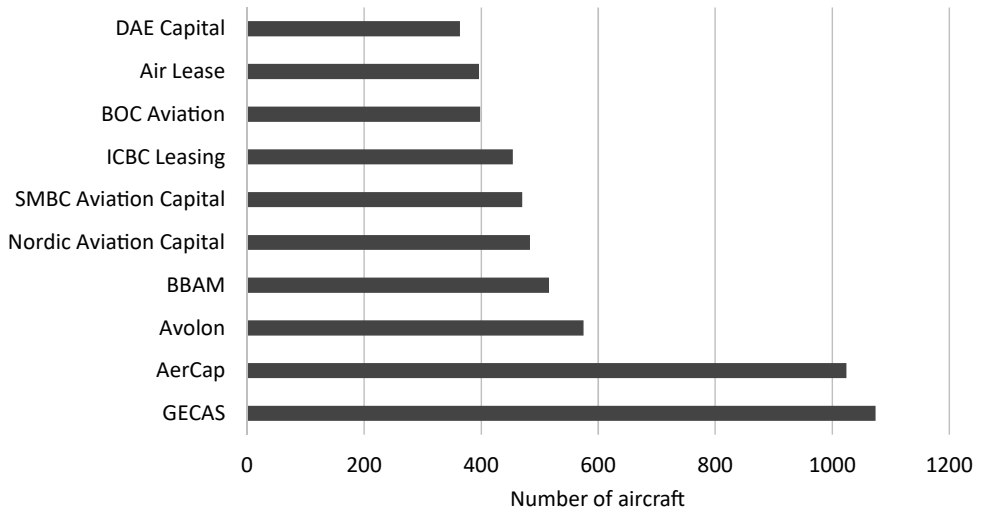
Figure 15.
Aircraft order cumulative cancellation by aircraft type (as of July 2020).



Data source: Statista 2021.

Figure 16 represents leading aircraft leasing companies (lessors) in 2020, by fleet size. It can be seen that the two leading lessors, by fleet size, were General Electric Capital Aviation Services business (GECAS) and AerCap.

Figure 16.
Leading aircraft leasing companies in 2020, by fleet size.



Data source: Statista 2022b.

Regarding the profit of the leading lessors, it is noticeable that GECAS reported a profit reduction from year to year, while business results of AerCap were more consistent (Table 6). COVID-19 impacted both companies and according to their annual reports, they recorded losses in 2020 (AerCap USD 295 million, GECAS 786 USD million) (AerCap 2019; 2021a; General Electric 2019; 2020).

Table 6.
Profit of leading lessors (billions of USD)

	2017	2018	2019	2020	2021
GECAS	2.1	1.2	1.02	-0.786	n.a.
AerCap	1.1	1.02	1.2	-0.295	1.01

Data source: AerCap 2019; 2021a; General Electric 2019; 2020.

However, AerCap recovered and finished 2021 with the profit of more than USD 1 billion, approaching the pre-Covid level of profit. Moreover, AerCap the global leader in aircraft leasing, announced on 1 November 2021 that it had completed its acquisition of GECAS from General Electric (AerCap 2021b). Now, questions that require answers have appeared, and these are:

does this capital transaction prove the resilience of leasing companies and their ability to manage their business and keep it successful even in this turbulent period for the aviation industry, or does this capital transaction prove the vulnerability of the leading lessors, hence the need to strengthen their positions, in regard to competitors.

Usually, in crises, aircraft leasing companies had the option of taking back their aircraft and leasing them to other airlines. The COVID-19 pandemic was specific due to the fact that there was no other airline that could lease an aircraft. As mentioned before, the pandemic period was extremely difficult for airlines, and they received financial supports from the governments. In such an unstable environment, the flexibility that leasing can offer airlines proved to be a very attractive option. The pandemic resulted in many sale-and-leaseback transactions between airlines and lessors, and these transactions were worth billions of dollars. Moreover, some of these transactions contributed to airlines liquidity, since airlines sold the aircraft they owned to lessors, and leased them back. Therefore, the crisis strengthened the relationships between lessors and their customers (O'Mara 2022).

8. PASSENGERS EXPERIENCE

As the spread of the COVID-19 pandemic gained momentum in most parts of the world and became more intense, the nature of the air travel experience began to change. By the end of March 2020, industry-wide passenger kilometres (RPKs) fell sharply, 52.9% below their level a year earlier (IATA 2020c). Travel restrictions and lockdowns were lifted by the begging of summer, but the willingness of consumers to travel by air remained limited. Many of them were reluctant to travel due to the remaining travel restrictions, such as quarantining and testing. These requirements remained an obstacle for flying during 2021, even for those people fully vaccinated with vaccines approved by the World Health Organization (WHO).

During the past two years, part of the population still felt insecure in public places and feared infection, especially if traveling by plane, which further slowed the recovery of air travel. An IATA survey showed that more than 30% of respondents were willing to wait six months or more before considering travelling by air, and an additional 16% did not want to travel for at least a year (IATA 2020d). Part of the demand was errored by the economic crisis that was triggered by the COVID-19 pandemic. Many people have lost their jobs or had their wages cut since the start of the pandemic.

Beck and Hensher (2020) reported that 78% of Australian households changed their travel plans, with young people and low-income families being the most affected.

After the first lockdown in 2020, it is notable that leisure trips started to recover earlier and more rapidly in comparison to business trips (The Points Guy 2022). Business trips were significantly affected by digital remote work and other flexible working arrangements, which will likely remain in some form in the future. Moreover, a large number of cancelled flights, delays and the constant uncertainty regarding the scheduled flights does not help airlines to reawaken business trips.

Although significantly eased, sustained restrictions in many regions influenced passengers to fly more on short and medium routes, due to a lack of passenger confidence. At first, people were reluctant to fly abroad or too far, prior to the development of medicines and vaccines. Later, after the development of a vaccine, the willingness to fly abroad increased, but some people still hesitate to fly because of the inconsistencies in national travel rules. During certain periods in 2021 it was difficult for passengers to keep up with the constant changes in national government travel document requirements (different COVID-19 test requirements, various timeframes for testing, vaccinations, etc.). It is notable that travel rules were applied differently even within EU member states. For example, 30% of states that used the EU Digital Covid Certificate (DCC) did not accept rapid testing, and 41% of states did not allow vaccinated travellers from non-EU 'White-List' countries to enter, etc. (Airlines, IATA 2021). This is why domestic travel dominated the industry recovery in 2020–2021, while the recovery on long-haul routes will take longer.

Moreover, COVID-19 completely distorted the passengers' experience at airports, due to social distancing rules combined with screening requirements. It is a known fact that waiting times are tremendously important for the successful management of airports in nominal conditions. However, with the novel airport screening operations and equipment introduced to efficiently combat the spreading of the virus (see e.g. Dollard *et al.* 2020; Hussain *et al.* 2020), waiting times have been greatly increased. In addition, these safety procedures also led to a reduced shopping experience and the significant shrinking of the airports' commercial revenues.

The COVID-19 measures have also affected the turnaround process, mainly through changing the boarding strategy. Accordingly, the applied boarding strategies during COVID-19 varied across airlines and over time, e.g. the middle seat empty strategy applied by Wizzair and Alaska Airline (Milne *et al.* 2020), the back-to-front by row with business class last by United Airlines, random boarding by Hainan Airlines, and many others.

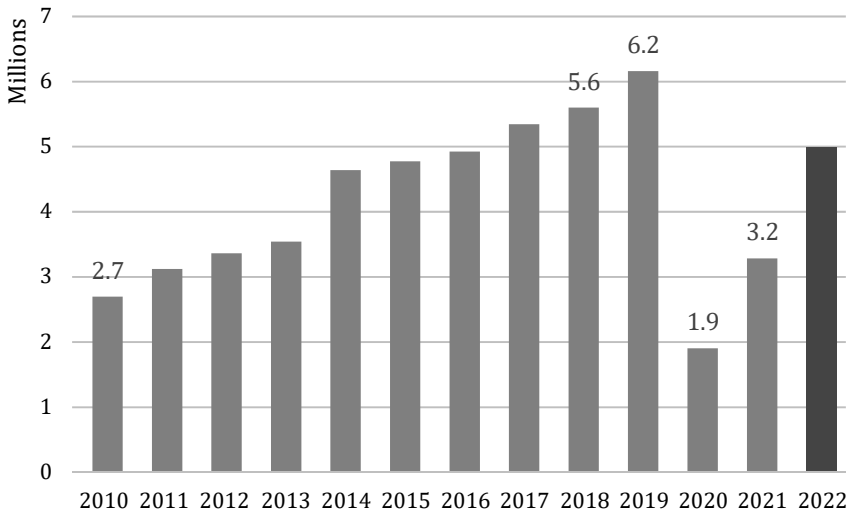
As time goes on, air travellers are showing signs of adjusting to the new normal, but many still remain concerned about how they can travel safely and what restrictions they will be subject to. Even before the COVID-19 pandemic, air travel was complex and stressful for many people, with rules that need to be followed. With the new rules and more documents, accompanied by longer waiting times at the airport, travelling by plane has become even more difficult. In order to increase passenger confidence in flying, airports and airlines will need to take many steps to increase standards for aviation safety and passenger wellbeing, and become even more safe, clean and hygienic.

9. IMPACT OF COVID-19 ON THE AVIATION INDUSTRY IN SERBIA

The COVID-19 pandemic also caused the decline in air travel in Serbia. The number of flights in the airspace under the jurisdiction of the Serbian ANSP in 2020 (January–September) decreased by 90%, compared to the same period in 2019 (SMATSA 2020). In 2020, the number of passengers at Serbia's largest airport, Belgrade Nikola Tesla Airport, was 69.4% lower than to the previous year (Figure 17). Air traffic in Serbia was suspended from March 20 to the end of May, with the exception of the transportation of goods, medical equipment, mail, humanitarian aid, and rescue. In 2021 the passenger volume increased, but it was still almost half the volume in 2019. There were 4.2 million passengers in first nine months of 2022 and it is predicted to reach 5 million by the end of the year (Figure 17).

During the summer 2020, air traffic recovered to some extent thanks to a temporary improvement in the health situation. The national airline, Air Serbia, gradually restarted some flights in the period after the initial easing of measures in May 2020. At the end of May, Air Serbia organized flights to London, Frankfurt, Zurich and Vienna, and later, in the first two weeks of June, to Podgorica, Tivat, Sarajevo, Banjaluka, and Skopje. A big problem for the further recovery of air traffic during the summer of 2020 was caused by the closure of Europe towards Serbia, through travel bans or strong travel restrictions for Serbian citizens (quarantine, self-isolation, tests for COVID-19). Consequently, Air Serbia cancelled the renewal of flights to Madrid, Kiev, Nice, Helsinki, Malta, Cairo, Beirut, Rijeka, Pula, Zadar, and St. Petersburg, and cancelled the launch of all new routes (with the exception of Oslo). In addition, due to the ban, the airline was not allowed to fly to its two main markets – Moscow and Krasnodar (Russia), and Podgorica and Tivat (Montenegro) (Tango six 2020).

Figure 17.
Number of passengers at Belgrade Nikola Tesla Airport



Data sources: Statistical Yearbook of the Republic of Serbia 2018; Vinci Airports 2020; Vinci Airports 2022.

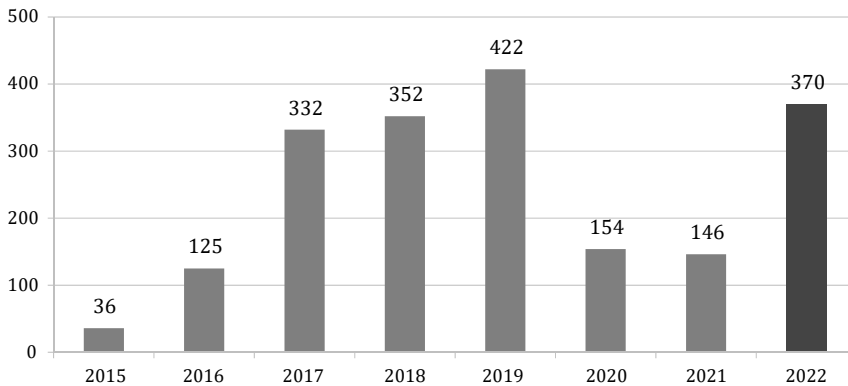
Despite this, Air Serbia had the strategy of reopening routes to a large number of destinations, but with low frequencies. Routes that had daily departures were reopened with fewer, some with only one departure per week. During the summer of 2020, Air Serbia had 135 weekly departures on 33 routes from Belgrade, and 6 weekly departures on 4 routes from Niš airport (Tango six 2020). During 2020 Air Serbia cancelled 23,079 flights, while during 2021 the airline cancelled 4,933 flights, which resulted in reduced revenue. Consequently, Air Serbia has reported a net loss of over EUR 77 million in 2020, while the net loss in 2021 was EUR 21.3 million. Air Serbia carried a total of 1,586,665 passengers in 2021, with the airline's average annual cabin load factor at 64%. The airline's traffic volume grew 39% compared to 2020, but was down 35% compared to 2019 (EX-YU Aviation News 2022).

Beside Air Serbia, other airlines gradually reopened routes to Belgrade Airport, which resulted in 1,904,025 passengers who used Belgrade Airport in 2020. This represents a decrease of 69% compared to 2019 (6,159,018 passengers). In 2021, Belgrade Airport served 3,286,000 passengers, or 73% more passengers than in 2020 (Vesti 2022). In 2020 the number of passengers at second largest airport in Serbia, Niš Constantine the Great Airport, was 63% lower than in 2019 (Figure 18). Cargo traffic also decreased, and the first seven months of 2020 63.8% less cargo was transported.

During April and May 2020, there was no cargo traffic at all (Danas 2020). Niš Airport had 2,662 passengers in January 2021, which is 93% less than in the same month the previous year. The crisis caused by the pandemic led to the reduction of the number of destinations from the Niš airport from 22 in 2019 to only two in 2021, and the number of weekly flights from 45 to five on average (Anadolu Agency 2021). In 2022 the first nine months counted 288 thousand passengers, and based on this it is expected to reach 370 thousand by the end of 2022 (Figure 18).

Even though the pandemic was in full swing, the largest development project in the history of the Belgrade Airport was launched, headed by operator VINCI and its partners, with the aim of creating the future hub in South-Eastern Europe. The construction is proceeding according in two phases (the first until 2025, the second until 2030). During the first phase plans call for the addition of an arrivals gallery on the roof of the existing terminal, the construction of a new boarding pier with three Multiple Apron Ramp System (MARS) contact stands, and the refurbishment of the existing facility with a new central security screening area. In the second phase the passenger processing areas, such as check-in, security screening, duty free and baggage delivery, will be added (EX-YU Aviation News 2021a).

Figure 18. Number of passengers at Niš Airport, Constantine the Great



Data source: Aerodromi Srbije 2022.

In 2020, Air Serbia and Etihad Airways decided to extend their partnership despite the fact that Etihad reduced its ownership stake in the Serbian airline from 49% to 18% during the pandemic. The two airlines have renewed and expanded their extensive codeshare agreement. Air Serbia has attached its code and flight numbers on Etihad's services from Paris, Zurich, Amsterdam, Frankfurt and London Heathrow to Abu Dhabi, while expanding its codeshare on Etihad's flights from Abu Dhabi to Manama, Bangkok,

Colombo, Dammam, Riyadh, Jeddah, Seoul, Karachi, Lahore, Kuwait, Muscat, Singapore, Sydney and Melbourne. The agreement presently covers more than thirty routes (EX-YU Aviation News 2021b).

10. CONCLUSION

The COVID-19 pandemic had a strong impact on global aviation in 2020 and 2021, affecting the entire value chain from aircraft manufacturers to ANSPs, resulting in several hundred billion Euros in losses. In order to prevent the fast spread of COVID-19 around the world, all countries imposed protective travel restrictions, and during certain periods the complete suspension of air transport, which undoubtedly hit the aviation industry harder than many other industries.

However, it is notable that not all markets were affected equally. The European aviation industry seems to have been the hardest hit by the pandemic, and this may be related to fact that countries acted disunited and individually implemented measures to fight the COVID-19 pandemic. This resulted in a large number of different national rules in terms of quarantine and testing requirements, which has been a major barrier for air travel. Most governments acted individually and introduced measures to restrict travel, without synchronisation with the industry and other governments. This impeded global air connectivity, resulting in massive negative economic and travel consequences. Moreover, constant policy changes by governments, which left most of the industry little time to prepare and to coordinate, resulted in a slow demand recovery and low public confidence, which was not so much because of fear of the virus, but of sudden and arbitrary border restrictions. Thus, universally recognized and harmonized rules and requirements facilitating air passenger travel should be provided to the aviation industry.

Moreover, the pandemic has demonstrated that the air transport system is not as resilient as it was thought to be. Even though the technical and operational resilience of the air transport system has been significantly improved over the years, the economic resilience is still highly dependent on government support. As observed, most governments gave a high priority to maintaining the aviation industry in order to protect domestic and international connectivity, economic activity, jobs, and related sectors (e.g. tourism). Unaided, many airlines, airports and ANSPs would have gone out of business before the end of the first year of the pandemic. How the industry and governments reacted to pandemic raised another question: are job cuts the best way to save the industry in the short term? The industry's

reaction – cutting jobs to mitigate the huge revenue losses – resulted in the loss of thousands of highly skilled workers in ground handling, security, and other professional services required for running daily operations in the air transport system. Consequently, once the travel restrictions were removed and the demand for international travel returned after the two-year pandemic, airports across Europe struggled to adapt due to the lack of skilled workers. In the future, the industry should consider and develop programs for how skilled workers from the aviation industry could be otherwise utilised in similar situations.

Countries with strong domestic markets and domestic tourism, experienced faster recovery. Although initially domestic traffic was the main driver of recovery, later airlines retreated to core networks and concentrated on short and medium-haul flights, but with lower capacity. This strategy was more favourable for LCCs and some smaller airlines, such as Air Serbia, and it helped them to position themselves on time and gain market share as short-haul leisure demand returned quickly following the distribution of COVID-19 vaccines. Some airlines found a solution in replacing the passenger flights with cargo flights and took advantage of increasing online deliveries during the pandemic.

Of particular importance to airlines and airports is the fact that the demand structure has changed, with leisure travel and passengers VFR becoming more prevalent, compared to business travel. Business trips have been significantly affected by digital remote work and other flexible working arrangements, which will likely remain in some form in the future. Also, some negative consequences caused a reduction in this segment, such as the collapse of small businesses, large companies facing with financial issues, and many employees losing their jobs or facing uncertain futures. The business segment has always been crucial for airlines and airports, and with this reduction it means a loss of valuable customers and revenue. However, it is expected that when demand fully recovers, this segment also will increase, and business travellers will start use air transport more.

One of the impressions regarding the aviation industry is that all stakeholders (governments, airlines, airports, the aircraft manufactures, ICAO, IATA, etc.) worked together to ensure that when people started to fly again, travelling by plane would be as safe as possible. At the time when they were suffering huge losses due to a drop in demand, the entire aviation industry implemented many protective measures – even more than what was required – to reduce the risk of getting infected during travel. A particular challenge was to keep the aviation industry as safe as before the pandemic, bearing in mind the grounding of aircraft (which are not designed for long periods without use) and that pilots and air traffic controllers had

to maintain their licences when a majority of flight were cancelled. This pandemic showed that some industries, such as the aviation industry, require specialists that have no other customers and no alternative working positions (e.g. airport workers, pilots, air traffic controllers, suppliers of aircraft parts, etc.) and as such, they also need some financial stability during periods without operations to prevent even greater long-term harm to the industry.

This pandemic also created numerous opportunities. Many airlines and airports started implementing touchless technologies to reduce costs and offer the highest level of hygiene. Wider implementation of touchless technology, including touchless biometrics to verify passenger identity, will help reduce waiting times in the future while improving passenger experience. The pandemic also led to the retirement of large number of old, fuel-inefficient aircraft, which contributed to making aviation greener. Now all that is left is to encourage the industry to invest in more fuel-efficient replacements, although this is currently a low priority.

As COVID-19 spread across the world, and air traffic dropped dramatically, on-time performance indicators improved. Also, due to the lower traffic levels, flight efficiency increased along with subsequent environmental (CO₂ emissions) and economic (fuel) benefits. These economic benefits refer to less fuel consumption due to less traffic congestion, so airlines use the most efficient routes, while the waiting times in the air and on the ground are minimized. This unexpected situation offers an opportunity to review and evaluate the operations of all the stakeholders involved and to find a more efficient way to maintain the better service levels when traffic returns on pre-pandemic levels.

This research and systematic review should provide a foundation for more in-depth research on the financial and operational impact of the pandemic, and the sustainability of current business models of airlines, airports and ANSPs, as a commercial service to users (private good), as opposed to the responsibility of governments, and the importance of this sector for the economy and the transport infrastructure of every country (public good). COVID-19 also offers an opportunity to rethink global air transport operations. Many issues, such as those addressing the demand recovery pace, the sector's resilience on massive exogenous shock, and the environmental impacts, are also important to analyse in the future, once full recovery from the pandemic is achieved.

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Article history:

Received: 1. 10. 2022.

Accepted: 15. 12. 2022.