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Pandemic vs. Post-Pandemic Airport Operations: Hard Impact, Slow Recovery

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Abstract: The elements of a new daily normal, airports need to face in post-pandemic operations, are massive flight delays, operational disruptions, and shortage of trained staff. The authors analysed the problems and reactions of airport human resources staff during the early stages of the COVID-19 pandemic and their approach to the management of human resources after the remission of the pandemic. Additionally, this paper describes problems of airports during the recovery phase and increases the understanding of specific problems airports are facing due to lack of qualified staff in their post-pandemic recovery period. Critical areas, in which airports underperform are ground handling services and security checks of passengers. Staff recruitment is not capable of providing enough workers to do the job. This leads to flight cancellations and delays or unsatisfied passengers during check-in and security. On top of this, ground-handling services remain unattractive for newcomers due to poor working conditions, such as low wages and 7 days a week shift work. 'Cross-training', allowing airports to have employees shadow colleagues from other airport teams, or 'employee sharing' (with other airports) could help in reducing problems, with unavailability of trained staff, especially at smaller airports.

Keywords: airport; operations; staff; shortage; delays; pandemic

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1. Introduction

A pandemic is defined as 'an epidemic occurring on a scale that crosses international boundaries, usually affecting people on a worldwide scale' [1] (p. 179). Pandemic is characterised by very widespread growth or extent; it kills numerous people, and it is highly infectious [2].

Eruptions of communicable diseases are not new to mankind or the aviation industry. Airports have learned from past situations, preparedness plans, advice from the government, businesses, and the help of associations to better prepare for pandemic situations, reinforce crisis communications, and plan together with robust business continuity strategies [3].

Our research goal is to analyse the problems during the early stages of the COVID-19 pandemic that impacted airports in the areas of human resources and airport operations, as well as the ways in which airports reacted to the situation, their approaches to solving problems, and how airport operations were carried out after COVID-19 remission. In addition, this paper offers insights into how airports managed to change their modus operandi during the decline in traffic as well as after the market's recovery, as these procedures directly have affected human resources management. Additionally, this research helps to create an understanding of the specific problems airports are still facing due to a lack of qualified staff in their post-COVID-19 growth period.

The effects of the COVID-19 pandemic on aviation have been very different from past situations, such as the SARS outbreak in Hong Kong in 2003 [4], the situation in the United Arab Emirates during the MERS crisis in 2012 [5], or the crises stemming from the volcano

ash that was ejected during the 2010 eruptions of Eyjafjallajökull in Iceland [6]. Hence, these scenarios cannot be compared. All of the abovementioned outbreaks were territorially limited. Although they each had a significant economic impact on the abovementioned countries or regions, they were well-managed from a medical point of view and did not have a serious global impact. For Hong Kong in particular, SARS had a significant impact on the economy and air traffic, which was virtually suspended for a year as a direct consequence of the outbreak [7]. COVID-19 was officially declared a pandemic by the World Health Organization (WHO) on 12 March 2020. In terms of its impact on air transport, it was unique in its global scale and the overall impact on all civil aviation stakeholders, including downstream companies directly connected to aviation, e.g., on-board catering and jet fuel production and distribution. The pandemic also indirectly affected companies connected to the aviation industry, e.g., shops, restaurants, and hotels. Moreover, the pandemic had an influence not only on large airports (those providing connectivity), but also on smaller, regional airports that had no previous experience with such difficulties.

Despite the short period of time, many authors have researched the problem from different perspectives. In our area of interest, i.e., airports, Schultz et al. [8] focused on airside problems—aircraft turnaround operations with respect to new standards resulting from anti-COVID-19 measures. Issues of aircraft commissioning after their long-term grounding and parking with a view to restoring operations in a 'post COVID-19 era' have been described by the authors of [9]. Problems related to COVID-19's impact on airport economics and airport changes connected with the market's collapse were analysed by [10]. Possible scenarios of post-COVID-19 airport operations and measures for the restoration of traffic and the assurance of confidence in passengers and staff were covered by [11]. The new normal of remote work and the reduction in work-related trips, the 'new normal' of daily living activities, and the concept of work are discussed by [12]. Various policy measures have been proposed and taken to address the impacts of COVID-19 in [13]. The impact of the initial response of European airlines at the beginning of the crisis on their operations as well as their strategic responses were examined by [14], and the impact of COVID-19 on the markets in interwoven catchment areas of close airports were researched by [15].

Various authors have linked the problems of aviation and COVID-19 to regions or states or described selected problems of airline and airport operations and made forecasts of aviation development in the post-COVID-19 period. However, understandably, in terms of the short time that has passed, there are just a few articles investigating the airport situation during post-COVID-19 aviation recovery, and none of these articles have addressed systematic problems that airports have had to deal with in terms of human resources in the rapidly changing nature of airport operations. Similarly, no attention has been given to the crisis management of the airport and the implications of different approaches to human resource management during COVID-19 in the incipient recovery of the air transport market. Additionally, there is no comprehensive view available on the relevant strategic options airports have with a view to limiting disruptions, reducing delays, and having trained staff available. For instance, the view of the International Finance Corporation of the World Bank Group on the impact of COVID-19 on airports is limited to effects on passenger traffic, revenues, future risks, earnings reviews, and credit downgrades. This limitation supports the need for the proposed research that should complement the currently available findings. Additionally, an analysis of the differences between pandemic and post-pandemic airport operations, as well as the reactions of airports to the crisis, which are both presented in this article, make this topic relevant. The results are novel in a sense that they show a comparison of airport operation provisions during both the COVID-19 period and the post-COVID-19 recovery period and tackle the unique problems of ground handling services and background checks. The relevance of this article is stressed by several strategic options, which are outlined by the authors in Section 6.3. Implications such as the cross-training of airport staff, employee sharing, and contactless technologies can easily be translated into effective policies to improve airport operations on a global scale.

2. Methodology of the Research

This paper partly represents exploratory research, which is typical for the early stages of problem examination, when little prior research has been conducted on the problem, or because of the limited scope of existing research. In principle, exploratory research does not provide conclusive results because of the lack of statistical data. However, it facilitates in explaining how and why things happen [16]. In our case, we have decided to use this type of research, as it helps to clarify what is happening at airports as a consequence of the unavailability of qualified staff, who were laid off by airports when travel restrictions were put into place during the pandemic. Additionally, we have used an inductive method in our research. This method is frequently referred to as 'bottom up'. Appropriateness of the method is ensured by the fact that, in principle, it is more exploratory and open-ended, in particular at the commencement of the research. Inductive reasoning begins with specific observations and measures, detects patterns and regularities, formulates some tentative hypotheses that could be further explored, and finally concludes with the development of a general inference [17].

The limitation of this method is that it only derives findings from relatively limited experiences that cannot be adequately verified [18]. This risk can be reduced by comparing inputs and data from different sources and confirming the implications outlined by different operational case studies once these become available. Additionally, the historical method is used in our research. Although the history of the last pandemic is relatively short, the existing principles and research approaches are appropriate for this case [19]. Kazda [20] suggests that this method is based on gathering data from situations that have happened in the past and performing statistical analysis on this data, just as we would in a traditional experiment. Findings in this article are based on the data available online. Data sources are properly referenced in the article. This article contributes to the literature by providing empirical evidence of differences between pandemic and post-pandemic airport operations that are not reported in the literature yet.

3. Impact of Pandemic on Airport Staff

Referring to [21], 25 million jobs are created by air transport globally. As a result of the COVID-19 pandemic, many of these jobs were put at stake, and airports and airlines have announced redundancies since March 2020. As a result of the pandemic, air travel has been severely curtailed, and many airports have had to reduce or suspend operations for several months. This has led to a crisis that neither airports nor airlines were able to influence [22]. Substantial financial losses were recorded, and the companies were forced to furlough workers or lay off their staff. Standard workflows have needed to be adjusted because of the unexpected progression of the crisis situation.

A high number of airport staff who did not report for duty (due to sick leave) during the pandemic created additional problems with the airport's daily rosters. Airports have needed to adjust to alternative shift patterns so that critical functions of the airport were continuously secured. Airports could have also opted for alternative suppliers of critical services and therefore reduced the number of required staff; or they could have decided for the smallest number of staff needed for the airport to continue operations, a so-called 'skeleton staff'. Dr. Karsten Benz, Professor of Aviation Management at Frankfurt University [23], suggested that airports run in a 'survival' or 'skeleton mode' and be ready for travel to come back. Airportwatch [24] shared that the busiest single-runway airport in the world before the coronavirus crisis was Gatwick, which was forced to run a 'skeleton operation'.

In general, to ensure that the spread of the virus remain limited, it was recommended that permanent teams of workers be created who would work together for the period of the crisis on the same days, at the same time, and at the same positions. Consequently, if one member of the staff had a positive test, it was possible to quickly identify everyone who was in contact with him/her. Additionally, it was necessary to plan the staff interchange so as to establish a healthy work environment and prevent possible problems between the operational teams and those staff members working remotely. Shift rosters were to

remain fair and flexible enough to meet operational requirements [25]. According to the CEO of Piestany Airport, another aspect guaranteeing the availability of key staff, in particular at small regional airports, was to ensure the substitution of workers by providing cross-training and qualification plans to guarantee that they could work in other positions, should the 'primary employee' become infected. In some cases, the worker could have two or three qualifications and could thus take any of the relevant positions [26]. In the case of big airports, where all processes are handled simultaneously, cross-training is unusual, except for specific cases such as winter operations. It was assumed that some employees would not be at work for months. Some of the furloughed workers could have been asked to return to their jobs once the pandemic receded [27]. Airports provided recurrent training by online courses or specialised training programmes for them.

The main task of airports has been to keep employees in their working positions to be able to resume work immediately after the restrictions were lifted or relaxed [28]. Employees who were unable to work (because they needed to stay at home to take care of their children, elderly/handicapped family, or they were caring for the elderly or sick house-bound that were in self-quarantine) were eligible for compensation schemes [29]. As an example, the UK Coronavirus Job Retention Scheme formed part of a collective national effort to protect people's jobs. Under this scheme, the government made a grant to UK employers to cover up to 80% of the wages of employees whom they continued to pay but who would otherwise have been laid off as a result of the COVID-19 crisis [30]. Airports, airlines, and ground handling services providers laid off thousands of workers when travel restrictions were introduced during the pandemic. In fact, flexible work arrangements, paid or unpaid leave, or employee layoffs were recommended options to reduce operating costs for airports [31]. The exact numbers of staff that needed to be laid off are unknown. According to Oxford Economics [32], there were 2.3 million fewer jobs in the global aviation industry in September 2021 compared to pre-COVID-19 levels.

Due to the possibility of unforeseen numbers of infected employees, it has been important to carefully assess whether or not leave could be granted to key personnel. Companies have been forced to balance between legislative guidelines and the crisis scenario to keep key personnel at work. Accordingly, airports have been reconsidering staff payment schemes and working patterns. Some airports have implemented 'work from home' and 'remote work' initiatives to limit the negative impact on the workforce that was on leave. The Changi Airport Group Media Centre reported that when COVID-19 hit Singapore in early 2020, one of the Changi Airport Group's (CAG's) immediate priorities was to ensure the safety and well-being of its almost 2000-strong workforce by allowing all CAG employees who were able to do their jobs remotely to work from home [33].

At the same time, some airports have introduced more close cooperation with their staff to maintain airport operations by 'pooling' available employees with the necessary skills and qualifications with a view to maintaining continuity in critical areas of airport operations. According to [34], this method was practiced at some small and regional airports.

To put the impact of the pandemic on airport staff into a simple perspective, it led to the layoff of airport staff, alternative shift patterns, airport operations with 'skeleton staff' (further discussed in Section 6.3), better flexibility of workers by providing cross-training (further discussed in Section 6.3), cumulative qualifications of airport workers, and 'work from home' or 'remote work' initiatives implemented by airports.

4. Managing the Decline in Traffic Volumes

The COVID-19 crisis hit world airports as a big surprise, leading to massive restrictions on international travel. As a consequence, millions of travellers were not able to travel at all. Figure 1 shows the evolution of international passenger throughput at UK airports from January 2020 to May 2022 with the highlighted consequences of the coronavirus pandemic. According to the Civil Aviation Authority (CAA), there were 255.2 million international passengers in the UK in 2019 [35]. This number decreased to 62.5 million in 2020 and 49.8 million international passengers in 2021, respectively.

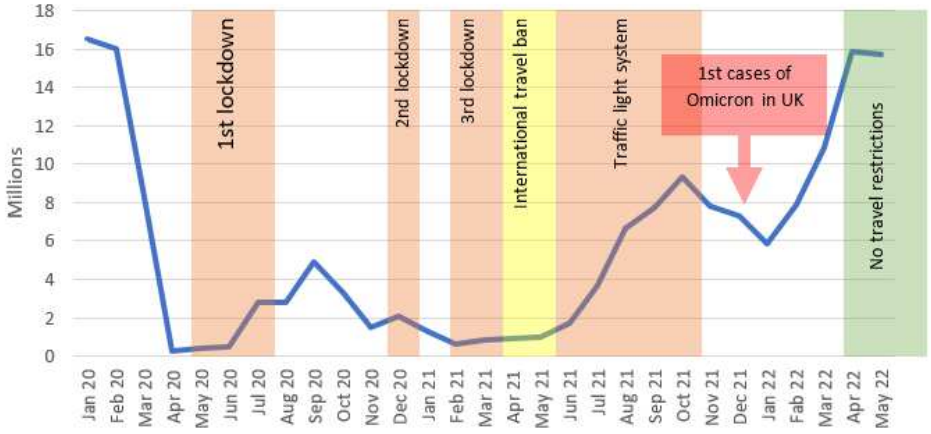

Figure 1. International passenger throughput at UK airports 20 January–22 May, drawn by the authors using data from the UK Civil Airport Authority (CAA), UK Airport Data, Table 10.1 EU and Other International Passenger Traffic [36].

Passenger traffic has accelerated since restrictions have eased. In January 2022, there were 5.8 million international passengers, a third (36%) of the pre-pandemic level of 16.3 million in January 2019. This increased to 15.7 million in May 2022, which is 68% of the pre-pandemic level of 23.0 million in May 2019.

During the pandemic, numerous airports set up crisis management teams that acted as decision makers during the crisis, closed unused areas, and merged their operations into a single terminal (or a part of it) to reduce operational costs and shortened hours of operation. Communiqué Airport Business [37] shared that in terms of knowledge sharing and effectively responding to COVID-19, the first important step is to be prepared before the crisis develops. Frankfurt Airport, for instance, has been building on its experience with former epidemics such as SARS, Ebola, and the swine flu, as well as other crisis situations, and has continuously been improving staff training and the defined operational procedures over the years. Based on past situational analysis, crisis plans, operating procedures, and health protection protocols were developed.

An increasing number of airport staff were able to work from home during the pandemic, and there has been evidence of so-called succession plans, which have been developed by airport operators to make sure the right leaders are always in place when a sudden change happens. Detroit Metro Airport (DTW), for instance, initiated a special programme focused on talented employees who were willing to progress in their careers and navigate the airport during the crisis [38]. Additionally, airport operators implemented robust long-term skeleton crew/shift pattern plans, so they were protected against sudden changes of operations and staff availability. Many airports changed their methods of passenger processing too. They set up a dedicated spot for the screening of passengers' temperatures and clearing their health declarations and handled flights arriving from high-risk countries in a dedicated waiting area in which they provided passengers with basic daily needs, such as food [39].

Another area that recorded dramatic changes was airport facility management. Airports regularly analysed the use of gates and ensured the most efficient gate allocation, so that certain sections of gates could be closed to reduce maintenance costs and prevent fast spreading of the virus. With a view to further reducing operational costs, airports could have opted for temporary closures of parts of terminal buildings ('single-roof operations') or even entire terminals. As an example, Singapore's Changi Airport closed two of its four terminals in the first half of 2020, representing a large-scale operational response to the changing landscape of tighter controls and dwindling flight and passenger numbers [33]. Other measures included postponing airport bill payments and making a number of employees redundant or renegotiating their working contracts, out of which some were offered part-time contracts.

As for airside operations, some airports performed solo working for the airside teams [40], developed plans for temporary aircraft parking [41], and identified locations for long, intermediate, and short-term parking of aircraft [42]. Some airports decided to change their security procedures. They minimised pat-downs and face-to-face contacts and opted for an increased number of Explosive Trace Detections (ETD) to resolve alarms.

A decline in traffic volume transformed into a steep decline in aeronautical revenues that are a direct function of traffic and include passenger-related charges and aircraft-related charges levied from aircraft operators. As traffic declined, revenues from charges decreased proportionally. Non-aeronautical revenues, which include such streams as retail concessions, duty free, car parking, and food and beverage, are also very much linked to passenger traffic and throughput. As airports have little flexibility in operating expenditures but also have capital costs that are largely fixed, the crisis has represented an unprecedented challenge for the airport industry's financial viability [43].

The COVID-19 situation has led to a significant financial crisis in aviation and has put pressure on airports to take immediate measures to reduce capital and operational costs. To recover from the COVID-19 crisis, airports have needed financial assistance, and governments have offered solutions to help airports to remain operationally active and keep aircraft in the sky to be able to serve cargo flights with emergency deliveries [44]. The COVID-19 crisis and its impacts continued to severely affect airport revenues in 2021. Globally, airports have lost more than USD 83.1 billion in revenues in 2021. The crisis cut airport revenues in 2021 in half (48.9%) compared to the projected baseline (the pre-COVID-19 revenue forecast). Compared to 2019, airport revenues were reduced by 45.2%. Europe, the most impacted region in absolute terms, lost more than USD 32.3 billion in revenues by year's end 2021 compared to the projected baseline (USD 29.4 billion compared to 2019) [43].

Airport operators have implemented business continuity management systems and developed effective business continuity strategies to continue providing essential services to their customers while sustaining revenue streams and protecting infrastructure [45]. Airports have had to start focusing on the training of new staff and investing in technology to better understand passengers' behaviour in the 'new normal' [46].

It has been necessary to learn to accept a rapidly changing environment in which events are decentralised and fluid. A lack of clarity about the way out of the crisis has made it hard to know whether current actions were correct or sufficient. Airports have had to have robust crisis management plans available to protect their human capital and their critical business. According to Osterholm [47], 'It's better to be prepared for something that doesn't happen than unprepared for something that does'. This experience shows that airports must always be ready to respond to global shocks and to protect their passengers. The reason for this is that airports (especially large ones) are robust enterprises and vital infrastructures that drive the economy. Supporting the stability of the industry during this most difficult moment has been critical in securing the fastest recovery possible for the airport sector.

During the pandemic, airports incurred huge operating costs due to the need to accommodate grounded aircraft and handle cargo and humanitarian flights. Different processes needed to be designed as a direct consequence of this change. The check-in process was no longer as speedy as in the past. Travellers needed to undergo additional procedures (e.g., body temperature scanning), and they needed to adhere to floor markings for social distancing implemented by airports. However, airports were endeavouring to adopt new technologies for touchless travel. This allowed for the completion of the check-in process with a facial identification interface or biometric identification and sped up processes without the necessity of showing a passport or boarding pass from the check-in all the way to the aircraft. The off-airport check-in of passengers and their bags from their homes, hotels, and other off-airport locations are other examples of processes facilitation [48]. Additionally, airports, in association with airlines and technological companies, developed new procedures to disinfect terminals and baggage [49].

Numerous operational examples in this section show so-called reactive airport management behaviour during crisis. Airports managed traffic volume declines and introduced effective crisis management strategies. For example, Frankfurt Airport set up a crisis management team and closed unused airport areas; Detroit Metro Airport initiated a special program focused on talented employees who were willing to navigate the airport during the crisis; and Singapore's Changi Airport introduced crisis facility management. On top of this, airports continue to adopt new technologies for touchless travel (as outlined in Sections 6.1 and 7).

5. Delays and Disruptions during Recovery

According to ACI Europe [50], 'the recovery of passenger traffic has accelerated sharply and suddenly'. Between February and March 2022, passenger volumes at EU+ airports jumped by +36%, with March volumes being nearly six times higher (+485%) compared to the same period last year.

With no hesitation, many travellers have been keen to resume travelling. This is partly thanks to 'vacation deprivation' and a growing confidence in air travel provided by increased vaccination rates, safety measures, and publications of the updated Aviation Health Safety Protocol. In this document, the European Union Aviation Safety Agency (EASA) and the European Centre for Disease Prevention and Control (ECDC) advised European states and industry on the progressive de-escalation of protective measures aimed at limiting the risk of COVID-19 infection during air travel. A relaxation of almost all health procedures and travel constraints, adopted by many European countries in spring 2022, is coming into fruition in the form of increased passenger numbers. In July 2022, Istanbul Airport, representing Group 1 airports (airports with more than 25 million passengers per year, as per airport classification methodology, adopted by ACI Europe, that groups airports into four groups based on annual passenger throughput), recorded +5% traffic performance change vs. 2019, Naples International Airport, representing Group 2 airports (airports with more than 10 and less than 25 million passengers per year), recorded +9% traffic performance change vs. 2019, Sochi International Airport, representing Group 3 airports (airports with more than 5 and less than 10 million passengers per year), recorded +118% traffic performance change vs. 2019, and Tirana International Airport, representing Group 4 airports (airports with less than 5 million passengers per year), recorded +58% traffic performance change vs. 2019. EU+ airports now remain only 14.6% below 2019 passenger volumes. There has been a potential upsurge in air travel demand in the third quarter of 2022 [43]. Further relaxation of travel restrictions will help to increase the propensity for air travel and boost aviation industry recovery.

Since May 2022, passenger traffic has become more concentrated over peak periods including weekends and school holidays. Traffic peaks have been at pre-pandemic levels or even higher, in particular at larger hubs. Flight cancellations have become more common during peaks. Problems with sudden traffic growth have been a real challenge for airports, especially for ground handlers. Such growth has resulted in flight cancellations and delays and unsatisfied passengers during check-in and security or due to lost or delayed baggage. Ground handling services providers have been unable to scale up staff recruitment to cope up with increased passenger traffic.

The problem of ground handling services providers was twofold: unavailable staff and unattractiveness for newcomers. Airports and ground handling services providers had to lay off many workers over the course of 2020 and 2021. The reason was inadequate or late financial support. (According to [50], EU+ airlines received EUR 37.5 billion in financial support from their governments compared to EUR 4.9 billion for EU+ airports and EUR 650 million for EU+ ground handlers. By way of comparison, US airports received over EUR 38 billion in financial aid from the US government). As a consequence, ground handling services providers came out of the COVID-19 crisis with depleted human resources.

Despite the fact that ground handling services employment forms a major part of employment in airport operations and handling, working conditions remain unattractive for newcomers, as these include shift work, working 7 days a week, and low wages.

Additionally, many ground handling workers who were laid off in 2020 as a result of the COVID-19 crisis left and began working for different companies, as they had no problem finding work that was easier and paid the same or better. In Germany, for example, employers say that many ground handling workers have joined online retailers such as Amazon [51].

The problem of ground handling services is more critical at bigger and hub airports with complicated operations, which provide most of the connectivity to travellers. It is a direct consequence of the Council Directive 96/67/EC of 15 October 1996 on access to the ground handling market at community airports, which ensures free access by suppliers of ground handling services to the market at airports whose annual traffic is not less than three million passenger movements or 75,000 tonnes of freight; or whose traffic has been not less than two million passenger movements or 50,000 tonnes of freight during the six-month period prior to 1 April or 1 October of the preceding year [52]. As such, these airports cannot influence either the selection process of the ground handling provider at a particular airport or the planning process of the entire ground handling operations.

As an example, the CEO of London Heathrow, John Holland-Kaye, says he warned ground handling services providers that they needed to recruit and train more staff. He said: "Airline ground handling shortage is now the constraint on Heathrow's capacity. The number of people employed in ground handling fell sharply over the last two years, as airlines cut costs during the pandemic." Heathrow estimates that airline ground handlers have had no more than 70% of pre-pandemic resources, and there has been no increase in numbers. Referring to [53], Heathrow airport has imposed an unprecedented cap on departing passengers, allowing no more than 100,000 per day. The limit was imposed due to a staffing issue in several areas, including security, ground staff, and baggage handling [54]. According to James Webb from the Aero Mag2000 company [55], the COVID-19 staff do not want to come back to the aviation sector because of: a loss of confidence in the industry; drops in job security; working from home having huge benefits; and a high demand for delivery drivers whose working hours and wages could be better than at airports or ground handling companies.

In the Netherlands, where the unemployment rate is much lower (3.3%), unfilled vacancies are at record highs, and KLM's Schiphol hub has seen hundreds of cancelled flights and long queues. During the months of July and August, Schiphol offered an extra hourly allowance to employees, which incentivised people to stay or even specifically apply for jobs at the airport [56]. Schiphol has given a summer bonus of EUR 5.25 per hour to 15,000 workers in security, baggage handling, transportation, and cleaning—a 50% increase for those on minimum wage, which was stopped at the end of August. Joost van Doesburg, from FNV (the union representing airport employees) [57], said "a lot of airport employees already indicated to work elsewhere after the summer period, the scenario now seems to be unfolding".

After consulting with airlines, Schiphol decided to place a cap on the number of travellers that can depart from the airport. The airlines were not happy with the decision. In a statement released at the end of September 2022 [58], the airport announced that the number of travellers will be reduced until the end of March 2023, as it works with security staff and trade unions towards solving capacity issues.

Though the most common European problem is a shortage of workers as a result of aviation industry redundancies, the UK faces distinctive challenges including Brexit and its approach to the COVID-19 pandemic. It is estimated that 30% of airport staff were EU nationals before the pandemic, indicating that Brexit could have reduced airports' employment pool [35].

According to the survey of ACI Europe [50], most European airports, in particular large airports and hubs, where operations are more complex, were affected by the staffing crunch during the travel season last summer, probably one of the most chaotic ones in

recent history. A serious problem is that a standard background check or an enhanced background check must be completed before the potential employee undergoes initial security training, which involves access to information that is not publicly available due to its security sensitivity [59]. This, combined with the subsequent specialized training, results in lead times of up to 16 weeks between staff recruitment and actual deployment [50].

Now, many airports seem to be getting back to relative normality, except for providers of ground handling services. These companies keep on suffering from staff shortages and the ongoing liberalisation of ground handling (as discussed in Section 6.1).

6. Discussion

Airports are now working hard on defining their future post-pandemic procedures and incorporating managerial implications into the organisation of their daily operations. Aside from the requirement for energy-efficient and sustainable operations, airports are being challenged by the necessity of the implementation of various technological advancements while maintaining operational costs as low as possible. On the other hand, airports call out for better systemic support of their basic functions, such as the provision of ground handling services and security checks.

6.1. Ground Handling

Ground handling (sometimes, especially in the US, the term ramp handling is used)—in contrast to passenger (terminal) handling, where automation (touchless technologies) has been significantly introduced in recent years—has not practically changed in the last few years. Even though processes and coordination between stakeholders have improved considerably, it remains both personally and physically demanding as it was in the past. Current ground handling problems were triggered by the ground handling liberalisation. The EU Ground Handling Directive 96/67/EC of 15 October 1996 [52] has resulted in a downward spiral that has now become both socially and operationally unsustainable. Low wages already influenced the market and the quality of ground handling services before the pandemic, and they are now heavily impacting airport operations. In the medium term, ACI Europe has called for a reconsideration of the EU rules on ground handling and a renewed focus on resilience. It is crucial that no further liberalisation of ground handling is pursued without a robust legal package aimed at guaranteeing a minimum quality of service and the promotion and recognition of the ground handling workers' skills [50]. They have also suggested limiting the number of ground handling suppliers at airports, which would go a long way in addressing both social and operational shortcomings. However, this requirement goes against the general EU liberalisation trend, and therefore, its enforcement might be complicated. Another suggestion from IATA [60] considers the creation of 'widely recognised training passports' and the 'standardisation' of ground operations across airports, which should give workers more flexibility to relocate if they wanted to. Similar proposals for the recognition of qualifications for firefighters or de-icing staff have already been submitted, but so far without result.

6.2. Background Checks

When it comes to security issues, airports are constrained by lengthy administrative procedures and background checks of airport and ground handling staff. Airports require 'faster security clearance from competent authorities for airport and ground handling staff'. It is necessary to emphasise that the promptness of the background check does not depend only on the competent authority, and there are a number of entities participating in the background check process. Information from the French national trade union center, The French Democratic Confederation of Labour (CFDT) [51] says that, in France, the time to obtain security clearance is up to five months for the most sensitive jobs. In these positions, for which an enhanced background check is required, the check 'covers intelligence and any other relevant information available to the competent national authorities' [59]. In the current tense international atmosphere with a high security threat and the war between Russia

and Ukraine, it is unlikely that it would be possible to relax these procedures. It should be emphasised that the requirements for background checks have become more stringent recently. Background checks shall be repeated at regular intervals not exceeding 12 months for enhanced background checks, or three years for standard background checks (it was originally 5 years for all positions), with a transitional period until 30 June 2024 for those checks completed before 31 December 2021. This will undoubtedly have a further negative impact, especially on airport security staff intake, for whom the enhanced background check is mandatory. Airports face problems with security staff recruitment, as well. Similar to ground handling personnel, security work is poorly paid but psychologically demanding shift work requiring specific training. Even though there have been significant technological improvements in recent years with the introduction of new scanners and X-rays with artificial intelligence (AI), security checks are still highly staff intensive. The situation might be eased if passenger profiling would be used to a similar extent as, for example, in Israel. However, passenger profiling, notably on the basis of ethnicity and race, is partly limited in the EU [61]. Issues of global aviation security in the post COVID-19 situation were also addressed during the recent 41st ICAO Assembly. The ICAO's Global Aviation Security Plan (GASeP) and the GASeP Roadmap [62] provide global structure and direction to states' enhancement of the effectiveness of global aviation security.

6.3. Managing Crisis Operations

Airports are gradually recovering from COVID-19 in Europe, and based on our research, it is possible to draw lessons to be learned from the pandemic crisis in airport operations and also from those problems during the post-COVID-19 market recovery. There is no doubt that future crises and contingencies will occur. However, we do not know when and what character they might have. The authors of this paper think that airports have several relevant strategic options (translated into managerial implications) for the crisis management of their operations and for coping with contingencies, stemming from lessons learned during pandemic operations that will be useful in the organisation of every-day post-pandemic airport business and operations such as skeleton mode operations, cross-training of airport staff, employee sharing, crisis management plans, contactless technologies, and automation. Many airports have been forced to operate on a 'skeleton mode' with a reduced number of employees due to the COVID-19 crisis. A requirement for skeleton mode operations resulted from the need to limit the spread of the virus by creating permanent teams of workers who worked together for the period of the pandemic. Additionally, skeleton mode operations demonstrated that multiple processes were streamlined thanks to the upskilling of staff, as less staff is then required to perform certain functions.

No matter the crisis, airports need to ensure the continued validity of professional qualifications of airport staff with initial and recurrent trainings. Although 'cross-training' was initially presented at small airports as a means of reducing the number of workers and thus operating costs [63], during the pandemic, cross-training made it possible to ensure the substitutability of functions and thereby to ensure operations in the event of staff illness. The 'cross-training' allowed airports to have employees shadow colleagues from other airport teams, and this could be one of the training possibilities for airport core staff, especially at small airports. Cross-training also helps employees to understand the value of other parts of airport operations. Cross-training has also proved to be essential for the skeleton mode of airport operations, as a reduced number of employees need to undertake cumulative functions (including those for which other staff members are responsible). At busy airports, the possibilities of 'cross-training' are rather limited due to the high workload of the workers in their 'prime' job position.

Airports are considered critical parts of transport infrastructure. They need to remain open so that emergency supplies of protective equipment and medicines can be secured during the crisis. Additionally, the closing and reopening of an airport usually means huge costs, and it consumes a lot of time. 'Employee sharing' (with other airports) remains a suitable form of securing critical airport operations (not only during the crisis but during

higher traffic demand as well) at small, regional airports not significantly competing with each other [34].

The current situation shows that the COVID-19 crisis hit many airports as a big surprise, and airports were completely unprepared (except for some airports in Asian countries that had previous experience with the SARS epidemic). Unlike the previous SARS and MERS epidemics and the territorial airspace restrictions caused by volcanic eruptions and the spread of volcanic ash, the COVID-19 pandemic was global, and it affected, in addition to large hub airports, all operators, as well as small regional airports. Whereas large airports had the necessary resources and experience from other operational disruptions, small airports were in a very vulnerable situation and did not even have enough available resources and staff to respond to the crisis. Generally speaking, this means that airports need to revisit their original 'airport disruption/crisis management plans' and try to understand which disruptions future crises are likely to cause and which mitigation actions could provide fast recovery. Putting this into an everyday perspective, airports need to have alternative plans (workforce planning for ground handling personnel, airport facility management plans, etc.) for a number of diametrically opposed situations. When plans are drafted, different scenarios need to be envisioned and alternative solutions planned on a per-scenario basis. It is also necessary to have an up-to-date crisis communication plan that helps to share information to airport customers and staff in a quick and efficient manner. One could conclude that airports failing to prepare for future crises are most probably preparing to fail.

6.4. Contactless and Digital Technologies

The automation and digitalisation of airport processes that help maintain safe and healthy airport operations are of vital importance in consideration of future airport operations. The current turbulent situation does not allow airports to continue exercising their pre-COVID-19 investment plans. However, technologies such as self-service and contactless technologies that improve passenger experience and, at the same time, minimise the spread of the virus (i.e., biometric solutions, facial/fingerprints/iris recognition) will help airports to improve their situation in the medium/long term and will result in a reduction in their operating expenses, more specifically, a reduction in their staff costs [11]. IT technologies will also assist airports in increasing the number of passengers that can be processed without the need to invest in extremely costly terminal expansions. A total of 89% of airports already confirmed that they offer self-service check-in options, 79% provide bag tag capability at kiosks, and 77% of airports will implement the infrastructure, or have already done so, to support biometric touchpoints across the airport [64]. This trend is also fully in line with the recent ICAO recommendations 'on the need for a contactless digital passenger experience to be achieved, supported by new public health related ICAO provisions' [62]. Those airports that have managed to adapt to contactless technologies before the pandemic have had an operational advantage.

Though the introduction of contactless and digital technologies is common in terminal operations and includes, in particular, border control, passenger check-in/baggage drop-off, and ramp-handling processes, such automation has only been implemented in information sharing, without a significant impact on reducing the number of employees. The introduction of contactless and digital technologies at small airports is facing the problem of high prices and a low return of investment at small traffic volumes.

6.5. Airport Operation Provisions

Based on the previous findings and points formerly discussed, Table 1 summarises airport operational changes and provisions during COVID-19, and Table 2 reviews airport operational provisions during the post-COVID-19 recovery. Provisions are divided according to the ACI Europe airport group classification methodology (referred to in Section 5) and the significance of provisions.

Table 1. Airport operation provisions during COVID-19.

	Airport COVID-19 Operation								
	Single-Roof Operations	**Contactless Technologies**	**Skeleton Operations**	**Staff Layoff**	**Staff Furlough**	**Staff Cross Training**	**Employee Sharing**	**Work from Home**	**Staff Pooling**
Group 1, 2 airports	●	●	●	●	●			●	
Group 3, 4 airports				●	●	●	●	●	●
Significant	●	Moderate	●						

Data source: created by the authors based on own research results.

Table 2. Airport operation provisions during the post-COVID-19 recovery.

	Airport Post-COVID-19 Recovery							
	Problems with Staff Recruitment	**Shortage of Workers**	**Flight Cancellations**	**Flight Delays**	**Baggage Lost/Delays**	**Contactless Technologies**	**Contactless Technologies**	**Departing Passengers Cap**
Group 1, 2 airports	●	●	●	●	●	●	●	●
Group 3, 4 airports	●	●	●	●	●			
Significant	●	Moderate	●					

Data source: created by the authors based on own research results.

7. Conclusions

COVID-19 has permanently changed the aviation industry. The airport industry is gradually getting back on its feet, and at the same time, it is struggling to hire new talents. Changes in travel habits and social behaviour continue to have a major impact on the overall operations in the recovery phase. The recovery of airports is equally dependent on global aviation regulations, as well as the health protocols adopted by countries. Airports that have focused on preparing robust and advanced recovery action plans by adopting innovative technologies are better able to master the difficult management of post-pandemic operations.

In this post-pandemic period, which is characterised by an increasing number of passengers, ground handling and security screening continue to be critical activities at airports in terms of staff shortages, in particular at big airports with hub operations. From the point of view of working requirements, these are both physically (baggage handling) and psychologically (security screening) demanding positions. All jobs at the airport require specific qualifications and skills. The positions are highly demanding in terms of responsibility, accuracy, and reliability requirements to ensure high safety standards with respect to the aircraft, ground equipment, and passengers. Shift work also has an impact on the employees' physical and mental health, as well as the family life of workers. In addition, workers must complete a background check before the start of initial security training, which significantly increases the time between the recruitment of employees and their actual deployment.

During the COVID-19 crisis, many workers were laid off due to dramatic declines in volumes of passenger traffic. Many of them discovered that the new jobs, they managed to find, were easier and paid the same or better. Therefore, they had no reason to return to airport operations. Potential applicants found work outside of aviation easily, with better perks and wages. They also perceive work from home to be a huge benefit, as the cost and the time of travelling is massively reduced. Therefore, airports must modify their recruit-

ment processes and the conditions of staff enrolment to respond to the changed labour market conditions and to be sufficiently attractive for potential employees compared to other sectors outside of aviation. It is necessary to achieve competitive benefits, appropriate incentives, and bonus schemes, as money is important, but it is not everything.

Another problem is that both ground handling and security screening are highly staff intensive, in contrast to terminal processes, in which it has been possible to introduce a higher degree of automation and touchless technologies and thus to significantly reduce the number of staff. From this point of view, ground handling processes have remained practically unchanged since the 60–70 s of the last century. However, turn-around times have been significantly shortened, which poses increased requirements for ground handling safety and the reliability of these processes.

Airport operators and ground handling companies must realise that the days of enthusiasts who considered it a privilege to be allowed to work at the airport and to smell the beautiful fragrance of burnt kerosene and who did not find their salary to be the most important issue are gone forever. Airports and ground handling services providers must take these facts into account when setting up salary levels.

From a long-term perspective, the major challenge is to reduce personnel demands and to automate the processes of ground handling and security screening. The recent crisis has helped airports to better understand the need for automation and possibly the digital transformation of their operations, and there has been an evident paradigm shift in the thinking of airports regarding the transition to contactless and other IT technologies, which help to secure the trust of passengers in airport processes with an improved feeling of control and to reduce personnel demands. Due to problematic returns on investment, automation is often not the right solution for airports with low traffic volumes. However, small airports have discovered the benefits of 'cross-training' during pandemics not only for the reduction in costs, but in particular, for increasing the reliability and flexibility of airport operations.

In line with the ICAO's 41st Assembly (October 2022), global adoption of recommendations of internationally interoperable health certificates featuring the verification feature of an ICAO Visible Digital Seal for Non-Constrained Environments (VDS-NC) could be expected in this decade. For further air transport facilitation, it is necessary to achieve the efficient and secure authentication of traveller vaccination statuses and test result certificate verifications. To be better prepared to respond to future public health emergencies, states and the ICAO have called for a new strategy to make aviation more resilient in the future [62].

The authors of this paper are aware that the future mitigation actions that airports are to exercise to cope up with crises and staff shortages are by no means limited to the managerial implications outlined in this paper. Therefore, future research could also look into the regulatory framework of post-pandemic airport operations, which would help airports to reveal other effective means of their fight with the 'new normal'. Different applicable policies could also be examined.

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