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The Impact of the COVID-19 Pandemic on the Aviation Industry

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Abstract

The impact of the pandemic is far from over, with most countries still grappling with whether and how to lift lockdowns and travel bans. The aim of this paper is to provide insights into the how the COVID-19 pandemic has impacted on international aviation. First, a brief review of the literature regarding previous crises that affected the aviation industry in recent decades is provided. Next, utilising PEST (Political, Economic, Socio-Cultural, and Technological factors) analysis, the influence of the pandemic on the aviation industry is investigated. The findings indicate that the aviation industry will enter a new round of the adjustment cycle, with the possibility of a large number of airlines going bankrupt, whilst others will need to reorganise, or be subject to merger with, or acquisition by, larger players in the sector. It would appear that the recovery of the aviation industry will be a long and slow process. Moreover, existing aviation business models may well need to be replaced by new ones, with airlines having to develop in the direction of unmanned and contactless service provision. The article is concluded with short-term and long-term recommendations for airlines regarding recovery of the demand for air travel.

Keywords: airline, aviation, business, PEST analysis, COVID-19.

1. Inrtoduction

The outbreak of COVID-19 has brought substantial losses to many industries worldwide. The pandemic has led to higher economic loss and social turmoil than initially expected by the experts, with the impact on the aviation and the tourism industries has been particularly severe. As of early April 2020, global air traffic had fallen by 80% compared to the year before, according to the International Air Transportation Association (IATA). Global quarantine measures have severed connections between different regions and caused a collapse in demand for air travel, leading to a crisis far more severe than earlier ones. In this paper, the current pandemic situation and relevant data from various industries are investigated via PEST (Political, Economic, Sociological and Technological) analysis. Probable changes and challenges regarding the post-epidemic era are

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discussed, while possible countermeasures are evaluated as well.

This paper is aimed at reviewing past events as well as the current situation in order to predict the near future of the airline industry and to produce appropriate recommendations. The significance of this study is that it considers the impact of the COVID-19 outbreak, which has been far deeper than expected at the beginning of 2020, with almost all industries affected worldwide. Patterns, operations, and even the development prospects and directions of the aviation industry are expected to inevitably change even after the pandemic has run its course. Preparing for and responding to these changes is vital to avoid associated risks and to ensure a continued presence in the airline market in the post-pandemic era.

Initially, only the Asia-Pacific region was affected by what was thought to be a domestic epidemic, with the number of flights only slightly decreasing before 29th January 2020 [1]. By mid-March, the number of global flights began to decrease sharply, and by early April this figure had dropped to 20% of its pre-pandemic level as of the beginning of the year – an indicator of the paralysis of global air travel. IATA's forecast in March was relatively optimistic, estimating a 38% drop in global RPK (Revenue Passenger Kilometres) in 2020 and a passenger revenue loss of US$ 252 billion compared to 2019. The actual decline, however, was far worse than what was forecast. Compared to March 2019, global passenger traffic decreased by 52.9%, and ASK (Available Seat Kilometres) decreased by 36.2%. Moreover, passenger demand in the international transport market shrank by 55.8% in March, while for the domestic markets it fell by 47.8% [2]. Brian Pearce [3], the chief economist of IATA, has anticipated that domestic flights all over the world can be resumed in about six months, whilst he expects only 50% of global international flights to be restored this year, which will amount to a worldwide loss of US $ 314 billion in revenue.

Due to the sharp drop in revenue and cash inflows global airlines are facing immense pressure. Virgin Australia, the second-largest airline in Australia, was the first airline to fail, having recently entered a state of voluntary administration [4]. Following the bankruptcy of Virgin Australia, Mauritius Airlines also entered the escrow process voluntarily [5]. Four of Norwegian Airline's subsidiaries in Sweden and Denmark have also filed for bankruptcy. According to Reuters [6], Avianca Holdings, the second-largest airline in Latin America, filed for bankruptcy on 10th May due to its failure to meet its bond payment deadline.

Travel restrictions due to the COVID-19 outbreak have drastically reduced the demand for crude oil, thus leading to price fluctuations. For the first time in US history, weak demand owing to the pandemic and the exhaustion of existing storage capacity has led to negative producer prices of oil. On 20th April 2020, the price of WTI (West Texas Intermediate) crude oil closed at -37.63 US dollars per barrel [7]. Brent crude oil, as the global crude oil benchmark, on the other hand, whilst not reaching a ground breaking negative value, has fallen by 70% compared to the beginning of 2020, closing at 19.33 US dollars per barrel [8].

At present, aviation stocks in various countries are experiencing a cliff-like plunge. Compared with the stock price at the beginning of 2020, the share price of Southwest Airlines, for example, has fallen by 50%, while that of Delta Air Lines is only one-third of what it was at the beginning of 2020. The price of the shares of Qantas fell as well, from a peak of 6.83, to a minimum of 2.03, in just one month. Back in early April, Berkshire Hathaway's subsidiary sold 13 million shares of Delta Air Lines and 2.3 million shares of Southwest Airlines, with a total transaction volume of US$ 400 million. Warren Buffett made it clear at Berkshire Hathaway's annual shareholders meeting that his company and its subsidiaries have now given up all of their shares in the airline [9].

Not only the recent the pandemic, but other factors, such as terrorist attacks and rising crude oil prices, have pushed the aviation industry into a precarious situation in the 21st century. Faced with such crises, airlines will need to respond quickly and decisively to deal with the pressures of restructuring, integration, and segmentation of the market in order to gain a competitive advantage [10].

The 9/11 event was the first in this century to have a profound impact on the aviation industry. In November of the same year, the United States passed the Aviation and Transportation Security Act and established the Transportation Security Administration. Congress conveyed upon the TSA important task as coordination of law enforcement

agencies at all levels to prepare for large-scale security actions [11].

Few, if any, events in modern history are comparable with the 9/11 terrorist attacks in terms of the impact on the economy of the United States and the world at large, in particular in relation to the aviation industry [12]. Many US trading partners, especially nearby Canada and Mexico as well as banks, insurance companies, pension funds, and other financial institutions were affected as well [13]. It was found that tightened airport security measures after 9/11 reduced the number of passengers on all flights by approximately 6%, while the number of passengers on flights departing from the 50 busiest airports in the United States decreased by approximately 9%. As a result, it is estimated that the aviation industry lost approximately US$ 1.1 billion [14].

Regarding the stock market, even though the average weekly earnings of airline stocks did not change significantly after the events of 9/11, regardless of the size of the company, the related systemic risk and the total risk increased significantly. Under such circumstances, airlines started to reduce their operating leverage by cutting salary expenses and hedging fuel price fluctuations. A lower operating leverage ratio can help airlines improve their inventory performance in terms of returns and risks [15].

For passengers, 9/11 resulted in psychological and emotional pressure on air travellers. Even the most experienced traveller was affected by a range of factors, such as the fear of separation from loved ones, anxiety and other safety-related fears [16].

The broad economic impact of every health-related emergency can be significant [17]. The first global infectious disease in the 21st century was SARS (Severe Acute Respiratory Syndrome) that began in February 2003, which is an airborne virus that can be transmitted through saliva in a manner similar to colds and flu (WHO). According to WHO [18] (World Health Organization), as of July 2003, SARS had spread to more than 30 countries, with widespread outbreaks in 6 countries. When the number of infected people is only 8439, the number of deaths directly or indirectly caused by SARS reaches 812, and the death rate is as high as 9.6%. In April of that year, global RPKs (Revenue Passenger Kilometres) dropped by 18.5% compared to 2002, while the Asia-Pacific region, which was severely hit by SARS, dropped by 44.8%. It is worth mentioning that when the epidemic was severe, global FTKs (Freight Tonne Kilometres) increased by 7.7%, and even in the Asia-Pacific region, it rose by 10.6% [19].

The outbreak of SARS strongly proved the possibility of the rapid international spread of emerging pathogens. The lack of sharing and assistance mechanisms makes it extremely difficult to control because spread on a large scale has often already occurred before detected and reported [20]. Therefore, the World Health Assembly passed the amendment in 2005 and formally implemented the IHR (International Health Regulations) in 2007. At the same time, the decision-making criteria of PHEIC (Public Health Emergencies of International Concern) are clearly defined.

At the H1N1 influenza pandemic in 2009, global passenger demand fell by 9.3% compared to the same period last year, while freight demand fell by 17.4%. In Mexico, its airline traffic dropped by nearly 40% in May [21]. Due to the rapid response of WHO and the rapid development of specific drugs and vaccines. Although 216 countries were infected in the end, the global H1N1 mortality rate was only 0.001%-0.007% [22]. As media reports on the H1N1 flu decrease, the impact on passenger confidence has also eased. Except for the Middle East, demand conditions in all regions improved in August. Although profitability has not recovered, the impact of H1N1 has begun to decrease [23].

Aviation is one of the most important pillars of the global economy, not only connecting people, but also, providing millions of jobs worldwide and making a significant contribution to the economy. According to Dobruszkes and Hammer [24] GDP change is the main driver of air services dynamics and the crisis of air services has much more affected the USA, Europe and Japan than the rest of the world. When the financial crisis of 2008 occurred, the aviation industry, despite being one of the fastest-growing industries, faced negative growth and huge losses.

After comparing the data published by 41 international airlines in four regions (Europe and Russia; North America; China and the Asia Pacific; and Africa and the Middle East) in 2005, the research results showed that low-cost airlines are generally more efficient than full-service airlines and that large airlines have the advantage of

economies of scale [25]. Despite airlines quickly responding to the 2008 economic crisis by adjusting their capacity and cost base after absorbing the lessons of the 2001 crisis, many airlines' profits have been slow to recover. The deep recession of 2008 widened the gap between the successful and unsuccessful business methods further, gradually eliminating the latter [26].

Driven by economic, technological, demographic, social, and political factors, globalisation has interwoven the economies of many countries, creating interdependent networks of global markets, global production, global competition, and global exchanges. Globalisation, as a process of international integration, not only depends on the air transport industry but, in turn, also facilitates the development of the aviation industry further [27].

However, globalisation also entails many risks as well as growth opportunities. Many developed countries have increasingly gone down the road to deindustrialisation, such that the share of the economy of tertiary industry is approaching 80% in many European countries, Australia, and the United States. This, what has been termed 'premature deindustrialisation' [28] has lowered the income level in some countries, while also decreasing employment opportunities for their low-skilled labour force.

Research has shown that fluctuations in various crude oil prices or changes in the oil price system have no significant effect on the aviation stock prices. However, the impact of the combination of crude oil prices, in terms of their fluctuation and the unreliability of the crude oil production system has been more acutely felt by particular airlines. In other words, airline inventory risk is extremely sensitive to crude oil volatility and oil systems determined by major global events [29].

2. Methodology

The research of this study is qualitative, for which the strategic planning aspect of the airline industry, the PEST (Political, Economic, Sociological, and Technological Aspects) (Fig. 1.) model is adopted as an appropriate research tool (Fig. 2.).

PEST analysis is a framework for analyzing macro-environmental factors, which aims to promote more effective strategic planning through inspection, evaluation and analysis of areas that may have an impact on the aviation industry, which divided into four aspects.

The data used in the research comes from multiple databases and related websites. Specifically, the main sources of data collection are the reports of IATA [30], The World Bank [31], and International Labour Organization, working documents and actual conditions as well as online versions of business journals and magazines, such as the Aljazeera and BBC NEWS. The data used in the research comes from multiple databases and related websites. Specifically, the main sources of data collection are the reports of IATA, The World Bank, and International Labour Organization, working documents and actual conditions as well as online versions of business journals and magazines, such as the Aljazeera and BBC NEWS

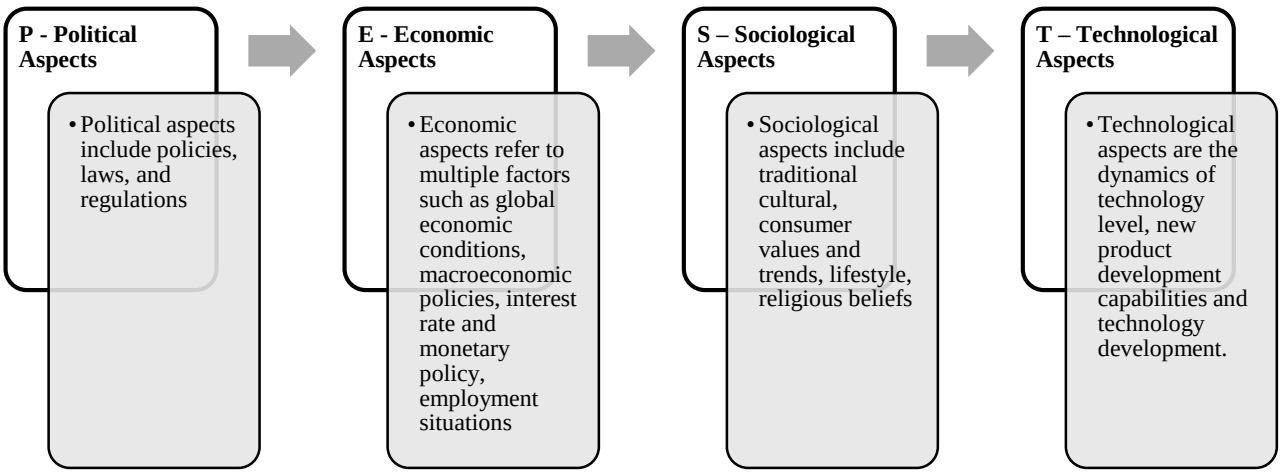

Figure 1. Elements of PEST analysis

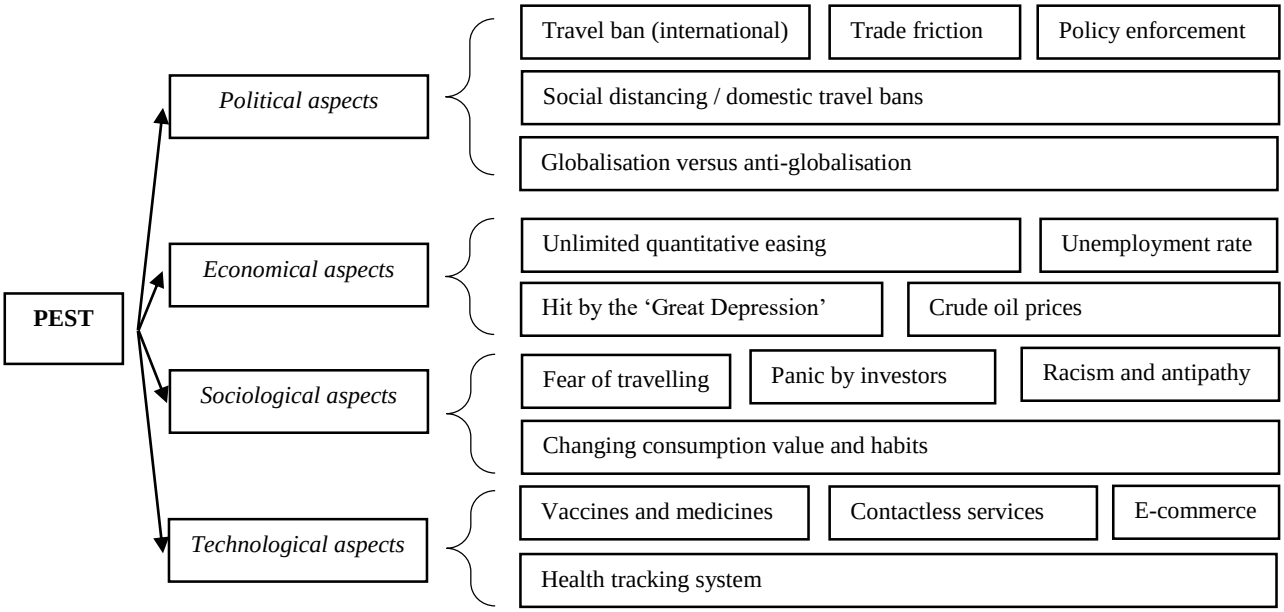

Figure 2. Adopted model of PEST analysis

3. Results and Discussion

3.1. Political aspects

Travel ban (international). At the end of January 2020, several countries began to issue travel bans on China, with the aim of avoiding the spread of the Covid-19 outbreak. However, the virus continued to spread globally, with the practice of lockdowns and travel bans gradually spreading from China then to Iran, Italy, South Korea, Spain, the United States, and finally, to most other countries around the globe. On 13th May 2020, the travel ban in the United States and Canada was extended to 21st June 2020 [31]. The disruption of travel bans on the transnational business of airline travel is clear. IATA (2020), in its statistical report of March 2020, pointed out that global international RPK dropped by 10.3% in February, reaching 55.8% by May. In the Asia-Pacific region, it was even measured as high as 65.5% – the largest decline ever recorded. The decision-makers who issued travel bans did not take into account the impact on the aviation industry, or they largely ignored them. The cancellation of thousands of flights heavily curbed the cash flow of all aviation companies. At this stage, whether or not an airline will face bankruptcy or voluntary administration depends on how long it can maintain its cash reserves.

Social distancing / domestic travel bans. While travel bans brought international air travel to a halt, the practice of social distancing further deteriorated the industry. There have been heated debates on whether to continue to isolate entire societies. Medical advisers to the British government have made it very clear that the only safe long-term route is vaccines and appropriate combinations of drugs [32]. Policy makers are concerned that premature lifting of the control measures could lead to a resurgence of the outbreak. On the other hand, continuing lockdowns depress the economy, which could lead to social unrest. The suspension of most international air travel has interrupted both the cash flows of airline companies and the physical flows of individuals across countries. In other words, the demand for airline travel by passengers as well as the supply of flights by airlines have been drastically reduced.

Globalisation versus anti-globalisation. For decades, the processes of globalisation have been steadily advancing, appearing to be almost unstoppable. However, anti-globalisation movements emerged as well, especially after the 2008 financial crisis, leading to populist political waves. According to OECD (Organization for Economic Cooperation and Development) data, global trade volume and foreign direct flows shrank by 20% in the first half of 2019, i.e. even before the current pandemic [33]. Now, under COVID-19, the globalisation patterns established in the past few decades are being redrawn. Globalisation is essentially a worldwide division of labour in the industrial supply and demand chain, which has the side effect that most countries have become heavily

reliant on global supply chains for many basic necessities. For instance, when Chinese factories were closed due to the COVID-19 outbreak, Apple started to delay the deliveries of iPhones, an action that opened the eyes of people to the inherent risks of dependence under such circumstances. Further, globalisation not only entails financial and economic integration, for it has also laid bare the possibility of the rapid spread of a contagious disease on a global level. Since 2003, several global pandemics have erupted, such as SARS, MERS, H1N1, Swine flu, Ebola virus, and the Zika virus, spreading across continents via 'convenient' and 'efficient' transportation channels [34]. Hence, it can be argued that the modern aviation industry is a spreader of epidemics as well.

Trade friction. Since 2018, the US-China trade war has weighed heavily on global air transportation, especially on the cargo industry. Airfreight volumes fell by around 3.9% globally, with freight tonne kilometres (FTKs) decreasing 5% in the Asia Pacific region, which has a 35.4% share of the world airfreight market. IATA has further noted that the demand for air cargo fell for ten consecutive months, a development that started well before the current travel restrictions. In addition to economic and trade factors, political ones have also been playing a significant role in the current trade friction between China and the US. The current US president appears to be using China as a scapegoat for the pandemic and its effects on the US. On this pretext, it is possible for Trump to tear up the agreement reached in January and announce new protectionist measures, in particular, given his forthcoming attempt at being re-elected [35]. Hence, a further escalation of the current trade friction can be expected.

Policy enforcement. Implementation of policies requires the acceptance and participation of the populace as even a perfect policy cannot be correctly and effectively implemented, if it is not embraced by those who have to adhere to it. After the onset of the pandemic, a large number of lockdown policies could not be effectively implemented due to their rejection by people. For instance, in Australia, a large number of tourists ignored public health warnings and visited Bondi Beach, which caused the federal government immediately to close the beach [36]. Regarding air travel, the CEO of Ryanair, Michael O'Leary, proclaimed that if he was forced to comply with the "stupid policy" of in-flight social distancing rules, his company's flights would not take off [37]. Similarly, Delta Airlines largely ignored social distancing. The lack of policy enforcement could lead to the prolonging of the epidemic cycle, thus slowing the speed at which society can return to normal.

3.2. Economic aspects

Unlimited quantitative easing (QE). The circuit breaker of US stocks was triggered four times within 9th to 18th March 2020. In order to stabilise the stock market, the Fed implemented a series of financial and monetary policies. Some analysts argue that infinite quantitative easing is a stimulant similar to epinephrine [38], whereby a large amount of US dollars has flowed into the capital market so that the US dollar can depreciate. This has meant that the operating costs of enterprises have increased due to the features of monetary policy. At present, commodity trading and financial settlement under global trade largely rely on the US dollar. Quantitative easing, as a method of 'printing money', can hide inflation and pass it on to all countries except for the United States. The global QE and negative interest rates after the 2008 financial crisis caused significant lasting effects. For instance, an increase in the gap between the rich and the poor along with the rise in populism have been major consequences. It has been reported that the UK government's fiscal austerity policy has damaged the standard of living and led to the government having insufficient policy leeway and currency bullets to cope with a crisis [39]. Today's unlimited QE has not only led to inflation, for it has also resulted in increases in the expenditures of airlines.

Hit by the 'Great Depression'. Demand for air travel has always been highly cyclical, whereby years of growth and decline in air passenger traffic have alternated. On average, the annual passenger traffic growth rate fluctuates between 7 to 9%. The first negative growth in the global aviation industry followed the 2008 financial crisis when all airlines felt the impact of the rapid global economic downturn. Before that, the last Great Depression had occurred in 1929, when after the collapse of the US stock market, a large number of Americans fell into debt. Due to global adherence to the 'gold

standard', the Great Depression gradually spread to the entire globe [40]. The current pandemic has also triggered economic shocks across the globe. That is, the global economy has once again declined rapidly, and the number of unemployed in the United States reached a record 20.5 million in April 2020. Moreover, a large number of offline retail stores went bankrupt, accompanied by a rise in online e-commerce. This structural adjustment of the economy means that a large number of retail jobs will not return, but the numbers of jobs that e-commerce can provide are far lower than the offline retail industry [41]. The continued spread of the virus itself may prevent any meaningful rapid recovery and hence, the world could fall into a state of long-term economic depression.

3.3 Crude oil prices. Storage location and capacity is one of the most critical reasons for the difference between the two benchmarks of global oil prices. Brent crude oil is priced in the central North Sea, where tankers have sufficient reserves and are easily available, whilst the WTI oil reserves in the United States are limited and landlocked. Another reason for the price difference is that WTI must be physically delivered and traders must remove crude oil from the warehouse before contracts expire. Other benchmark crude oils of the same grade do not have this requirement, such as Brent crude oil [42]. However, just as the stock market cannot always be rising, the price of crude oil cannot fall endlessly. As various economies have been gradually relaxing the lockdown, or are planning to do so, the market has already anticipated recovery in oil demand. Moreover, Russia and OPEC have reached an agreement to reduce production. Under the double stimulus of increased demand and reduced supply, the price of Brent crude oil once again rose to US$ 30.97 per barrel [43]. The current price of Brent crude oil as of March 2020 significantly decreased as shown in fig. 3. With the relief of the root cause of the oil crisis, crude oil prices are expected to increase further.

Figure 3. Brent Crude Oil Prices, $ per barrel (sources: Trading economics)

Unemployment rate. As of the end of April 2020, the unemployment rate based on US Department of Labour statistics had jumped to 14.7%, while in March it was measured at only 4.4%. The total number of unemployed in the US reached 23.1 million, with a rising trend as shown in fig. 4. The US Department of Labour's Chief Economist, Betsey Stevenson, held that the actual unemployment rate in April 2020 may have been close to 20% due to inaccurate classification and biased statistics [44]. This kind of rocketing unemployment rate has not occurred in other major economies. Those of the United Kingdom, Germany, Japan, and Australia have only increased by 0.1%, whilst for South Korea, France, and Spain this registered about 0.5%. In fact, in the two countries where the epidemic first broke out, China and Italy, unemployment rates even began to decrease. The pandemic is far from over, with governments facing a dilemma: lifting the blockade and social distancing may lead to a new COVID-19 break-out, while prolonged restrictions could cause unemployment and bankruptcy of businesses. Not even a larger scale of QE policy can solve the fundamental problem that recession will occur if consumers cannot consume.

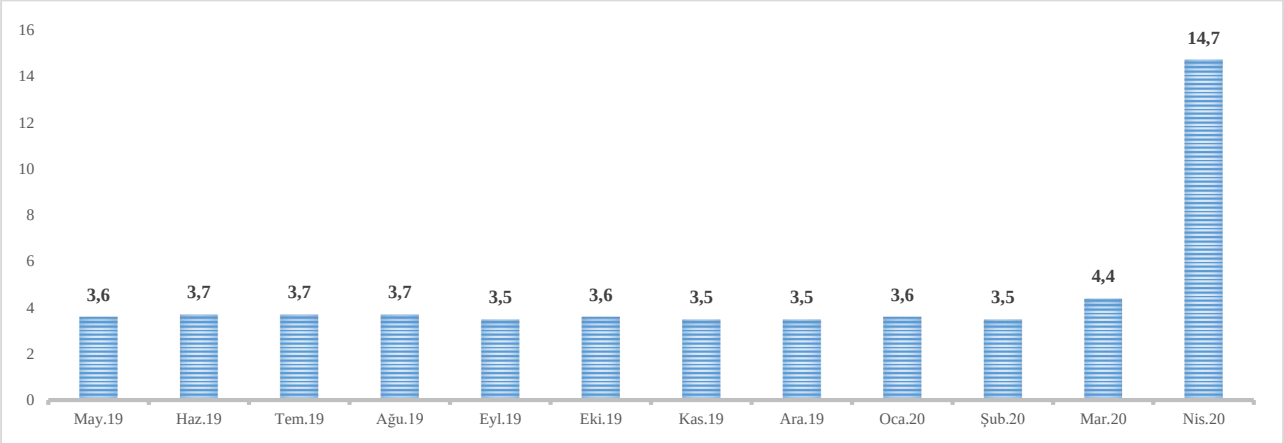

Figure 4. Unemployment rate (sources: The US Department of Labour's Chief Economist)

3.4. Sociological aspects

Fear of travelling. Public panic about the virus outbreak is difficult to eliminate in the short term. Primarily due to the spread of false information, in many places both locals and tourists exhibit fear of travelling or engaging in contact with travellers. In India, it was reported that in some tourist hotspots, people were finding it difficult to obtain accommodation, because panicked hotel managers were shutting them out. At the same time, restaurants and taxis refused to provide services [45]. Some travellers have cancelled their original itinerary because of these unresolved factors.

Panic by investors. Warren Buffett is just one of many investors. However, investors' panic has reached extreme levels. Just as with a panic bank run, a panic sell-off can happen whenever there is bad news. The impact of the pandemic on tourism and the aviation industry is obvious to every investor. Despite monetary policy (such as unlimited QE) or government bailout policies helping airlines to avoid bankruptcy and to maintain minimum operations, whilst investors' fears are not allayed, the share prices of airlines in various countries are not expected to rise back to 2019 levels.

Changing consumption value and habits. Customers' consumption value and consumption habits may have changed forever. Under global quarantine, they have been trying to deal with uncertainty. The risk of unemployment caused by the current crisis has made consumers' purchasing behaviour unstable, with many having reduced their expenditure on non-essential products and services so as to ensure coverage of necessities. Also, due to changes in living habits, consumer behaviour has changed. According to one survey, consumers in almost all countries and regions covered have increased spending on home entertainment [46]. This suggests that consumers' consumption value and consumption habits have probably changed for good.

Racism and antipathy. The current epidemic has sadly revealed racist attitudes, especially the resentment and hatred of Asians, initially thought to be associated with the epidemic, having reached a peak in the United States. In the past two months, just one council in Los Angeles has received more than 1,100 reports of discrimination against Asian-Americans due to COVID-19. The US government's extensive use of inappropriate vocabulary and the utilisation of China as a scapegoat to cover up the failure of its own crisis management during the epidemic have further exacerbated anti-Chinese and anti-Asian sentiments [47]. This is not the first time for such attitudes coming to the fore. In the 1980s, when the Japanese economy was booming, and the automobile manufacturing industry surpassed that of the United States, Japan became a similar target of hatred [48]. Discriminatory attitudes are extremely detrimental to the aviation industry. If they continue to spread on a large scale, this will inevitably hinder exchange and integration between regions, thus resulting in a negative impact on global trade. Hence, both the aviation manufacturing industry and the air transportation industry are bound to be affected.

3.5. Technological aspects

Vaccines and medicines. Countries and companies are competing to develop antiviral drugs and vaccines at a fast pace. The US goal is to provide hundreds of millions of vaccines by the end

of 2020. The University of Oxford in the UK has been collaborating with AstraZeneca, a pharmaceutical company, with the aim of providing millions of vaccines by the autumn. To this end, in May 2020, more than 1,000 patients participated in a preliminary experiment. China has also published research in Science Magazine relating to a vaccine it has developed that can protect rhesus monkeys from infection, which has been tested on 144 people [49]. Theoretically, it will take 12-14 months from vaccine development to mass production at the very earliest. Given large-scale trials in the Northern Hemisphere can be expected this summer, a vaccine could be ready in early or late 2021. However, the above expectations are optimistic estimates as these reflect a timetable based on the successful completion of each and every step. It is possible that no effective vaccine may come out at all from these endeavours.

Health tracking system. Some countries and regions are currently using health tracking systems to help prevent the spread of the coronavirus, such as Australia's COVID-Safe and China's Health QR code. The Public Health Agency of Canada is using an existing system for tracking influenza to monitor the spread of COVID-19 [50]. Health detection and monitoring systems have been developed rapidly in recent years. In particular, intelligent systems have been proposed that focus on monitoring various physical indicators, such as the blood pressure, heart rate, and body temperature of patients combined with GSM and GPS technology, to achieve 24/7 health and safety tracking and monitoring systems [51].

Contactless services. Consumers under the pandemic do not want to touch anything except their mobile phones. However, when delivering the goods, customers can also require that the deliverer put the goods outside the external door to avoid face-to-face contact. The current contactless service is still based on the procedures of the mobile terminal of the mobile phone. Naturally, the next step is to use robots to achieve true contactless delivery and relevant technologies in this regard have entered an experimental operation stage. In China, some hotels are almost entirely serviced by robots [52]. Even if the pandemic comes under control, these new consumption habits are likely to be retained.

E-commerce. The pandemic has changed customers' shopping preferences. Many individuals have started to rely on online purchasing for their daily needs, whilst businesses are factoring these into their strategic models. Accordingly, the demand for e-commerce has been rapidly increasing at around 25-30% [53]. IATA's (2020) air freight statistics show that the demand for air cargo in March had decreased by 15% compared with the previous year, whilst the supply capacity had dropped by 23%. At present, there is not enough transportation capacity to meet the demand for air freight, as the number of passenger aircraft commonly used for air mail transportation has decreased significantly by about 95% during the pandemic. The industry-wide cargo load factor reached a record-high for September (up 10.6ppts vs. a year ago) (fig. 5).

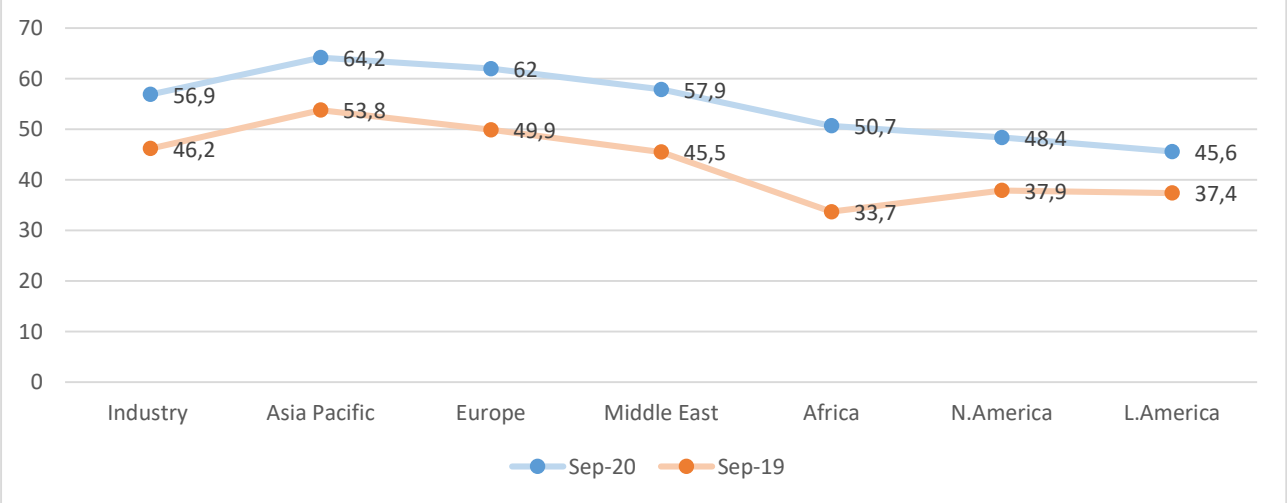

Figure 5. Industry-wide cargo load factors by region (sources: IATA, 2019)

4. Challenges in the post-pandemic era

The challenges relating to the operational environment of airlines are affected by macroeconomic as well as political factors. The drivers of change are complex and interconnected in multiple ways, but there are still some certain factors that will impact on the future of the aviation industry. Based on the analysis of the existing situation of the industry, the current policies and the state of the macro-economy, whilst keeping in mind the changes in light of past events, airlines are going to have to face many challenges in the post-epidemic era.

The development of hygiene safety standards. The COVID-19 outbreak is an exogenous disaster. As aforementioned, similar incidents that occurred in recent decades have been the Ebola and Zika viruses. The attacks on the Twin Towers on 9/11 nearly twenty years ago also affected the aviation industry significantly. After 9/11, the United States quickly passed the 'Aviation and Transportation Security Act', leading to airports and airlines across various countries strengthening their security checks. Most members of the public actively or passively accepted more stringent security regulations. In the face of the rampant Ebola outbreak, the World Health Organisation and other agencies suggested that countries cooperate in carrying out screening for passengers before leaving or entering relevant countries [54]. In order to deal with any possible pandemic in the future so as to prevent a rapid spread, relevant hygiene laws and regulations need to be promulgated, such as the 'Aviation and Virus Quarantine Safety Act', thus enforcing biological security procedures.

Anticipating negative growth. Retraction of global connections as well as economic depression caused by the recent epidemic are expected to have a huge impact on the global aviation industry. Economic depression will cut the demand for global aviation, as situation that will be further exacerbated the likely increasing trade friction and anti-globalisation movements. Hence, the global aviation industry may enter a cycle of negative growth, and various airlines could face the situation of a 'stock massacre'.

Extended recovery. Under the combined effect of various factors, the aviation industry is expected to enter a long-term 'L-shaped' crisis, where demand will be the key to recovery. The recent outbreak has caused a huge collapse in demand, while growing unemployment has not only hit the demand for business travel, but also lowered private consumption. Furthermore, at present, airlines are in a state of hibernation, with almost all international routes having been suspended, and a large number of aircraft grounded as of June 2020. When lockdowns are lifted due to economic and policy improvements, airlines will need to reintroduce flight capacity at extremely high costs, which will also exacerbate their operational risks and slow the recovery speed. Also, industry and private consumers need more time to rebuild confidence. As a comparison, the demand for air travel fell immediately after the 9/11 incident due to fears regarding safety. Similarly, the SARS outbreak caused the RPK to fall, with demand not recovering to previous levels until well into 2004. In sum, the lack of consumer confidence is bound to slow down the recovery of the aviation industry [55]. Moreover, the measures taken and prevention policies implemented in various countries are still at different stages of development. Before 'herd immunity' is acquired globally, or specific drugs and vaccines are successfully developed, such a differentiated pandemic prevention measures will inevitably prevent countries from fully lifting travel bans. The recent IATA conference pointed out that the implementation of quarantine measures needs to take into consideration their likely impact on the aviation industry [56]. If demand cannot be restored, the recovery cycle of the global aviation industry will take longer.

The rise of transnational e-commerce and air freight. The pandemic has seen most air passenger traffic shut down; however, air freight traffic has continued to operate to a certain degree. Due to the connectivity and interdependency established over the past few decades, global industries have become highly dependent and complementary. The pursuit of maximisation of profits has led to unprofitable industries at unprofitable locations disappearing. A large number of materials needs to be produced in different regions; thus, air freight is utilised to ensure that necessary materials can reach production areas safely and swiftly.

Trade wars and anti-globalisation forces are not expected to damage the existing industrial connectivity overnight. Even if the business of air passenger transportation enters a decay cycle in the post-pandemic era, global supply chains are expected to stay dependent on each other for a long time, thereby ensuring continuing demand for passenger travel and freight delivery. In fact, IATA expects air freight to enter a period of slow but sustained development in the not too distant future.
Market volatility caused by airline bankruptcies, and reorganisation and integration efforts. Whether it is bankruptcy or voluntary administration, both procedures entail complicated and painful outcomes for all stakeholders involved. In times of normal business operations, a company is expected to produce a continuous cash flow. The recent outbreak and the subsequent lockdowns have interrupted the regular cash flow of airline companies. Whilst demand has disappeared, fixed costs and any debts have remained. Thus, for some airlines, bankruptcy has become inevitable. At present, airlines applying for bankruptcy have three main characteristics: low yields, exhausted cash reserves, and the absence of a bailout. More airlines might follow, if global travel bans are not lifted. Virgin Australia, which fell first, had cash reserves to maintain operations for one month, and the current median cash reserves of most airlines can only to meet the demand for two months. By the end of May 2020, the number of bankrupt and custodial airlines due to cash flow disruption further increased. Faced with this fact, IATA [57] has proposed a variety of relief plans, including:
Provision of direct financial support to passenger and freight companies to compensate for the decline in revenue and liquidity;
Provision of loans by governments or central banks, loan guarantees, and support for the corporate bond market;
Provision of tax relief, and/or temporary exemption of ticket taxes and other taxes levied by governments.

It doubtful whether these recommendations will be applied to the full extent and hence, airlines that once exhibited healthy development may end up bankrupt, in particular, if their operations and their resulting cash flow do not return to 'normal' levels.
Changes in the business model of airline services. The aftermath of previous crises witnessed the development of LLCs (low-cost carriers). In the post-pandemic era, the business model of airlines may face further changes. One possibility is that in the context of global economic contraction, the demand for high-end business aviation might be greatly reduced, with LLCs becoming the preferred choice for customers due to economic considerations. Hence, reducing operating costs can be expected to become the main theme of airlines. Through the application of artificial intelligence and digital management, unmanned and contactless operations could be realised in some aspects, thereby reducing company personnel and related expenses. With further technological development, the first unmanned contactless airline may well appear in the near future.

5. Conclusion

Due to the events triggered by the recent pandemic and the lockdown measures taken in response, combined with the aviation laws that resulted from the previous crises, the following conclusions can be drawn via the undertaken PEST analysis: In the post-pandemic era, countries will be expected to implement 'aviation safety' legislation to deal with possible recurrences of the epidemic. It is anticipated that the aviation industry will enter a recession cycle, due to the economic recession as well as trade friction.
The pandemic has eroded the confidence of passengers in air travel, whilst rising unemployment and other adverse economic risk factors are expected to prolong the aviation industry's recovery cycle. During this new cycle, many airlines will face bankruptcy or mergers with and takeovers of, other companies. New business models that are more adaptable to the trend of the times may emerge, while firms insisting on existing business models might well suffer. Compared to the air passenger transport business that is expected to enter a recession cycle, cross-border e-commerce may lead to continuous and yet slow growth of the air freight transport business.
The recent crisis was caused by the outbreak of COVID-19. Even though the suffering has been severe, the pandemic will eventually end, and a new

wave of development and growth will ensue. However, individual airlines have to survive in the short term. At present, the primary goal of most airlines is to resume flights, that is, restoring the supply and demand in the market, in order to ensure a regular cash flow. Nevertheless, restoring flights means the lifting of lockdowns and travel bans, which is down to the policies of various governments and the expectations and needs of different societies. Even if all flight routes are resumed, a resurgence in COVID-19 cases might see a mass cancellation of flights again.

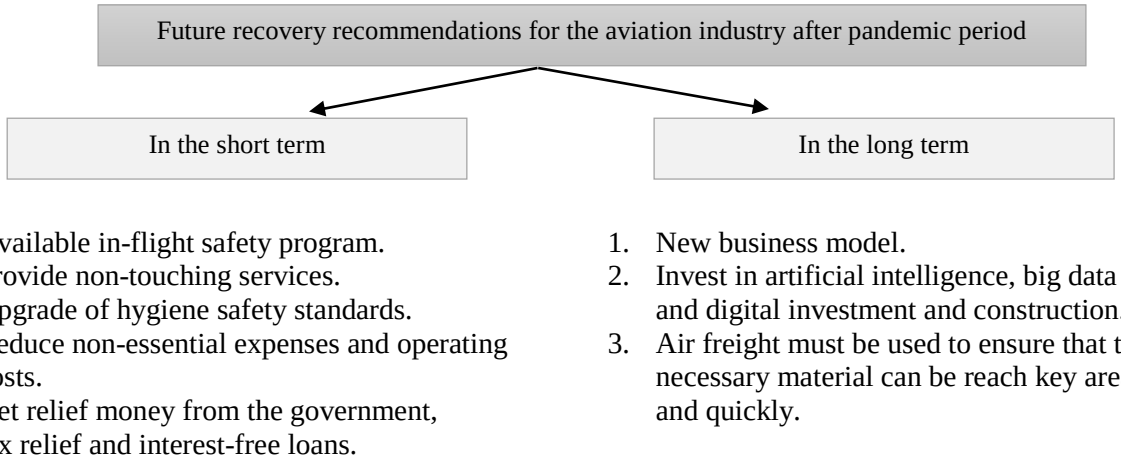

Figure 6. Recovery recommendation for aviation industry after COVID-pandemic

Recommendations in the short term:

Airlines should provide in-flight safety measures to reduce the probability of passengers being infected during the flight as much as possible as well as addressing people's fear regarding health and safety. To reduce non-essential expenses and operating costs, layoffs will be necessary for most companies. However, in the current epidemic situation, countries are doing their utmost to control the unemployment rate, which will adversely affect the company's brand image and might cause a negative social impact. As a mitigating measure, working hours of employees should be appropriately reduced, thus diminishing personnel expenditure effectively, but without resorting to laying off staff. Applying for and advocating of bailouts by governments, tax relief, or provision of new loans or loan extensions are essential for providing liquidity. It is also important to resist any possible bankruptcy by adopting measures aimed at keeping airline companies afloat after their original reserves have been exhausted, until regular flights, and normal operations can be fully resumed.

Recommendations in the long-term:

Airlines need to help governments in rebuilding confidence in air travel. Forces of globalisation should also be supported to curb isolationist tendencies so as to ensure a continued expansion of the demand for air travel.

Due to concerns relating to health, safety, employment and economic viability customer needs and preferences are expected to change. Hence, airlines need to explore new business models that are commensurate with these new needs and preferences. Old business models may no longer be suitable in the post-pandemic era. Companies that do not meet the new needs of their customers and that do not differentiate their products and services are likely to get squeezed out.

Ethical Approval

Not applicable

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