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A PESTEL Analysis of The Impacts of COVID-19 Crisis on Air Transportation Sector's Future

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Abstract

In this study, the Covid-19 pandemic, which has significantly impacted the aviation industry, is examined from six external factors including political, economic, sociological, technological, environmental, and legal using a PESTEL analysis. Initially, flight restrictions were implemented due to the Covid-19 pandemic, and airline companies were also affected by government-imposed social distancing measures. Economically, the Covid-19 pandemic has been particularly damaging to passenger transportation, with some countries experiencing a recovery but others facing employment issues in the industry. Sociologically, there has been an increase in reluctance to fly and changes in consumer behavior and habits, with a decrease in demand for unnecessary products. This process has also led to a number of positive developments from a technological standpoint, such as the rapid development and deployment of new vaccines and health monitoring technologies, as well as a decrease in emissions from the industry. This study is original in its examination of the Covid-19 pandemic impacts on the aviation industry using a PESTEL analysis. Based on the study's findings, strategies should focus on restructuring the aviation industry for Covid-19 pandemic readiness and recovery, including promoting restructured travel packages, low-cost flights, and popular routes. Emphasis on energy efficiency and environmental sustainability is crucial.

1. Introduction

The outbreak of COVID-19 in December 2019 in China and its subsequent declaration as a pandemic by the World Health Organization on March 11, 2020, have had a noteworthy influence on several industries. Including healthcare, transportation, global supply chains, communication, and manufacturing. The threat of the pandemic disease has led to the implementation of new policies, such as travel restrictions and the closure of national borders by countries, which have caused a significant disruption in air and sea transportation, a halt in passenger transport services, and a striking increase in the costs of commercial goods. These disruptions have had a profound impact on the international transportation industry (Vo & Tran, 2021; Zimmerling & Chen, 2021).

The Covid-19 crisis has had a significant impact on the aviation industry in many ways. When examined from a political perspective, flight restrictions began in the early months of 2020 due to the pandemic, causing the global cost per kilometer per passenger to drop by up to 65%. Airlines were affected by social distancing restrictions implemented by governments, and Ryanair and Delta airlines even opposed these measures (Heiets & Yibing, 2021).

From an economic standpoint, Covid-19 has dealt a major blow to the aviation industry, particularly in passenger transportation. While some countries experienced recovery during the pandemic process (Su et al., 2022; Vieira et al., 2022), rising fuel prices and the crisis in Ukraine led to employment issues in many countries' aviation sectors (Deveci et al., 2022). Sociologically, the Covid-19 pandemic has increased concerns about flying, changed consumer behaviors and habits, and reduced demand for unnecessary products. Another sociological issue could be the potential increase in prejudice towards Asian races in Western societies due to the virus originating from China. From a technological perspective, the rapid development of new vaccines, health monitoring technologies, contactless delivery systems such as drones, and the proliferation of e-commerce can be seen as positive effects of the pandemic (Heiets & Yibing, 2021).

Regarding the environmental effects of the pandemic, besides the positive effects such as improved air quality due to reduced CO2 emissions, clean beaches, and reduced environmental noise, negative effects such as increased waste and decreased recycling can also be considered among the pandemic's negative impacts (Irfan et al., 2022). As for the its effects on legal issues, the restriction of human rights and freedoms, healthcare workers' rights and job security, and mandatory mask and vaccine requirements in emergency situations, especially regarding travel, have been the subject of debate in many countries, affecting the aviation industry as well (Kang & Disemadi, 2021; Kaya et al., 2021).

In this study, the effects of the COVID-19 pandemic on the aviation sector is investigated by conducting a comprehensive PESTEL (political, economic, sociological, technological, environmental, and legal) analysis (Fahey & Narayanan, 1986;

Sammut-Bonnici & Galea, 2014). The research questions guiding this study are:

How did the COVID-19 pandemic impact the aviation industry in terms of political, economic, sociological, technological, environmental, and legal factors?

What were the contrasting effects of the COVID-19 pandemic on global and domestic passenger and cargo flights?

Based on these research questions, the research hypothesis was that the COVID-19 pandemic significantly affected the aviation industry, resulting in a range of consequences such as changes in government policies, economic downturn, shifts in consumer behavior, technological advancements, environmental implications, and legal considerations. By analyzing the PESTEL factors, it is aimed to gain a comprehensive understanding of the positive and negative effects of the pandemic on the aviation sector and identify the short, medium, and long-term trends in its impact.

In the second part of the study, the literature was reviewed, in the third part, the methodology was explained and the effects of COVID-19 on the aviation sector were presented in light of the criteria. In the fourth part, conclusions were drawn, and future research was suggested. In this study, the term "pandemic" refers to the COVID-19 pandemic that began in China in 2020.

2. Literature Review

The effects of the pandemic on the aviation industry has been studied in the literature by considering both global and local dimension. Heiets and Yibing (2021) analyzed the global effects of the pandemic through a PEST analysis, identifying short and long-term solutions from a political, economic, social, and technological perspective. Avcı et al. (2022) examined the effects of the pandemic on the air cargo sector, noting that aircraft have undergone modifications. Metehan et al. (2021) investigated airline companies decision parameters (strategic and financial) during the pandemic crisis through data envelopment analysis, revealing the requirements for a robust structure.

In terms of future-oriented analyses, Kurnaz and Žilinskienė (2022) examined the problems of the aviation sector during the pandemic and made projections for the post-pandemic period on a global scale. Serrano and Kazda (2020) evaluated the effects of this crisis on the future of airports. Many studies have been conducted on the effects of the COVID-19 crisis on the aviation industry at the country level (Table 1.b.). Onianwa (2022) examined the impact of the pandemic on Nigeria's air cargo sector, Deveci et al. (2022) investigated the effects of the pandemic on Turkey's civil aviation sector, Vieira et al. (2022) analyzed the effects of the pandemic on Brazil's airline transportation and CO2 emissions, and finally, Su et al. (2022) found that the air passenger transportation sector in China, where the COVID-19 outbreak began, recovered more quickly than other countries. To summarize the literature review, it can be concluded that the majority of research regarding the effects of the COVID-19 pandemic on the aviation sector has focused either on a regional level (Table 1.b) or has examined the topic within a global context (Table 1.a) but with narrow parameters, such as financial crises or future ramifications exclusively.

Table 1.a Literature Review (Global Impacts of COVID-19)

No.	Author(s) and Year	Topic of the Study	Methodology	Findings
1	(Heiets & Yibing, 2021)	The Effects of COVID-19 Pandemic on Aviation	PEST Analysis	Political, economic, social, and technological impacts were identified and short and long-term solution proposals were presented.
2	(Kurnaz & Žilinskienė, 2022)	The Impacts of COVID-19 on the Future of Aviation	Analyses	It was indicated that although the difficulties during the pandemic period are starting to improve, lessons must be learned for the future from these problems.
3	(Avcı et al., 2022)	The Effects of COVID-19 Pandemic on Air Cargo Sector	Analyses	It was noted that cargo demand increased during this period, some passenger aircrafts were modified, and passenger and cargo (combi) transportation began.
4	(Serrano & Kazda, 2020)	The Future of Airports in the Post-COVID-19 Period	Explanatory Analyses	The future of airports was examined according to three different scenarios and it was predicted that designs related to safety and other issues will be renewed.
5	(Metehan et al., 2021)	Analysis of Strategic and Financial Decision Factors of Airline Companies During the COVID-19 Crisis	Data Envelope Analyses	The financial structures of airline companies were analysed and the necessary paarmeters to set up a good financial structure during the COVID-19 crisis were identified.
6	(Atalan & Atalan, 2022)	The Impact of Air Transportation on the Spread of COVID-19	Analyses	As a result of the analysis of the first 8 months of the pandemic period, it was suggested that air transportation directly affected the spread of the pandemic and measures should be continued.

Table 1.b Literature Review (Regional Impacts of COVID-19)

No.	Author(s) and Year	Topic of the Study	Methodology	Findings
1	(Su et al., 2022)	Impact of COVID-19 on China's air transportation sector	Moran index and econometric models	The Chinese aviation sector was severely affected by the COVID-19 crisis, with transportation in major cities recovering before the global aviation sector.
2	(Onianwa, 2022)	Impact of the pandemic on air transportation in Nigeria	Analysis	Global cooperation and information sharing are recommended to mitigate the negative effects of the pandemic.
3	(Deveci et al., 2022)	Impact of the pandemic on Turkey's civil aviation sector	Analysis	Increased cargo flights, decreased passenger transportation, and negative effects on personnel salaries and unemployment were observed.
4	(Vieira et al., 2022)	Impact of the pandemic on Brazil's air transportation and CO2 emissions	Analysis	Despite a 68% decrease in passenger numbers at the beginning of the pandemic, Brazil's aviation sector saw a 64% increase in 2021.
5	(Kang & Disemadi, 2021)	Legal perspective of the pandemic, case study of Indonesia	Normative research	The pandemic's effects on travel freedom, occupational safety, quarantine, and other legal and human rights issues were evaluated in Indonesia.,
6	(Daon et al., 2020)	2020 Pandemic risk in air transportation	Probabilistic analysis	A scenario analysis showed that the risk of future pandemics in East Asian airports is higher than that in airports in India, Brazil, and Africa.
7	(Kökény et al., 2022)	Impact of COVID-19 on European airlines	Data analysis and sampling	Different business models of European airlines resulted in varying effects of the pandemic.
8	(Perez & Camargo, 2022)	Economic impact of the pandemic on air transportation sector	Regional Input-Output Model	Only the economic cost of the pandemic on air transportation in Texas Austin was identified.
9	(Nižetić, 2020)	Impact of COVID-19 on mobility, energy, and environment in air transportation sector	Analysis	A decrease of 89% in flights and an improvement of up to 3.5% in emissions were observed in the Croatian region at the beginning of the pandemic.

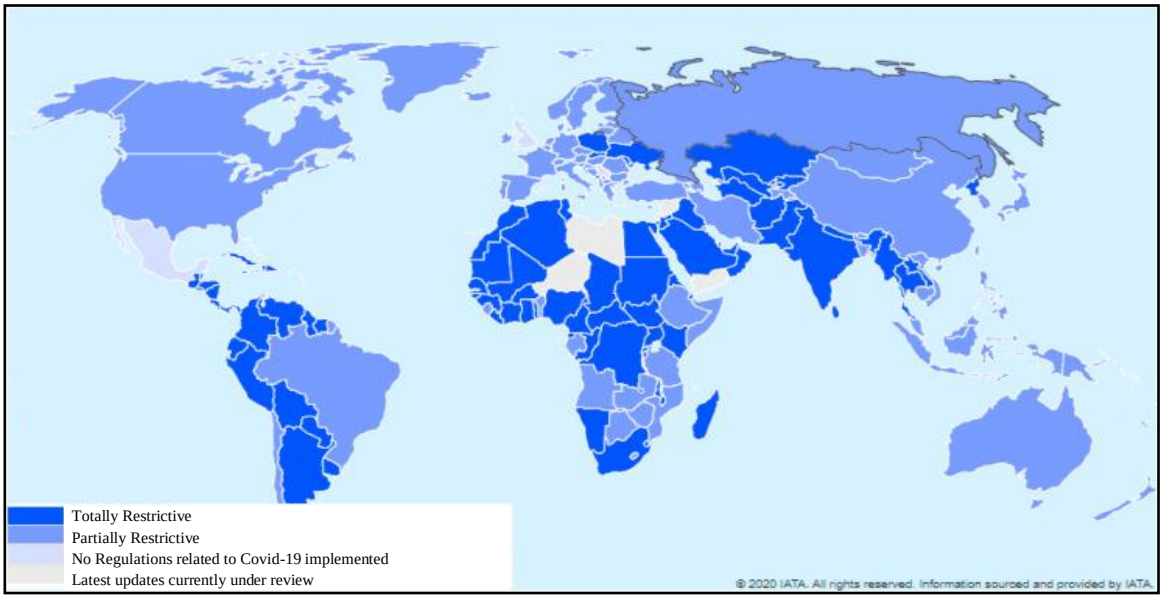

Figure 1. Global Flight Restrictions as of May 31, 2020 due to the Pandemic (IATA, 2020)

3. Methodology and Application

PEST analysis, proposed by Fahey and Narayanan in 1986, has evolved into PESTEL analysis by adding environmental and legal dimensions over time. The ETPS (economic, technological, political, and social) framework proposed by Agiular was modified to STEP method by the Arnold Brown Institute. Later, the macroeconomic dimensions of environmental factors were added, resulting in the STEPE framework, and finally, in the 1980s, the legal dimension was also incorporated into the analysis, resulting in the current PESTEL approach (Yüksel, 2012). After explaining the PESTEL methodology in this section, the impact of the pandemic on the air transportation industry will be examined using this approach.

3.1. Methodology

The PESTEL analysis is based on examining external factors in six areas: political, economic, sociological, technological, environmental, and legal. Political factors (P) refer to a range of aspects, including government interventions and lobbying activities. Economic factors (E) primarily address the macroeconomic landscape of the external environment, while also encompassing cyclical economic concerns. Social factors (S) encompass sociological, cultural, and demographic factors of the external environment. Technological factors (T) encompass technology-related initiatives, incentives, technological infrastructure, technological advancements, and external factors that influence technological progress (Ho, 2014). Economic factors (E) may cover many issues, such as unemployment, domestic and foreign debt, national income, investment incentives, budget deficit, and fiscal policies depending on the subject. Environmental factors generally include topics such as carbon dioxide emissions, urbanization, environmental pollution, traffic, public health, and recycling.

Several studies have highlighted the importance of PESTEL analysis in different areas. Yüksel (2012) acknowledges that while PESTEL analysis provides a general idea about the macro environmental conditions of a company, it lacks an integrated approach. To address this, the study proposes a multi-criteria decision-making model that combines AHP and ANP techniques to model the relationships between PESTEL factors. Song et al. (2017) utilize the PESTEL framework to analyze the waste-to-energy incineration industry in China, identifying obstacles and providing suggestions for policy changes and efficient project operation. Gregoric (2014) applies PESTEL analysis to tourism destinations, comparing and analyzing Croatia and Qatar in terms of political, economic, socio-cultural, technological, ecological, and legal factors, particularly in the context of the MICE (Meetings, Incentives, Conferences, and Exhibitions) industry. Matović (2020) emphasizes the significance of PESTEL analysis for startup success, proposing its use as a tool to evaluate the business environment and improve competitiveness. Çitilci and Akbalık (2020) emphasize that PESTEL analysis is essential for environmental scanning, providing a comprehensive understanding of factors that cannot be controlled or affected by an organization. These studies demonstrate the diverse applications of PESTEL analysis in assessing macro-environmental factors and guiding strategic decision-making processes in various domains.

PESTEL analysis, which is used in strategic management, has two main functions for organizations. The first is to provide a better understanding of the environment in which the organization operates, and the second is to provide data and information that will enable the organization to predict future situations and conditions (Yüksel, 2012). In this study, using the PESTEL methodology, the effects of the pandemic, which has deeply affected our lives in many ways, on the aviation industry will be examined.

The utilization of the PESTEL methodology in this research showcases its robustness and advantage in providing a comprehensive approach by considering all six external factors: political, economic, sociological, technological, environmental, and legal. This allows for a holistic analysis of the impact of the COVID-19 pandemic on the aviation industry. While other methods may focus solely on one factor, the strength of PESTEL lies in its ability to consider multiple dimensions, providing a more comprehensive understanding of the challenges faced by the industry. However, it is important to note that the extensive scope of PESTEL may also be considered a potential disadvantage, as it may overlook certain specific influences on the industry, such as cultural, ethical, and competitive factors.

3.2. Analyses

Based on the experiences gained from epidemic diseases such as SARS, Ebola, and influenza, it has been observed that air travel provides a suitable environment for the spread of pandemic diseases (Sun, Wandelt, Zheng et al., 2021). Similarly, numerous studies have suggested that intercontinental air transportation has played a significant role in the spread of the COVID-19 pandemic (Atalan & Atalan, 2022; Daon et al., 2020). Therefore, the aviation industry has been affected by external factors in many ways during the COVID-19 pandemic. In this section, six factors that have affected the aviation industry during the pandemic are examined in detail using a PESTEL analysis (Table 2).

Under the political aspect, it has been observed that governments declared full or partial flight bans at the beginning of the pandemic (Figure 1). As a result of these bans, many airports were closed, and longer flight connections were established. As seen in Figure 2, there was a significant decrease in passenger numbers in March 2020, and although passenger numbers have slowly increased in the following months, even in 2021 and 2022, they have not yet reached the 2019 level. As seen in Table 3, there is still more than 30% decline in global passenger numbers in the South Africa and Southeast Asia regions compared to the same period in 2019.

During the pandemic, governments financed these companies, especially to prevent an increase in unemployment and to prevent airlines from going bankrupt. Many governments supported large companies operating internationally and provided more support to local Chinese airlines. Consequently, supported companies have experienced fewer economic losses (Abate et al., 2020; Warnock-Smith et al., 2021; Zimmerling & Chen, 2021).

The current economic downturn in the aviation industry has led to unemployment rates ranging between 7% and 13% that are expected to only recover in the next 5-6 years (Sobieralski, 2020). It is considered that not all airlines have been equally affected by the pandemic, with companies focusing on international markets and discretionary leisure travel being less financially supported and therefore more affected by the crisis and expected to have a longer recovery period (Warnock-Smith et al., 2021). While passenger airlines have suffered significant losses, cargo carriers or combination (passenger and freight) airlines have increased their profits

after the relaxation of flight restrictions. The improvement in profitability in the cargo sector has resulted in changes to the designs of some passenger aircraft to make them suitable for freight transportation.

The economic impact of the Covid-19 pandemic on the aviation industry has been significant, as evidenced by the available data on revenues, costs, profitability, and various performance metrics (IATA, 2022 December). A thorough examination of these statistics helps support the claims made in the article regarding the economic effects of the pandemic.

The data (Table 4) reveals a sharp decline in revenues for the global commercial airlines in 2020, with a staggering-54.4% year-over-year decrease. However, there has been a gradual recovery in subsequent years, with revenue increasing by 32.4% in 2021 and 43.6% in 2022. Despite this recovery, it is important to note that revenues in 2022 still remain down by-13.2% compared to 2019 levels. Passenger growth, measured by Revenue Passenger Kilometers (RPK), was severely impacted in 2020, with a dramatic decline of -65.8% year-over-year. However, there has been a rebound in passenger growth in 2021 and 2022, with increases of 21.8% and 69.4% respectively. Nevertheless, when compared to 2019, passenger growth in 2022 is still down by -29.4%.

Expenses for airlines experienced a decline of -37.9% in 2020 due to cost-cutting measures, but showed an upward trend in 2021 and 2022, with increases of 11.8% and 33.6% respectively. Despite these increases, expenses in 2022 are still down by -7.3% compared to 2019 levels. Profitability, as indicated by operating profit and net profit, saw a negative trend in 2020, with significant losses recorded. However, there has been improvement in subsequent years, with operating profit moving from -110.8 billion dollars in 2020 to 3.2 billion dollars in 2022. Similarly, net profit improved from -137.7 billion dollars in 2020 to 4.7 billion dollars in 2022. These improvements are reflected in the return on invested capital, which increased from -19.3% in 2020 to 0.6% in 2022.

Regarding ATK (the total cargo capacity available for transportation, measured in ton kilometers) we observe a decline in capacity growth, with a significant decrease of -44.3% in 2020. However, there has been a recovery in subsequent years, with capacity growth increasing by 16.2% in 2021 and 23.7% in 2022. When compared to 2019, capacity growth in 2022 is still down by -19.9%. When it comes to ASK (the total seat capacity available for transportation, measured in seat kilometers) the data reveals a decline in passenger capacity growth, with a significant decrease of -35.3% in 2020. Similar to ATK, there has been a gradual recovery in subsequent years, with capacity growth increasing by 16.2% in 2021 and 23.7% in 2022. However, when compared to 2019, passenger capacity growth in 2022 is still down by -29.4%. Similarly, the decline in passenger yield in 2020 can be attributed to reduced demand, travel restrictions, and changes in consumer behavior. The subsequent recovery indicates an improvement in passenger demand and an increase in ticket prices. On the other hand, the significant increase in cargo yield in 2020 reflects the surge in demand for air cargo services during the pandemic, driven by the need for medical supplies, e-commerce growth, and global supply chain disruptions. While the growth rate moderated in the following years, cargo yield remained higher than pre-pandemic levels, indicating sustained demand for air freight services. By considering the yield data alongside other key performance metrics, we can gain a comprehensive understanding of the financial dynamics within the aviation industry. These insights contribute to a more nuanced analysis of the economic impact of the pandemic and the subsequent recovery patterns, allowing for a better evaluation of the industry's resilience and adaptation to the changing market conditions.

From a social perspective, studies have shown that the pandemic-related layoffs have caused stress and job insecurity among flight attendants, leading to reduced service quality and negatively impacting the trust and loyalty of employees towards their companies (Athanasiadou & Theriou, 2021; Battisti et al., 2022; Sim et al., 2022). It has been observed that companies focusing on social responsibility projects can mitigate these effects. The decrease in trust in the aviation industry due to the pandemic has also led to similar concerns among individuals' trust in those around them (Lamb et al., 2021).

When examining the technological impacts, it is observed that the hygiene and distance rules brought to the agenda due to COVID-19 have led to the development of contactless technologies, a decrease in documentation and face-to-face communication requirements, and an increase in the use of facial recognition technologies. It has been revealed that artificial intelligence and machine learning techniques are increasingly used in demand forecasting for passenger numbers and pilot training (Heiets & Yibing, 2021; Sun, Wandelt, & Zhang, 2021). All these technological developments are expected to lead to the redesign of aircraft, a reduction in fuel consumption, and the reconstruction of airports as smart airports by developing their technological infrastructure in the near future.

In the environmental domain, many positive effects of the pandemic can be seen, such as a decrease in emission levels, an improvement in air quality, and a relatively slower rate of global warming. With regard to legal issues, the protection of airline workers' rights, compliance with health and hygiene rules, and maximum passenger capacity on planes have been brought to the agenda and necessary changes have been made by reviewing legislation in many countries (Rachmat & Susetio, 2021).

Even the Covid-19 pandemic had a significant impact on the air industry, as of March 2023 there are positive signs of recovery in global international air connectivity (IATA, 2023). As it can be seen from Figure 3, overall international air connectivity stood at 79% of its pre-pandemic level. Africa has exceeded its 2019 level with 104% connectivity, while Latin America & the Caribbean and the Middle East are approaching pre-Covid levels at 97% and 98%, respectively. Europe and North America are currently at 87% of their 2019 levels. Asia-Pacific has shown a strong increase of 40 percentage points over the past year, with further improvements expected as travel restrictions are lifted. International air connectivity has recovered faster than domestic connectivity, playing a crucial role in driving economic growth and enhancing global trade, investment, tourism, and travel. This highlights the industry's resilience and gradual recovery from the pandemic's impact.

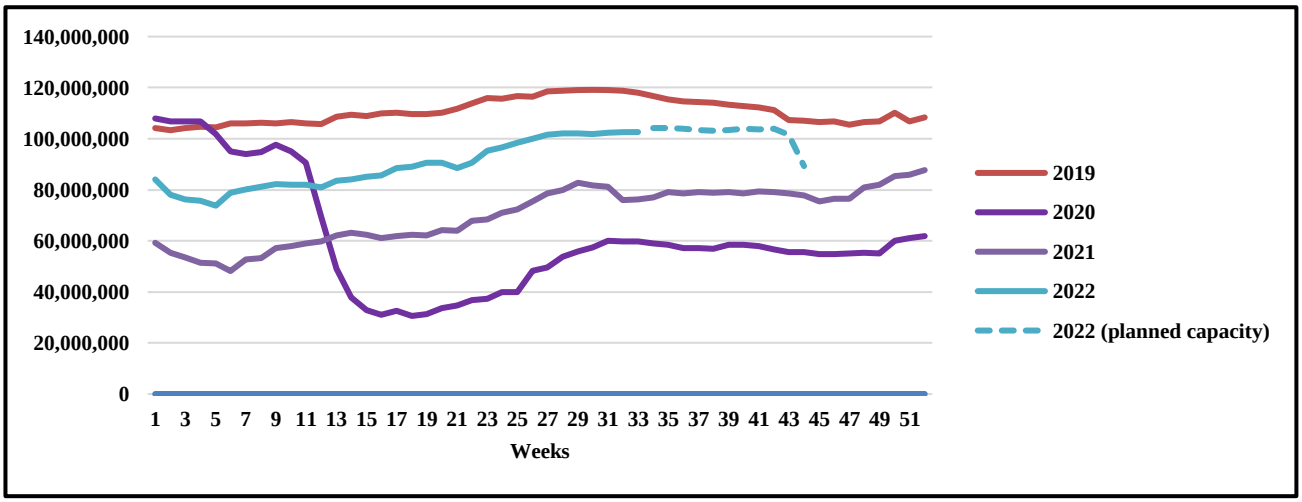

Figure 2. Global Air Passenger Transport Situation (OAG, 2022)

Table 2.a PESTEL Analyses

Field	Topic	Results and Effects	Reference
Political	Closure of airports	At the start of the pandemic, more than 600 airports out of 3,700 worldwide were closed, resulting in longer flight connections.	(Bao et al., 2021)
	Government support for aviation	Most governments prioritize high-support for sectors such as aviation or tourism to protect economic activity and employment. While large companies operating internationally are often supported by governments, international airlines targeting the Chinese market experienced significant economic losses compared to local companies due to less support.	(Abate et al., 2020) (Warnock-Smith et al., 2021)
Economic	Differential impact of pandemic on companies according to wage policy	Due to governments providing support primarily to larger aviation companies during the early months of the pandemic, low-wage airlines faced significant economic difficulties.	(Kökény et al., 2022)
	Economic impact of COVID-19 on the aviation sector	In 2020, the total loss in the Texas Austin aviation sector alone was estimated at USD 1.02 billion, with a total loss of 3.87 thousand jobs, USD 229.97 million in personal income, and a loss of value-added estimated at USD 514.20 million.	(Perez & Camargo, 2022)
	Unemployment in the aviation sector due to COVID-19	Unemployment rates in the aviation industry are expected to increase by 7-13% and require a recovery period of 5-6 years.	(Sobieralski, 2020)
Social	Impact of pandemic-related stress on flight attendants	Pandemic-related stress has increased job insecurity and work-related stress among flight attendants, leading to a decrease in social service behavior, with indirect effects on job insecurity and community-oriented service behavior.	(Sim et al., 2022)
	Relationship between the mental state of young people and COVID-19 with regard to air travel	There is a significant relationship between the mental state of the younger generation regarding air travel experience and the negative impact of COVID-19.	(Battisti et al., 2022)
	Emotional and social perspectives of airline passengers	Due to concerns regarding pandemic risks, a lack of trust in the airline industry's ability to take necessary precautions, and other factors, individuals have increased their personal precautions (e.g. masks, distancing, hygiene).	(Lamb et al., 2021)
	COVID-19-related unemployment and social responsibility activities of firms	COVID-19-related unemployment has negatively affected employee trust and loyalty in aviation companies. Additionally, social responsibility activities of firms during this period have increased employee trust and loyalty towards their company.	(Athanasiadou & Theriou, 2021)

Table 2.b PESTEL Analyses (cont.)

Field	Topic	Results and Effects	Reference
Technological	Structural changes in aircraft	The pandemic has led to a redesign of passenger aircraft to carry cargo due to the cargo demand surpassing passenger transportation.	(Sun, Wandelt, & Zhang, 2021)
	Technological impacts on fuel and emissions after COVID-19	Future technologies are expected to reduce fuel consumption and emissions of carbon dioxide and nitrogen compounds by more than half in airline operations.	(Grewe et al., 2021)
	Development of technological infrastructure at airports	Airports that use contactless technologies, facial recognition systems for passport and health checks, and generally contactless technologies are being built.	(Heiets & Yibing, 2021) (Sun, Wandelt, & Zhang, 2021)
	Effects of COVID-19 on technology	The COVID-19 crisis has led to new technologies and developments in 3D printing, personal protective equipment, communication, distance learning, telemedicine, vaccines, and respiratory equipment.	(Zimmerling & Chen, 2021)
	Use of artificial intelligence in demand forecasting and pilot training	After the stagnation period caused by COVID-19, some airlines are using data science and machine learning techniques to forecast passenger numbers. Artificial intelligence techniques have also become widespread in pilot training.	(Sun, Wandelt, & Zhang, 2021)
Environmental	Effects of the pandemic on carbon dioxide emissions and air temperature	Projections for South America by 2050 suggest that COVID-19 restrictions will contribute to reducing global warming and emissions. In the Croatian region, a decrease of 1.8% to 3.5% in carbon dioxide emissions was observed.	(Calderon-Tellez & Herrera, 2021) (Nižetić, 2020)
	Effects of the pandemic on air pollution	Pandemic measures such as reduced air transportation, remote work, and consumption restrictions have led to improved air quality in Turkey.	(Dursun et al., 2022)
Legal	Global and local travel restrictions and bans	The aviation industry has been economically affected, especially due to the decrease in the number of air passengers. Restrictions in 11 cities in China have reduced COVID-19 cases in those cities, but initial restrictions were only effective for a short period.	(Bao et al., 2021), (Li et al., 2020)
	Implementation of legal regulations on various issues	Legal regulations regarding the protection of the rights of airline employees during crisis situations, compliance with health and hygiene rules, maximum passenger capacity on planes, and other related issues should be made by all countries.	(Rachmat & Susetio, 2021)

Table 3. Change in Air Passenger Numbers from August 2019 to August 2022 (OAG, 2022)

Region	Domestic	International	Total
South Africa	-40.1%	-31.6%	-36.9%
Southeast Asia	-13.6%	-54.4%	-30.7%
Southwest Pacific	-12.3%	-43.0%	-21.3%
Eastern Europe	16.8%	-31.7%	-18.0%
Northeast Asia	3.3%	-81.8%	-17.9%
Middle East	-13.1%	-16.7%	-16.0%
America (Southern)	-8.0%	-27.6%	-11.3%
Europe (West)	-9.9%	-11.4%	-11.0%
Europe (North)	-5.4%	-8.8%	-8.3%
America (North)	-6.7%	-13.1%	-7.7%
Caribbean	-19.5%	-5.1%	-6.5%
Eastern Africa	9.7%	-13.4%	-5.4%
South Asia	-1.1%	-8.4%	-3.1%
West Central Africa	31.0%	-6.5%	7.4%
America (Upper South)	14.1%	-6.8%	8.7%
Central America	10.4%	8.3%	9.6%
Central Asia	19.0%	4.8%	11.7%
Total	-3.5%	-26.1%	-13.1%

Table 4. Global economic parameters for airline industry (IATA, 2022 December)

Parameters	Years 2020	2021	2022*
Revenues, $ billion	**382**	**506**	**727**
% change year over year	-54.4%	32.4%	43.6%
% change vs 2019		-39.6%	-13.2%
Passenger, $ billion	189	239	438
Cargo, $ billion	138.5	204.2	201.4
Traffic volumes			
Passenger growth, RPK, % change year over year	-65.8%	21.8%	69.4%
% change vs 2019		-58.3%	-29.4%
Cargo growth, CTK+MTK, % change year over year	-9.9%	18.8%	-8.0%
%change vs 2019		7.0%	-1.6%
Cargo tonnes, millions	55.4	65.6	60.3
World economic growth, % change year over year	-3.5%	5.8%	2.9%
Passenger yield, % change year over year	-9.1%	3.8%	8.4%
Cargo yield % change year over year	52.5%	24.2%	7.2%
Expenses, $ billion	**493**	**551**	**737**
% change year over year	-37.9%	11.8%	33.6%
% change vs 2019		-30.6%	-7.3%
Fuel, $ billion	80	103	222
% of expenses	16%	19%	30%
Non-fuel, $ billion	413	448	515
cents per ATK (non-fuel unit cost)	48.1	44.9	41.7
% change year over year	22.7%	-6.7%	-7.2%
Capacity growth, ATK, % change year over year	-44.3%	16.2%	23.7%
% change vs 2019		-35.3%	-19.9%
Flights, million	16.9	20.1	27.9
Break-even weight load factor, % ATK	76.8%	67.2%	68.3%
Weight load factor achieved, % ATK	59.5%	61.7%	67.5%
Passenger load factor achieved, % ASK	65.2%	66.9%	78.9%
Operating Profit, $ billion	**-110.8**	**-45.1**	**-9.3**
% margin	-29.0%	-8.9%	-1.3%
Net Profit, $ billion	**-137.7**	**-42.0**	**-6.9**
% margin	-36.0%	-8.3%	-1.0%
per departing passenger, $	-76.22	-19.20	-2.02
Return on Invested Capital, %	**-19.3%**	**-8.0%**	**-1.7%**

* Forcest as of 2022 December

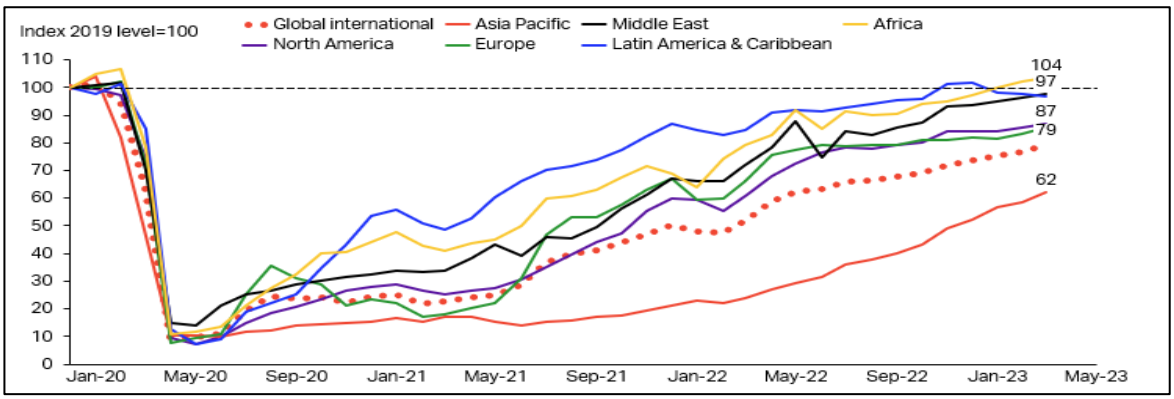

Figure 3. IATA Global Air Connectivity Index 2020-2023

4. Results and Discussion

4.1. Results

Regarding political factors, governments implemented full or partial flight bans and travel restrictions at the beginning of the pandemic, leading to airport closures and longer flight connections. Additionally, there was a significant decline in passenger numbers in March 2020, with gradual but incomplete recovery in subsequent months. Notably, the South Africa and Southeast Asia regions experienced more than a 30% decline in global passenger numbers compared to the same period in 2019.

In terms of economic factors, governments provided financial support to prevent airlines from going bankrupt, although the level of assistance varied for international and local airlines. Passenger airlines faced significant losses, while cargo carriers or combination airlines saw increased profits following the relaxation of flight restrictions. Revenues for global commercial airlines sharply declined in 2020 but showed a gradual recovery in subsequent years, albeit still below 2019 levels (IATA. 2022b). Similarly, passenger growth and capacity experienced a substantial decline in 2020, followed by a rebound in 2021 and 2022, but remaining below 2019 levels.

Concerning sociological factors, layoffs resulted in stress and job insecurity among flight attendants, impacting service quality and employee trust and loyalty. However, companies that focused on social responsibility projects were able to mitigate some of the negative effects on employee morale. Trust in the aviation industry also decreased, raising concerns about trust among individuals.

Regarding technological factors, the hygiene and distance rules brought about by the pandemic led to the development of contactless technologies and reduced face-to-face communication requirements. The use of facial recognition technologies increased, and artificial intelligence and machine learning were integrated into demand forecasting for passenger numbers and pilot training. These technological advancements are expected to contribute to aircraft redesign, fuel consumption reduction, and the development of smart airports.

The pandemic had positive environmental effects, including decreased emission levels, improved air quality, and a slower rate of global warming. These outcomes have raised environmental awareness and are likely to influence future industry practices.

In terms of legal factors, legislation in many countries was reviewed and amended to address issues such as airline workers' rights, compliance with health and hygiene rules, and maximum passenger capacity on planes.

4.2. Discussion

The findings of this study highlight the significant impact of the COVID-19 pandemic on the aviation industry across various dimensions and these findings highlight the multifaceted challenges faced by the aviation industry during the pandemic and provide insights for future strategies and decision-making processes.

This study has several limitations. Firstly, it primarily focuses on analyzing the effects of the COVID-19 pandemic on the aviation sector using the PESTEL framework, which may not encompass all potential influences on the industry, such as cultural, ethical, and competitive factors. Secondly, the study is confined to examining the initial impact of the pandemic and its short, medium, and long-term effects, thereby potentially overlooking future developments that could have further implications for the industry. Lastly, the research acknowledges that most studies on the effects of the pandemic in the aviation sector have been conducted at either regional or limited global levels, thereby potentially missing out on capturing the specific challenges and dynamics faced by individual countries or regions.

In comparing this research with the study "Understanding the pandemic's impact on the aviation value chain" (IATA, 2022b) several similarities and differences emerge. Both studies recognize the significant economic losses suffered by the aviation industry during the pandemic. They both highlight the challenges faced by airlines, which consistently generated substantial economic losses even before the pandemic, and acknowledge the varying performance and resilience of different sectors within the aviation value chain. However, there are also notable differences between the two studies. This research primarily focuses on the effects of the COVID-19 pandemic on the aviation sector through the PESTEL framework, while the IATA (2022b) report provides an analysis of the entire aviation value chain. It focuses on specific economic losses experienced by different sectors within the value chain, with air cargo carriers and freight forwarders standing out as exceptions due to increased demand and yield. It also emphasizes the importance of collaboration and mutual efforts among value chain partners to enhance performance, improve efficiency, and generate higher returns.

So, both studies shed light on the detrimental impact of the pandemic on the aviation industry. While this research concentrates on the COVID-19 effects through the PESTEL framework, the report mostly deals with examination of the aviation value chain, its sectors, and their performance.

5. Conclusion

This study employed a comprehensive PESTEL analysis to examine the profound impact of the COVID-19 pandemic on the aviation industry. Through the examination of political, economic, sociological, technological, environmental, and legal factors, it is evident that the pandemic has had far-reaching consequences on the industry, particularly in terms of passenger transportation. The findings of this study underscore the urgent need for the development of effective strategies to address the challenges faced by the aviation industry in the post-pandemic era. These strategies should encompass both short-term measures to enhance pandemic readiness and long-term efforts for industry recovery and resilience.

For future studies, it is suggested that research focuses on the development of global-scale initiatives for industry recovery, combining PESTEL analysis with multi-criteria decision-making methods. Additionally, efforts may be directed towards restructuring travel packages, exploring low-cost flight options, and identifying popular routes to facilitate industry recovery. Furthermore, environmental sustainability should be prioritized, with the exploration of energy-efficient practices and innovative solutions to reduce fuel consumption and minimize the industry's ecological footprint.

Supporting the well-being of airline employees and fostering a positive work environment are also essential considerations. Future studies may explore social responsibility projects to mitigate the sociological impacts of the pandemic on the workforce.

Technological advancements, such as the adoption of contactless technologies and the integration of artificial intelligence and machine learning, may be further explored to enhance operational efficiency and decision-making processes. Continued vigilance in complying with health and hygiene regulations, protecting workers' rights, and regularly reviewing legislation are critical in navigating the post-pandemic landscape.

In conclusion, future studies may focus on developing strategies for industry recovery, environmental sustainability, employee well-being, and leveraging technological advancements. By utilizing comprehensive analysis frameworks and considering multi-criteria decision-making methods, the aviation industry may build resilience and adapt to the changing market conditions.

Ethical approval

Not applicable.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

References

Abate, M., Christidis, P., & Purwanto, A. J. (2020). Government support to airlines in the aftermath of the COVID-19 pandemic. Journal of Air Transport Management, 89, 101931.

Atalan, A., & Atalan, Y. A. (2022). Analysis of the Impact of Air Transportation on the Spread of the COVID-19 Pandemic. In Challenges and Opportunities for Transportation Services in the Post-COVID-19 Era (pp. 68-87). IGI Global.

Athanasiadou, C., & Theriou, G. (2021). Corporate Social Responsibility (CSR) Employee Outcomes in the Aviation Industry during the COVID-19 Pandemic Era. A Conceptual Framework. Management and Business Research Quarterly, 18.

Avcı, S., Çengel, Ö., & Kibritci Artar, O. (2022). Implications of COVID-19 pandemic on air cargo transportation.

Bao, X., Ji, P., Lin, W., Perc, M., & Kurths, J. (2021). The impact of COVID-19 on the worldwide air transportation network. Royal Society open science, 8(11), 210682.

Battisti, E., Giachino, C., Iaia, L., Stylianou, I., & Papatheodorou, A. (2022). Air transport and mood in younger generations: The role of travel significance and COVID-19. Journal of Air Transport Management, 102230.

Calderon-Tellez, J. A., & Herrera, M. M. (2021). Appraising the impact of air transport on the environment: Lessons from the COVID-19 pandemic. Transportation research interdisciplinary perspectives, 10, 100351.

Çitilci, T., & Akbalık, M. (2020). The importance of PESTEL analysis for environmental scanning process. In Handbook of Research on Decision-Making Techniques in Financial Marketing (pp. 336-357).

Daon, Y., Thompson, R. N., & Obolski, U. (2020). Estimating COVID-19 outbreak risk through air travel. Journal of travel medicine, 27(5), taaa093.

Deveci, M., Çiftçi, M. E., Akyurt, İ. Z., & Gonzalez, E. D. S. (2022). Impact of COVID-19 pandemic on the Turkish civil aviation industry. Sustainable Operations and Computers, 3, 93-102.

Dursun, S., Sagdic, M., & Toros, H. (2022). The impact of COVID-19 measures on air quality in Turkey. Environmental Forensics, 23(1-2), 47-59.

Fahey, L., & Narayanan, V. K. (1986). Macroenvironmental analysis for strategic management (The west series in strategic management). St. Paul, Minnesota: West Publishing Company.

Gregoric, M. (2014). PESTEL analysis of tourism destinations in the perspective of business tourism (MICE). In Faculty of Tourism and Hospitality Management in Opatija. Biennial International Congress. Tourism & Hospitality Industry (p. 551).

Grewe, V., Gangoli Rao, A., Grönstedt, T., Xisto, C., Linke, F., Melkert, J., Middel, J., Ohlenforst, B., Blakey, S., & Christie, S. (2021). Evaluating the climate impact of aviation emission scenarios towards the Paris agreement including COVID-19 effects. Nature Communications, 12(1), 1-10.

Heiets, I., & Yibing, X. (2021). The Impact of the COVID-19 Pandemic on the Aviation Industry. Journal of Aviation, 5(2), 111-126.

Ho, J. K.-K. (2014). Formulation of a systemic PEST analysis for strategic analysis. European academic research, 2(5), 6478-6492.

IATA. (2020). Interactive Coronavirus (Covid-19) Travel Regulations Map (Powered by Timatic). IATA. Retrieved 31 May 2020 from https://www.iatatravelcentre.com/ international-travel-document-news/1580226297.htm

IATA. (2022 December). Industry Statistics (Fact Sheet). https://www.iata.org/en/iata-repository/publications/economic-reports/global-outlook-for-air-transport-december-2022-data-tables/

IATA. (2022b) Understanding the pandemic's impact on the aviation value chain, McKinsy Company Report, https://www.iata.org/en/iata-repository/publications /economic-reports/understanding-the-pandemics-impact-on-the-aviation-value-chain/

IATA. (2023). International air connectivity closing in on pre-COVID levels. https://www.iata.org/en/iata-repository/publications/economic-reports/international-air-connectivity-closing-in-on-pre-covid-levels/

Irfan, M., Ahmad, M., Fareed, Z., Iqbal, N., Sharif, A., & Wu, H. (2022). On the indirect environmental outcomes of COVID-19: short-term revival with futuristic long-term implications. International journal of environmental health research, 32(6), 1271-1281.

Kang, C., & Disemadi, H. S. (2021). The COVID-19 Pandemic Outbreak Impact And Prevention From Legal Perspective: An Indonesian Experience. CoMBInES-Conference on Management, Business, Innovation, Education and Social Sciences,

Kaya, S., Khan, M. D., & Mujtaba, A. (2021). A review of legal impacts of COVID-19 studies: Trends and future challenges. International Journal of Innovation, Creativity and Change, 15(8), 511-520.

Kökény, L., Kenesei, Z., & Neszveda, G. (2022). Impact of COVID-19 on different business models of European airlines. Current issues in tourism, 25(3), 458-474.

Kurnaz, S., & Žilinskienė, D. (2022). The Effects of the COVID-19 Pandemic and the Future of Aviation. In Digitalization and the Impacts of COVID-19 on the Aviation Industry (pp. 53-72). IGI Global.

Lamb, T. L., Ruskin, K. J., Rice, S., Khorassani, L., Winter, S. R., & Truong, D. (2021). A qualitative analysis of social and emotional perspectives of airline passengers during the COVID-19 pandemic. Journal of Air Transport Management, 94, 102079.

Li, J., Huang, C., Wang, Z., Yuan, B., & Peng, F. (2020). The airline transport regulation and development of public health crisis in megacities of China. Journal of Transport & Health, 19, 100959.

Matović, I. M. (2020, September). PESTEL Analysis of External Environment as a Success Factor of Startup Business. In ConScienS Conference Proceedings (pp. 96-102).

Metehan, A., Eroğlu, Y., & Seçkiner, S. (2021). COVID-19 Krizinde Operasyonel Aksaklık Altındaki Havayolu Şirketlerinin Stratejik ve Finansal Karar Faktörlerinin Analizi. Havacılık ve Uzay Çalışmaları Dergisi, 2(1), 70-88.

Nižetić, S. (2020). Impact of coronavirus (COVID-19) pandemic on air transport mobility, energy, and environment: A case study. International Journal of Energy Research, 44(13), 10953-10961.

OAG. (2022). COVID-19 AIR TRAVEL RECOVERY. Official Aviation Guide. https://www.oag.com/coronavirus-airline-schedules-data

Onianwa, O. I. (2022). COVID-19 Pandemic and Air Transport Business in Nigeria: An Analysis. In Global Air Transport Management and Reshaping Business Models for the New Era (pp. 20-38). IGI Global.

Perez, R., & Camargo, A. C. (2022). The Economic Impact of COVID-19 in the Air Transportation Industry: Estimates From a Regional Input-Output Model. In Challenges and Opportunities for Transportation Services in the Post-COVID-19 Era (pp. 88-103). IGI Global.

Rachmat, M. N., & Susetio, W. (2021). Legal Analysis in Airlines Business Over Middle of Covid-19 Pandemic at Indonesia. Journal of Multidisciplinary Academic, 5(4), 315-320.

Sammut-Bonnici, T., & Galea, D. (2014). PEST analysis.

Serrano, F., & Kazda, A. (2020). The future of airports post COVID-19. Journal of Air Transport Management, 89, 101900.

Sim, M., Kim, H., & Choe, Y. (2022). Does COVID-19 induce stress influence job insecurity, general job stress, pro-social service behavior at work place?: A case of aviation industry. 한국관광학회 국제학술발표대회집, 91, 827-828.

Sobieralski, J. B. (2020). COVID-19 and airline employment: Insights from historical uncertainty shocks to the industry. Transportation research interdisciplinary perspectives, 5, 100123.

Song, J., Sun, Y., & Jin, L. (2017). PESTEL analysis of the development of the waste-to-energy incineration industry in China. Renewable and Sustainable Energy Reviews, 80, 276-289.

Su, M., Hu, B., Luan, W., & Tian, C. (2022). Effects of COVID-19 on China's civil aviation passenger transport market. Research in Transportation Economics, 101217.

Sun, X., Wandelt, S., & Zhang, A. (2021). Technological and educational challenges towards pandemic-resilient aviation. Transport Policy, 114, 104-115.

Sun, X., Wandelt, S., Zheng, C., & Zhang, A. (2021). COVID-19 pandemic and air transportation: Successfully navigating the paper hurricane. Journal of Air Transport Management, 94, 102062.

Vieira, J. P. B., Braga, C. K. V., & Pereira, R. H. (2022). The impact of COVID-19 on air passenger demand and CO2 emissions in Brazil. Energy Policy, 164, 112906.

Vo, T. D., & Tran, M. D. (2021). The impact of covid-19 pandemic on the global trade. Int. J. Soc. Sci. Econ. Invent, 7, 1-7.

Warnock-Smith, D., Graham, A., O'Connell, J. F., & Efthymiou, M. (2021). Impact of COVID-19 on air transport passenger markets: Examining evidence from the Chinese market. Journal of Air Transport Management, 94, 102085.

Yüksel, I. (2012). Developing a multi-criteria decision making model for PESTEL analysis. International Journal of Business and Management, 7(24), 52.

Zimmerling, A., & Chen, X. (2021). Innovation and possible long-term impact driven by COVID-19: Manufacturing, personal protective equipment and digital technologies. Technology in Society, 65, 101541.

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