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## Challenges and Opportunities for Transportation Services in the Post-COVID-19 Era

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Giuseppe Catenazzo

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# Challenges and Opportunities for Transportation Services in the Post-COVID-19 Era

Giuseppe Catenazzo  
*ICN Business School, France*

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Sustainable Transportation in Western Europe.....	1
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*Isaac Yeboah, Pentecost University, Ghana*

This chapter presents a literature review of the evolution of sustainable transportation in Western Europe. It examines the historical development in sustainable transportation and the way forward for future sustainable transportation models and strategies. It reviews the sustainable practices of 12 Western European nations and their contributions to reducing the impact of global environmental degradation. The choice of these 12 nations is based on sustainable progress in enhancing environmentally friendly means of mobility. The literature reveals that the emphasis on sustainable transportation system in Western European nations is worthy of discussion primarily because of the dramatic improvement attained in reducing emission of carbon dioxide. This chapter also aims to identify some of the applied policy instruments and the monitoring processes enacted in several of these European nations.

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Sustainability has emerged as central theme in logistics during the last decades. This is further pushed by legislation and stakeholder demand. The COVID-19 pandemic and related preventive measures have had enormous impacts on all logistics and transportation. The purpose of this research is to study value of sustainability as well as impacts of the ongoing pandemic, from perspective of logistics service providers representing different parts of intermodal transportation networks. The chosen approach is qualitative case study, comprising of interviews targeting 12 Finnish logistics companies. In addition, data from a survey on logistics companies' confidence during the pandemic is used to elaborate results in macro-level further. All transportation modes excluding aviation are covered in this study. The results show that value of sustainability (especially environmental) is increasing in intermodal transportation networks. On top of this, the COVID-19 pandemic has hit the sector heavily, but the examined companies seem to have survived the worst and are in the process of recovering.

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Due to environmental and market access requirements, companies need to be able to serve versatile transportation modes. Therefore, multimodality and management of supply chains of different transportation modes as one service is vital for companies to succeed. This is also arising as finding from two case studies of this research. The authors analyze two Estonian companies, one international manufacturer, and another one from logistics services. In the situation of manufacturer, different transportation modes are tied more on location of its alternative suppliers. Earlier railway was not an option, but nowadays even distant Chinese suppliers are evaluated with this alternative. Within logistics service companies, different transportation modes are tied to/from where handled products (cars) are coming from and their destination. For example, Russian markets are served by railways, which creates delays due to larger transportation lot size as compared to trucks.

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With the COVID-19 pandemic, some restrictions in social life were imposed on people by the administrators. The basis of these restrictions was to prevent the spread of this epidemic in order to overcome it. Many sectors were directly or indirectly affected as a result of the restrictions. This study was conducted to reveal the statistical impact of travel by airline transportations on the COVID-19 pandemic in the United States (the U.S.). The data of the confirmed COVID-19 cases were handled for 223 days of covering between March 5, 2020 and October 13, 2020. This study provides statistical evidence that travel by airline transportation is statistically related to a significant impact on COVID-19. The result of this study suggests that social restrictions should continue for a while for the COVID-19 pandemic to be less affected by the second wave worldwide.

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Public policy design plays a significant role in alleviating the economic effects caused by this pandemic in local economies across the globe. This chapter suggests the use of input-output analysis (IO) to provide guidelines to stakeholders and policy makers in the air transportation sector to address economic concerns during the pandemic and in the post-pandemic era. IO is helpful in estimating the economic effects of COVID-19 pandemic in the air transportation sector and allows to estimate its impact on other economic sectors in a local economy. Output, value added, employment, and personal income are the variables estimated through IO. The chapter applies IO technique to evaluate the economic impact of COVID-19 on the air transportation sector in Austin, Texas. Impact estimates suggest a total loss of \$1.02 billion USD in Austin MSA's economy in 2020; the number of jobs lost are estimated at 3.87 thousand and the total loss in personal income at \$229.97 million USD in Austin MSA in 2020. Lastly, the value-added loss in Austin MSA is estimated at \$514.20 USD in 2020.

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This chapter is devoted to the issue of entry and activity of European low-cost airlines in the Ukrainian market. Ukraine, with the largest territory and population in Eastern Europe, is an important partner of European countries. The rapid development of air transportation between Ukraine and European countries in the 21st century is

based on two factors: 1) high tourist interest in the historical and cultural heritage of Europe and 2) communication of migrant workers, the number of which is steadily growing. The authors reveal the specifics of the entry and development by European airlines of market niches of low-cost transportation in Ukraine in 2008-2021. In particular, the activities of airlines are considered: Ryanair, Wizz Air, German Wings, Meridiana, Ernest Airlines, Vueling Airlines, AegeanAir, Air Baltic, Austrian Airlines, and others. The activity of European low-cost carriers in the number of flights and directions of passenger transportation in Ukraine is evaluated.

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Air transport traditionally plays a critical role in the maintenance of converting human potential benefits into significant social and economic effects. However, the COVID-19 crisis influences air transport reduction, causing losses of jobs and human capital capacities. Thereby, the main problems that need to be solved are air transport human capital management and financial support, providing background for its transformation in the post-COVID-19 era. Both theoretical and applied approaches to human capital and its role for air transport development are defined. The chapter is based on indicators and financial determinants of human capital development. The current research purpose is to consider the availability and potential for human capital of air transport transformation, considering the example of Ukrainian economy in the time of the COVID-19 pandemic crisis. Thus, this chapter provides a possible direction for further studying the post-COVID-19 impact on the transformation of human capital on air transport.

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The unforeseen emergence of the COVID-19 pandemic back in March 2020 made a huge impact both nationally and internationally in Turkey. One of the impacts of this disaster was on transportation services both for goods and passengers. Therefore, the focus of this study was determined to be on airline passengers' satisfaction and complaints in this bothersome period. The aim was to discover the problematic dimensions of the service provided and possibly minimize these incidents both for the sake of the airline companies and the passengers. The content analysis method was utilized, and 125 reviews containing 280 complaints were analyzed. It was

discovered that the most criticized SERVQUAL dimension for Turkey-based airlines in the first year of the COVID-19 pandemic was reliability. These findings have the potential to guide professionals of passenger transportation services on which practices should be improved.

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New technologies like autonomous vehicles (AVs), grouped under the concept of mobility as a service (MaaS), provide new experiences for users. To be considered as an innovation, these technologies must be accepted and adopted by users. AVs provide a public transport service in a new manner, without a service provider or driver. This kind of service is called self-service. For this research, the acceptance and adoption of AVs is investigated in a touristic ecosystem in the context of a post-COVID era. This chapter presents the result of a quasi-experiment conducted in Switzerland with students that testing an AV enhanced the user acceptance of this technology for the first and last mile of a journey (FMLM) in a touristic context. To this end, they used a revised model of the technology acceptance model (TAM) and administered the same questionnaire before and after the test of an AV. In the context of a post-COVID era, AVs could provide solutions for personal mobility for long distance as well. However, it will be necessary to provide a test-bench for these new services.

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*Olli-Pekka Hilmola, Kouvola Unit, LUT University, Finland & Estonian Maritime Academy, Tallinn University of Technology, Estonia*

During the coronavirus pandemic, the business and operating environment worsened rapidly in 2020, and effects lasted throughout the year. This chapter analyzed three countries of Baltic States and their publicly traded companies through longitudinal

perspective (2010-2020). Examination is mainly made through revenue development, but profit and loss is briefly discussed. It is concluded that revenue declines were already in 2019 in many situations, reality and pandemic only accelerated this trajectory. The travel and service sector was of course in big trouble, but also textile production and sales were having similar effects as did also some energy industry actors. It could be said that apart of these branches, manufacturing was showing rather good performance. In general, banks in these countries also performed well during the pandemic. It is surprising that Lithuanian companies overall showed the highest profits of the examination period in year 2020, even in a situation that analyzed companies contained troubled sectors and the country was having worsening employment throughout the year.

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At the end of December of 2019, the first cases of COVID-19 alerted the health authorities about the rise of a new pandemic. Although some voices have claimed that mass tourism as well as the public and private transport system are fertile ground for lethal virus propagation, governments systematically overlooked these alerts. In this respect, COVID-19 generated an unparalleled halt to the tourism industry and the transport system. The globalization world sets the pace to new fractured geography fraught with geopolitical tensions, chauvinist, and separatist discourses without mentioning the rise of global fears and anxieties. Having said this, the chapter discusses critically the effects of COVID-19 and the future guidelines of research for the next years. The chapter holds the thesis the world is being feudalized towards an atomized climate that marks a new form of production/consumption. Far from being a foundational event, COVID-19 reaffirms culturally and symbolically a trend initiated just after the War on Terror was declared during Bush’s administration.

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# Preface: A Snapshot into Challenges and Opportunities for Transportation Services in the Post–COVID–19 Era

The outbreak of the COVID-19 pandemic at the end of 2019 plunged the global economy even lower than the global financial crisis did. The risk of infection on top of movement restrictions and lockdowns severely affected transportation services. Fotiadis et al. (2021) claimed, “The COVID-19 pandemic will result in losses [that] will be persistent at least until the next summer and will backtrack the growth of the tourism industry as much as 15 years” (p. 9). Tourists’ low intentions to travel after the end of the COVID-19 pandemic (Teeroovengadam et al., 2021) also reveal that “back to normal” has eventually a long way to go. The transportation of goods and passengers makes no exception to this picture: The blow to aviation services was particularly painful. The passenger traffic decreased sharply, with an incredible drop of –65.9% for 2020 compared to 2019 (International Air Transport Association, 2021). Florido-Benítez (2021) reported, “The drastic drop in flight frequencies at Andalusian airports during the pandemic has caused an average decrease of 65% in passenger arrivals in this tourist destination” (p. 849). Governments helped airlines throughout the pandemics: By August 2020, only a few months after the outbreak of the global pandemic, “Governments [had] provided about USD 160 billion of support to airlines, almost two-thirds of which consists of direct aid, such as subsidies, loans, equity and cash injections” (OECD, 2020). Interestingly, despite such a profound crisis, new players and new ways to transport passengers and goods have emerged or are about to emerge. New airlines such as Connect Airlines in Canada, Norse Atlantic Airways in Norway, EGO Airways in Italy, Pinceair in India, (Sun et al., 2022), and many more were founded during the pandemic. The sales of electric cars boomed (Cooban, 2022). Night trains, which mostly disappeared in Europe a decade ago, are seemingly back on track (Buckley, 2020).

Overall, in the post-COVID–19 era, transportation will unlikely look the way it did before 2019. The pandemic has lasted at least 3 years: Having experienced movement restrictions for an extended amount of time has undoubtedly reshaped travelling and the movement of goods. “Entire populations [had to] radically modify their travel behavior and shaping a worldwide change which is unprecedented in human history compared to other recent epidemics (MERS, SARS, Ebola)” (Barbieri et al.,



2021, p. 12). Such a profound change “may make previous knowledge somewhat irrelevant. . . . As the future is uncertain, tourism researchers are challenged to actively contribute to understanding the consequences of the pandemic” (Björk et al. 2021, p. 31). Transportation researchers should also be involved in this process. Within this perspective, the present book analyses the ways COVID-19 has disrupted the industry and guides practitioners, scholars, and students to shape future goods and passengers’ transportation. At the time of writing, several countries have levied movement restrictions. The number of daily flights in Europe at the end of March 2022 was 77% compared to the equivalent weeks of 2019. This figure also includes the effects of the Ukrainian crisis (Eurocontrol, 2022). Although the number of infections is rising, the situation seems under control. Yet, the Sars-COVID-19 pandemic is not over. For instance, China has recently deployed policy tools to contain a new epidemic wave (Craft, 2022). In such turmoil, players have a fantastic opportunity to make “the transport sector [which] contributes approximately one-quarter of all energy related greenhouse gas (GHG) emissions” (United Nations Environment Programme, 2022), more environmentally friendly.

*Challenges and Opportunities for Transportation Services in the Post-COVID-19 Era* investigates the challenges and the new directions to match travellers and goods’ transportation needs in a post-COVID–19 world. All contributors’ works aim to inspire scholars, researchers, and policymakers. Chapters, authored by one or more scholars, provide a detailed analysis of the effects of the pandemic on transportation of services or goods around the world. Empirically grounded studies, illustrating challenges and respective avenues in several settings, comprise most of this book. A conceptual chapter on the future of tourism and travelling research “at least as we know it” (Korstanje, 2022) paves the way for fascinating and cutting-edge future directions.

The first part of the book investigates the connections between transportation and sustainability through COVID-19 as well as new directions for the future. First, Afedzie, Owiredu, and Yeboah from Ghana present their work: “Sustainable Transportation in Western Europe: A Literature Review of the Evolution of Sustainable Transportation in Western Europe” (Chapter 1). They examine the sustainable practices of 12 Western European nations and their contributions to reducing the effects of global environmental degradation. The authors also aim to identify some of the applied policy instruments and the monitoring processes enacted in several of these European nations. Next, Chapter 2, “A Multi-Faceted Investigation of the Value of Sustainability in Logistics Services and the Impact of COVID-19,” was authored by Lähdeaho, Vilko, and Hilmola from Finland. The purpose of this work is to study the value of sustainability and the effects of the COVID-19 pandemic from the perspective of 12 logistics service providers representing different parts of intermodal transportation networks. Chapter 3, “Transportation Modes and

***Preface: A Snapshot into Challenges and Opportunities***

Supply Chains: Case Studies from Estonia,” was written by Tolli and Hilmola, from Estonia and Finland, respectively. In their study, the authors analyse two Estonian companies: In the case of a manufacturer, different transportation modes are tied more to the locations of its alternative suppliers. Earlier, railway was not an option, but nowadays, even distant Chinese suppliers are evaluated with this alternative. In the case of a logistics service company, different transportation modes are tied to places from which handled products originate as well as their destinations.

A second and most prominent part of the book investigates more closely the passenger aviation market, which was severely hit by the COVID-19 pandemic. Chapter 4, “Analysis of the Impact of Air Transportation on the Spread of the Covid-19 Pandemic,” was authored by Atalan and Atalan from Turkey. Their study reveals the statistical result of airline travel on the COVID-19 pandemic in the United States. In Chapter 5, “The Economic Impact of COVID-19 in the Air Transportation Industry,” Perez and Camargo, respectively from the U.S. state of Texas and the Netherlands, suggest the use of input-output analysis to provide guidelines to stakeholders and policymakers in the air transportation sector to address economic concerns during the pandemic and in the post-pandemic era. Rutynskyi and Kushniruk from Ukraine authored Chapter 6 on the “European Low-Cost Airlines in Ukraine.” They examine the rapid development of air transportation between Ukraine and European countries in the 21st century. Chapter 7, “Transformation of Human Capital of Air Transport in the Post-COVID–19 Era” by Shkoda and Gernego, again from Ukraine, considers the availability and potential for human capital of air transport transformation, focusing on the case of Ukraine. This chapter provides a possible direction for further studying the post-COVID–19 impact of human capital transformation on air transport. In “Airline Customer Complaints During COVID-19 Pandemic: The Case of Turkey-Based Airlines” (Chapter 8), Gidener and Morcote Santos from Turkey examine airline passengers’ satisfaction and complaints in this bothersome period. The aim was to discover the problematic dimensions of the service provided and possibly minimise these incidents both for the airline companies and the passengers.

The final part of the book collects several works from various fields. Once again, chapters mainly report empirical studies worldwide. In Chapter 9, a team from Switzerland, Nanchen, Ramseyer, and Fragnière, wrote “Autonomous Vehicles (AVs), Mobility as a Service (MaaS), Technology Acceptance Model (TAM), Quasi-Experiment, Tourism, Service Design, Perceived Usefulness, and Behavioral Intention of Use.” They studied the acceptance and adoption of autonomous vehicles in a touristic ecosystem in a post-COVID era. Hilmola, from Finland, authored the “Effects of Pandemic on Performance of Publicly Traded Companies Within the Baltic States” (Chapter 10). This chapter analyses three countries in the Baltic States and their publicly traded companies through a longitudinal perspective. Finally, Korsanje, from Argentina, critically discusses the effects of COVID-19 and future research

guidelines for the next years in his chapter entitled “COVID-19 and Effects in the Global Transportation System: Is This the End of Tourism at Least as We Know It?”

I hope that scholars and students will find this edited book valuable for their research, teaching, and learning. The timely themes and analyses in this collective book will help practitioners in several fields, such as transportation service management. In addition, analysts and decision-makers in neighbouring areas such as governmental or public management will find some takeaways to guide them to overcome challenges in their respective fields.

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I hope this work will be the first of a long-lasting, rewarding and fruitful research collaboration. I would be delighted to continue working together on passionate projects such as this one. Thank you very much.

Section 1

# Transportation and Sustainability

# Chapter 1

## Sustainable Transportation in Western Europe

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### **ABSTRACT**

*This chapter presents a literature review of the evolution of sustainable transportation in Western Europe. It examines the historical development in sustainable transportation and the way forward for future sustainable transportation models and strategies. It reviews the sustainable practices of 12 Western European nations and their contributions to reducing the impact of global environmental degradation. The choice of these 12 nations is based on sustainable progress in enhancing environmentally friendly means of mobility. The literature reveals that the emphasis on sustainable transportation system in Western European nations is worthy of discussion primarily because of the dramatic improvement attained in reducing emission of carbon dioxide. This chapter also aims to identify some of the applied policy instruments and the monitoring processes enacted in several of these European nations.*

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## **INTRODUCTION**

The concept of sustainability has gained much traction in our 21<sup>st</sup> century business world. With the onset of globalization and advanced paced of technological advancement, much of the western world's development agenda has increasingly focused on ways and means to create less harm to the ongoing climate crisis and environmental degradation. Governments and major corporations across the world have adopted policies over the past two decades to moderate the trend of environmental destruction. Sustainability in the world of energy production and transportation has been an area that has generated much policy interest (Black 1997). Global international institutions and governments in several developed nations have passed policies seeking to encourage sustainability development in transportation, energy and urban development (Chini, 2020).

United Nation's Agenda 2030 for Sustainable Development focuses on ideals of shared prosperity and the realization of intergenerational responsibilities been attainable through collaborative partnership with all countries and relevant stakeholders. United Nations (2030) Agenda seeks to promote and encourage coordinated approach to sustainable development which in the long term seeks to improve the health of the environment. Reducing the consequences of environmental risk enhances the resilience of societies which ultimately fosters socio-economic development in the society. The concept of sustainability has become more urgent in our 21<sup>st</sup> century world, specifically because of the concerns of climate crisis, environmental pollution and large scale of deforestation across the globe. There is an unending sight to the rate of economic development and growth of population in urban areas.

Over the past two decades, nation states and international organisations have enacted policies and international treaties with the singular goal of regulating the rapid pace of environmental destruction. This chapter is focused on the twelve countries in Western Europe primarily because the European Union countries have enacted policies with the primary objective of placing more attention to the value of smart cities in their economic development. (Karyy & Knjazevska, 2009). The EU's 2020 strategic goals includes the development of smart and sustainable communities in Europe (European Union, 2014). Transportation plays a key role in the urban development plans of major developed nations and many Western European nations have taken a significant leap in systematical upgrading and uplifting their transportation system to fit into the 21<sup>st</sup> century era of fostering policies and concepts of sustainability (De Jong & Van de Riet, 2008). Sustainable transportation is defined as the mode of transportation that is "green" and has minimum impact on the environment. In essence, it is the type of transportation system that creates less cost and burden for future generation to handle or endure. The "green" type of transportation promotes



car sharing, transit type of development and fuel-efficient transport system. Non-motorized type of transportation includes walking and biking.

This study provides insight and in-depth understanding of the major factors that influence the development of sustainable transportation in Western Europe. It seeks to identify some of the key factors in transportation and urban development that is creating global environmental degradation and climate crisis. It also attempts to highlight aspect of the urban development plans that is destroying the natural habitats of the earth's ecosystems and their subsistence. In this context, this chapter aims to present a review of critical studies conducted over the past two decades by exploring the issues of environmental issues which has been precipitated by the growth of exponential population growth and economic growth. Importantly, this chapter reviews the literature on Western European transportation systems and the progress made towards an environmentally sustainable transports system in these nations.

The objectives of this chapter attempt to find out the background of sustainable transportation in Europe and the changes resulting from technological developments in mobility systems over the past two decades. Similarly, this chapter will explore the historical context of sustainable development in Western Europe and the significant improvement attained in the area of environmental degradation. In so doing, this chapter will examine sustainable development initiatives that has influenced energy conversation and environmental protection. It seeks to assess the following factors on sustainable transportation in Western Europe (i) the role of technological advancement on sustainable transportation; (ii) the role of government investments in trains, tram and bicycles in sustainable transportation; (iii) the impact of government policies on carsharing and current development in electric cars. This chapter will provide recommendations for fostering new sustainable initiatives that will enhance transportation network that is sustainable and ecologically viable for the global environment.

## **SUSTAINABLE TRANSPORTATION IN WESTERN EUROPE - A HISTORICAL PERSPECTIVE**

The world has attained significant development in technology in many areas of our world of work. Most of the technological innovations has been precipitated by the quest to reduce environment degradation and create an efficient work life for businesses. The area of sustainable transportation has seen dramatic growth and transformation over the past two decades. Much of the sustainable development in transportation is widely noticeable in Western European nations. This historical analysis reflects on the evolution of transportation in Western Europe from the 17<sup>th</sup> century to our 21<sup>st</sup> century world of globalization.

The majority of sustainable transportation methods and concepts were created before the term was defined. Dating back to the era of Blaisé Pascal's creation of the public bus in 1662, public transit has existed (Cresswell, 2010). In 1807, the first passenger tram was introduced in France, followed by the first passenger rail service in 1825 in England. (Goodwin & van Dender, 2013). Prior to World War II, these were the only personal transportation options available to most individuals in Western European countries, and they remain the sole possibilities for most people in developing countries.

Increased prosperity and a demand for far greater mobility for people and products accompanied the postwar years. Between 1950 and 1979, the number of road vehicles in the United Kingdom climbed fivefold, with comparable patterns in other Western European countries (EU Commission, 2010). Several Western European countries and cities made significant investments in larger and better-designed roads and highways, which were critical to growth and prosperity. Transport planning evolved into a discipline of civil engineering, intending to design enough road capacity to accommodate predicted traffic growth while maintaining acceptable levels of traffic congestion — a practice known as “predict and provision” (Cresswell, 2010).

During the 1973 oil crisis and the 1979 energy crisis, there were widespread concerns about the viability of this method. The high expense of gasoline, combined with its scarcity, sparked renewed interest in alternatives to single-occupancy vehicle travel (Schwanen, et. al. 2004). High-occupancy vehicle lanes, citywide carpool programs, and transportation demand management are examples of transportation developments during this period. Between 1980 and 2000, relatively low and stable oil prices resulted in significant increases in vehicle travel, both directly because people chose to travel by car more often and for longer distances, and indirectly because cities developed tracts of suburban housing, far from shops and workplaces, now known as urban sprawl. Freight traffic rose faster than general vehicle traffic due to trends in freight logistics, such as a shift from rail and coastal shipping to road freight and a necessity for just-in-time deliveries (EU Commission, 2011). The British Government's White Paper on Transport in 1980s signaled a shift in the country's transportation planning. In the introduction to the White Paper, Prime Minister Tony Blair stated that “we recognize that we cannot simply build our way out of the problems we face. It would be environmentally irresponsible – and would not work” (Alterman, 2001, p. 343).

A companion document to the White Paper called “Smarter Choices” looked into the possibility of scaling up the small and scattered sustainable transportation initiatives that were happening at the time across the United Kingdom and found that a comprehensive application of these techniques could reduce peak period car travel in urban areas by over 20%. In 2004, the US Federal Highway Administration produced similar research that indicated that a more proactive approach to transportation

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demand was an essential component of the overall national transportation strategy. Western European countries are often noted with common transportation network which tend to define a key aspect of their contribution to sustainable development (Cresswell, 2015).

The government invests significantly in creating a comprehensive rail and urban road network based.

- National policies are periodically enacted primarily to minimize the rate of pollution, reducing dependence on fossil fuels and promoting green energy initiatives
- Adopting policies that would make it conducive for private sector investment in green transportation and other environmentally friendly approach to citizens mobility.
- Creating awareness of the consequences of environmental degradation and the need to promote sustainable development in urban transport.

Table 1 shows the twelve (12) Western European countries which has made significant progress in sustainable transportation in their respective countries.

*Table 1. Western European countries and sustainable transportation*

<b>Country</b>	<b>System of Sustainable Transport</b>
United Kingdom	Underground trains and public bus system
France	Underground trains and public bus system
Netherland	Tram and public bus system
Spain	Railroads and public bus system
Italy	Railroads and public bus system
Austria	Trams and public bus system
Norway	Railroads and public bus system
Sweden	Tram and public bus system
Belgium	Underground trains and tram
Denmark	Railroad and public bus system
Switzerland	^Railroads and public bus system
Germany	Railroads and public bus system

Source: World Bank 2020

## LITERATURE REVIEW

A review of studies in sustainable transportation will be discussed in this section. This shall cover definitions and concepts of sustainable transportation, the need for sustainability indicators and empirical studies in sustainable transportation.

### Definition and Concepts of Sustainable Transportation

Transport plays an essential role in shaping the socio-economic and cultural well-being of the society. It directly affects the liveability of our shared habitats and the human and environmental health in them, whether they are urban or rural (SLOCAT, 2019). Consistent with the broad definition of sustainable development (WCED, 1987), the specification for a sustainable transport system requires that the movement of people and goods is provided in an environmentally, socially, and economically viable way. Specifically, the socio-economic mobility for any purpose is to be considered as a means rather than an end. Black and Sato (2007) show that the concept of ‘sustainable transport’ was broadened between 1989 and 2006, from a strict focus on greenhouse gas emissions to a concern with the possibility of peak oil, health effects from injuries or emissions, congestion of streets and roads, and issues of equity (Black & Sato 2007). According to Jha et al. (2013), sustainability in transportation usually refers to contributing to the sustainable development of a community that has and uses a particular system. Sustained transport is defined by the transport ministers of the European Union as access, communication, and rapprochement between needs of individuals, powers and Society with less cost and safety and speed that is compatible with body health and environment that gives equality between next generations.

The World Bank (1996) explains sustainable transportation to cover economic and financial, environmental and ecological and social components. The definitions highlighted issues such as adequacy of transportation infrastructure funding (economic and financial), influence on energy consumption, emissions, habitat (environmental and ecological), air and water quality and access to transportation services by all sections of society. The Centre for Sustainable Transportation broadened this definition for Sustainable Transportation (CST) (2005) to outline four-dimensional areas to explain what sustainable transportation entailed. According to Centre for Sustainable Transportation (2005), there are; social, economic, environmental and degree of participation. These dimensions are described in detail as:

- **Social dimension:** this permits primary access and enables people development needs to be met safely. Also, social dimensions should promote fairness within and between successive generations.

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- **Economic dimension:** focuses on affordability, operational equity and efficiency, and fostering a balanced regional development.
- **Environmental dimension:** Controlling of emissions of air pollution, waste and minimization of noise generation.
- **Degree of participation:** ensures participatory process, which encompasses relevant stakeholders in all facets of Society.

Dalkmann and Huizenga (2010) posited that a sustainable transportation system aimed at reducing the negative impact on both the local and international environment and has the economically viable infrastructure and operational elements to provide safe and secure access for both persons and goods.

Judging from the above definitions, one can conclude that the sustainable transportation system is a system that meets short and long term social, economic and environmental goals while incorporating technological, institutional and political considerations into planning, programming and implementation processes U.S. Federal Highway Administration (FHA) (1997) In effect, sustainable transportation symbolizes ecologically friendly transportation- thus 'green' and low impact on the environment.

### **The Need for Sustainability Indicators**

Sustainability in transport is now an acceptable norm given the undesirable environmental, social and economic influences of movements of passengers and goods in cities and across the globe. Air pollution, congestion, noise, road safety, and equitable access have been challenging issues that is consistently been addressed through sustainable transportation systems. Policymakers, in an attempt in tackling the troubling trend of environmental issues, may need some indicators to guide. As defined in the European COST 356 project (COST 356, 2010, 28), “it is a measurable variable that represents an accurate and necessary a phenomenon of interest”, that is., sustainable transport. Carvalho (2017) discusses how smart cities has an interconnection with sustainable transportation. The author asserts that sustainable transportation generates a creative environment which is beneficial for advancing the quality of life of any society and enhances innovative businesses and social projects. Table 2 highlights the key indicators of sustainable transportation and its related environmental, social and economic dimensions.

*Table 2. Indicators of sustainable transportation*

<b>Sustainable Dimension/Indicator</b>	<b>Underlying Sustainability Goal</b>	<b>Indicator type</b>
<b>Environment dimension</b>		
Percentage of population affected by local air pollutants (e.g., PM10 concentration, Non-Methane Hydrocarbons [NMHC] emissions, Local biodiversity impacts)	Reduce detrimental effects on human health and the environment	High effect
Land consumption by transport infrastructure (as % of total surface)	Avoid sprawl and destruction of the environment by transport infrastructure	Low/ medium effect
<b>Social dimension</b>		
Road fatalities	Drastically minimizes the number of people killed or injured in road traffic accidents	High effect
Share of transport cost from total Household expenditure	Offer affordable transportation for all members of the Society	
Noise exposure	Reduce noise-making	
Coherence within municipality	Provide equitable access to all	
<b>Economy Dimension</b>		
Minimum taxation on fuel	Consider the external costs caused by transportation based on fossil fuels (Especially Road Traffic)	High effect
Transport investments by mode	prefer transport modes that are accessible and environmentally Sound	
Infrastructure and operations cost traffic demand and future proofing	Affordable and accessible	

Source: Carvalho (2017)

## **Sustainable Transportation Methods**

Despite the broadening of the sustainable transportation concept, much of transport research remains set in the techno-rational model, focused on technical or economic aspects of transport. Even radical proposals, such as the transport reducing measures proposed by Givoni and Banister (2013) or the ‘resilient cities’ of Newman et al. (2009), tend to treat sustainable transport as a primarily technical issue to be managed by ‘good planning’ or technological innovation. The utilization of sustainable

transportation methods is defended throughout the world, aiming in a general way to reduce energy consumption and the emission of polluting gases.

## **Minimizing Carbon Emissions**

Many sustainable building standards, codes, policies, and guidelines packages have been introduced in many countries worldwide, which aim to improve building energy performance and reduce CO<sub>2</sub> emissions. More than 60 countries worldwide initiated plans to implement these either mandatorily or voluntarily (Abergel, Dean and Dulac, 2017). Over the past two decades, governments and policymakers have been urged to mitigate CO<sub>2</sub> emissions in various sectors (Langevin, Harris and Reyna, 2019). Low carbon technology is one of the technical strategies adopted in buildings to reduce carbon dioxide emissions. Low carbon technology refers to the technology that has a minimal output of greenhouse gas emissions into the environment, specifically for CO<sub>2</sub> emissions (Tan, Ismail and Ahmad, 2016). Closing down the operation in particular areas and shutting down associated devices is a straightforward approach to minimizing the CO<sub>2</sub> emissions and energy utilization in buildings. The most accessible practice is to keep the doors closed and switching off the lights and electrical appliances of vacant rooms. As part of mitigation measures, the assessment of embodied carbon of building materials is one of the fundamental approaches that can positively impact carbon footprint. The selection of appropriate sustainable building materials can reduce about 30% of embodied CO<sub>2</sub> emissions over the lifespan of the building (González and Navarro, 2006; Chastas, Theodosiou, Kontoleon & Bikas, 2018).

## **Urban Mobility**

Proponents of a mandatory approach argued that non-action would endanger the achievement of critical European objectives, including a competitive and resource-efficient transport system, reducing greenhouse gas emissions, air pollution, and noise pollution to reduce the effectiveness of businesses. Hence “impacting the well-being of virtually all populations, including those living in cities” (European Commission, 2013. pp. 17, 485). One line of reasoning was to link urban mobility to the European Trans-European Network (TEN-T) policy, under which DG MOVE has a strong influence on mobility policies: Articles 170 and 171 (2) of the TFEU empower the E.U. to “contribute to the establishment and development of trans-European networks” and that the “Commission may, in close cooperation with the Member States, take any useful initiative to promote such coordination” (Van Weenen, Burgess and Francke, 2016.p. 28). It was argued that since “urban congestion has a negative impact on inter-urban and cross-border travel, as most transport starts

and ends in urban areas” (European Commission, 2013., p. 14), urban mobility was an integral part of the Trans-European Transport Network. The TEN-T Regulation (E.U.) No. 1315/20131, among other things, defines standards for the development of roads, railway systems, waterways and airports that are part of the network. Urban nodes and sustainable mobility are explicitly mentioned in the TEN-T Regulation. The Commission has the right to start up a procedure against the Member States if their infrastructure is not adapted to the requirements (Durlin, 2018).

## **Steps Towards Sustainable Transportation in Europe**

ECMT is one of the first intergovernmental organizations that articulated policy tools for “sustainable urban travel”, an alternative name for sustainable transportation (Hidas & Black, 2001). As early as 1995, the ECMT released a report titled “Urban Travel and Sustainable Development”. In this report, the ECMT emphasizes the following policy tools:

- Economic incentives and disincentives;
- Land-use planning;
- Traffic management schemes;
- Marketing, telematics and other innovations to improve public transport.

In 2000, the ECMT further elaborated the above tools to cover the following sustainable transportation policy goals:

- Improved decision making incorporating best practices in cost-benefit analysis and environmental assessment;
- Efficient and coherent pricing and financing of infrastructure;
- Reducing CO<sub>2</sub> emissions from road transport;
- Promoting the use of low emission trucks;
- Improving the competitiveness of road alternatives – rail and inland shipping – and removing barriers to the international development of their markets;
- Improving road safety;
- Resolving conflicts between transport and sustainable development in urban environments (ECMT, 2000)

In another document focusing on urban transportation sustainability, ECMT (2002) believe that cities could reduce car travel to “achieve sustainable urban development”. For member national governments pursuing sustainable transportation, ECMTs recommended strategies are the following:



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- Establish supportive national policy frameworks;
- Improve institutional coordination and cooperation;
- Encourage effective public participation, partnerships and communication;
- Provide a supportive legal and regulatory framework;
- Ensure a comprehensive pricing and fiscal structure;
- Rationalize financing and investment stream;
- Improve data collection, monitoring and research.

In 2003, the European Council of Town Planners (ECTP) released *The New Charter of Athens 2003*, which details ECTP members' shared visions on the future of European cities. The document ECTP emphasizes that European cities of the future should provide their citizens with "a varied choice of transportation modes" and "accessible and responsible information networks". ECTP points out that sustainable transportation should cover the movement of "persons", "materials", as well as "information flows". At different "scales", ECTP puts forward different strategies and goals for sustainable transportation. At the strategic scale, ECTP treats sustainability as one of the four goals for the future E.U. transportation network. At the city level, ECTP regards "ease of movement and access" and "greater choice in the mode of transportation" as "critical element[s] of city living". ECTP attaches great importance to interchange facilities and separation of residences and rapid transportation networks within the city transportation network. At the travel demand management scale, ECTP advocates for "full integration of transportation and town planning", "imaginative urban design", and "easier information access" (ECTP, 2003).

One of the most significant steps towards sustainable transportation is online information sharing and marketing. For instance, to increase public awareness of the U.K.s sustainable development strategy, the U.K. government launched a gateway website in 2005 (The Sustainable Development Unit, 2007). This website is not specifically dedicated to sustainable transportation. However, the transport was mentioned as a component of "sustainable communities", one of the four key priority areas in the U.K.s sustainable development strategy. Per the strategy, a sustainable community should be "well connected—with good transport services and communication linking people to jobs, schools, health and other services". The strategy also lays out 68 indicators to evaluate sustainability at the national level. Of these indicators, many are transportation-related, such as greenhouse gas emissions, road transport connectivity and efficiency, accessibility, and road accidents.

The U.K. Department for Transport (DfT), following the U.K. governments footsteps, has published a series of online reports covering in-depth the following topics that are related to sustainable transportation:

- Alternatives to travel: how employees can reduce trips while do not compromise productivities;
- How greenhouse gas emissions can be measured and reported according to the Dft requirements (DfT, 2011a);
- Information about biofuels (DfT, 2011b);
- How to consider sustainable transportation in new development (DfT, 2008);
- How 15 local governments in the U.K. had simultaneously addressed the sustainable transportation and housing growth issues (DfT, 2010);
- How different individuals can use travel plans to make more green trips (DfT, 2011c);
- Guides for local governments about delivering sustainable, low carbon travel (DfT, 2009).

## **Empirical Studies in Sustainable Transportation**

Sustainable transport according to Adeeb et. al. (2020) should be encouraged, this so because in their view it is almost impossible to deal with climate change without establishing sustainability. In the view of IEA (2018), transportation account for 23% of global emissions. This as a result makes sustainable transportation systems an essential ingredient of meeting the economic efficiency and social demand of a country's population and thus curtailing the negative influences on the environment (Keeling & Mooney 2011). Therefore, it is not coincident that studies have revealed an astonishing growth in transportation sustainability worldwide. Sustainable transportation problems associated with urban stretch are generally studied in Western cities (Gillham, 2002). The highly studied fields comprise travel time or distance, pollution caused by the increasing sprawl traffic, and efficiency in providing supporting infrastructure (Weber & Sultana, 2005).

Deakin (2011) found in his study that sustainable transportation issues centered on environmental quality, social equality, economic vitality, and safeguarding against climate change. Norhazlin & Shah M Z (2008) identified congestion as a significant problem in urban transportation and further indicated that it harms the economy, environment, and quality of life. Cavagnoli & Norman (2008) also elucidated that most of these findings are underpinned by social changes and structural changes in the economy.

## Sustainable Transportation in Western Europe

Table 3. Overview of similarities in transport and land-use policies implemented in major Western European cities

<b>Policies that restrict car use</b>	
<i>Price of gasoline</i>	In 2015, the retail price of gasoline in most Western European countries was more than twice the price in the United States and over half of the retail price was due to taxes
<i>Traffic calming &amp; speed limits</i>	Residential streets in many Dutch and German cities are traffic-calmed at 30km/h or less, with speeds reduced to 20km/h on shared streets, and to 7 km/h on some residential streets (home zones). Except for motorways and major arterials, the general speed limit on urban streets is 50km/h
<i>Road supply</i>	Motorways rarely penetrate into city centers; many neighborhood streets discourage through-traffic by 30km/h speed limits and infrastructure modifications, such as narrowing roads and installing curves, diverters, chicanes, speed bumps, raised intersections, and artificial dead ends
<i>Parking</i>	Many European cities have reduced car parking supply in downtowns, increased parking fees, and imposed time limitations for on-street parking since the 1960s
<i>Driver licensing</i>	Strict and expensive driver training and licensing; probational licenses for young drivers
<i>Road revenues &amp; expenditures</i>	Revenue from roadway user taxes and fees are higher than roadway expenditures by all levels of government, providing an important source of revenues for every European national government
<i>Congestion charging</i>	In London and Stockholm, fees imposed on motor vehicles to drive in designated central zones
<i>Environmental zones</i>	In many German cities, only certified low-emissions vehicles allowed in designated central zones
<b>Policies that promote public transport</b>	
<i>Quantity of service</i>	Most cities have increased public transport service since 1990: expanded route network, increased operating hours, and more frequent service
<i>Quality of service</i>	Public transport systems have modernized their vehicles and stations and better coordinated schedules, fares, and routes across modes and operators, enabling quicker and easier transfers
<i>User information</i>	Online information about regional, state-wide, & national routes, timetables, and fares; real-time information at most rail & some bus stops, and on-board most trains & buses
<i>Discounts</i>	Discounts for children, university students, and seniors; deeply discounted monthly and annual tickets available to all groups
<i>Region-wide integration</i>	Most large cities have regional public transport authorities which integrate fares, ticketing, operations, & financing across operators and jurisdictions
<b>Policies that make walking and cycling more attractive</b>	
<i>Car-free zones</i>	Many cities have pedestrianized large areas of their city centers that are off-limits for automobiles with parking garages at the periphery
<i>Traffic calming</i>	As noted above, many residential streets discourage through-traffic and greatly reduce car speeds

## **CHALLENGES AND OPPORTUNITIES FOR SUSTAINABLE TRANSPORTATION IN THE POST-COVID-19 ERA**

Public transportation dealt with severe strain in historical proportion in many European cities during the pandemic due to reduced service levels, and deferred routes because of significant drop in the number of passengers and the quest to adhere to social distancing rules. Covid-19 pandemic has shaped the trend of decarbonization in the area of transportation. Covid-19 to a considerable extent has slowed the impact of environmental denigration as most factories and economic productivity grinded to a halt because of low demand and the need to reduce the rate of human contact. Covid-19 has created a major upheaval of public transportation across the globe, especially in Europe where public transport network contributes significantly to citizens socio-economic mobility.

The onset of covid-19 pandemic has created a huge disruption in public transportation by straining the supply chains and logistics operations across the globe. Every country is impacted by the reduced flow of goods and resources to ensure continued production of goods and services. Although, covid-19 has changed the world of work to remote working, the reduction in carbon dioxide emissions and environmental pollution had created a new normal to transportation in Western Europe. Cities are finding ways to sustain the new normal of less pollution and environmentally friendly means of public transportation. Many residents in Western Europe switched to cycling, walking and micromobility as many governments sought ways to respond accordingly to the pandemic. The impact of covid-19 on mobility of people and the transport of goods is still not predictable in the short term. However, it has caused significant changes in the behaviour, business model and the approach to government intervention in public transportation.

As covid-19 recovery pace is taking place, there is the huge opportunity to invest in sustainable transportation with the knowledge that the 21st technological advancement calls for cleaner air and environmentally friendly transportation system (Bloom, 2020). Policies to restart the economy and ensure the resilience of the transport network can help tremendously in addressing the environmental challenges bedeviling the 21st century world (Buckle et al., 2020).

## **RECOMMENDATIONS**

The last two decades has been transformed by technological development. This sustained technological advancement has resulted in innovations in transportation and urban mobility in our work life and business transactions. Better planning and the quest to ensure higher efficiency in economic productivity has brought in more

## ***Sustainable Transportation in Western Europe***

private investment in transportation. This economic benefits of meeting the needs of consumers by applying 21<sup>st</sup> century business model of sustainability has shaped the trend of transportation across land, sea and air. The efficiency and convenience underpinned with the concept of reducing environmental negative consequence is driving consumers purchasing power. As such this chapter recommends that more education should be provided to citizens on the need to utilize energy efficient products and automobile. The means to achieve this educational goal is to increasingly promote the development of skills, understanding, knowledge and values among the citizenry to create a sustainable society.

Further, the need for citizens to understand the harmful effect of pollution and excessive carbon dioxide should be offered as part of the curricula in citizenship class in primary, elementary and tertiary institutions. Furthermore, more tax incentives should be offered to citizens who choose to purchase energy efficient vehicles. Likewise, industries should be given tax incentives to motivate them into producing more energy efficient products.

Special focus should be given to revamping some of the engineering programs taught in tertiary institutions to focus more on sustainable energy programs which will serve our 21st century world of work. Above all, there should be government policies to encourage the labour force to gain competencies and capabilities in the technical areas of energy efficiency.

## **FUTURE AREAS OF RESEARCH**

Several economic factors have contributed to the rapid pace of sustainable transportation in Western Europe over the past two decades. Among them are the heavy investment by private entrepreneurs in electric automobiles and government policies on encouraging private financial capital into sustainable transportation. The governments of the various European countries have all injected significant investment in sustainable transportation networks primarily to minimize the rate of environmental destruction. In particular, qualitative studies on sustainable transportation could be undertaken in some of the city administrators in major Western Countries such as Germany, England, France and Spain to provide deeper insight to the literature review conducted. Further, an empirical analysis can also be employed to compare major European cities and their approach to sustainable transport initiatives. Future research should also explore the amount of public and private investment undertaken in the area of sustainable transportation.

## **CONCLUSIONS, CHALLENGES, AND OPPORTUNITIES**

This chapter concludes that countries such as Austria, Belgium, France, Germany, Liechtenstein, Luxembourg and the United Kingdom have implemented policies to enhance sustainable transportation. However, the effect of these policies on the economies of many western European nations depends on the country's stage of economic development. Transport markets and related transport infrastructure networks are key drivers in the promotion of more balanced and sustainable development, particularly by improving accessibility and the opportunities of less developed regions or disadvantaged social groups. In many cases, several Western European nations have passed legislation obligating governments to take action to ensure sustainability.

Similarly, technological advancement in our 21<sup>st</sup> century world has created numerous opportunities to reduce the harmful effects of carbon dioxide emissions. Specifically, the introduction of technological innovations such as Intelligent Transportation System (ITS) applies a set of telecommunications, electronics and information technologies to enhance transportation efficiency and safety, which provides a considerable benefit to managing emissions from automobiles. Further, innovations in the areas of fuel cell technologies and diverse fuel sources have offered more opportunities to considerably reduce the impact of greenhouse gas emissions. Likewise, more stringent controls on engine emissions, exhaust and vehicle noise, and town and country planning legislation are all designed to reduce the environmental impact of transportation (Prado-Lorenzo, et. al. 2011).

Considerable attention should also be focused on addressing some of the pertinent challenges in the areas of (i) identifying how to gradually replace vehicles with high carbon dioxide emission, (ii) identifying the trend of future population growth and promoting more efficient sustainable mode of transportation, (iii) critically reviewing current and potential public policy impact on mobility and finally creating more modelling tools to measure the link between transportation systems and air pollution using more precise datasets. (Skrucany, et. al., 2018).

Ultimately, to match the pace of increase urbanisation of western nations, reshaping transport systems to catch up with the level of technology in the new economic activities of the twenty-first century would be a massive boost to a sustainable transportation in most western European countries.

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## **KEY TERMS AND DEFINITIONS**

**Environmental Degradation:** Is a process by which the natural environment is purposely destroyed for economic benefits thereby destroying the ecological system within that particular space.

**Sustainability:** Satisfying our present needs while preserving our resources to meet the needs of future generations.

**Sustainable Transport:** This refers to the type of transportation that is planned with environmental intentions, primarily to minimize pollution and excessive emission of carbon dioxide.

**Technological Advancement:** The continuous growth and rapid development generated in the area of science to meet the needs of work life in business and socio-culture existence.

**Urban Development:** It is the use of urban space with the intention of balancing our present needs and population growth in the future.

**Western Europe:** Is the geographical region specifically carved out and noted for high level of economic development and standard of living.

## Chapter 2

# A Multi-Faceted Investigation of the Value of Sustainability in Logistics Services and the Impact of COVID-19

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### **ABSTRACT**

*Sustainability has emerged as central theme in logistics during the last decades. This is further pushed by legislation and stakeholder demand. The COVID-19 pandemic and related preventive measures have had enormous impacts on all logistics and transportation. The purpose of this research is to study value of sustainability as well as impacts of the ongoing pandemic, from perspective of logistics service providers representing different parts of intermodal transportation networks. The chosen approach is qualitative case study, comprising of interviews targeting 12 Finnish logistics companies. In addition, data from a survey on logistics companies'*

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*confidence during the pandemic is used to elaborate results in macro-level further. All transportation modes excluding aviation are covered in this study. The results show that value of sustainability (especially environmental) is increasing in intermodal transportation networks. On top of this, the COVID-19 pandemic has hit the sector heavily, but the examined companies seem to have survived the worst and are in the process of recovering.*

## **INTRODUCTION**

Value from sustainability has become increasingly important source of competitiveness for logistics service providers (Arvis et al., 2018). While regulative and societal actions targeting sustainability of all business sectors act as drivers for transformation towards sustainability, some companies have identified competitive advantages in sustainability and therefore possess proactive orientation towards it. Indeed, top-down approaches promoting sustainability come in form of global (e.g., Paris agreement; UNFCCC, 2021), regional (e.g., EU decarbonization targets; European Commission, 2021) and national regulation (Haas and Sander, 2020). However, from the competitiveness point of view, stakeholder pressure towards companies to improve sustainability of their operations (i.e., bottom-up approach) is becoming increasingly important (Seuring and Müller, 2008). In addition, Covid-19 has had dramatic impact on logistics sustainability in terms of transportation modal shift and on mobility of both passengers and goods.

Clearly, sustainability can provide value to logistics service providers. However, it is extremely difficult to measure in quantifiable terms (e.g., short-term profits), making it harder for companies to justify investments towards improving sustainability (Hristov et al., 2019). Some measurements are used currently, such as CO<sub>2</sub> emissions amounts, which via carbon trading platforms can be assigned with a price tag. As a response for external stakeholders' pressure towards sustainability, companies also increasingly involve these stakeholders in designing and developing their operations (e.g., Söderholm & Bergquist, 2012). The role of logistics is vital for any modern society, and as the movement of people and goods is tied to energy use, the role is also central in improving environmental sustainability of societies.

Rather than sustainability, functionality and price are still the most commonly used measures in logistics (Arvis et al., 2018). Functional logistics is dependent on utilization of different transport modes. These modes (i.e., rail, road, sea, inland waterways, aviation, and pipelines) differ in characteristics, one of those being their environmental sustainability. For example, electrified railways can be seen as more environmentally friendly option over road transportation or aviation. However, this is not always obvious, and for example railway operators seem to not notice or in

some cases overlook the natural competitive advantage their transportation mode possesses. As the pressure towards environmental sustainability of transportation is increasing for logistics service providers, competitive advantages can be reaped by those actors with proactive orientation towards environmental sustainability (Wu & Pagell, 2011). Especially in passenger transportation, where consumer is in direct and close interaction with the service provider.

Logistics service providers act as intermediary entities and thus participate value creation within network (Wang et al., 2016). As sustainability is established as a factor for value creation, the organizational orientation, culture, and strategy towards sustainability emerge in importance (Wang, 2019). While societal awareness towards environmental challenges has been increasing, using environmental sustainability as competitive advantage seems to be still lacking in logistics sector. Currently, environmental sustainability in logistics is tied to processes and isolated actions. Similarly, research on logistics environmental sustainability can still be seen as lacking (Björklund et al., 2016). Sustainability is not something that one actor alone can resolve, rather it requires collaboration and network wide strategies not to manifest as exercise in futility (Chen et al., 2017; Pakdeechocho & Sukhotu, 2018). It seems that the network collaboration is one of the dimensions that is currently lacking in pursuit towards sustainability in logistics industries. In addition, the recent Covid-19 pandemic has brought its own challenges, and the clientele in “new reality” expect resilience of service provision to be part of sustainability.

Considering the drastic changes and market turbulence caused by Covid-19, the current situation offers both challenges and opportunities in incorporating sustainability to logistics. Pandemic required new prioritization within societies, leaving focus on sustainability as lesser. However, measures related to pandemic mitigation can provide opportunities for sustainability (e.g., digitalization, networking, information exchange and transportation mode change). Digitalization and information exchange has been found to help in improving sustainability of logistics operations (Centobelli et al., 2020; Facchini et al., 2020). Operational environment for logistics has clearly changed during and will be different after Covid-19 pandemic (Hilmola et al., 2020; Hilmola & Lähdeaho, 2021).

The aim of this chapter is to explore the role of sustainability in logistics companies' network value creation. More precisely, this research focuses on intermodal logistics service context from the perspective of different actors, different value system levels, and different transportation modes. The research question is as follows: What is the impact of Covid-19 and the value of sustainability before, during and after the pandemic in logistics service provision? This exploratory study is carried out with qualitative case study approach utilizing multiple data gathering methods. The rest of this chapter is structured as follows: relevant past research and literature are presented in Background section. Then the employed methodology for this research

is explained in Methodology section. Results section contains the information gathered during the case study, and triangulation of these data. The outcome of the data triangulation is reflected with the previous literature in Discussion section. Thereafter, recommendations for succeeding studies are laid out in Future research directions section. Lastly, Conclusion section completes the chapter with conclusions of the carried-out research.

## **BACKGROUND**

Covid-19 has had substantial impact on different sectors of business across the board, transportation being one of the most affected one (Abu-Rayash & Dincer, 2020; Arellana et al., 2020). While people around the world seem to be willing to restart the economy, individual people seem to be nervous about exiting their homes (Abu-Rayash & Dincer, 2020). Tourism has also decreased, leading to economic difficulties in regions reliant to tourism (Madani et al., 2020). Decreased tourism has also some other implications, e.g., to conservation of wildlife (Buckley, 2020). Sustainability of tourism as it was before the pandemic has been questioned, and the pandemic might present an opportunity to improve that (Romagosa, 2020). Mobility in urban areas is heavily reliant on public transport, which has been forced to notably diminish its volumes to accommodate the measures set to prevent spread of the virus (Arellana et al., 2020). Sharing economies have enabled efficient transportation solutions, but during the pandemic they are under an intensive stress test due to the nature of contracts the micro-entrepreneurs offering those transportation services are operating under (Hossain, 2020). In summary, transportation has suffered from the pandemic, and previous solutions to enhance that business sector has been also set back by Covid-19. This situation proposes for rethinking the inner workings and mechanisms of transportation and logistics sector.

Sustainability in logistics operations often originates from external factors (Seuring and Müller, 2008). Usually, sustainability actions are seen as trade-offs with operational and cost efficiency, but these decisions can also benefit a company's performance (Azevedo et al., 2011; Morgan et al., 2018). While companies act individually towards sustainability, substantial advancements require coordinated effort through collaboration between actors (Chen et al., 2017; Centobelli et al., 2020; Pakdeechocho & Sukhotu, 2018).

As the pandemic has had diminishing effect on transportation, the decreased volumes have translated to significant reductions in greenhouse gas and air pollutant emissions. In China, during the first months of 2020, NO<sub>x</sub> emissions decreased by approx. 60% in larger cities and by approx. 30% in small to medium-sized cities (Feng et al., 2020). Between January and April 2020, it is estimated that NO<sub>2</sub>

emissions were reduced by approx. 17% in India and 25% in China (Metya et al., 2020). During the same period, SO<sub>2</sub> emissions declined approx. 17% in Eastern India, while CO emissions diminished by approx. 6.5% in North-Central China (Metya et al., 2020). Between January and April 2020 in China, CO<sub>2</sub> emissions were estimated to have declined 11.5%, however, it seems that quickly after that the emission levels returned to pre-pandemic levels as the affected industries began to recover (Zheng et al., 2020). While the pandemic has had its immense negative impact on societies globally, it has also forced a temporary environment of decreased emissions from transportation. Based on the mentioned research, eliminating harmful emissions from transportation with various solutions can have notable positive impact on environmental sustainability of regions.

Sustainability value in logistics value creation can be perceived from different perspectives and levels of the system. In this study the highest level of examination is *the network*, which consists of different actors and actor groups, i.e., companies, customers, regulative bodies, and other stakeholders. Network is based on the common value goal of the involved companies, where this research focuses on studying networks from the perspective of collaborative sustainability value creation. Networks can be examined through value system levels, where the unit of analysis changes between these levels. At the network level, we examine active groups of actors within the network (focal companies), but also external actors affecting the network, e.g., surrounding society, investors, shareholders, environmental agencies (Barratt and Barratt, 2011; Seuring et al., 2008).

External actors can be seen as extremely influential to companies' operations from the sustainability point of view. Increasing regulation and simultaneous stakeholder demands have led to urgent need for companies to adopt more sustainable modes of operations. For example, historical feuds between non-governmental organizations and large enterprises have evolved into civil collaboration due to the modern circumstances (Söderholm and Bergquist, 2012).

*The offering level* consists of dyadic relationships between focal actors involved in network value creation, in this case via supply chain dependencies and dyadic partnerships. Ultimately, the studied network of actors is formed from these relationships. On offering level, the unit of analysis goes beyond the boundaries of a singular company to regard interorganizational relationships but does not go as far as network wide. This lens gives a more focused view on value creation and value capturing than on the wider network level.

Customers' role is crucial on the offering level. They are the primary target for value creation of the companies within the network. Moreover, customers determine the monetary value of offered services, i.e., how much and for what are they willing to pay. Especially in passenger transportation, individual customers are in direct contact with the service provider. Furthermore, the role of individual customer

is peculiar, as they are part of the surrounding society with particular needs and demands towards companies, but at the same time they hold unique relationship to the same companies due to individual preferences.

*Strategic level* in the framework represents the highest level of examination within singular companies. In value creation, strategy can be explained as being formed by the long-term goals for studied companies' value creation. These long-term goals seek to utilize the companies' competences, capabilities, and available resources to capture value from arising opportunities. Within company, the administration and board represent the strategic level.

Below strategic level within companies is *the managerial level*. Management at this level is characterized by tactical coordination of company's competence, capabilities, and resources to produce short-term (often monetary) value. This coordination is continuous and aims to steer company's value creation activities to flexibly appeal to customer demand, while at the same time keeping adequate level of efficiency. Managers are the primary actors on this level.

Lastly, *process level* stands for the technical activities of the companies. In other words, this is the everyday workflow within companies producing value. It is based on operative functions (e.g., transportation), which acts as the backbone of the offering for customers. Ideal processes can be described as flexible and efficient, in order to resiliently and opportunistically serve customer needs, while at the same time performing in a manner that creates profit for the company. In this level, value is created directly from the companies' competences, capabilities, and resources. In addition, employees of a company determine how flexible and efficient processes of companies are.

## **METHODOLOGY**

This research employs qualitative case study approach (Eisenhardt, 1989; Yin, 2003) to examine intermodal transportation networks from company level perspective. As value creation via sustainability in logistics networks can be regarded as complex issue, this approach enables studying the phenomenon from the point of view of varying value network roles. Moreover, as sustainability value is difficult to measure in quantifiable terms, qualitative case study approach helps in theory generation for navigating through this complex theme (Eisenhardt and Graebner, 2007).

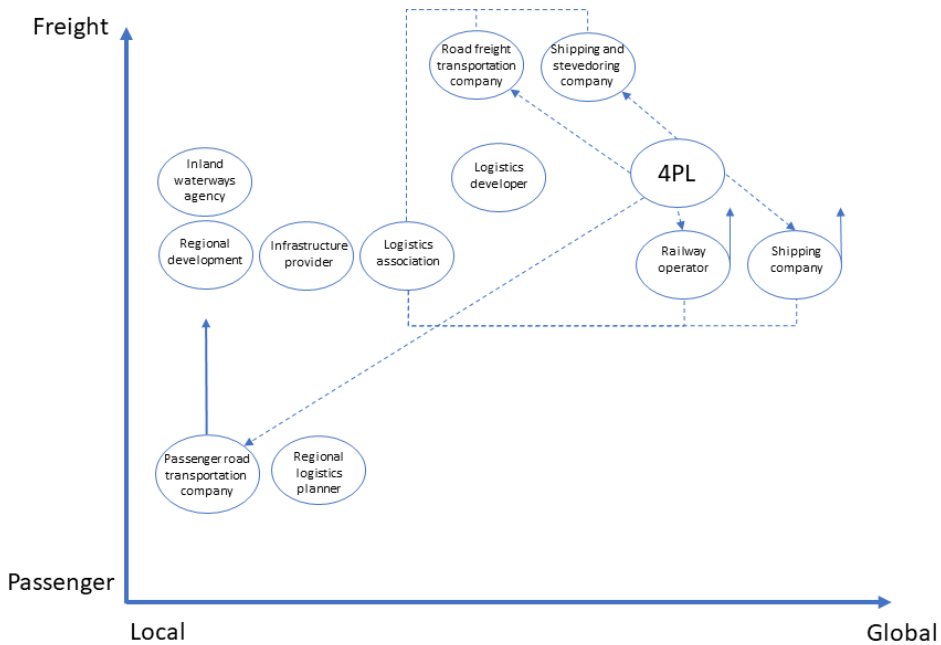
Primary data is gathered through semi-structured interviews targeting twelve representatives of logistics industry actors in Finland. The interviewees each hold managerial position in their respective organization. In addition, each interviewee has more than 10 years of experience in logistics industry, except the regional passenger logistics planner representative. The chosen companies represent different transport



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modes, i.e., railway, road, and maritime as well as passenger and freight transportation. As this study focuses on specific region rather than the global logistics system, aviation was excluded. The interviews took place between autumn 2020 and spring 2021 and they were conducted online. Each interview took around 45 minutes to one hour, where semi-structured interview protocol was used as a guide of discussion. However, as the studied theme is not extensively established and dependent on the role of different actors, the interviewees were given the freedom to describe their point of view and experiences without a strict, limiting interview protocol or schedule. The transcribed interviews were sent to the respective interviewee, giving them a chance to correct possible misinterpretations towards their answers. Afterwards, the interview recordings were transcribed, and the resulting interview data was analyzed via coding. The coding was reviewed and further validated by researchers with background in logistics value creation and logistics sustainability. The informants for this research consist of following companies (and informant's position in the organization): 4<sup>th</sup> Party Logistics (4PL) service provider (CEO), railway operator (Key Account Manager), road freight transportation company (Chief Development Officer), shipping and stevedoring company (Internal Auditor), logistics association (Managing Director), infrastructure provider (Development Manager), inland waterways infrastructure agency (Regional Manager), logistics developer (Project Manager), regional development company (Sales Manager), shipping company (Sales Director), passenger road transportation company (CEO), and regional passenger logistics planner (Public Transport Coordinator). Collaborative relationships between these companies are illustrated in Figure 1 with a hypothetical presentation. The studied logistics association acts as an intermediary between different companies both from public and private sector. Moreover, the 4PL company can provide services to the logistics and transportation companies (although it is not known if such cooperation exists, thus the figure is hypothetical). It should also be noted, that the companies are placed on the axis in relation to each other. As passenger traffic has decreased significantly during the pandemic, some of the companies (i.e., passenger road transportation, railway operator, shipping company) have added some freight transportation to their operations.

*Figure 1. Hypothetical structure of the relations between studied companies*



Moreover, for secondary data, a survey targeting group of 77 logistics service providers and service purchasers for their realized and expected market performance during and after Covid-19 pandemic is used. The study was conducted by a Finnish logistics association LOGY (please see LOGY (2021) for further details). This survey further helps linking the emerging demand for sustainability with the recent turbulence in the market caused by the pandemic. The survey data enables holistic perspective view on mobility and volumes in logistics during and after the pandemic.

## Results

The aim of this research is to gather information from different actors working towards creating a national logistics network. The main themes of the research are sustainability and impact of Covid-19 in this context, and interviewees' main points towards these themes are presented in Table 1. Intermodality (i.e., combining different transportation modes fluently as efficient transportation service) is vital for national logistics network to operate fluently. While all the interviewees called for improvements in collaboration within logistics sector, at the same time many challenges were identified. Logistics sector by nature does not allow extensive

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collaboration between separate actors simply due to regulation related to competition. This accompanied with the fierce competition within the sector make the environment challenging for extensive collaboration. Many of the companies are not willing to share information, even if it would be legal, to not to lose their perceived competitive advantages. However, interviewees recognized the importance of collaboration towards sustainability related goals. Most were already engaged in sustainability programs, demanded sustainability reporting and implementation of measures from their partners, and utilized new technology to improve operational and sustainability related efficiency. These technologies include digital technologies for optimization, alternative fuels used in transportation, and energy efficiency solutions at their sites.

*Table 1. Impact of Covid-19 and future of logistics industry according to the interviewees*

<b>Organization</b>	<b>Main points on perceived impact of Covid-19 and future of logistics industry</b>
4PL	Transport mode diversification, digitalization, and sustainability are growing trends
Railway operator	Railway freight volumes are expected to grow, and investments have been made to capacity, but also to increase environmental sustainability with more energy efficient trains and growing share of renewable energy source usage.
Road freight transportation company	Company has been positioning as forerunner in environmental sustainability and foresees that as a growing competitive advantage.
Shipping and stevedoring company	Environmental sustainability should be woven into the used business models, i.e., having different pricing for more environmentally sound services does not work.
Logistics association	Survival through the pandemic is the priority for companies over sustainability efforts.
Infrastructure provider	New infrastructure is designed to support further digitalization and utilization of alternative fuels. Environmental sustainability is growing concern for the construction projects themselves.
Inland waterways infrastructure agency	Digitalization decreases need for maintenance related travelling on inland waterways, contributing to environmental sustainability.
Logistics developer	Capacity on railways is expected to grow and related infrastructure enables usage of railways as environmental alternative for transportation.
Regional development company	Sustainability related measuring and reporting need more industry standards to enable benchmarking.
Shipping company	Passenger traffic volumes disappeared, but freight volumes are growing. Investments have been made to capacity. Further collaboration and integration are needed between modes in intermodal transport chains (namely between road and maritime modes).
Passenger road transport company	Passenger traffic volumes are extremely low, especially between cities. While the pandemic situation is improving, travelling culture has changed (e.g., related to commuting). Pace of digitalization has increased.
Regional passenger logistics planner	Urban public transport volumes have decreased sharply as well as travelling between cities. Culture changes related to commuting is one of the main challenges for recovering the traffic volumes.

Impact of Covid-19 was prevalent according to the interviewees. Firstly, it has had shocks on the expected demand for logistics services. For some companies, such

as those involved in passenger traffic, the volumes simply suddenly disappeared. On the other hand, some companies, such as shipping, had more demand than they could possibly serve. Therefore, different companies had to adapt accordingly. Shipping companies have thereafter invested to increase their capacity. Passenger traffic was forced to optimize their operations heavily, and many routes were cancelled. This was especially the case for routes between different cities. Some of the lost volumes have been able to be substituted with transporting freight with buses between cities. For passenger traffic, the interviewees had hope that travel restrictions would gradually ease during the coming weeks and month, but this remains to be seen. Interviewees operating with public transportation name passenger cars as their largest competitor going forward. It is a large challenge itself to attract potential customers to use public transportation again, even if the restrictions ease up notably. Moreover, as commuting used to make up for large share of public transportation volume, the now changed culture on remote work could make it extremely difficult for public transportation to reach pre-pandemic levels. While passengers also disappeared from maritime transport, they can continue to be profitable with focus on freight traffic.

Environmental sustainability was one of the focal themes going forward for the interviewed representatives. While admittedly still in its infancy, most of the companies recognized environmental sustainability as future competitive advantage. Some of the companies were even positioning themselves as forerunners in this regard. In other words, those companies invest resources and effort notably on environmental sustainability, more than the regulation as it demands. However, mismatch between the national and regional environmental strategies and transportation operations were identified. Often the strategies target processes of companies with top-down approach, but bypass the regional level requirements for realizing the set goals for environmental sustainability. For example, for road transportation to switch to alternative fuels, such as electricity, supporting infrastructure need to be available. Even the incremental improvements, such as using biodiesel instead of regular, fall short, since the customers of road transportation companies are not willing to pay extra for the service utilizing more sustainable and costly alternative fuel.

The study findings indicate that logistics industry consists of different roles in networked sustainability value creation. Other actors have implemented strategies and operational models beyond their own organization to match with their respective network, whereas others have not yet taken such mature orientation towards sustainability. Interestingly, companies with natural competitive advantage in environmental sustainability seem to be lacking in this regard, while those facing more challenged have evolved further.

The results show that environmental sustainability enables opportunities for logistics industry to increase competitiveness in the post Covid-19 market setting. Especially collaboration within company networks towards sustainability is focused

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by companies with mature and proactive disposition towards competitiveness. As logistics industry is traditionally not known for fluent collaboration and information exchange between separate actors, change of management and organizational culture is needed to achieve common goals. During the initial stages of the pandemic, these companies had to focus more on their survival. However, as the initial shock was endured, stronger willingness towards improving environmental sustainability of operations seems to be arising. Analogies can be drawn based on this, where companies with capabilities and flexibility can survive and thrive through uncertainty (be it Covid-19 or increasing pressure towards sustainability).

In Table 2, the studied companies perceived importance of environmental sustainability on different levels of conducting business are presented. Offering and Managerial levels act as intermediary levels in this table, meaning that strategic importance of environmental sustainability is translated to network importance via offerings made between companies. Similarly, managerial action ties strategy of the company with their employed processes in terms of sustainability. The results presented in Table 2 indicate that companies perceive environmental sustainability as important for their strategy. However, different actors’ perception varies on whether environmental sustainability is more important in their surrounding network of actors or in their own processes. This divides the companies to be reliant on either top-down (5 companies) or bottom-up approaches (5 companies), as well as to those with strategy-driven sustainability approach (2 companies). Interestingly, all the companies value environmental sustainability moderate to high in their strategy.

*Table 2 (a). Importance of environmental sustainability on different levels of business from the interviewee point of view*

Value system level	4PL	Railway operator	Road freight transportation company	Shipping and stevedoring company	Logistics association	Infrastructure provider
Network	xx	xx	xx	xxx	xx	xxx
Offering						
Strategic	xxx	xxx	xxx	xxx	xxx	xxx
Managerial						
Processes	xxx	xxx	xxx	xx	xxx	xx

x: Low; xx: Moderate; xxx: High

*Table 2 (b). Importance of environmental sustainability on different levels of business from the interviewee point of view*

Value system level	Inland waterways infrastructure agency	Logistics developer	Regional development company	Shipping company	Passenger road transport company	Regional passenger logistics planner
Network	xxx	x	xxx	xx	xxx	xx
Offering						
Strategic	xx	xx	xxx	xxx	xxx	xxx
Managerial						
Processes	xx	xx	xx	xx	xxx	x

x: Low; xx: Moderate; xxx: High

It seems that bottom-up approach, i.e., process oriented, efficiency-driven, incremental approach to enhancing sustainability has been chosen by the interviewed 4PL, railway operator, and road freight transportation companies as well as the logistics association and logistics developer. On the other hand, shipping and stevedoring company, infrastructure provider, inland waterways infrastructure agency, regional development company, and regional passenger logistics planner are bolstering their sustainability with top-down approach, arising from changing legislation and regulation. The two remaining companies (shipping and passenger road transport), which did not fit this breakdown, seem to have balanced view on sustainability value on different business levels. Both these companies also rate the strategic importance of sustainability as high. It seems that companies, which are operating within conditions of the market supply and demand, having skin in the game, favor the bottom-up approach. This is closely related to improving business performance and sustainability hand in hand. At the same time, state and regional organizations go with the top-down approach, where sustainability related advances come from legislation and regulation set at the top-level of decision-making, trickling down to these organizations. Most of the interviewed companies rated strategic importance of sustainability as high, with only two regarding it as moderate. This confidence could signal about shifting factors for business value, but could also stem from possible low sustainability awareness and overestimation of own capabilities.

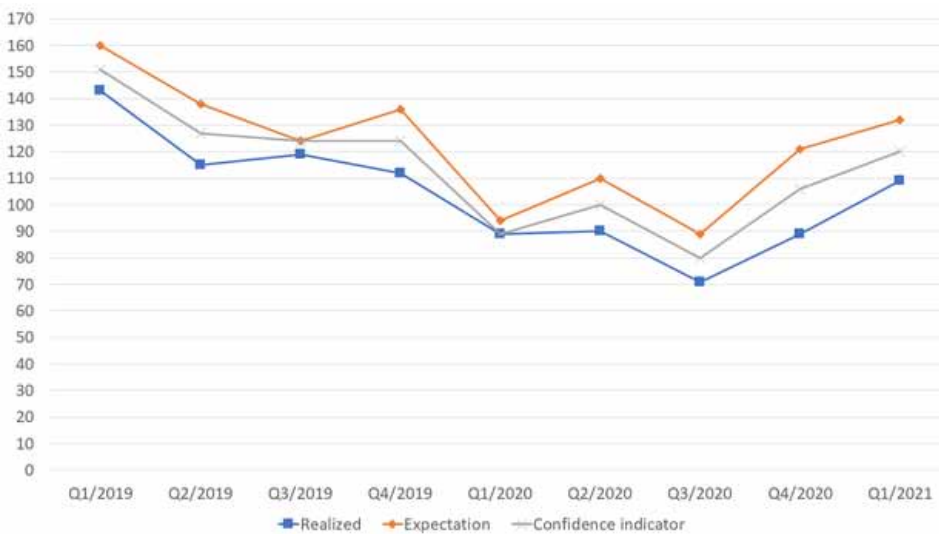
## **LOGISTICS COMPANY CONFIDENCE SURVEY BAROMETERS**

During the initial phases of Covid-19 pandemic in the early 2020, purchasing of the studied companies saw fluctuation with a downwards trend until in the end of that

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year, when realized purchases began to increase again. The situation is illustrated in Figure 2. The expected purchases seem to follow similar trend, but they are higher than the realized purchases, signaling hope for a quick recovery after the initial impact of the pandemic. It seems that the first quarter of 2021 marks return to anticipated growth in the market. As for the sales (Figure 3), realized sales have been sluggish during whole 2020, but similarly as with the purchases, modest growth is seen in the beginning of 2021. In sales, the expectations are fluctuating more as in the first quarter of 2020 the expectations are much lower than the realized sales. However, in the coming quarters the expected sales soar and continue to do so until the end of study period. The confidence on sales and purchases reflects the hopeful views of the interviewees: Most anticipate that the worst impact pandemic impact is over and look forward to recovering their lost volumes. Shipping and railway companies even have preemptive capacity increasing investments progressing or nearly complete to accommodate expected growth in demand.

Figure 2. Survey index on realized purchases, expectations and confidence indicator of companies purchasing logistics services Source: LOGY, 2021



*Figure 3. Survey index on realized sales, expectations and confidence indicator of companies offering logistics services (Blue: Realized; Red: Expectation; Green: Confidence indicator) Source: LOGY, 2021*



Much more conservative developments are seen in the realized and expected purchases of companies responsible for sourcing logistics services. As can be seen in Figure 4, the expectations and realized volumes seem to go hand in hand without any greater impact from Covid-19. The levels are similar to first quarter of 2019 until a growth that starts in last quarter of 2020. Interestingly, in the beginning of Covid-19 pandemic (the first quarter of 2020) the realized purchases somewhat hike up, while the expectations dip in similar fashion. This is however corrected in the following quarter with expectations and realized purchases returning to the prevailing situation. The anticipated growth from logistics service sourcing perspective is slightly more conservative in comparison to service providers point of view. As pointed out in the interviews, some capacity constraints has been experienced, possibly down tuning the expectations for the sourcing parties.



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*Figure 4. Survey index on realized purchases, expectations and confidence indicator of companies responsible for sourcing (Blue: Realized; Red: Expectation; Green: Confidence indicator) Source: LOGY, 2021*



Figure 5 illustrates realized transportations from the perspective of companies purchasing logistics services. The studied companies' domestic transports in Finland were slowing down in growth during 2019, and in the beginning of 2020, they started to decline. This was followed immediately by a slight growth in second quarter, and then again, a decline lasting until the first quarter of 2021. As for the imports, the growth was similarly slowing through 2019, coming to a halt in first quarter of 2020. Thereafter, import transportation saw a serious decline through 2020, which ended in slight growth during the first quarter of 2021. Exports have behaved quite differently in comparison to domestic and import transportation. They stagnated already in the second quarter of 2019, which was followed by growth lasting until the first quarter of 2020. During 2020 the volumes were declining, but at the last quarter the decline halted, and exports started a modest growth.

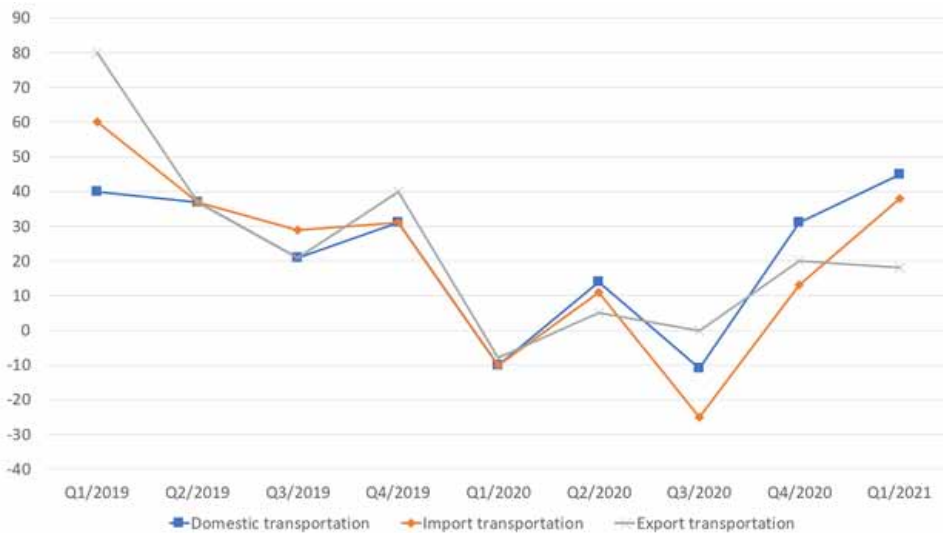
*Figure 5. Survey index on actual transportations of companies purchasing logistics services (Blue: Domestic transportation; Red: Import transportation; Green: Export transportation) Source: LOGY, 2021*



The anticipated transportations from the perspective of companies purchasing logistics services follow similar patterns for all the different transportation classes, as can be seen in Figure 6. A slight decline was anticipated throughout 2019, ending the fourth quarter with a proclaimed growth. First quarter of 2020 saw sharp decline in anticipated growth, followed by stagnation on second quarter. Then, third quarter came with anticipated decline for domestic and import transportation, while exports were predicted to continue stagnating. This was followed by anticipated growth, biggest in domestic flows. Both domestic and import transportations were anticipated to continue growing in the beginning of 2021, while growth of exports was expected to slightly dry up.

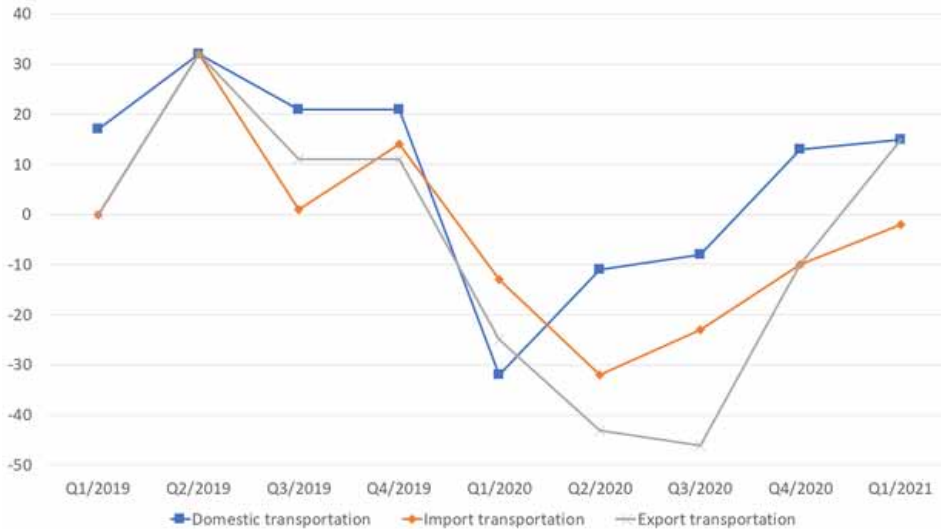
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*Figure 6. Survey index on anticipated transportations of companies purchasing logistics services (Blue: Domestic transportation; Red: Import transportation; Green: Export transportation) Source: LOGY, 2021*



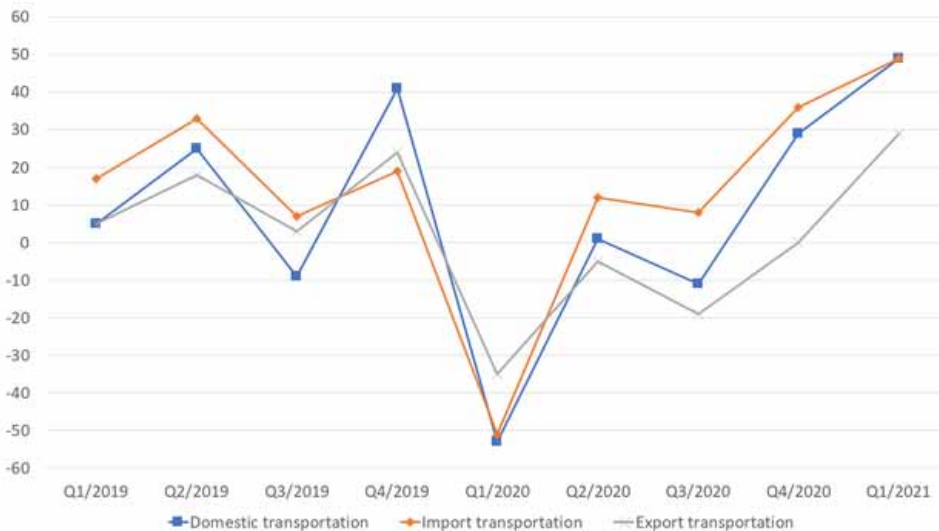
Realized transportations for companies offering logistics services are presented in Figure 7. It should be noted that year 2019 already had turbulence for different classes of transportation. Exports and imports were stagnating in the first quarter, while domestic transportation was somewhat growing. By second quarter, all the classes were notably growing, followed by slight decline in growth for domestic, notable decline for export, and complete decline of growth for imports in the third quarter. Last quarter of 2019 saw again a growth for all the transportation classes. During first quarter of 2020, sharp decline hit all the classes, notably domestic transportation went from handsome growth to even bigger decline. During second quarter, domestic transportation started to grow again, which it did until the end of the study period. At the same time, imports declined until reaching stagnation in the start of 2021. Exports did the same, but managed to start growing again in the first quarter of 2021. The recovery of exports was also noticed by the interviewed shipping companies, which at the time of interviews experienced demand exceeding their capacities. Recovering exports and imports also affect the interviewed companies in railway logistics, their notion being expected growth in demand.

*Figure 7. Survey index on actual transportations of companies offering logistics services (Blue: Domestic transportation; Red: Import transportation; Green: Export transportation) Source: LOGY, 2021*



Anticipated transport volumes from the perspective of logistics service providers (Figure 8) follow similar patterns for the different transport classes. Transportation was anticipated to grow during the first half of 2019, followed by decline during third quarter, and then a sharp increase in growth during fourth quarter, especially for domestic transportation. Transport volumes were expected to plummet during the first quarter of 2020. Then, during second quarter the anticipations took forms of slight growth for imports, stagnation for domestic transports, and conservative decline for exports. Third quarter saw expectations for imports to grow only marginally, and the decline to steepen for domestic transportation and exports. After that the anticipated volumes have been growing gradually until the end of the study period, expected domestic transportation even reaching the level of imports. The confidence on increasing transportation activities was also signaled by the interviewees, who were expecting demand growth for their services. Some of the interviewed companies had their focus already in competition (differentiating from rivals with environmental sustainability), while others grew their capacity to meet the anticipated demand growth.

*Figure 8. Survey index on anticipated transportations of companies offering logistics services (Blue: Domestic transportation; Red: Import transportation; Green: Export transportation) Source: LOGY, 2021*



Realized sourcing of transportation services, as illustrated in Figure 9, fluctuates from quarter to quarter during the study period. Purchases were stagnating during first quarter of 2019, followed by growth in second quarter, then decline in the third and fourth quarter. Purchasing was actually on the rise during the first months of Covid-19 pandemic. But it was followed by steepening decline during the second and third quarters. Thereafter, last quarter of 2020 and first quarter of 2021 saw increasing growth in purchases. Received orders were behaving similarly during the study period, except for 2019 where those did not decline, but simply stagnated during third and fourth quarters. Concerning experienced delivery times, those were shortening during first half of 2019, reaching stagnation in third quarter, only to begin increasing during the last quarter. This trend continues during 2020, with notable lengthening during second quarter. By third quarter, the delivery times settled back to the levels of first quarter. However, after that the delivery times have been increasing notably until the end of the study period. The value invested to the studied companies' warehouses seem to be behaving separately from the other indicators. The tied value to warehouses was growing during first half of 2019, then declined notably in third quarter, only to sharply grow in the fourth quarter. Thereafter, the growth of value tied to warehouses starts to decline, reaching stagnation after the first half of 2020. However, first quarter of 2021 saw the warehouse values starting to grow again. Stretching delivery times were noticed by the interviewed shipping

company, which called for better integration between separate parties in intermodal transportation chains to reduce slack. Moreover, as value tied to warehouses seem to be growing, interviewed regional development company and logistics developer were underway on increasing regional warehouse capacities serving intermodal transportation chains.

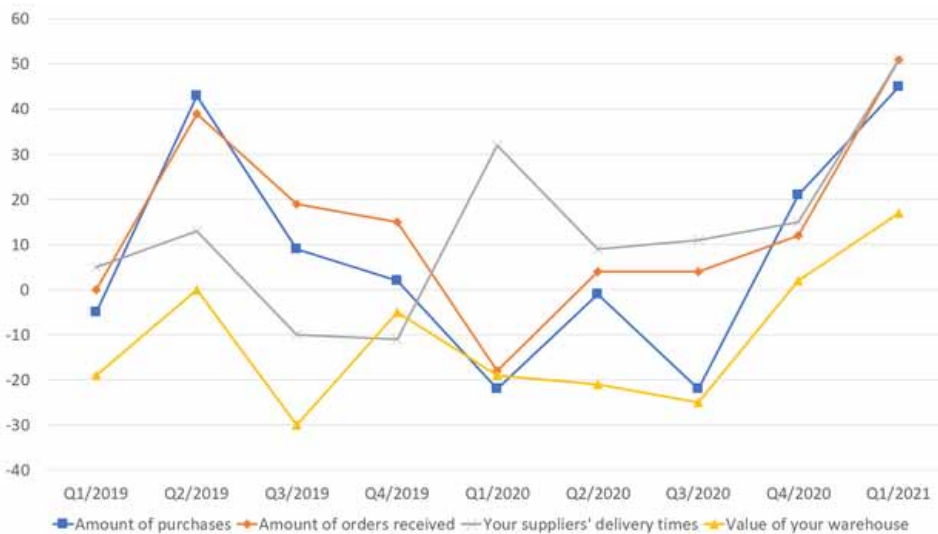
*Figure 9. Survey index on actual sourcing (Blue: Amount of purchases; Red: Amount of orders received; Green: Your suppliers' delivery times; Purple: Value of your warehouse) Source: LOGY, 2021*



In the meanwhile, anticipated sourcing seems to behave somewhat different manner in comparison to the actual sourcing, as can be seen in Figure 10. Amount of purchases during 2019 were anticipated to grow throughout that year (aggressively in the beginning, with very modest growth towards the end). First quarter of 2020 came with anticipated decline in purchases (which actually turned out to be growing during that quarter). Second quarter purchasing was expected to stagnate, and then decline in the third quarter. However, purchases were significantly declining during this period. Expected purchases in the last quarter of 2020 and the first quarter of 2021 were growing, reflecting the actual situation. Anticipated received orders follow similar pattern as the purchases. Anticipated delivery time developments follow the realized situation. However, the first quarter of 2020 was anticipated to have sharp increase in delivery times, while this was the case later in second quarter. In addition, delivery times beyond the second quarter of 2020 were expected to grow moderately,

however, they are increasing quite notably from quarter-to-quarter. As for the value tied to the studied companies' warehouses, the companies continued to anticipate decline throughout the study period until last quarter of 2020. The confidence on sourcing parties anticipated received orders adhere to the interviewees' expectations on demand growth; if orders for the sourcing parties grow sharply, the demand for transportation services do so accordingly.

*Figure 10. Survey index on anticipated sourcing (Blue: Amount of purchases; Red: Amount of orders received; Green: Your suppliers' delivery times; Purple: Value of your warehouse) Source: LOGY, 2021*



## **DISCUSSION**

Covid-19 seems to have varying impact on different transportation modes presenting opportunities and challenges (Abu-Rayash & Dincer, 2020; Arellana et al., 2020). For example, heavy decrease in passenger traffic has hurt the studied passenger road transportation company, while the studied shipping company could navigate through the pandemic with focusing more on freight segment. As some modes have survived the pandemic in an excellent manner (e.g., maritime freight companies, which have in some instances been able to improve their business performance), some are facing extreme difficulties (e.g., public transportation, such as bus transportation between cities). Since intermodal transportation relies on different modes, these chains are ultimately as strong as their weakest links. In addition, shocks to these

systems are created by non-synchronized turbulence in supply and demand ends of the chain. While the pandemic has created multitude of challenges for companies to navigate through, it has had some positive impact in accelerating digitalization of transportation companies. For example, companies with direct contact to consumers, such as passenger road transportation companies, have more extensively adopted digital payment methods to comply with restrictions set by the measures to prevent spread of Covid-19. However, this change momentum has not been largely utilized to address sustainability related challenges in transportation. Thus, calls of previous research for further employing digitalization to increase sustainability have not yet been largely answered (Centobelli et al., 2020; Facchini et al., 2020). According to the studied companies, collaboration has not been growing. This can be seen as typical for logistics industry, where fierce competition and regulation hinders collaboration between separate actors. These actors seem to rely on observing and studying others during the pandemic, and further information is gained from public sources.

It seems that the supply and demand shocks of Covid-19 are evening out in 2021. The confidence of logistics sector in Finland is recovering, and companies anticipate further growth in the sector. However, this is not a return to “normal”, as there are obvious signs of “new normal” in how the studied companies conduct their business. These are namely the growth of warehouses, and the increase in delivery times. This is to be expected since the pandemic exposed some weaknesses in supply chains. Larger warehouses and longer lead times are measures to improve resilience against disruptions to supply chains. Moreover, companies associated with railway transport expect growth in demand. Similar trend was found in previous research on Finnish logistics companies during Covid-19 pandemic (Hilmola et al., 2020; Hilmola & Lähdeaho, 2021), and this especially in international transports.

On network level, sustainability related value is created through collaboration, trust, and partnerships (Chen et al., 2017; Pakdeechocho & Sukhotu, 2018). As mentioned, direct and indirect competitors in logistics industries do not engage in in extensive collaboration. However, it seems that companies are deepening collaboration within their partner networks. This manifests as measures such as sustainability related demands for partners and sub-contractors as well as involvement of clientele to service design and business processes. The studied road transportation company seems to also have realized their unique role in creating sustainability related value within their network, as proposed by Wang (2016). Some of the studied companies also see sharing economies and different digital platforms as enabling further this type of collaboration. However, Covid-19 has had negative impact on these types of businesses (Hossain, 2020).

Networks consist of dyadic relationships between companies, and between companies and customers. These relationships realize the offerings of logistics companies, which consist of value the companies seek to provide. As sustainability is



growing as a factor for value, logistics companies aim to enhance their offering with the addition of sustainability. This can be seen realized as sustainability reporting, services that include more environmentally sustainable transportation solutions, and improved operational and thus environmental efficiency.

The offering of companies is the outward facing interface of their strategy. Companies that have assumed sustainability as a part of their strategy also attract partners and customers with similar values (e.g., in sustainability). At the same time, in logistics industry, actors benchmark themselves with actors in their network. In the case of sustainability, it is evaluated accordingly, but the comparison is often between direct network actors that they are in contact with (tier 1) and it is not network wide. Also, some of the interviewees pointed out, that benchmarking is hindered by the absence of competent industry standards in measuring sustainability.

Within the companies, managers are responsible for implementing the strategy to their processes. Processes are the concrete, measurable actions that a company carries out. These are typically reliant on technology available for the company. Currently, sustainability measures focus primarily to process level of companies. Also, current regulation seems to focus on the process level of companies, rather than the larger picture.

## **FUTURE RESEARCH DIRECTIONS**

The role of sustainability is increasing in importance in transportation sector value creation. Drastic turbulence caused by Covid-19 has highlighted the importance of collaboration, not only in logistics, but also in sustainability associated with it. It would be beneficial to further delve within the complex networks of actors creating common value from sustainability. Transportation is vital part of virtually all business activities and functional societies. At the same time, transportation is responsible for significant part of global greenhouse gas and air pollutant emissions. Therefore, the transport networks producing value from environmental sustainability and underlying mechanisms need to be further studied to solve challenges related to sustainability of modern business. Moreover, the scope of this research did not include aviation industry, which is extremely important part of global logistics network. In further studies, aviation industry should be included to further understand the complex network that intermodal transportation is.

## **CONCLUSION**

The importance of collaboration to achieve improvements in sustainability of logistics sector is further illustrated in this research (Chen et al., 2017; Pakdeechocho & Sukhotu, 2018). As mentioned, the logistics sector by nature is not the most suitable setting for extensive collaboration between separate actors. This is mostly due to competition related legislation as well as the fierce competition itself. Therefore, some companies are used and successful at operating alone, separating themselves from surrounding actors. One could say that the sector has “introverted and extroverted” companies that operate in common network. However, some advances in this frontier have been made due to the forced circumstances of Covid-19 pandemic. Concrete example for this could be accelerated digitalization, which inevitably increases accumulation of data and information. Some of the data can be shared with the network in future, if the companies find opportunities in that. However, digitalization for the benefit of sustainability in transportation (Centobelli et al., 2020; Facchini et al., 2020) seems to be still in its infancy for the studied sector. Future policymaking regarding logistics should facilitate the described collaboration in the industry to enable further advancements in sustainability.

As intermodal transportation relies on the network of companies enabling these chains, untapped opportunities lie in further utilizing those networks. Some of the studied companies explain that efficiency within their own operation is quite optimized, but the seams between different operators (i.e., transition from one transport mode to another) create inefficiencies. The studied shipping company underlined the importance for further collaboration in intermodal chains. Thus, the same companies call for further information sharing between partners to enable more efficient and flexible intermodal transportation chains. Moreover, further utilization of logistics company networks enables diverse use of transportation capacity available to meet existing demand. As the pandemic exposed some weaknesses in incumbent supply chains, diverse use of different transport modes could protect companies from problems arising in depending too much on a particular transport mode. Some shifts are already visible in transportation mode selection in Finland due to the Covid-19 (Hilmola et al., 2020; Hilmola & Lähdeaho, 2021). In addition, during the pandemic, some companies had to utilize their capacity in novel ways, as passenger traffic volumes plummeted, whereas freight still needs to move.

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# Chapter 3

## Transportation Modes and Supply Chains: Case Studies From Estonia

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### **ABSTRACT**

*Due to environmental and market access requirements, companies need to be able to serve versatile transportation modes. Therefore, multimodality and management of supply chains of different transportation modes as one service is vital for companies to succeed. This is also arising as finding from two case studies of this research. The authors analyze two Estonian companies, one international manufacturer, and another one from logistics services. In the situation of manufacturer, different transportation modes are tied more on location of its alternative suppliers. Earlier railway was not an option, but nowadays even distant Chinese suppliers are evaluated with this alternative. Within logistics service companies, different transportation modes are tied to/from where handled products (cars) are coming from and their destination. For example, Russian markets are served by railways, which creates delays due to larger transportation lot size as compared to trucks.*

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## **INTRODUCTION**

For decades, maritime transport has been the main transportation mode used in routes from Asia to other continents. More than 90% of international trade moves by sea, which is why a lot of emphasis is placed on the development of both ports and ships. Larger ships are being built and developed, and the carrying capacity of ships has grown faster than the demand for them. This has led to oversupply and limited freight rates and reduced the profits of shipping companies. Reconciliation of supply and demand has been pursued in recent years (United Nations, 2017). However, coronavirus pandemic changed situation so that first shipping capacity was removed (lockdowns, due to demand shock), and with some months delay the entire transportation system started to malfunction (Handfield et al., 2020), and as a result, demand as well as prices of freight are now uncommonly high in 2021 (Hilmola et al., 2021). Therefore, it has been popular to use all possible transportation capacity and modes, especially in times of coronavirus pandemic (Butt, 2021; Hilmola et al., 2021). A very common solution for some years now is the successive use of several modes of transport and the shift from air to less expensive or more environmentally friendly sea and rail transport. Freight forwarders offer more air/sea, air/road or air/rail combinations to create flexibility in different dimensions such as price, delivery time and emissions (e.g. Tan & Hilmola, 2016; Lagoudis & Shakri, 2015). Today, a new competitor to the European air freight is also the “Silk Road” based on rail and road, which connects China with Europe and takes a lot of business from sea and air transport (IATA, 2018; Hilmola et al., 2021). China has been a world factory and factory of industrial goods for decades. Country’s ascent has yielded important growth effects in many parts of the world. The development of China depends on the manufacturing export-oriented growth model, but it should be noted, this model is under change. China’s export-oriented growth model (which comprises of supportive investment, financial and trade policies) has resulted in a large expansion of Chinese trade and rapid upgrade in the value-added chain. It has significant implications for the global supply chains. For instance, during the financial crisis, it attenuated the effects of global shocks down the supply chain. Its increased domestic demand and investment during and after the financial crisis also led to higher imports of commodities and capital goods (Chen et al., 2019).

There are also challenges as for example production costs increase in China. The main argument is made by employees’ wage growth, which has reduced past profits due to cheap prices. Also, when the goods are at sea, the capital is stuck for a long time. Another major reason is still the question of quality (Za, 2014; Chai, 2017). China has set the goal of making production more innovative and prioritizing quality over production volumes. In recent years, the development of China’s economy has put forward higher requirements for the transportation industry. A single mode of



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transportation is increasingly unable to meet customers' low-cost, high-efficiency transportation requirements. Multimodal transport is an organic combination of two or more modes of transport. It captures and integrates the advantages of various modes of transportation and is an advanced mode of transportation. The "One Belt and Road" strategy has provided an opportunity for the development of China's multimodal transport and put forward higher requirements for multimodal transport. The development of multimodal transport has been designated as a national level strategy and has become one of the important tasks of the transportation industry (Huang & Mu, 2018) The Silk Road plays a major role in this, which should help to increase the volume of high-quality exports. Today, this major project is called "One Belt-One Road". "Belt" refers to a land route from China to Europe through Asia, and "Road" refers to a sea route connecting China to Europe. Together with increasing exports China hopes through this project to encourage people to accept Chinese standards. On the top of these, this venture is considered to be very environmentally friendly, as rail emissions are similar to those of maritime transport (Chai, 2017; Cheng, 2017).

If coronavirus era is taken only to transportation logistics context, it could be concluded that certain transportation modes have been doing well despite of the crisis time (Hilmola et al., 2021; Butt, 2021; Tradivo et al., 2021). These all modes are also environmentally sustainable as they are sea transportation, pipeline transports and railways. We have witnessed in 2021 the importance of sea transportation and particularly container side of it. Railways have all done well too in the freight side during both years 2020 and 2021. This is the situation in Estonia as well, where governmentally owned railway operator has shown profits in the midst of pandemic, and in the first half of 2021, increasing ones with rather significant recovery in revenue terms (Operail, 2021a & 2021b). In 2021 we have also witnessed troubles of road transportation in Europe, which has resulted e.g., in fuel shortages (Ellyatt, 2021; Holden, 2021). These experienced shortages are actually result of long-term trend in trucking – drivers are getting increasingly older, and in this branch, it is very common that people change work (LeMay & Keller, 2019) as salaries are rather low (Ellyatt, 2021). Even though following two case studies have been completed pre-coronavirus era, they were selected due to the reason that transportation mode selection will become increasingly more apparent, frequent, and business critical choice in the following years. Situation is already today (in the end of 2021) such in increasing number of companies. Sea transportation and railways are also rather good choices in the long-term from the perspective of ageing society – direct labour productivity is much higher than in trucking and airlines. World will never go back without changes to pre-coronavirus world in the forthcoming years as so many things have changed, including behavioural models of consumers and governments (Donthu & Gustafsson, 2020). It is even questionable whether in public transportation

modes pre-pandemic passenger volumes will be reached before 2030 (Christidis et al., 2021). This also means changes on transportation logistics, and used modes (e.g., Tradivo et al., 2021).

## **BACKGROUND**

Supply chain management is one of the most important, strategic level, management tools - it deals with maximizing the value, performance, and long-term profitability of the entire supply chain (Christopher & Holweg, 2011; Hilletofth, 2011). The goal of supply chain management is, on the one hand, to maximize the sales of products and services to the end user, and, on the other hand, to minimize costs across all links in the supply chain – product groups inside of company can be seen as a portfolio, where different strategies are applied in performance dimensions, including innovation (Hilletofth, 2009 & 2011). A critical success factor for supply chain quality is strategic partnership and cooperation between all stakeholders, adherence to similar principles and adherence to agreements. The smooth and coordinated operation of the entire chain is critical to achieving a quality result (Tammaru, 2016). In the case of multimodal transport, the transport is carried out under a single contract, but the movement of goods takes place using different modes of transport (Rodrigue et al., 2013). A multimodal transport chain is a logistical process, in the various stages of which several different activities, agreements, cooperation, exchange of information, etc. take place between the parties. Supply chain costs can account even up to 80% of a company's total costs. The vast majority of costs are usually known in advance as planned costs. For example, the price of raw materials, labor costs, transport, etc. Together with these, in many cases, there are a number of unexpected or additional costs involved in customer service, manufacturing, or logistics. For example, exceptional costs of purchasing or transporting goods to avoid delays, costs due to downtime, fines for undelivered goods or extraordinary equipment repair costs.

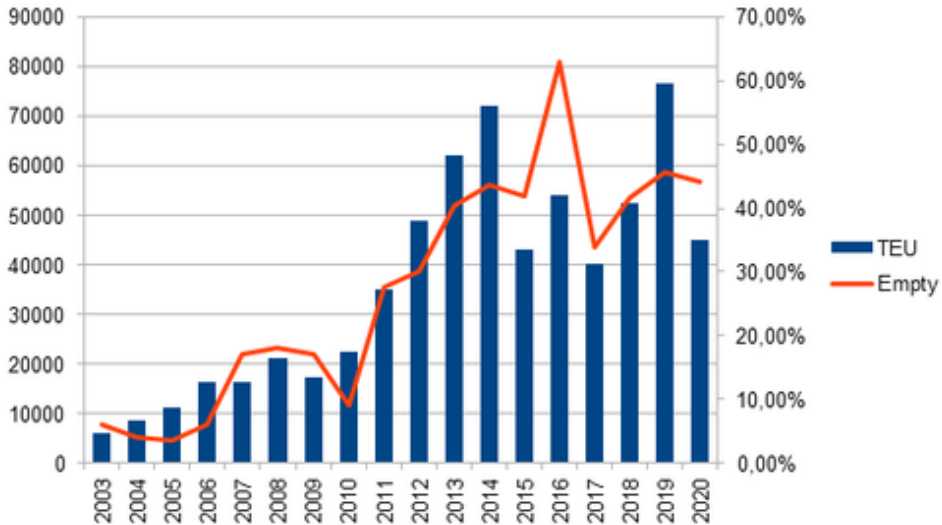
One of the alternatives considered is the introduction of rail transport in order to reduce delivery times compared to maritime transport and costs compared to air transport (Seo et al., 2017; Hilmola et al., 2021). Another alternative would be to bring most of the company's production back to Europe, as many companies have already done (Lepiku, 2018; Engström et al., 2018). In the chapter case study examines the feasibility of these alternatives and seeks to answer the question of whether or to what extent these alternatives would be more reasonable and to what extent. This is done by analyzing delivery time reports and calculating transport costs. The production of many goods has moved to places, where low-cost production is possible and the possibility of setting up global production points that deal with the creation of only one specific product.

## ***Transportation Modes and Supply Chains***

As most of the international trade is transported by sea, and different customs, structures and practices related to global trade have been established during the decades. Goods that are in large quantities and are not sensitive to time, are ideal to be transported with this mode. The challenge is that sea mode of transport is slow and there are delays due to the risks. The use of rail transport for freight has been constantly emphasized in recent years (e.g., Hilmola, 2021). This together with the European Commission's strategic document from "Transport 2050: Commission outlines an ambitious plan to increase mobility and reduce emissions", the European Union's transport system must increase mobility, employment and growth. By 2030, 30% of road transport over 300 km should be diverted to other modes of transport, such as railway transport, and by 2050 this amount should be more than 50%. There have also been a number of plans to develop the rail network from China to Europe and thereby increase the use of rail transport. Thus, rail transport is still at initial stages compared to other modes of transport and many problems need to be addressed. (UIC, 2014). Rail wagons cannot be made wider until the railways allow it. The length and speed of wagons also depend on the curves they have to travel on and the speed at which they are designed to pass. Despite of these, there have been a number of developments in rail transport, especially intermodal freight transport, using ISO containers as the main unit of goods. In addition to containers, many different freight wagons and trailers are used on the railways. In general, rail transport is considered as an inflexible mode, and it incurs additional costs, if the consignor and the consignee do not have direct access to the rail network (UIC, 2021).

Unitized railway transport (containers) in an environment of two case companies, that of Estonia, has been on the rise within previous decade (Figure 1). First growth phase until 2014 was driven by mostly transit of Russian and eastern market railway container connections (Hilmola & Henttu, 2015). Most recent growth wave back to these earlier high volumes was also due to domestic market needs (peak in 2019). At the same time with these developments, it should be stressed that at railways it is difficult to arrange transportation in both directions (unbalanced system) – typically for one direction there exist high transportation volumes and needs, however, trains and containers come back mostly as empty (second reason for empty container transports is that railways are lower cost for this activity, and typically empty containers do not require any tight schedule). This is one main improvement issue at railways to increase cost competitiveness and efficiency. Most recent year 2020 in Figure 1 was having declining volumes in the midst of coronavirus, but as mentioned earlier, domestic container transport was strong, and increased to highest level ever, and they accounted nearly half from overall volumes (Statistics Estonia, 2021; Operail, 2020). In domestic markets transporting agricultural goods with special and easy to load as well as unload containers have been one key product group (Operail, 2020). It should be noted that from sea port handling railway hinterland share was

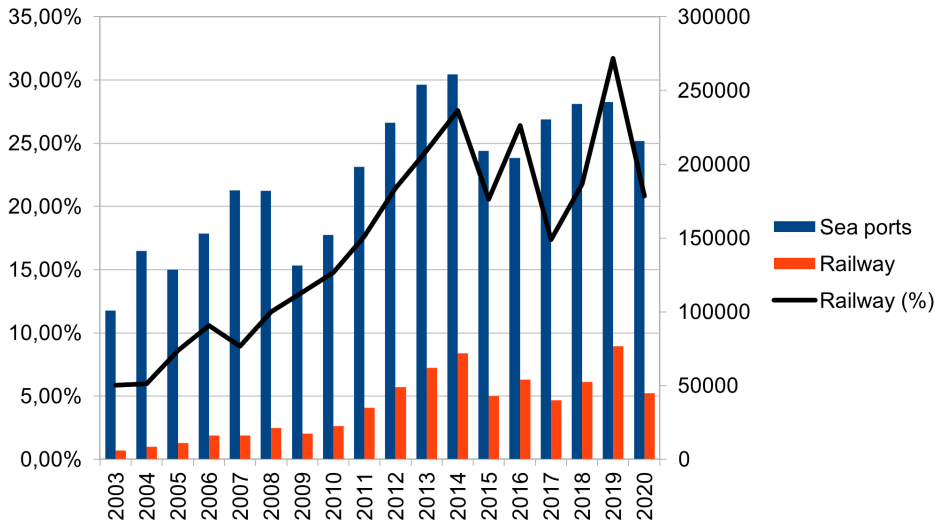
Figure 1. Estonian railway container transportation volumes (TEU, Twenty-foot Equivalent Unit) and share of empty container transport from total. Source (data): Statistics Estonia, 2021



increasing until 2014 (from slightly below 6% in 2003 to 27.6% in 2014) and has thereafter developed in sideways (having its swings on down- and upwards). Highest share was achieved in 2019, when it was 31.7% (see Figure 2). In 2021 during the first half year, railway volumes in general have increased, and container handling at sea ports have recovered from slump of year 2020.

## Transportation Modes and Supply Chains

Figure 2. Estonian container handling volumes at sea ports (in TEU), railways (in TEU) and share of railway volume from sea port handling. Source (data): Statistics Estonia, 2021



Road transport is mostly used for domestic freight transport. In international transports there is no shortage either on road fleet, where it is often the only possible mode of transport used and trucks have to travel very long distances. This mode of transport is one of the most competitive and widely used in Europe and elsewhere in the world. Road transport is used as either the primary or secondary means of transport in the supply chain. In the case of the primary means of transport, the goods are usually transported from the place of departure to the place of destination without intermediate handling, and as a second means of transport, the lorry is the final link to the consumer and may include several stops. (Kiisler, 2011).

This chapter is structured as follows: In the first part is analyzed case regarding to company A, which purchases many of the materials needed for its production from China. Air transport is widely used for deliveries from China, as it is a faster solution than maritime transport and can meet unexpected production needs. As a result, transport costs have risen significantly and new transport solutions need to be found that are faster than maritime transport to meet production demand, but cheaper than air transport in order to save on transport costs. The aim of the first part is to explore possible alternatives for supplying goods from China on the example of company A. The second part of the article is planned to be conducted in a company B that deals with multimodal transport, and handles mostly cars.

In the final part, chapter provides concluding discussion with further research avenues being proposed.

## **CASE STUDY OF THE COMPANY A: SUPPLIER NETWORK MANAGEMENT**

The company A is large international company, which one buys materials needed for its production all over the world, but mainly from Asia and Europe. Case study reported in here is based on B.Sc. thesis supervised by one of the authors (Lepiku, 2018). Company provides wide production range of products, different systems, services and software to company's customers in the industrial, utility and transportation industries all over the world in more than 100 countries. China is very important market and supplier, because the second biggest production plant is situated in Beijing. According to minimizing supply chain and production risks, some quantities of the goods are always ordered from Chinese suppliers. Production globalization, which is when firms expand their supply chains across national boundaries, creates an opportunity for developing countries to engage in international production networks via trade. Described as the world's factory, China specializes in assembly manufacturing mainly through processing exports. Firms use imported intermediate inputs for production and, after processing or assembly, re-export the finished products to international markets (Zhang et al., 2020).

Many materials are purchased also from Europe. Mainly goods come from Europe by land transport. One material is needed to order from both Asia and Europe from time to time. To reduce risks in the supply chain, it is good to have option between few suppliers. Precise schedule and product quality are very important for the company. But often in supply chain there exist problems regarding to holiday seasons and vacations of China. Unfortunately, there are inevitable problems with raw materials from time to time in the world. All the challenges and problems that lie ahead shipments of finished products by the supplier are delayed and the materials arrive at company later. In addition, increasing orders increase the problems. Avoiding such situation company ordering suppliers use air transport both as a standard consignment arriving at its destination in 14 days and as an express consignment with a transport time approximately 3 days by company information and feedback on door-to-door solution.

Transport is mostly ordered through one company that organizes suppliers transport around the world with different modes of transport. Company storage stock balance is kept low and supply chains have to work smoothly. Ordinarily the transport price found by comparing the volume and weight of the consignment with the weight / volume ratio specified by the carrier.

## ***Transportation Modes and Supply Chains***

The case study's objective was to find different solutions transportations of goods from China. One alternative solution for company is to start transport of goods from China by rail. By company information and feedback delivery schedule is for door-to-door transportation two months plus / minus a few weeks for the ship and about two weeks for the air transport. Company is expecting that the products by rail should arrive up to month for door-to-door transportation (somewhere in one month).

Another great alternative is to start buying large quantities of goods directly from Europe. Such an alternative supports to save transport costs and time, but the challenge is the higher price of goods. And deliver lighter goods from China only by plane, if the latter is needed. However, both of these options require preparation and close cooperation and will between the suppliers and company. These ideas cannot be implemented immediately, but it requires preparation work forecasts to be adjusted to meet demand, stocks to be replenished for a transitional period, and suppliers to be informed of changes.

At the same time, it must be taken into account that the electronics industry is very well developed and this is very important for the company ordering electronic products in large quantities.

To calculate the costs, it was decided to set up three hypothetical consignments, consisting of only one product, and the calculations were made for full containers for each mode of transport. To this end, the two largest suppliers in Asia ('supplier X' and 'Y'), each with a share of orders with the same European supplier ('supplier Z'), were first selected. Most of the lighter products are ordered from supplier X and heavier products from supplier Y; this decision was made on the basis of pre-existing best practice with these suppliers. Both suppliers were examined so that the difference in transport costs could also be compared depending on weight and volume. Next products were selected from these suppliers, which have been used extensively over the years. One product was selected from supplier X and two from supplier Y. All three are also ordered from supplier Z. The quantity was 300 pieces on all three materials and the standard 120x80x100 was chosen as the Euro pallet. The quantity was stored on Euro pallets according to the size of the products. The full container was a standard 40-foot container (FEU) that can hold 25 pallets of the aforementioned size. Most daily orders are shipped in accordance with FCA delivery terms and therefore it was decided to proceed with and determine the costs under these terms.

The Chinese suppliers were based in Guangdong area, and the European supplier in Romania. Destination in both deliveries was distribution center located in Germany (feeds all factories, including Estonian). (Lepiku, 2018).

In terms of prices, air transport is still the most expensive mode of transport and the cheapest is transport by ship. Road transport and transport by rail are positioned between air transport and sea transport in terms of transport prices. In this case

study, where the goods are light, it is not necessary to be so clearly distinguished, but also in air transport, where the price is calculated exactly by weight. However, when transferring heavier materials, for example the difference with other modes of transport cost increases considerably. In conclusion, it makes sense to transport large and heavy loads, for example, in full loads or in full containers by ship or rail.

## **CASE STUDY OF THE COMPANY B: MULTIMODAL LOGISTICS SERVICES**

The aim of the second case study is to find out the possibilities of optimization in the multimodal transport chain on the example of company B. How optimization can be performed in the multimodal transport chain and in which parts?

This case study is based as well on B.Sc. thesis supervised by one of the authors of this research work (Meigas, 2018). To this, we describe the nature of the multimodal transport chain and the different modes of transport and describe the optimal possibilities for combining modes of transport and the provision of additional services in the transport chain. Company B is a company whose main field of activity is the organization of logistics for cars and other means of transport. The company's customers are vehicle manufacturers, importers and distributors in the Baltic States, Scandinavia, Western Europe, Russia and other CIS countries.

In the case of long distances, the movement of goods must combine different modes of transport, for which responsibility in the transport chain arises as one of the important issues. The advantage of multimodal transport over unimodal transport is that the combination of different modes of transport makes it possible to reduce the constraints of single mode transport. Combining modes of transport makes it possible to carry out transport of large goods and different geographical distances (Cansiz, 2018). Multimodal transportation is a key component of modern logistics systems, especially for long-distance transnational transportation (Seo et al., 2017). There are many ways to combine different modes of transport. The final version of the supply chain depends on the type of goods and the geographical distance between the consignor and the consignee. The multimodal transport system connects the international and domestic markets, supporting the international economic and trade cooperation (Wenwen, 2020). Which modes of transport to combine in the transport chain depends on the type of cargo and the geographical distance. Emerging issues and new challenges of globalization have forced companies to design their supply chains for not only minimizing cost, but also considering other factors. Supply chains are exposed to new environmental regulations to reduce their carbon emissions and compelled to consider other overlooked factors, such as risk (Kabadurmus & Erdogan, 2020).



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Vessels for carrying new vehicles have been built to hold up to 8,000 vehicles, although most are designed to transport between 4,000 and 5,000 vehicles. Factories in Europe produce millions of new cars, for most of new cars maritime transport is used to reach the destination.

All in all, maritime transport plays an important role in the movement of goods and is a low-cost mode of transport. Due to the long distances involved in the transport of goods by sea and the relatively large volume of transport, this can lead to long-distance transport schedules, which in turn lead to more time.

Rail transport is primarily used for the regular transport of large consignments of mass and unit goods over medium and long distances in a situation where speed is not decisive. The main advantage of conventional rail transport is its relative cheapness (Kiisler, 2011). In a situation, where the policy of the European Union favors the movement of freight transport from road to more environmentally friendly railways it is extremely important to create an opportunity for the smooth connection of sea and rail transport (Civitta Eesti AS, 2018). European Union has set itself the goal of reducing the backlog of rail transport and investing in the development of this infrastructure.

Due to its flexibility and ability to be the only mode of transport to provide door-to-door transport (i.e., direct transport without the need for transshipment), road transport is one of the most competitive and fastest-growing modes of transport in Europe and most other parts of the world. The increase in road transport volumes has also been strongly influenced by the widespread use of precision modernization delivery principles, which require the frequent delivery of small quantities of goods (Kiisler, 2011; Kiisler & Hilmola, 2020).

The increase in the share of road transport in international transport is related to the European Union's transport policy becoming more friendly to this mode of transport and the permissibility of long trains in international transport (not only in the Baltic States, but also on our routes to North Sea ports) (Tallinn University et al., 2014).

Road transport is the most polluting mode of transport and low fuel efficiency. Other disadvantages of road transport include relatively high cost of transport, low load capacity and technical limitations (weight, dimensions) (Kiisler, 2011).

Kiisler points out that one of the main factors of logistics, together with financial costs and customer service, is time. Time has a significant impact on both company and supply chain costs. To assess the supply chain time, it is seen as a value chain with value-added and non-value-added activities. According to various estimates, 5% of the time is spent on transport and 85%-94.8% of the time the goods simply stand in different storage locations (Kiisler, 2011).

The case company B deals with the logistics services of new and used passenger cars, providing road and rail transport services for passenger cars with its trailers and

railway vehicles, respectively as well as storage and pre-sale preparation services for passenger cars. The company has grouped its services because of sales revenue into three groups: freight forwarding, passenger car transport by rail and passenger car transport by road. The company organizes various modes of transport, where sea, rail and road transport are integrated into the logistics chain. In order for the goods to reach the customers company cooperate with various cooperation collaborates from Estonia and abroad. The vehicles arrive via company or cooperation partners mostly from the Nordic countries, England, Europe, Asia and elsewhere using sea transport. The company handles the logistics of vehicles upon arrival in Estonia from the vessel.

After the post-arrival inspection of the cars, the cars will be transported to either the company warehouse, the PDI (pre-delivery inspection) center or the loading area. In PDI center, where cars are first washed and thorough inspections are carried out to detect minor paint damages, install carpets, instructions for use, safety package, number plates and perform initial refueling and add window cleaner. Cars are usually fueled with 10 liter of fuel by prior agreement. When the cars are ready to be delivered to the final customer, a road transport contract CMR will be drawn up in the program, on the basis of which vehicles with car trailers will be transported to the dealerships. During the pre-shipment preparation, the factory-specified campaigns are also carried out, if necessary (Meigas, 2018).

The parking of cars after the post-arrival inspection depends on the decision of the importer. By offering customers full-service solutions for organizing multimodal transport, it is also necessary to offer additional services that increase customer comfort and therefore revenue of the company (Meigas, 2018).

From the point of view of cost optimization, it would be more expedient to use subcontractors to transport cars. This provides the company with cost and financial savings, because then the company does not have several different cost items such as drivers' salaries, truck maintenance, insurance costs, etc. on its disposal. There is possibility to optimize cars transportation by ship. For example, if it is necessary to transport cars from the company's Swedish branch to Estonia, where a certain price has been set for each car by the ship operator. If company's truck is also coming to Estonia with the same ship, where the given cars fit, then these cars are transported as a truck load and not as single item.

When compiling transport rounds, there is important that the trucks are fully loaded, when leaving the company terminal, which in turn ensures an increase in the profit margin. In the case of optimal planning of the traffic routes, the return journey to the terminal should also be monitored so that, if possible, something can also be transported over a given distance to avoid empty trucks. This as well increases company's profit margin.

## ***Transportation Modes and Supply Chains***

A study of the company's work processes revealed that time-optimization is possible in the car transport chain by allowing drivers to load cars on the day the ship arrives, allowing for faster transport. Time costs can be further optimized thanks to the round-the-clock charging option, which allows drivers to load the load the night before and transport the cars the next day or to cover the necessary distances at night to avoid increased traffic (Meigas, 2018).

There are activities in different parts of the supply chains of the company and the possibilities of optimizing time and financial costs in them. The service chain has been selected, which is the main set of services offered by the company to regular customers. The chain of operations begins with the arrival of cars at the port and ends with the arrival of the vehicles at the customer site. It was analyzed the possibilities of optimizing time costs in terms of reducing non-productive time. By information gained from company, unloading cars from a ship takes 3-5 hours, car inspection takes 1.5-2.5 hours, car refueling takes 0.1 hours, and loading cars 1-1.5 hours (Meigas, 2018). For example, unloading and inspection time would be reduced, if there were no injuries during transport that need to be addressed and further operations on the car are disrupted.

A minimum total time of car processing is 5 hours and 36 minutes and a maximum total time of 9 hours plus 6 minutes. In reality, company is very fast in its logistical organization, because cars that arrive at the port in the morning are usually forwarded in the afternoon of the same day. Delivering cars to dealerships faster than planned guarantees a financial bonus to company. The company has tried to optimize the costs of downtime as well as possibly creating more favorable agreements with customers by enabling fast car transport. At the same time, it turned out that cars moving to Russia by rail will remain in the customs warehouse until the necessary number of cars is available to load the full wagon. Transportation lot size increases the time delay and overall lead time. To shorten delay time in transportation by rail or somehow avoid it is not possible, because the quantity of cars depends on the orders. It is important to emphasize that rail transport to Russia is an indispensable means of transport, which allows to transport large volumes of goods over long distances thanks to the well-developed railway network in this country.

## **CONCLUSION**

Transport costs depend largely on the quantity transported. There are of course exceptions to this as e.g., in air transport, transport price is often depending on the bases of the pallet price and pallets quantities. In terms of prices, air transport is still the most expensive mode of transport and the cheapest is transport by ship. Road and rail transport are positioned in freight price terms between air and sea

transport. In the first case study, where the purchased goods were light, the price is calculated exactly by weight. However, when transferring heavier materials, for example the difference with other modes of transport cost increases considerably. In conclusion, it makes sense to transport large and heavy loads, for example, in full loads or in full containers by ship or rail. Based on this research work and two case studies, it has become more evident that supply chains need to have capability and readiness to serve all transportation modes. Even very distant suppliers or markets could have vast number of transportation mode alternatives, and these might arise as potential based on market conditions.

The multimodal supply chain consists of different modes of transport (Rodrigue et al., 2013). The advantage of multimodal transport over unimodal transport is that the combination of different modes of transport makes it possible to reduce the constraints of single mode transport, and also reach distant markets in effective way. The movement of goods must combine different modes of transport, for which responsibility in the transport chain arises as one of the important issues. Multimodal transportation is a key component of modern logistics systems, especially for long-distance transnational transportation (Seo et al., 2017). As the world's manufacturing plant and the world's largest exporter, China, can enable its rapid economic growth through efficient global multimodal supply chains. A multimodal supply chain enables the global economy to develop and expand international trade between different states. As first case study illustrates, Chinese originating supply chains can be integrated to European factories with different transportation modes and transportation chains. As the second case study from logistics service provider shows, different markets might require different transportation modes (e.g., Russian markets served by railways). Thus, domestic markets nearby are still of course served by road transportation in the end of the transportation chain, which has totally different clock-speed. Same applies to first case of manufacturing unit, and its incoming purchases from Europe. However, case studies were made in pre-coronavirus era, and in 2021 as well as onwards, it could be so that even increasing amount of intra-European transports will be completed with railways (early indications in general, see Tardivo et al., 2021; Butt, 2021). Shipping has become costly due to significant change in freight rates in 2021 as well as container leasing costs, and trucking is having its challenges with capacity, and availability of drivers (LeMay & Keller, 2019, Ellyatt, 2021; Holden, 2021; also border-crossing was troublesome in virus lockdowns, see Tardivo et al., 2021). Therefore, evaluations made in this research within cost side are becoming increasingly common among companies, even in domestic and intra-European market.

The supply chain in turn, consists of several processes, the effective management of which depends on the quality and price of the service provided. The more complex the logistics solutions, the higher the costs. Supply chain costs can account for

up to 80% of a company's total costs. Today, there is an increasing trend towards finding effective solutions, how to optimize processes and operate more efficiently. A multimodal transport chain is a logistical process, in the various stages of which several different activities, agreements, cooperation, exchange of information, etc. take place between the parties. In order to stay competitive, it is important to identify opportunities that help to operate more efficiently. Multimodality in an efficient international supply chain helps reduce costs for companies and in some cases speeds up the movement of goods. More case studies are needed as future research to understand this change better. Especially need is on intermodal change in EU area, and that in direction of Baltic States. For Baltic States forthcoming built-up and finalization of Rail Baltic railway alignment will mean more capacity and capability for railways, and it is also offering more competitiveness as it is direct link with Europe, and it is entirely new railway alignment without gauge changes (e.g. Civitta Eesti AS, 2018).

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Section 2

# Passenger Aviation Market

## Chapter 4


# Analysis of the Impact of Air Transportation on the Spread of the COVID-19 Pandemic

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### ABSTRACT

*With the COVID-19 pandemic, some restrictions in social life were imposed on people by the administrators. The basis of these restrictions was to prevent the spread of this epidemic in order to overcome it. Many sectors were directly or indirectly affected as a result of the restrictions. This study was conducted to reveal the statistical impact of travel by airline transportations on the COVID-19 pandemic in the United States (the U.S.). The data of the confirmed COVID-19 cases were handled for 223 days of covering between March 5, 2020 and October 13, 2020. This study provides statistical evidence that travel by airline transportation is statistically related to a significant impact on COVID-19. The result of this study suggests that social restrictions should continue for a while for the COVID-19 pandemic to be less affected by the second wave worldwide.*

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## **INTRODUCTION**

Corona Virus (COVID-19) is a virus recognized on January 13, 2020, as a result of investigations directed in a group of patients who first breathing indications (fever, cough, shortness of breath) in Wuhan Province, China, in the last days of December 2020 (Djilali & Ghanbari, 2020; Gupta et al., 2020; Muhammad et al., 2020; Reis et al., 2020). The SAR-CoV-2 virus is caused by the new Coronavirus Disease (Ministry of Health, 2020). The outbreak was primarily noticed in those in the seafood and animal market in this district. Corona virus has extended rapidly to other metropolises in Hubei region, other parts of the Republic of China, and other world countries. The World Health Organization (WHO) defined COVID-19 disease as a pandemic on October 23, 2020, with 41,138,340 COVID-19 cases and 1,131,156 deaths due to COVID-19 in the European region (WHO Europe, 2020). The death/case rate due to COVID-19 is calculated as 2.75% for these dates.

Governments had to take many preventive measures such as education, healthcare, transportation to block the blowout of the COVID-19 outbreak. The restrictive measures such as the closure of borders and travel ban that came into force around the world negatively affected the aviation industry by announcing the new type of coronavirus outbreak to the world in terms of transportation. The demand for air travel has reduced significantly due to the COVID-19 pandemic, with the ban on non-essential travel. This study dealt with how the transportation sector was affected by the outbreak. The study data includes the number of travelers traveling by air transportation to the USA and daily COVID-19 cases. The present research evaluates the impact of travel restrictions on the spread of the COVID-19 pandemic. The natural logarithm analysis, Box-Cox normality test, and correlation analysis were used for data.

This section consists of four sections. The first part of the study contains information about the subject of the study, its purpose and the method used. The background section of the study includes a literature review of research related to the COVID-19 pandemic. The third part of the chapter provides detailed information about the methodology of the chapter. The statistical results obtained from the procedures described in the methodology section and the interpretations of these results are examined in the fourth section. The conclusion of the research has been provided in the last section of the chapter.

## **BACKGROUND**

Respiratory complaints occur in COVID-19 infection (Acter et al., 2020). COVID-19 can spread through small droplets or mouths that spread into the environment where

there is coughing or breathing. COVID-19 viruses fall on objects and surfaces around the person. People get infected by touching the eyes, nose, or mouth after touching the COVID-19 virus-containing objects or surfaces (Ali & Alharbi, 2020). People are, therefore, essential to stay at least a few meters (called social distance) away from a sick person (Paital et al., 2020). Authorized institutions took curfews and aimed to prevent people from approaching each other and slow the spread of this pandemic. For the first time, Atalan has conducted the lockdown effect on the spread of the COVID-19 pandemic statistically (Atalan, 2020; Kang et al., 2020). Therefore, there is a high level of membership in the “stay at home” request by authorized organizations.

From the time of the COVID-19 outbreak worldwide, approximately 186 million people have been infected with this virus, and 4 million people have died due to this virus (Worldometer, 2021). Although the number of deaths and transmission cases of COVID-19 is decreasing day by day, and it is known that the speed of this outbreak has slowed down due to the COVID-19 vaccines developed by different countries, there is no clear information about when this pandemic will end.

People have experienced significant changes in their social lives since the first day of the COVID-19 pandemic (Al-Tawfiq et al., 2020). In fact, there are restrictions in many social areas rather than changes and humanity experiences during the pandemic (Choi, 2021). Perhaps the most important limitation that affects people is freedom of travel (Hou et al., 2021). The U.S. warned its citizens not to travel to China for the first time on January 30, 2020 (Taylor, 2020). Most countries have had to acquire global restrictions that prevent their citizens from travelling overseas. According to the United Nations World Tourism Organization (UNWTO) report, 96% of all destinations worldwide were restricted by countries due to the COVID-19 outbreak (World Tourism Organization, 2020). With such a restriction, many sectors, especially the travel industry, had adverse economic effects (Chinazzi et al., 2020). Countries have not wanted to continue these restrictions for a long time with the increase of negative economic impact in terms of sectors and adverse social effects for people, and at the same time, have desired to reduce the spread of this pandemic. The measures and prohibitions put forward by the countries to prevent the COVID-19 outbreak have been analyzed by scientists with different methods. This study reports statistical analysis of the relationship between travel and the spread of the COVID-19 pandemic.

Transportation systems can be defined as the transportation of a product or a passenger from a certain location to another location by using different vehicles (Sussman, 2000). Today, intelligent (or smart) transportation systems have started to form by using technology and information infrastructures in transportation systems. Research shows that sea, air, and road transport, which are the main elements of all transportation systems, are currently experiencing problems with the COVID-19

### ***Analysis of the Impact of Air Transportation***

epidemic. The transportation industry provides two types of activities in terms of passenger and product transportation. Transportation activities are carried out with vehicles compatible with the sea, land (including railway), and air. For more than a year, this pandemic has negatively affected organizations operating with all airline types. There are many studies that deal with the negative situations that develop between the COVID-19 outbreak and the transportation sector. Even though the transportation density strongly correlates with the population ratio, this outbreak also affects the countries where the population density is low and the transportation infrastructures are weak (Mogaji, 2020). The transportation sector, which was affected by the outbreak, was influenced not only by the passengers but also by the logistics sector, which transports products to meet the basic food needs of people. In particular, it has been examined in a study that the logistics sector, which is in the supply chain of agricultural products to consumers by mass sea transportation, rail transportation, and truck transportation, is significantly affected, and even longer waiting times were occurred for food products to reach retailers in North America (Gray, 2020).

Daily public transportation vehicles, most preferred by people for transportation, have been affected during this pandemic process. These transportations are also called urban transportation. In one study, the authors measured the impact of the pandemic on urban transport by fuel consumption. According to this study, it was determined that fuel consumption was less than the pre-pandemic period during the pandemic April and May 2020 periods. In addition, it was analyzed in this study that the density of urban traffic congestion decreased during the pandemic period (Tian et al., 2021). In another study related to urban transportation, it was analyzed that the use of public transportation decreased by 50% due to the COVID-19 outbreak and that people use their personal vehicles for daily compulsory activities such as paying bills and taxes, supplying drugs, shopping for food. It is stated in this study that people generally prefer the use of private vehicles for long-distance travel (Fatmi, 2020).

Another means of transportation, railway transportation, was determined using the RegARMA method, which was affected by the COVID-19 outbreak (Wang et al., 2021). In another study, 43 thousand passengers using the Wuhan-Beijing railway were analyzed, and a quantitative study was conducted that rail transport caused the COVID-19 epidemic. The result of the study is that the epidemic spread despite the normal COVID-19 measures applied by people traveling using the railway line (Liu et al., 2020). Especially in the world where the trade volume by sea is 80%, many COVID-19 measures, such as export and import bans and border closures, to slow down or prevent the COVID-19 pandemic also affect maritime transport, which is another transport sector (Heiland & Ulltveit-Moe, 2020). One study emphasized that maritime transport in terms of tourism is significantly affected by the COVID-19

bans (Haryanto, 2020). Economic data was evaluated in a study, which affected the maritime sectors, fishing, and sea tourism due to the Covid-19 pandemic between January and July 2020 in Malaysia (Menhat et al., 2021).

It has come to the fore that implementing social distances with the COVID-19 outbreak measures in the countries and the need to take extra new measures on airplanes and airports. To prevent people's health and lives, airline companies have taken measures to leave gaps between the seats to protect them from the COVID-19 outbreak during the flight. This situation had a profound impact on airline companies, which were in a difficult economic situation. Airlines began to charge exorbitant fees for the few seats reserved for passengers. However, the reduction of flight flights, the demand for strict health checks before and after the flight, and the application of high fees directly affected the airline companies. With the ban on non-essential travel, the demand for air travel has decreased significantly. Air traffic has come to a standstill due to the COVID-19 pandemic, and flights have been reduced by almost 90% in many countries. A study for the EU region reported that the COVID-19 outbreak has seen a more than 89% decrease in the number of flights and air transport in the EU has been affected by this outbreak (Nižetić, 2020). In 2018, before the pandemic, there were 611.74 million passengers, 548.06 million passengers on domestic flights, and 55.45 million passengers on international flights (Lau et al., 2020).

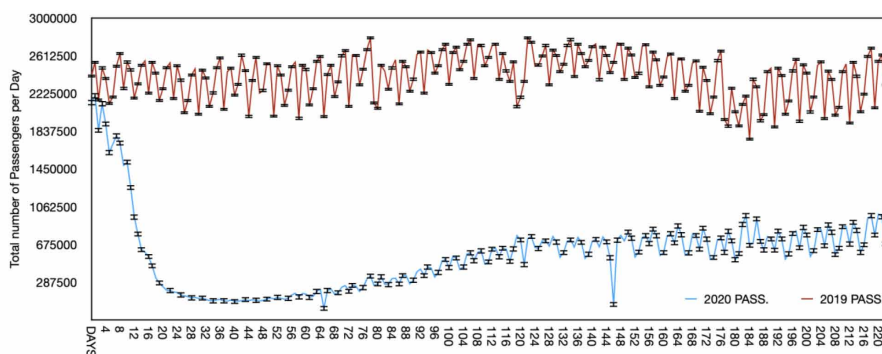
Even though there are differences in methods in scientific studies, it is striking in research that air transportation is negatively affected. A study emphasized that flights carrying passengers are more likely to transmit the COVID-19 virus than flights carrying cargo, with a dataset covering 150 airline companies between 2751 airports (Sun et al., 2020). Another study shows that the COVID-19 outbreak is spread by the preferred airline for travel. The association between the rising number of cases and increasing flight numbers has been shown in Brazil (Pequeno et al., 2020). Although there are studies that analyze the spread of the COVID-19 outbreak by air transport with different methods or observations, it has been determined that both passenger and commercial air transport in the USA decreased by 71.5% in the period of May 2020 compared to the period of May 2019 as a result of people's compliance with the measures taken (Hotle & Mumbower, 2021). In a study on air transport, the authors investigated how the increase in the number of confirmed cases of COVID-19 affected air transport from a socio-economic point of view and provided some recommendations about the adversely affected air transport. In this study, it has been suggested that countries react late to air transport in the rise in the number of cases, and for a solution, it is recommended to reduce the flight capacities as well as to reduce the multiple flight operations in the flights. (Sun et al., 2021).

## DATA AND METHODOLOGY

The impact of the COVID-19 outbreak on air transportation was measured by choosing flight data and daily confirmed cases in the USA as data selection in this chapter of the book. The daily cases to the U.S. were obtained from the worldometer website (Worldometer, 2021), and the data regarding the total number of passengers by airline transportations were obtained from the Transportation Security Administration (TSA) checkpoint travel numbers website (TSA, 2020). There are approximately 14702 airports for private use, while there are 5217 airports for general use in the USA in 2020 (Statistica, 2021). Approximately 16.4 million flights are carried out in the USA annually (Federal Aviation Administration, 2021), while more than 40.3 million flights are carried out throughout the world (Nižetić, 2020).

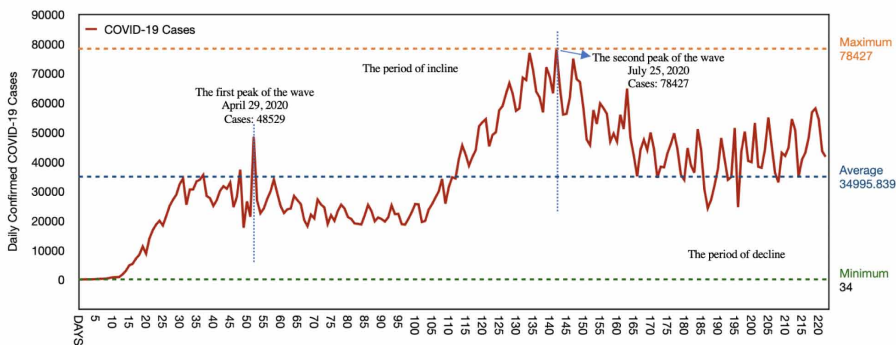
Before the COVID-19 pandemic period, the number of air passengers carried in the United States for 2019 was 926 million, with an annual average increase of 3.73% (Knoema, 2021). The number of scheduled flights in the U.S. in 2020 has decreased by 46.6% compared to 2019 with the emergence of the COVID-19 pandemic. Overall, over the long term, it carried 557 million fewer passengers in 2020 than in 2019, down 60% year-over-year during the COVID-19 pandemic (Bureau of Transportation Statistics, 2021). Figure 1 shows the data of people travelling with scheduled flights in the U.S. in 2019 and 2020. The considered period in 2020 for this research, approximately 5.4 million passengers traveled by air transport in 2019, while only 1.26 million traveled in 2020. The decrease rate between the two periods was calculated as 76.6%.

Figure 1. The number of passengers in the U.S. for 2019 and the considered period in 2020



A total of 38,349,116 confirmed active COVID-19 cases were documented worldwide as of October 13, 2020. The number of approved active COVID-19 cases in the U.S. considered for this study was recorded as 8,150,043 as of October 13, 2020 (Worldometer, 2021). In the U.S., the peak point of the daily number of cases during the COVID-19 pandemic was recorded as 48529 on April 26, 2020. This point can be perceived as the maximum level of the first wave for the COVID-19 pandemic. The second peak point of the daily number of cases during the COVID-19 pandemic was recorded as 234633 on July 25, 2020, the considered period in 2020 (See Figure 2).

*Figure 2. Daily New Cases in the United States for the considered period in 2020*



All dimensions related to transportation were discussed in background section for this book chapter. However, for this study, the data on the number of passengers belonging to the type of air transportation for travel were preferred for the analysis. For the data used in this study, three different normality tests were used to test whether the data fit the normal distribution. Statistical analysis was performed by generating null (the data is not normally distributed due to  $p\text{-value} > 0.05$ ), and alternative (the data is not normally distributed due to  $p\text{-value} \leq 0.05$ ) hypotheses for each test (Ayaz Atalan et al., 2020). In the current chapter, Box-Cox transformation natural logarithm regression analysis was preferred based on the optimum lambda ( $\lambda$ ) value, which is one of the statistical analyzes and for non-normally distributed data.

The linear regression analysis with the Box-Cox normality test was applied to statistically show the effect of passengers travelling by airline transportations on the COVID-19 pandemic in this study. In this study, Numbers and Minitab 18.0 statistical computer programs were utilized to statistically explain the effect of the total number of daily travelers on the COVID-19 outbreak in the U.S. A correlation analysis was estimated between the spread of the COVID-19 pandemic and the travelling.



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The correlation value differs between -1.00 and 1.00. The value of correlation a variable denotes that it has an adverse relationship as it approaches -1.00 and a positive association as it approaches 1.00. The correlation effect size was found in the literature as a weak correlation value of 0.10, a moderate correlation value of 0.30, and a strong correlation of 0.50 or greater correlation data as a result of the rules created by Cohen (Cohen, 1988). The norm quantifies the formula for these data to show a trend suitable for normal distribution by the Box-Cox transformation method since the data considered for the study were not normally distributed. The sorting of data is shown as below:

$$x_1 \leq x_2 \leq \dots \leq x_o \quad (1)$$

where  $x_1, x_2, \dots, x_o$  represent the observation value of the sample data. The values of  $x_1, x_2, \dots, x_o$  are defined as the order statistics of the actual data. The quantile is defined for the fraction  $f_i$  as follows:

$$f_i = \frac{(i-1)}{o-1}, \quad i = (1, 2, \dots, o) \quad (2)$$

Defining the quantile by using linear interpolation between the two nearest  $Q(f)$  is shown as:

$$Q(f) = (1-f)Q(f_i) + fQ(f_i+1) \quad (3)$$

where  $Q$  denotes the quantile function in this study. Quantile characters are a method expended to compare the distributions of two data sets. Generally, the following formula is used to convert the yardstick distribution to the standard normal distribution:

$$P[X \leq x] = \frac{1}{2\pi} \int_{-\infty}^x e^{-\frac{t^2}{2}} dt \quad (4)$$

where  $P$  symbolizes the probability value of sample data in the standard normal distribution form. In cases where data such as COVID-19 case data and passenger number data are not significantly normal, the Box-Cox transformation method is used to improve the normality of the variables. Box-Cox transformation method was developed by Box and Cox in 1964 (Box & Cox, 1964). Eq. 5 for positive dependent variable values and Eq. 6 for negative dependent variable values are

constituted. For a data set with an unknown  $\lambda$  value and n sample size (Vélez et al., 2015):

$$y^{(\lambda)} = \begin{cases} \frac{y^{(\lambda)} - 1}{\lambda}, & \text{if } \lambda \neq 0 \\ \log(y), & \text{if } \lambda = 0 \end{cases} \quad (5)$$

$$y^{(\lambda)} = \begin{cases} \frac{(y + \lambda_2)^{(\lambda_1)} - 1}{\lambda_1}, & \text{if } \lambda_1 \neq 0 \\ \log(y + \lambda_2), & \text{if } \lambda_2 = 0 \end{cases} \quad (6)$$

where  $y$  represents the dependent variable. The  $\lambda$  notation is included in the equation as the power of the Box-Cox transformation. The Box-Cox transformation method can be interpreted with the  $\lambda$  values in Table 1. Also,  $\lambda$  can take other values than these values. Generally, the  $\lambda$  value is accepted by researchers between -2.00 and 2.00, while the  $\lambda$  value is kept within the limits of [-5.00, 5.00].

*Table 1. Behaviors of the box-cox transform according to the  $\lambda$  power*

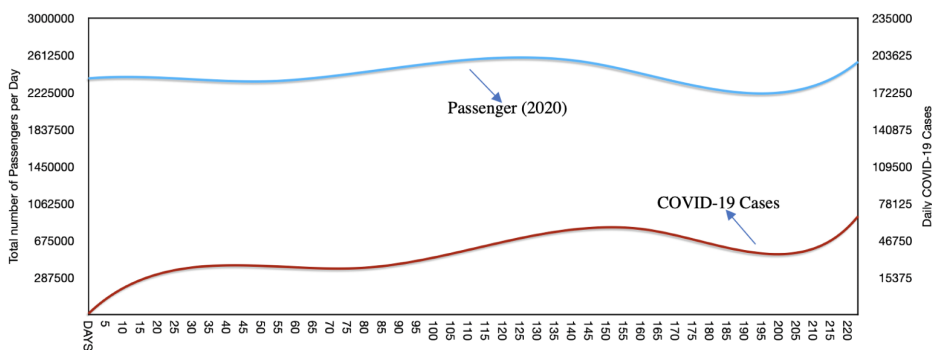
The value of $\lambda$	Interpretation
$\lambda$ : -1.00	The reciprocal (inverse) conversion is performed with this value.
$\lambda$ : -0.50	With the value of 0.25, the reciprocal square root conversion is performed.
$\lambda$ : 0.00	The natural log transformation is performed with this value of 0.
$\lambda$ : 0.25	The fourth root transformation is performed.
$\lambda$ : 0.33	The cube root transformation is performed with this value,
$\lambda$ : 0.50	The square root transformation is performed with this value
$\lambda$ : 1.00	There is no need to transform the data for this value.

The optimum  $\lambda$  value and lower and upper limits are calculated for the box-cox transformation for the 95% confidence interval. For this study, the regression analysis of the power was performed according to the optimum lambda value of the selected data. The results of statistical analysis are discussed in the next part of the chapter.

## SOLUTIONS AND RECOMMENDATIONS

The data of the passengers travelling by the airline transportations were considered in the present chapter. Passenger data travelling by other means of transport are not taken into account for this study. It has been observed that the number of confirmed cases of COVID-19 and the number of passengers traveling is parallel to the polynomial trend analysis in fluctuations. Figure 3 shows the relationship between the number of passengers of domestic and international approved flights in the U.S. between March 5 and October 13, 2020, and confirmed COVID-19 cases between these dates with nonlinear curves.

Figure 3. Relationship between the number passengers and COVID-19 cases



Descriptive statistical studies were obtained for all the data handled in this chapter in Table 2. The results of the descriptive statistical analyses were created based on 95% confidence intervals for upper and lower mean in total travelers on a daily basis and confirmed cases of COVID-19. The statistical test was two-sided, and a value  $p < 0.05$  was estimated for the statistical model and parameters statistically significant.

*Table 2. Descriptive statistics data for the passenger (2020), and confirmed COVID-19 cases*

Parameters	Notations	2020	COVID-19 Cases
Size	$N$	223	223
Mean	$\bar{x}$	565137	34996
Median	$\tilde{x}$	578131	33871
Standard Deviation	$s$	392033	17877
Standard Error of Mean	$SE_{\bar{x}}$	26252	1197
Sum of Squares	$SS$	1.05E+11	3.44E+11
Coefficient of Variation	$CV$	69.37	51.08
The First Quartile	$Q_1$	244176	22593
Interquartile Range	IQR	494697	25468
The Third Quartile	$Q_3$	738873	48061
Variance	$s^2$	1.54E+11	3.20E+08
Skewness	$\gamma_1$	1.55	0.09
Kurtosis	$\beta_2$	4	-0.43
Mode	$M$	0	0
Minimum	$min$	16958	34
Maximum	$max$	2198517	78427
Range	$R$	2181559	78393

There is a moderate correlation between the number of confirmed cases of COVID-19 and the number of passengers preferring air transport for travel in 2020. The value of correlation was calculated as 0.333 with  $p=0.001$  using the Spearman rho test. The data on the number of passengers travelling by airway during 2020 and the data on the number of new COVID-19 cases do not show a normal distribution. The data used for this study do not follow the normal distribution according to the Anderson-Darling, the Ryan-Joiner normality, and the Kolmogorov-Smirnov normality tests. In other words, while the null hypothesis (the data is not normally distributed due to  $p\text{-value} > 0.05$ ), the alternative hypothesis must be accepted (the

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data is not normally distributed due to  $p\text{-value} \leq 0.05$ ). The normality test results of the data belonging to the study are given in Table 3.

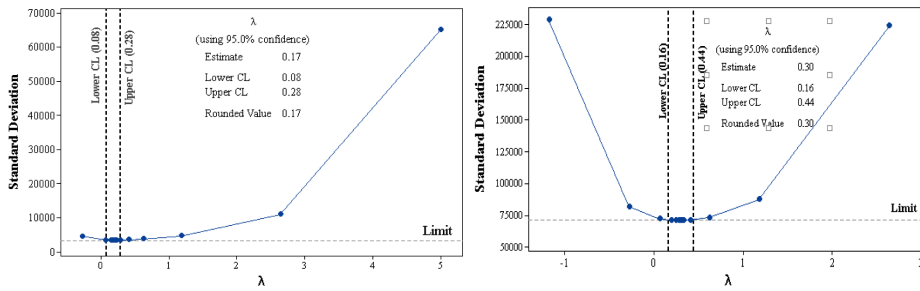
*Table 3. The results of the normality test of the data*

Data	Test Type	N	Mean	StdDev.	Test	P-Value	Statue
COVID-19 Cases	Anderson-Darling	223	34996	17877	1.199	0.005	Reject $H_0$
	Ryan-Joiner	223	34996	17877	0.991	0.001	Reject $H_0$
	Kolmogorov-Smirnov	223	34996	17877	0.066	0.028	Reject $H_0$
Passengers (2020)	Anderson-Darling	223	565137	392033	6.502	0.005	Reject $H_0$
	Ryan-Joiner	223	565137	392033	0.923	0.001	Reject $H_0$
	Kolmogorov-Smirnov	223	565137	392033	0.127	0.001	Reject $H_0$

StdDev.: Standard Deviation

According to the statistical analysis, the  $R^2$  (Deviance R-Sq) values obtained were high and calculated as 0.830. The optimum  $\lambda$  score for the Box-Cox transformation of the number of confirmed cases of COVID-19 was 0.17, and the lower and upper limits were determined as 0.008 and 0.28, respectively, according to the 95% confidence interval. In addition, the optimum  $\lambda$  score for the Box-Cox transformation of the number of confirmed cases of passengers (2020) was 0.30, and the lower and upper limits were determined as 0.16 and 0.44, respectively, according to the 95% confidence interval. However, the optimum lambda value was 0.00 for the dependent and independent variables, according to the 95% confidence interval, and statistical analysis was performed according to the natural logarithmic linear regression feature. Optimum lambda values, Box-Cox transformation force, for both confirmed COVID-19 case numbers and passenger numbers are shown in Figure 4. The Tukey-Lambda distribution governs a family of distributions that can be close to normal spreading. The maximum correlation of traveling and confirmed new COVID 19 cases for the  $\lambda$  value of 0.00 and the data of new COVID-19 cases were examined according to a normal distribution. The correlation value, which shows the effect of the number of passengers travelling according to the Tukey-lambda distribution on the spread of the COVID-19 pandemic, is powerful.

Figure 4. The Box-Cox Plot for the confirmed COVID-19 (left) cases, and 2020 Passenger (right)



The statistical analysis result shows that passengers traveling by airline transportations caused the spread of the COVID-19 outbreak in Table 4. In this study, 223 data were used to calculate the travelling in the countries mentioned earlier in the spread of COVID-19 pandemic with 95% relative confidence intervals (t-ratio=-10.24; F-ratio=104.95; prob= 0.001). The established statistical model was instituted significantly according to the statistical analyses. Among the confirmed data on COVID-19, fourteen were identified as unusual observations.

Table 4. Box-Cox transformation natural logarithmic regression analysis data

Statistics	Spearman Rho	Model	Passenger (2020)
Sum of Square	-	121.40	121.40
Mean of Square	-	121.38	121.38
F-value	-	104.95	104.95
t-value	-	88.360	-10.240
Contribution (%)	-	67.800	32.200
Probability (>F)	-	-	0.0010
Probability (> t )	-	-	0.0010
Chi-Square	-	-	-
P-value	0.001	0.001	0.0010
Correlation	0.333	-	-
Box-Cox Transformation	-	0.000	-

With the declaration of the COVID-19 disaster as a global epidemic by WHO that many factors such as education, health, transportation, and economy are directly and/or indirectly affected. All of these factors are socially related to each

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other. In this study, one of these factors, as a generalization, is discussed how the transportation sector is affected by the COVID-19 outbreak. More specifically, this study deals with the relationship between the number of passengers preferring air transport and the increasing number of confirmed cases of COVID-19. The main reason why this topic is preferred is that the SAR-CoV-2 virus, which causes the COVID-19 outbreak, meets people by contact and airway. The possibility of causing the spread of this outbreak in air transport processes, which cause people to stay in closed areas for a long time and where there is much exchange of goods if care is not taken, has been analyzed.

Many factors such as high cost, limited flight routes, and private vehicle preference of people due to social distance. Many outbreak measures created at the airport are why air transport is affected by the COVID-19 outbreak. Despite the decrease in passenger volumes with air traffic, for some people, they have to use air transport due to the fact that land transportation is limited and sea transportation takes a long time in transportation between countries. For people who choose air transportation, the authorities demanded that people comply with the outbreak measures by airline companies. Although serious measures were taken during the pandemic, the authorities were too late to prevent deaths due to COVID-19. With the increase in the number of confirmed COVID-19 cases, borders for air transportation were closed, and only domestic flights were allowed, except for mandatory international flights.

The present chapter has statistically demonstrated that long- or short-distance mobility of people triggers the spread of the COVID-19 pandemic. For this reason, authorities need to take more measures for travel to slow the spread of the COVID-19 pandemic. According to the data discussed in this study, the U.S. reached the peak point of the first wave of the COVID-19 outbreak in July. However, when the data of the dates selected for this study are sifted through, the recent data show that the author can emphasize that the second wave in the U.S. is very close. After September 15, 2020, both the number of passengers and the COVID-19 cases increased. Suppose the rate of spread of the COVID-19 is not reduced immediately. In that case, the measures to be taken by both the U.S. and other countries will severely damage the countries' social and economic structures. As a result, the increased number of confirmed cases and deaths due to the COVID-19 pandemic will cause more interference in people's social lives. A study emphasized that the SALUTARY (Safe and Reliable Public Transport Systems) method was developed for transportation in crowded transportation locations during the COVID-19 epidemic period, and this improvement determines an appropriate crowd level by measuring at stops would be protected from the epidemic (Darsena et al., 2020). The development and implementation of the proposed technological tools and information systems for air transport can be presented as another suggestion.

Even if this study data is for the USA, it can be said that there is a serious adverse relationship between COVID-19 and air transport worldwide. Flight plans need to be taken into account not only for domestic routes but also for international routes globally. During the pandemic process, flight routes had to be re-created for every airport in the world. Although the information and data are limited, as a result of the statistical analysis obtained, air transport has been deeply affected by the global crisis, the COVID-19 outbreak.

## **CONCLUSION**

People have experienced significant changes in their social lives such as economy, education, health, transportation since the first day of the COVID-19 pandemic occurred. In fact, there are restrictions in many social areas rather than the changes and human experiences during the pandemic process. Perhaps the most critical limitation affecting people is freedom of travel. Countries have taken many measures to prevent the COVID-19 outbreak, such as closing borders, traveling in distance seats, carrying a limited number of passengers. In the present section, statistical analyzes from numerical methods based on COVID-19 data were carried out to be effective in epidemic management, and concrete results were obtained. A case example is presented to suggest the link between the outbreak and the constraints being considered. In addition, air transport from the sectors affected as a result of the spread of the pandemic was examined in this chapter.

This chapter was conducted to reveal the statistical effect of air travel in the USA on the COVID-19 outbreak. Data confirmed COVID-19 cases were covered for 223 days from March 5, 2020, to October 13, 2020. This study has shown statistically that long or short-distance mobility of people triggers the spread of the COVID-19 pandemic. This study presented those social restrictions should continue for a while for the COVID-19 pandemic to be less affected by the second wave worldwide.

The link between the spread of the pandemic and the airline industry involved in air travel was covered in detail. With this study, it was observed that a statistical link emerged with the probability of people catching the virus during flight. Yet, a cause-effect relationship cannot be proven. Indeed, it should not be excluded that in addition to the spread of the virus during travel, gathering of people in destinations, visiting different locations (usually for paperwork), frequent use of eating and drinking locations, visiting locations used for cleaning needs are very effective in spreading the virus. For such reasons, the spread of the virus is also caused by people's old habits (not paying attention to cleanliness, not maintaining social distance, etc.).

Passengers who preferred the airline for travel were exposed to many precautions and bans due to the COVID-19 outbreak. However, there were cases where these



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measures provided many advantages such as unnecessary travel, social distance protection, hygiene. Therefore, some of these measures should continue to be implemented continuously by airlines for the post-COVID-19 outbreak. The only thing that the results of this chapter show are that transportation systems in general and air transport in particular, which are deeply affected by the COVID-19 epidemic, the transportation sector will continue to be affected in many ways as long as the epidemic continues.

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# Chapter 5

## The Economic Impact of COVID-19 in the Air Transportation Industry: Estimates From a Regional Input-Output Model

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### **ABSTRACT**

*Public policy design plays a significant role in alleviating the economic effects caused by this pandemic in local economies across the globe. This chapter suggests the use of input-output analysis (IO) to provide guidelines to stakeholders and policy makers in the air transportation sector to address economic concerns during the pandemic and in the post-pandemic era. IO is helpful in estimating the economic effects of COVID-19 pandemic in the air transportation sector and allows to estimate its impact on other economic sectors in a local economy. Output, value added, employment, and personal income are the variables estimated through IO. The chapter applies IO technique to evaluate the economic impact of COVID-19 on the air transportation sector in Austin, Texas. Impact estimates suggest a total loss of \$1.02 billion USD in Austin MSA's economy in 2020; the number of jobs lost are estimated at 3.87 thousand and the total loss in personal income at \$229.97 million USD in Austin MSA in 2020. Lastly, the value-added loss in Austin MSA is estimated at \$514.20 USD in 2020.*

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## **INTRODUCTION**

The COVID-19 outbreak has impacted the transportation service industry. Worldwide travel restrictions, changes in the demand for travel, and scarce government budgets due to the COVID-19 pandemic represent financial and planning challenges faced by the transportation sector. As vaccination programs have been initiated around the globe and travel restrictions are gradually being relaxed, public policy design is necessary to alleviate the economic impact brought by this pandemic. Given the dynamic and changing nature of the course of this pandemic, local governments around the globe have provided and implemented strategies in the air transportation sector to cope with the effects of COVID-19. Some of these action plans overlooked theoretically informed methodologies on their planning processes. One of the many challenges of COVID-19 pandemic is seeking modeling tools that could guide policy advocates and stakeholders in the decision-making process. These tools can be used to inform strategies in allocating resources efficiently and sustainably while finding ways to achieve an economic recovery by coping with pandemic and post-pandemic world challenges.

Input-Output Analysis (I-O) is a modeling technique consisting of linear algebra applications which combine economic facts and theory to inter-industry analysis; I-O was developed by a Nobel Prize Laureate, Wisely Leontief. Leontief defined I-O as “a method of analysis that takes advantage of the relatively stable pattern of the flow of goods and services among the elements of an economy to bring a much more detailed statistical picture of the system into the range of manipulation by economic theory” (Leontief, 1986, p. 4). The original I-O model was applied to the United States of America national accountability but later applications of I-O along with regional science advancements allowed the application of I-O to smaller areas such as states, counties, or cities. For example, Hewings (1985) develops an analytical framework to apply I-O to regions by applying macroeconomic accounting principles to geographic and regional studies. This type of analysis could be helpful in estimating the effect of COVID-19 in the air passenger transportation sector and its impact on other economic sectors in a local economy.

The primary objective of this chapter consists of suggesting the use of I-O to provide guidelines for stakeholders and policy makers in the air transportation sector to address economic concerns during and at a post-pandemic era in local economies. In this sense, the chapter applies I-O to estimate the impact of COVID-19 in the air passenger sector and its related sectors in the economy of Austin-Round Rock-Georgetown, Texas Metropolitan Statistical Area (MSA). The chapter consists of this Introduction and six additional sections. These sections are: Input-Output Analysis, Input-Output Models: Applications and Resources, Regional Input-Output Modeling,

Regional Economic Impact of COVID-19 on the Air Transportation Industry, Future Research Directions, and Conclusion.

The I-O model can be applied to air passenger travels in the short-run, the medium-run, and the long-run by air transportation sector representatives and by regional governments seeking to implement policy strategies to cope with the negative effects of COVID-19 pandemic as described in the Conclusion of this book chapter.

## **INPUT-OUTPUT ANALYSIS**

Input-Output Analysis (I-O) is an economic modeling technique consisting of linear algebra applications widely used as an attempt to predict how the economy of a country will respond to exogenous or planned changes (Hastings and Brucker, 2019). For example, a planned change in the economy of a country could be the construction of a new highway or changes in government policy. Examples of exogenous changes in a country's economy include natural disasters or public health crisis such as a pandemic. In addition, I-O is used to calculate intermediate demand of final goods and services produced by an economy because it portrays the way industries interact with each other. This interaction is given by the interconnectivity of industries (Rey, 2000). Moreover, I-O provides information about the economic sectors of a country in terms of sales, wages, and employment. I-O serves as an attempt to quantify, at a point in time, the economic interdependencies in an economy. More specifically, "a fundamental underlying relationship of input-output analysis is that the amount of product (good or service) produced by a given sector in the economy is determined by the amount of that product that is purchased by all the users of the product" (Hasting and Broker, 2019, p. 3). In order to further elaborate on applications of I-O analysis applications and its purpose, an explanation of the model is provided next.

Input-Output Analysis is informed by a group of tables or matrices of national accounting. These tables are called supply and use tables. Supply and use tables (SUTs) describe how goods and services are brought into and used in a country by describing its entire economy by industry and by product. SUTs are an important part of the System of National Accounts, yielding a framework for the compilation of a single estimate of Gross Domestic Product (GDP) of a country and provide a detailed description of a national or regional economy. Input-Output tables, which show the links between final and intermediate uses of production (goods and services), are used by many countries to produce their national accounts (UN, 2018)

SUTs consist of two interconnected tables. The supply table provides information on the output generated by an economy and its imports by type of product and type of industry. The use table provides information on how the different products are used in an economy either by intermediate consumption, final consumption, or exports.



In addition, use tables show the gross value-added components by industry. Once these tables are balanced, that is where the total supply by product (industry) equals the total use by product (industry), both tables can be integrated to a single matrix: the SUTs framework, which show a single estimate of GDP. Input-Output tables are derived from SUTs to a single matrix where total input and total output are equal, and describe the interrelationships between products and industries, as well as the relationships between producers and consumers within an economy. (UN, 2018)

Additional resources providing detailed description of the mathematical framework underlying the I-O model are recommended in the following section through readings suggestions in addition to the references cited in this and other sections.

## **INPUT-OUTPUT MODELS: APPLICATIONS AND RESOURCES**

The following section elaborates on how input-output analysis and its results have been applied to provide recommendations for policy evaluation, the identification of key industry sectors, and planning purposes. These recommendations have been applied in different geographical scales such as groups of countries, single countries, as well as states and cities within a country. Additionally, the section includes available resources to inform the reader about how to build an input-output from scratch. These resources explain the mathematical framework of input-output models and specify some countries that have developed input-output tables for their economies.

The input-output analysis has been applied for policy evaluation purposes in groups of countries and for identifying key sectors in those countries. For instance, Giammetti et al. (2020a) estimates the potential economic impact of Brexit in the European Union. The analysis includes an application of input-output to identify and rank the most relevant industries in the UK and in the European Union. Once the key industry sectors in the UK-EU were identified, the potential effects that Brexit could have in the different industries in the EU are estimated. The author recommends using these results to mitigate the potential negative effects of Brexit by safeguarding UK key sectors.

Input-output analysis can be applied to identify relevant industries in a country. Identifying key sectors can be helpful to quantify how changes in those sectors could affect the economy nationally. In addition, once the key sectors in a single country have been identified, input-output analysis can be used to quantify the effects of a change in those sectors in other countries. For instance, Alariste-Contreras (2015) applied input-output analysis to identify key sectors in the countries of the EU. Once identified, the author computed the effect of sectoral shocks and its diffusion to the rest of the EU countries. A sectoral shock could be interpreted as a decrease of sales in a particular sector of the economy of a country.

Input-output can be applied for planning purposes such as providing strategies to guide governments in designing safe and efficient reopening policies during the COVID-19 pandemic. In this regard, Giammetti et al (2020b) applied input-output analysis to track Italy's inter-industry interactions in transmitting the economic impact of COVID-19 lockdown measures. By using I-O analysis, the author first identified the key sectors in the Italian economy and provided different rankings of the most interconnected sectors involved in the COVID-19 lockdown. Lastly, the author suggested that his results could be used by governments for planning reopening policies.

Input-output analysis can be scaled down to provide policy recommendations in the decision-making processes of planning of smaller geographical areas other than countries, such as states or cities. For example, Fuentes et al (2019) applied input-output analysis to estimate the effects of climate change in the different sectors of the State of Baja California in Mexico. Noori et al (2020) developed a framework to implement input-output analysis in the design, planning, and implementation stages of smart cities. The objective of his paper is to develop a conceptual understanding of the smart city and describe their different facets. The author further elaborates on those facets to complete an Input-Output model helping policymakers and analysts make informed design choices. Further examples of input-output analysis applied to cities and states are included in the following section.

International agencies such as the United Nations (UN), the Organization for Economic Cooperation and Development (OECD), and the World Bank (WB) have available resources to explain the mathematical framework of input-output analysis in detail such as those provided in UN (2018), OECD (2021), and Belotti et al (2020) for the World Bank.

In addition to the available online resources on the mathematical framework input-output tables, several countries have incorporated input-output matrices in their national accountability systems. European Union countries have developed input-output tables for each single country and as a region (EUROSTAT, n.d.). Mexico, Canada, and the United States, for example, have developed input-output tables that allow each country to conduct economic impact studies at the national level. Their input-output tables are available at INEGI (2013), Statistics Canada (2011), and Bureau of Economic Analysis (2020). The list of countries with input-output table is longer than the one included in this section.

In order to scale down the input-output analysis and estimate effects at the state or city levels, additional methodological frameworks have to be applied and some regional information needs to be available. The following section elaborates on regional input-output models which are used to conduct studies at the city or state levels.

## **REGIONAL INPUT-OUTPUT MODEL**

Regional input-output model refers to the application of the I-O framework to a smaller geography than its original national accountability application. Based on multiplier effects, the I-O methodology can be employed to estimate the economic impact of an initial change in the final demand of an industry on all other industries within a specific geographic area. This geographic area can be either a country or a smaller geography such as a state or a city. Multiplier effects refer to the idea that an initial change in economic activity leads to diminishing rounds of leakages through saving and spending outside the local economy that are greater than the initial investment (Bess and Ambargis, 2011).

An economic impact analysis through the use of regional I-O model estimates the direct, indirect, and induced effects of a change in economic activity on various outcomes. These economic outcomes are generally measured as changes in output, employment, labor earnings, and value added. Direct effects account for the initial positive or negative changes in the industry in question. Indirect effects reflect changes in inter-industry transactions as supplying industries respond to changes in demand from the directly affected industries. Induced effects refer to the changes in local spending resulting from income changes in the industries sectors directly and indirectly affected (Lobo et al, 2011).

Through the regional I-O estimation of multiplier effects, interrelationships between industries can better be studied. This type of analysis is helpful in identifying key sectors where the most important industries in an economy operate and enables decision makers to identify the industries whose impact from a shock affects other industries the most. Analyzing the inter-industry linkages of an economy is relevant since the current global system is characterized by a complex network of industries intertwined by production ties, implying a faster propagation of shocks and stimulus (Giammetti et al, 2020a). In various regions, I-O has been widely applied to estimate economic impact analysis of transportation projects (Bess and Ambargis, 201; Idaho Transportation Department, 2008; Lynch, 2000). In addition, efforts to estimate the economic impact of COVID-19 in regional economies have been conducted (Dai and Jiaqi, 2013; Demski 2020; Strong and Welburn, 2020; Walmsley et al, 2020).

The economic impact analysis of an exogenous change in a region can be performed by using one of the commercially available regional input-output models in the USA (Lynch, 2000). The three most common models to estimate economic impact analysis are: Regional Input-Output Modeling System (RIMS II), Economic Impact for Planning (IMPLAN), and Regional Economic Modeling Inc. (REMI). Because the prices for these three options vary significantly, the choice between these models is complex and depends on many factors such as research budget. However, results obtained from using any of the three different model options are

closely similar to each other. This can be achieved by controlling for differences in certain rules and techniques used to regionalize national input-output coefficients (Rickman and Schwer 1995).

Economic impact analysis has some limitations because of the assumptions embedded in the I-O model. These limitations are: I-O is a static model; resulting multipliers reflect inter-industry relationships at a given point in time, it does not account for price changes and general equilibrium effects. Second, the I-O model assumes constant returns to scale where rises in output are proportional to a given change in the input levels, which can be unlikely in the real world. Lastly, a limitation that needs to be accounted for when employing I-O models is the assumption of linear production functions.

## **REGIONAL ECONOMIC IMPACT OF COVID-19 ON THE AIR TRANSPORTATION INDUSTRY**

This section applies Regional Input-Output Modeling System (RIMS II) to attempt estimating the impact of COVID-19 in the air passenger sector and its related sectors in the economy of Austin-Round Rock-Georgetown, Texas Metropolitan Statistical Area (MSA). It first provides a background of the Austin-Bergstrom International Airport (ABIA) and elaborates on the methodology used to estimate the monetary loss of deplaned passengers from ABIA due to COVID 19 restrictions.

ABIA is the second-fastest growing mid-sized airport in the USA, providing passenger transportation services to a total of 70 destinations within the USA and abroad (Austin-Bergstrom Airport, 2020). As did other airports around the globe, ABIA restricted both domestic and international flights as an attempt to diminish the spread of the COVID-19 virus. Mobility measures caused substantial losses to the air passenger sector and its related industries. According to ABIA's reports, the total number of domestic flight passengers in 2020 decreased by 61.98% relative to 2019, equivalent to around 10.44 million less domestic passengers flying from and to ABIA as compared to pre-pandemic times. Moreover, total international passengers flying through ABIA experienced an astonishing fall of 84.63% with the emergence of Covid-19 travel bans as compared to 2019.

In order to estimate ABIA's monetary losses from passenger consumers flights, ABIA flight reports including data on passenger totals for the year 2019 and 2020 were used along with the average flight prices per passenger. Hence, monetary losses are built using the absolute change in total domestic passengers and the average cost incurred for travelling. The calculated average price per one-way flight ticket from ABIA was estimated to equal \$120.23 USD for domestic destinations. The

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drastic fall in total domestic passengers in ABIA due to the COVID- 19 pandemic represented a monetary loss of approximately 1.25 billion USD.

To construct this measure, booking prices for all flight destinations serviced by the Austin-Bergstrom Airport were consulted using Google Flights data for one-way tickets. These prices represent the average cost incurred by domestic travelers flying from ABIA, and can be multiplied by the total number of passenger losses resulting from the imposed travel restrictions to estimate the airport's total losses on passenger airfare purchases. In this example, the estimated \$1.25 billion USD monetary loss in the air passenger industry represents an exogenous change in the Austin-Round Rock-Georgetown MSA necessary to conduct a regional I-O analysis. By using RIMS II, it is possible to obtain total multipliers for four different variables: output, employment, value-added, and earnings in Austin-Round Rock-Georgetown, Texas MSA. For simplicity, the rest of the document will use Austin MSA and Austin-Round Rock-Georgetown, Texas MSA indistinctly. Table 1 presents the Final Demand Type II multipliers for the air transportation industry in Austin MSA.

*Table 1. RIMS II Total Multipliers (2012-2019) in Austin MSA (Type II)*

<b>Industry</b>	<b>Output</b>	<b>Employment</b>
Air Passenger	1.61	6.08

*Source:* RIMS II

The estimated output multiplier of 1.61 suggests that for every \$100 USD loss in the air passenger sector in Austin MSA, its economy incurred an additional loss of \$61 USD. This additional loss in output is attributed to indirect and induced effects. Indirect effects refer to the monetary loss in related industries to the air passenger industry. Induced effects refer to the monetary loss attributed to local spending that is given away because of employment loss in the local economy.

The estimated employment multiplier of 6.08 suggests that for every 100 jobs loss in the air passenger sector in Austin MSA, its economy incurred an additional loss of 508 jobs. This additional loss is attributed to indirect and induced effects. Indirect effects refer to the employment loss in industries supported by the air passenger industry. Induced effects refer to the employment loss attributed to local spending that is given away because of employment loss in the local economy. By using RIMS II's Type II multipliers, it is possible to estimate the total economic impact of COVID-19 in the air passenger sector and its related sectors in Austin MSA. Table 2 presents the total economic effects due to COVID-19 impact in the air passenger industry in Austin in the year 2020.

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*Table 2. Total Economic Effects due to COVID 19 Impact in Air Transportation Sector in Austin, 2020*

Indicator	Total Effect
Output (in million 2020 USD)	-\$1,027.39
Earnings (in million 2020 USD)	-\$229.97
Employment (in jobs-year)	-3,875
Value Added (in million 2020 USD)	-\$514.20

*Source:* Authors' calculations using RIMS II Type II Multipliers.

Total output loss in Austin MSA is estimated at \$1.02 billion USD due to COVID-19 effects in the Air Transportation Sector in 2020. In addition, RIMS II analysis estimates that 3,875 jobs were lost within Austin MSA due to COVID-19 effects in the Air Transportation Sector in 2020. This job loss represented a total earnings loss of \$229.97 million USD. Lastly, the value-added loss in Austin MSA is estimated at \$514.20 USD in 2020.

RIMS II analysis allows breaking down the total estimated loss in output by industry. Table 3 presents the most impacted sectors in output loss experienced by the air transportation sector in Austin due to COVID-19 in 2020.

*Table 3. Top 10 Industries by Output Loss due to COVID 19 in Austin, 2020*

Rank	Industry	Estimated Output Loss in Million 2020 USD
1	Transportation and warehousing	-\$674.55
2	Real estate and rental and leasing	-\$66.69
3	Finance and insurance	-\$40.10
4	Wholesale trade	-\$29.07
5	Food services and drinking places	-\$26.27
6	Health care and social assistance	-\$25.57
7	Retail trade	-\$23.91
8	Admin. and supt. and waste mgmt. and remediation services	-\$21.93
9	Information	-\$21.68
10	Professional, scientific, and technical services	-\$20.98

*Source:* Authors' calculations using RIMS II Type II Multipliers.

Table 3 suggests that Austin's Transportation and warehousing sector was the most impacted sector of the list with a total estimated loss of \$674.55 million

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USD. Real estate and rental and leasing sector’s output loss is estimated at \$66.69 million USD. Finance and insurance sector output loss ranks third in the list and is estimated at \$40.10 million USD. Wholesale trade sector’s output loss is estimated at \$29.27 million USD followed by Food services and drinking places. Health care and social assistance’s total output loss is estimated at \$25.57 million USD. Retail trade output loss is estimated at \$23.93 million USD and Admin. and supt. and waste mgmt. and remediation services sector ranks eight in the list and its output loss is estimated at \$21.93 million USD. Information sector and Professional, scientific, and technical services sector incurred in a total output loss of \$21.68 and \$20.98 million USD, respectively.

Additionally, RIMS II allows estimating the most affected sectors in terms of employment loss attributed to losses in the air transportation sector. Table 4 presents the most impacted sectors in employment loss experienced by the air transportation sector in Austin due to COVID-19 in 2020.

*Table 4. Lowest 10 Industries by Employment Loss due to COVID 19 in Austin in million 2021 USD*

<b>Rank</b>	<b>Industry</b>	<b>Estimated Employment Loss in Million 2020 USD</b>
1	Transportation and warehousing	-1278
2	Food services and drinking places	-427
3	Real estate and rental and leasing	-349
4	Retail trade	-273
5	Admin & supt & waste mgmt & remediation services	-263
6	Finance and insurance	-257
7	Health care and social assistance	-223
8	Other services	-159
9	Professional, scientific, and technical services	-135
10	Accommodation	-95

*Source: Authors’ calculations using RIMS II Type II Multipliers.*

Table 4 suggests that Austin’s Transportation and warehousing sector was the most impacted sector of the list with a total estimated loss of 1278 jobs. Food services and drinking places sector’s employment loss is estimated at 427. Real estate and rental and leasing sector’s employment loss ranks third in the list and is estimated at 349. Retail trade sector’s employment loss is estimated at 273 followed by Admin

& supt. & waste mgmt. & remediation services which accounted with an estimated employment loss of 263.

Finance and insurance sector's employment loss is estimated at 257. Health care and social assistance's total employment loss is estimated at 223. Other services sector, Professional, scientific, and technical services sector and Accommodation sector incurred in a total employment loss of 159, 135, and 95 jobs, respectively.

## **FUTURE RESEARCH DIRECTIONS**

This section discusses ideas to further elaborate on the I-O methodology to be implemented in estimating the environmental impact of post-pandemic demand in the air passenger transportation sector and interrelated sectors for future research purposes. By integrating the calculations of economic impact and environmental impact analyses into the available modeling tools to measure impacts related to COVID-19, local governments could implement policy recommendation theoretically informed to achieve sustainable economic development.

In an effort to integrate the goals of economic development and environmental challenges, the United Nations Brundtland Commission of 1987 defines sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (UN General Assembly, 1987). Sustainable development hence differentiates from pure economic growth and environmentalism by pursuing the preservation of resources for future generations. Seeking long-term economic and environmental stability while accounting for intergenerational equity is only plausible through the joint acknowledgement of social, economic, and environmental interests throughout the decision-making process (Emas, 2015). Sustainable development cannot be secured unless development policies account for changes in resource access and oversee the distribution of these policies' costs and benefits (UN General Assembly, 1987).

I-O model is not limited to the estimation of economic impact analysis of transportation projects, natural disasters or public health crises. This methodology is also suitable for environmental applications, providing insights to propose sustainable and informed policies, as seen in Su and Ang (2013) and Wiedmann et al (2006) who apply I-O modeling to assess energy-related CO<sub>2</sub> emissions and the environmental impacts embodied in international trade. For instance, a future research path could provide a methodological framework to use I-O using environmental outcome variables to estimate the environmental COVID-19 impact in the air passenger industry in a specific geography.

Along with the limitations of the I-O model described in this book chapter (i.e. static model, linear production functions, and constant returns to scale assumptions),



it is important to highlight that I-O analysis conducted with RIMS-II does not account for the effects on environmental or social variables due to changes in economic activity. Nevertheless, I-O modelling can be combined with cost-benefit analysis in order to assess policy makers and stakeholders on informed decisions that align with the goals of sustainable development and entail the economic, social, and environmental impact of programs and policies. In essence, cost-benefit analysis provides insights into the advantages and disadvantages of a policy measured as the impact of society as a whole, often expressed as the balance of benefits minus the costs converted to monetary terms (Renes & Romijn, 2013).

By incorporating social aspects into a cost-benefit analysis a social cost-benefit analysis (SCBA) could be implemented. SCBA has been widely used for the assessment of new projects and programs around the world. To provide an example, Murty et al. (2006) provide a SCBA assessing the costs and gains derived from the construction of the Delhi Metro in India. The study accounts for the social and environmental benefits of this project, including reductions in pollution and fuel consumption, savings in travel time, and decreases in traffic congestion and accidents.

## **CONCLUSION**

The main focus of this book chapter consisted of explaining to what extent I-O and its applications to regional level could be applied to estimate the economic impact of COVID-19 in the air transportation industry and as an economic instrument for planning. In times of crisis, like the one brought by the COVID-19 pandemic, the identification and prioritization of key industries through I-O analysis is heavily relevant for faster economic recovery and the provision of relief aid by governments and policy makers.

The I-O model can be applied to air passenger travels in the short-run, the medium-run, and the long-run by air transportation sector representatives as well as by regional governments seeking to implement policy strategies. In the short-run, this type of analysis is helpful in identifying the most affected industries related to the air-passenger industry. By identifying the most affected industries, local governments could be able to set up recovery strategies and prioritize the industries that will contribute for a faster regional recovery.

In the medium run, as travel restrictions are lifted, passengers will start traveling and spending money locally, local governments could assess the performance of those high value-added industries and plan taxing strategies. If those high value-added industries are supported through incentive relieves government funds a faster recovery could take place compared to either not providing incentive relief or providing them to other industries without a methodologically supported, or uninformed, decision.

In the long-run, as the air passenger industry and their related sectors fully recover, pollution and green-related issues could be incorporated and assessed through complementary techniques such as social cost-benefits analysis or willingness to pay in combination with input-output analysis. With these techniques, government officials can eventually impose green taxes to both the air passenger industry and their related industries. By imposing taxes, the incentive reliefs could be paid off first, then the remainder could be used to repair environmental damages.

A document including a methodological framework to apply I-O in estimating the economic impact of COVID-19 in the air passenger transportation sector in a local economy along with its application to a particular area and providing available resources regarding the mathematical framework of I-O was yet to be included in the literature. Along with the I-O framework description and its applicability, this chapter estimated the economic impact of the air passenger transportation industry in Austin MSA, Texas, USA using the Regional Input-Output Modeling System (RIMS II). I-O could serve as a theoretically informed planning framework for policymakers and governments to support the funding allocation process. Governments could direct resources to the most impacted industries related to the air passenger industry in the local economy by analyzing intra-industry interactions and subsequent economic impacts. Additionally, I-O could contribute to alleviating the uncertainty faced by decision-makers during and at a post-pandemic era.

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## KEY TERMS AND DEFINITIONS

**Direct Effects:** Initial changes in production or spending emerging as a result of a change in economic activity or policy by the final-demand industry.

**Earnings:** Total value of all forms of labor income.

**Economic Impact Analysis:** Methodology used to estimate the direct, indirect, and induced effects of a change in economic activity, policy change or project taking place in a particular area on various outcomes. These outcomes are generally output, value added, earnings, and employment.

**Employment:** Number of full-time and part-time jobs.

**Indirect Effects:** Changes in intra-industry demand as it responds to a change in economic activity in directly affected industries.

**Induced Effects:** Changes in spending resulting from changes in household labor earnings due to changes in production in directly and indirectly affected industries.

**Metropolitan Statistical Area (MSA):** It is a city and its adjacent areas. More formally, it is a central urbanized area and contains the majority of the population hub and surrounding communities that have a high degree of economic and social interaction with that center, as determined by the United States Census Bureau.

**Output:** Total value of production measured as the value of intermediate expenditures plus value added.

**Total Effects:** Sum of direct, indirect, and induced effects.

**Value Added:** Equivalent to gross domestic product. It is the total income generated from production measured as the difference between an industry's total output minus the costs of its intermediate inputs.

## Chapter 6

# European Low-Cost Airlines in Ukraine: Features of Entry and Consolidation in the National Market

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### ABSTRACT

*This chapter is devoted to the issue of entry and activity of European low-cost airlines in the Ukrainian market. Ukraine, with the largest territory and population in Eastern Europe, is an important partner of European countries. The rapid development of air transportation between Ukraine and European countries in the 21st century is based on two factors: 1) high tourist interest in the historical and cultural heritage of Europe and 2) communication of migrant workers, the number of which is steadily growing. The authors reveal the specifics of the entry and development by European airlines of market niches of low-cost transportation in Ukraine in 2008-2021. In particular, the activities of airlines are considered: Ryanair, Wizz Air, German Wings, Meridiana, Ernest Airlines, Vueling Airlines, AegeanAir, Air Baltic, Austrian Airlines, and others. The activity of European low-cost carriers in the number of flights and directions of passenger transportation in Ukraine is evaluated.*

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## **INTRODUCTION AND BACKGROUND**

Low-cost flights in Europe have become quite popular and stimulate the development of mass tourism. They are successfully developed by low-cost airlines, which allow to fly at budget prices in different directions. Low-cost carriers (LCCs) have become an ideal alternative to transportation in the global economic crisis. It is especially relevant for Ukrainians, because it allows to travel even to those who have a relatively low income.

Low-cost airline is an air carrier that offers generally low rates, but at the same time does not provide most of the traditional passenger services. Key elements of LCC business model in today's conditions there is one class of service, simple tariff structure with limited differential services and there is no practice of return money for an unused ticket and rebooking services.

This chapter aims to investigate the issue of entry and consolidation of European low-cost airlines in the Ukrainian market in the Pre-Covid-19 Era, the impact of the COVID-19 crisis on the activities of LCCs, and Post-COVID-19 recovery of the low-cost air transportation market in Ukraine in 2021.

Ukraine is a member of such international aviation organizations as the European Civil Aviation Conference (ECAC), the European Organization for the Safety of Air Navigation (EUROCONTROL) and the International Civil Aviation Organization (ICAO). On 12 October 2021, Ukraine and the EU signed a Common Aviation Area (CAA) agreement, as part of the 23<sup>rd</sup> Ukraine-EU summit in Kyiv. It is an important step in supporting the process of liberalization of air services.

The development of international tourism and air transportation in Ukraine should be considered as interdependent processes. They were significantly influenced by international geopolitical factors.

The aviation industry in Ukraine began to develop after the state gained independence. In September 1992, Ukraine became a member of ICAO. In October 1992, the State Air Traffic Services Enterprise (UkSATSE) was established. In May 1993, it adopted its own Air Code and established scheduled flights to more than 70 countries.

In the difficult economic realities of the formation of the state of Ukraine in the 90s of the twentieth century there was a sharp decline in air traffic: the number of departing passengers decreased 11.5 times (from 15 million in 1990 to 1.3 million in 1999), and in a number of regional airports even more – dozens of times. The economic crisis in Ukraine, the rupture of planned economic ties with the countries of the former USSR, the formation of a market economy, a sharp decline in real incomes have led to this. Since 2000, a slow increase in air traffic has been observed. In 2001, according to the State Statistics Service of Ukraine, 2.1 million passengers used air transport in Ukraine, in 2007 – 6.2 million.

Since 2008, Ukrainians have been able to fly more economically and more often thanks to the entry into the market of the first European low-cost airline Wizz Air.

There are several stages in the development of international low-cost air transportation in Ukraine, in particular:

- rapid formation of the low-cost air transportation market: from the arrival on the Ukrainian market of the first low-cost airline Wizz Air to the beginning of the Russian aggression against Ukraine (2008-2013);
- geopolitical depression of the low-cost market, due to the beginning of the Russian aggression against Ukraine and the occupation of Crimea and border cities in eastern Ukraine (2014-2016);
- restart and exponential growth of the international low-cost air transportation industry, due to the introduction on June 11, 2017 for Ukrainian citizens of a visa-free regime with the EU (2017-2019);
- COVID-19 collapse of the LCC market (March 2020-May 2021);
- partial recovery of low-cost air transportation (spring-summer 2021);
- Post-COVID-19 recovery of the low-cost air transportation market in Ukraine and the competitive struggle for the consumers (from summer 2021).

Since 2012, when Ukraine hosted the EURO 2012 football championship, the entry of European LCCs into the Ukrainian market has been intensified. In 2012-2013, such companies as the Spanish Vueling Airlines, the Italian Air One (subsidiary Alitalia), Air Onix, the Latvian AirBaltic, the Turkish Atlasjet and others have established themselves in the Ukrainian market thanks to powerful marketing companies and promotional prices. Over the next few years, low-cost brands became established in Ukraine: the Arab Air Arabia, the Israeli UP, the Italian Ernest Airlines, the Greek AegeanAir, the Turkish Pegasus Airlines, and the Azerbaijani AZAL jet.

The main limiting factor in the growth of Ukrainian demand for international low-cost travel in 2008-2016 was the difficulty in obtaining Schengen visas. Wealthy Ukrainians, who received visas without problems, traditionally remained loyal to traditional scheduled airlines. Instead, tens of thousands of poorer Ukrainians, potential consumers of LCCs, faced the problem of complying with the financial formalities required to obtain a tourist Schengen visa.

In 2016-2017, the LCC market recovered after a two-year decline due to the Russian aggression against Ukraine. Thus, in 2016, the volumes of passenger air transportation exceeded the figure of 2013 by 2%, and in 2017 – by 30%. During 2017-2019, the outbound tourist flow received a strong impetus to growth due to the introduction of a visa-free regime with EU on June 11, 2017.

The work of low-cost airlines due to the introduction a visa-free regime with the EU showed an exponential growth trend. Qualitative changes have taken place in the



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structure of the incoming tourist flow from non-border countries. Thus, during the first year of the visa-free regime, a significant increase in the flow of air tourists was achieved: from Lithuania – by 32.0%, Latvia – 18.1%, Germany – 17.5%, Canada – 11.4%, China – 11.1%. The trend of increasing tourist flows also continued: from France – 6.0%, USA – 5.6%, Czech Republic – 5.6%, Georgia – 4.5%, Italy – 3.9%, Great Britain – 2.7%, Bulgaria – 2.4%.

Such a dynamic growth of incoming passenger flights to the cities of Ukraine had a positive effect on the country's economy in general and for the tourism industry in particular. Statistics of Kyiv, Lviv, and Odessa recorded an increase in average 40-55% of revenues to local budgets, the flow of air tourists led to job creation, improving living standards. For example, in 2017, revenues to the local budget of Lviv from inbound tourism increased by 81%; 2.6 million tourists spent EUR615 million in Lviv. On average, one tourist spent EUR75 a day.

Before the beginning of the COVID-19 crisis, European LCCs dominated the market of budget passenger transportation in Ukraine. In 2019, the leadership in the Top 10 ranking in popularity among the citizens of Ukraine was held by the following airlines: Ryanair, Wizz Air, SkyUp, Ernest Airlines, EasyJet, Vueling, AirBaltic, EstonianAir, AegeanAir, and GermanWings. In 2019, foreign low-cost airlines opened 29 new flights in Ukraine, including 21 new flights by leading airlines Ryanair and Wizz Air.

## **LITERATURE REVIEW**

Fundamental market transformations of the airline industry have been going on since the end of the 20<sup>th</sup> century (Belobaba, Odoni, Barnhart eds., 2015; Evert R. de Boer, 2018). The development of mass tourism is forming an ever-increasing demand for transportation, an alternative to expensive traditional airlines (Pappas & Bregoli eds., 2016). Over the past 20 years, we have seen an unprecedented boom in a new type of airlines – low-cost carriers (Atiqur, Hossan, Zaman, 2012). In the 21<sup>st</sup> century, LCCs are steadily increasing their market niche and actively ousting traditional airlines from the market (Detzen et al., 2012; Mason, Morrison, Stockman, 2013; Gross & Lück eds., 2016; Heshmati & Kim, 2016; Dhingra & Yadav, 2018; Mazareanu ed., 2021; Global LCC Market Research Report, 2021). Price rivalry in airline markets of a network carrier against a low-cost carrier intensifies and in some cases encourages traditional airlines to establish their own low-cost subsidiaries (Fageda, Jiménez, Perdiguero, 2011; Bubalo & Gaggero, 2015; Pérez & Dobruszkes, 2019; Panduwinasari, Afandi, Wahyuni, 2020).

The LCC's business concept makes flights available to millions of average consumers and radically changes the picture of international tourist flows (Button,

2012; Vidović, Štimac, Vince, 2013; Koo, Lim, Dobruszkes, 2017; Akpur & Zengin, 2019; Dileep, 2019; Graham & Dobruszkes eds., 2019; Arora, Mittal, Mishra, 2020). New information technologies of simplified ticket booking and combination of routes, various smartphone services and applications actively contribute to this (Hassan, 2020).

In recent decades, LCCs have mastered not only the markets of economically developed countries. They are actively developing the markets of less developed countries (Huderek-Glapska, 2020), for example, Ukraine. In these countries, they are rapidly gaining popularity and loyalty of the mass consumer due to their attractive tariffs and opportunities to make budget trips (Dobruszkes, 2013; Forgas-Coll, Palau-Saumell, Sánchez-García, 2015; Riorini & Widayati, 2018).

Many scientific works of leading scientists, business analysts and experts-practitioners are devoted to the study of the processes of development of the low-cost air transportation sector every year. Thanks to the efforts of the international scientific community, a comprehensive research methodology has been developed with the involvement of a range of methods: from empirical to econometric (Dobruszkes, 2014a; de Wit & Zuidberg, 2016; Miranda, Baltazar, Silva, 2016; Antunes & Martini, 2020; Iacus, Natale, Santamaria, Spyrtatos, Vespe, 2020; Sabaitytė, Davidavičienė, Van Kleef, 2020; Mazareanu ed., 2021).

The modern geography of European air transport is inconceivable without Ukraine (Bjelicic, 2013; Dobruszkes, 2014b). Since 1991, the airspace of Ukraine has been actively integrated into the pan-European market and has been functioning according to its rules (Huderek-Glapska, 2020; Savych & Shkoda, 2020). Following the examples of successful European companies, the industry of national LCCs and traditional scheduled airlines with low-cost tariffs has been born in Ukraine in recent years (Kasianova & Suvorova, 2016; Savych & Shkoda, 2020).

In a number of works, scientists convincingly prove the positive effect of low-cost air transportation on the local economy (Ivanova, 2017; Tomczewska-Popowycz & Quirini-Popławski, 2021). This statement is true for both developed and third world countries (Graham et al. eds., 2020; Zhang & Graham, 2020).

Features of the evolution of the air transportation market in Ukraine are presented in publications of Kasianova & Suvorova (2016), Oleshko & Heiets (2018), Savych & Shkoda (2020), etc. In Ukraine, low-cost airlines make a significant contribution to the development of international tourism. Destinations to which LCCs arrive show rapid statistical growth of the economy of tourism and hospitality, growth of welfare and mobility of the population (Dziedzic & Warnock-Smith, 2016; Dobruszkes, Givoni, Vowles, 2017; Butowski, 2018; Nistoreanu ed., 2020; Wisła & Nowosad, 2020).

COVID-19 caused a devastating crisis for the aviation sector, including in the low-cost segment (Albers & Rundshagen, 2020; Budd, Ison, Adrienne, 2020; Nhamo,

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Dube, Chikodzi, 2020; Dube, Nhamo, Chikodzi, 2021; Sun, Wandelt, Zheng, Zhang, 2021). However, low-cost airlines in 2020 and 2021 show better recovery trends compared to traditional airlines. It should be noted that in Ukraine today LCCs, along with charter airlines, play a significant role in reviving the air potential of the state (State Statistics Service of Ukraine, 2021).

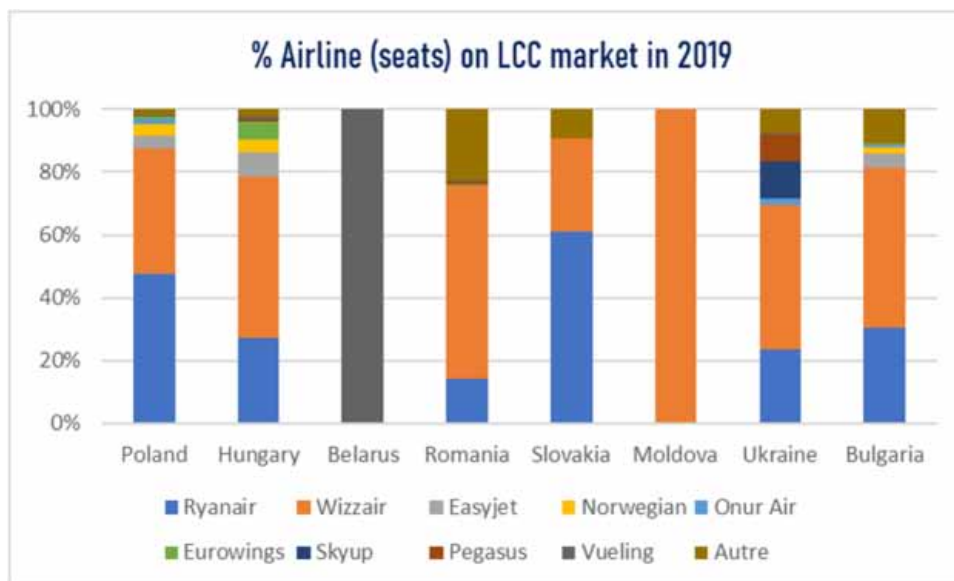
## PRESENTATION OF DATA AND RESULTS

### Statistical Trends in the Development of Air Transportation in Ukraine

In the 21<sup>st</sup> century, Ukraine's air transportation industry is experiencing a difficult stage of development, complicated by external geopolitical, economic and pandemic challenges (Figure 1).

Figure 1. En-Route in Ukraine, in 2000-2020

Source: [www.eurocontrol.int](http://www.eurocontrol.int)



A few years before the global pandemic, Ukraine's aviation industry survived the crisis of 2014-2016, caused by the invasion of the military of the Russian Federation in Ukraine, the occupation of Crimea, the loss of airports in Simferopol, Donetsk

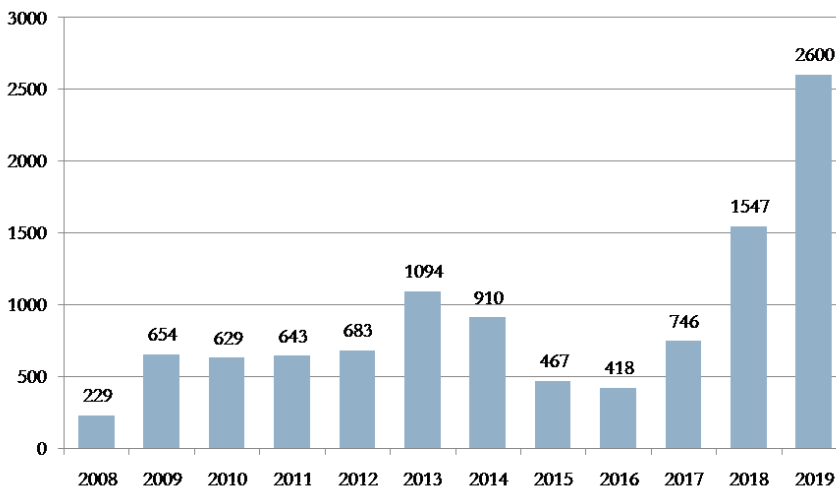
and Lugansk, the shooting down of 1 civilian and 9 military aircraft by modern missile systems of the Russian army, the closure of airspace in eastern Ukraine, the cessation of Russian air transit and flights to the Russian Federation.

About 30% of Ukraine's transit traffic passed over Crimea, 27% over the eastern part of the country. That is, in 2014, up to 60% of transit potential was lost. Until now, Ukraine loses up to 7 million passenger traffic annually due to the Russian Federation's occupation of the territories with the airports of Simferopol, Donetsk and Luhansk. It should be noted that the top airport in Simferopol in 1991-2014, which is now located in the occupied territory, annually serves about 5 million passengers.

By 2014, the volume of low-cost transportation by companies on international routes through the airports of Ukraine was steadily growing: from 550.2 thousand people (7% of the total air traffic of Ukraine) in 2011 to more than 1.2 million people (12% of total traffic) in 2013. The government and all international experts have modeled one of the highest forecast trends for the industry in CEE in correlation with the increase in the welfare of the population and the simplification of the visa regime with the European Union. More than 80% of low-cost transportation was operated by Wizz Air Ukraine, Wizz Air Hungary, Air Arabia, FlyDubai, Pegasus Airlines and Wind Jet. The aggression of the Russian Federation in 2014 brought down the aviation market of Ukraine to indicators of ten years ago (Figure 2). At the same time, there was a sharp decline in GDP, the devaluation of the national currency (by 97.3%), the deterioration of the purchasing power of the population and the reduction of tourist mobility.

*Figure 2. Dynamics of development of LCC markets in Central and Eastern Europe (CEE) in 2011-2019*

*Source: Eurostats, Aérogestion, 2021*



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In such crisis realities, the airports of Ukraine since 2014 (after the criminal shooting down of the Boeing 777 flight MH17 by the Russian Buk missile system) continued to actively fight for passenger traffic and gradually restore trust and reputation.

In 2017, airlines in Ukraine carried a record number of passengers (10.55 million). In 2017, Ukrainian airports also showed record growth. So, passenger traffic through the air gates of Ukraine increased in 2017 by 28%. The number of serviced aircraft was almost 160 thousand, which is 20% more than in 2016. Interestingly, 98% of total passenger traffic was concentrated in seven airports in Ukraine: Boryspil, Kyiv, Odessa, Lviv, Kharkiv, Dnipro and Zaporizhia. In the ranking of the largest airports in Central Europe, Kyiv Boryspil took 6<sup>th</sup> place after Vienna, Warsaw, Prague, Budapest and Bucharest.

In 2018, Ukrainian airports served more than 20 million passengers. In 2019, 24.3 million passengers were served (+ 18.5%), of which almost 22 million travelers (+19.8%) took advantage of international flights. The Ukrainian market of passenger air transportation for the first 6 months of 2019 showed a record growth of 20% compared to the same period last year (+10.7 million passengers). It was a record 2<sup>nd</sup> place among Central European countries. (Poland was the leader, +22.3 million passengers).

In 2019, scheduled passenger flights to Ukraine were operated by 40 foreign airlines from 37 countries (including four new ones – the Austrian Laudamotion (until October 31, 2020), the French Aigle Azur (until September 27, 2019), the Israeli Israir Airlines and the Norwegian Scandinavian Airlines System).

In 2019, Ukrainian airlines carried 13.7 million passengers, which are 9.5% more than in 2018, of which 12.6 million people were transported on international flights (+9.7%). Ukraine's largest airline is UIA, which has been successfully developing since 1992 under the protectorate of governments and influential oligarchic groups. On average, 65-69% of all passengers of Ukrainian airlines use UIA services every year.

In 2019, Azur Air Ukraine set new record in the charter segment (1.74 million), and SkyUp – in the charter and low-cost segment (1.7 million passengers, which is 4 times more than 442 thousand people in 2018). The average load of low-cost international flights SkyUp in 2019 was 89%, Wizz Air and Pegasus Airlines – more than 95%. In 2019, airBaltic carried 215,438 passengers on three Ukrainian routes (+ 62% vs 2018); 35% of travelers traveled to Riga or from Riga, 65% – used Riga for transfer to the next flight. The most popular airBaltic transfer destinations for Ukrainian passengers were Tallinn, Helsinki, Oslo, Stockholm, Turku, Copenhagen, Amsterdam, Berlin, Moscow and St. Petersburg.

On the eve of the COVID-19 crisis, Ukraine fully felt the positive effects of the global increase in air traffic as, firstly, a transit country between Europe and Asia, and secondly, as a country with a high balance of migrant workers and tourists.

(Labor migration of Ukrainians to the EU increased from 0.51 million in 2008 to about 2.4 million in 2019. During 2017-2019, 14.0-14.2 million foreign tourists visited Ukraine annually).

In total, in recent years, Ukraine served more and more flights: in 2018 – 300,853 flights (+ 18.5%), in 2019 – 335,407 flights (+ 11.5%). The density of air traffic in the country had a parity balance at the level of 1 to 2 between domestic and foreign airlines. Thus, in 2018, 106,654 flights were operated by Ukrainian airlines (+ 9.7%) and 194,199 flights – by foreign airlines (+ 23.9%), in 2019, respectively – 109,777 flights (+ 2.9%) and 225,630 flights (+ 16.2%). By type of flight in 2019, 141,680 were transit (+ 13.2%), 162,937 – international (+ 11.5%), 30,790 – domestic (+ 4%). That is, in recent years, Ukraine has established the status of an active subject of global air communications with an approximately equal ratio (41-48%) of segments of transit and international flights with departure or landing at the country's airports.

In 2014-2019, the most frequent flights in the Ukrainian sky were operated by UIA, Turkish Airlines, Belavia, Wizz Air and LOT (according to UkSATSE, which provides air navigation services in Ukraine). And the highest traffic growth trends in 2019 were demonstrated by low-cost and mixed-type companies: SkyUp – 10631 flights (+ 340.9%), Ryanair – 9295 flights (+ 437.9%), Azur Air Ukraine – 7229 flights (+ 48.8%), Wizz Air Hungary – 20944 flights (+ 37.3%), Turkish Airlines – 33716 flights (+ 12.5%), Qatar Airways – 5893 flights (+ 26.1%), etc.

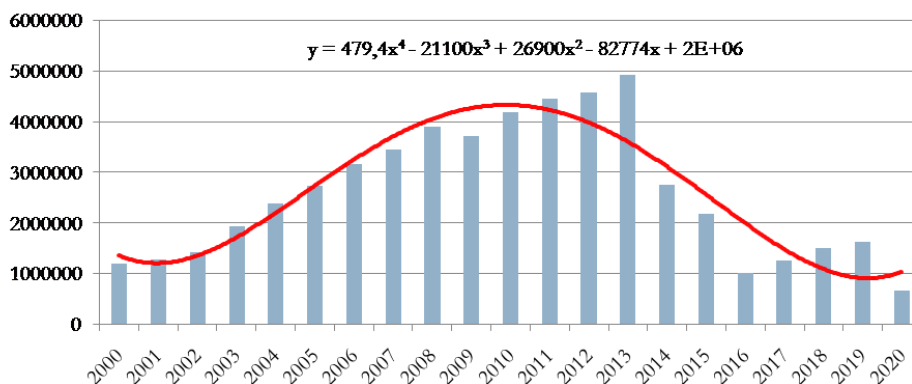
At the beginning of quarantine in March-May 2020, the number of flights in the airspace of Ukraine decreased by more than 96%. The gradual revival of air flights in Ukraine began with the resumption of domestic passenger flights on June 5 and the resumption of international air transportation from June 15, 2020. In the tourist peak of August 2020, 6,690 flights took place, which is 56.3% less than in August 2019. Ukrainian airlines operated 6,373 flights, which is 45.5% less than in August 2019, foreign airlines operated 10,317 flights, which is 61.1% less than in 2019.

Passenger traffic at Ukrainian airports in the first half of 2021 showed a high rate of recovery: 479.1 million people were carried (Figure 3). The reason is the easing of quarantine restrictions and the beginning of the tourist season. Charter flights in the south-eastern direction (Turkey, Egypt, Bulgaria, Cyprus) were the first to resume.

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Figure 3. Ukraine: dynamics of recovery of the average daily flights for April-August 2021 compared to the same period in 2019

Source: [www.eurocontrol.int](http://www.eurocontrol.int)



In July-August 2021, a new powerful impetus to the resumption of intensive low-cost communication between Ukraine and the EU was given by the governments of a number of European countries, which allowed vaccinated Ukrainians to enter for tourist purposes. This permit led to a sharp increase in passenger traffic from Ukraine to the tourist countries of the Mediterranean in the second half of the summer. Consumers sought to take the opportunity to rest, as in the autumn of 2021, new restrictions on air travel are likely to take effect in the EU due to the spread of the Delta strain.

## SUCCESS STORIES OF EUROPEAN LOW-COST AIRLINES IN 2008-2019: COMPETITIVE DEVELOPMENT AND CONSOLIDATION IN THE UKRAINIAN MARKET

In 2008, a new stage in the development of the air transportation market began in Ukraine. In September 2008, at the Ukraine-EU summit in Paris, President Viktor Yushchenko agreed with the EU leadership to launch a dialogue to determine the conditions for a visa-free regime. Since 2005, Ukraine has started an international promotion and abolished visas for tourist visits of EU citizens. As a result, 2008 was a record year for Ukraine in all years of independence in terms of inbound tourism – the country was visited by about 25.5 million people. An increase of 13% was observed in 2012, due to the final matches of the European Football Championship “Euro-2012”. The last positive stimulus to another sharp intensification of international

passenger exchange between Ukraine and the EU was the decision of the Council of the European Union on May 11, 2017 to abolish short-stay visas (for up to 90 days-180 days) for Ukrainian citizens visiting the Schengen States (except the UK and Ireland). As a result, for the period from May 11, 2017 to May 11, 2019, citizens of Ukraine made more than 33 million trips to EU countries and the Schengen Area.

Since 2008, Ukrainians have been able to fly more economically and more often thanks to the entry into the market of the European low-cost airlines. EU LCCs have actively contributed to the development of European sympathy of the population of Ukraine, especially tourist-mobile youth. Young people, who actively traveled through Europe for 5 years thanks to budget flights, became the basis of the youth uprising in 2013, which was called the Revolution of Dignity and won the desire of Ukrainians for European integration.

The leaders among foreign airlines in 2010-2019, which carried out low-cost air transportation in Ukraine, were:

- Wizz Air operates direct flights to Poland, Germany, Lithuania, Latvia, Estonia, Great Britain, Denmark, Hungary, Greece and other countries;
- Ryanair carries passengers to all major EU cities and main hubs of the British Isles (London, Manchester and Dublin);
- SkyUp is the first national low-cost carrier;
- Pegasus operates flights to Turkey and Asian countries;
- Onur Air operates flights to Turkey;
- Vueling operates flights only from Kyiv to Rome and Barcelona;
- AirBaltic operates flights to Riga, Vilnius;
- EstonianAir operates low-cost flights from Kyiv to Tallinn;
- Ernest Airlines operated flights to Rome, Milan, Venice and Naples in 2017-2019;
- Meridiana operated flights from Kyiv to Calgary and Naples in 2014-2016;
- AegeanAir operates flights from Kyiv to Athens;
- GermanWings operated flights (until April 7, 2020) from Kyiv to Frankfurt am Main and Munich;
- Buta Airways, a low-cost brand within the structure of the Azerbaijani state airline AZAL, operates flights from Baku to the airports of Ukraine.

The success story of Wizz Air in Ukraine began in 2008. The fact that Ukraine reached the peak value of inbound tourism in 2008 is a significant contribution of this low-cost airline, which opened and made Ukraine available to thousands of budget tourists through the introduction of a promotional tariff policy.

In the Ukrainian market, Wizz Air for the period 2008-2021 experienced 2 stages of ups and downs, stagnation in 2020, and a rapid increase in passenger traffic in 2021.

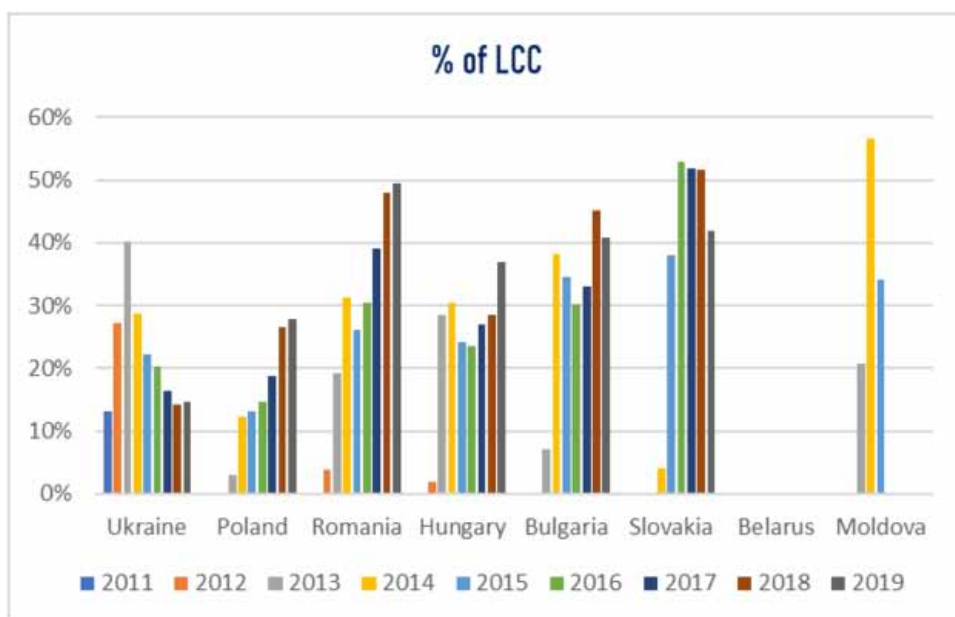


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In 2008, Wizz Air carried 229 thousand passengers, and 5 years later in 2013 – more than 1 million passengers. Large-scale aggression of the Russian Federation against Ukraine, criminal shooting down of flight MH17 by Russian missiles, disinformation fake campaigns against Ukraine collapsed Wizz Air passenger traffic in 2016 to 416 thousand people. However, before the COVID-19 pandemic in 2019, the airline carried 2.6 million passengers on Ukrainian route (Figure 4).

Figure 4. Wizz Air passenger traffic on Ukrainian routes in 2008-2019, thousand passengers

Source: Wizz Air, 2021



In July 2008, a subsidiary of Wizz Air Ukraine began operations. It had a separate IATA code WU, a Ukrainian operator's certificate and a fleet consisting of one Airbus A320 aircraft with Ukrainian registration. Boryspil became the base airport. In July-December 2008, the network consisted only of domestic routes – from Kyiv to Lviv, Odessa and Simferopol, and from Lviv to Simferopol. For the first time in the history of Ukraine, the airline sold tickets at an unprecedentedly low price of \$ 1.5 one way. For six months of operation on the Ukrainian market, the Wizz Air brand has become a symbol of budget tourism for the economically active population of the country.

In December 2008, Wizz Air Hungary entered the Ukrainian market and opened its first flight to Ukraine – London (Luton)-Kyiv. In January 2009, Wizz Air Ukraine opened the first international routes. Low-cost began flying from Kyiv to Dortmund, Katowice, Cologne, Thorpe, and from Lviv to London and Dortmund.

It was very difficult for traditional international airlines to compete in the Ukrainian market with the Wizz Air brand, which won the trust of consumers. An illustrative example was the competition with the Lufthansa Group. In 2009, Lufthansa Group in the competition for the Ukrainian market with Wizz Air opened a flight program of its low-cost subsidiary GermanWings on the route Kyiv-Cologne. However, the greater popularity of the Wizz Air brand in the following 2010 forced Germanwings to cancel this flight program due to low aircraft load.

In February 2013, Wizz Air Ukraine announced the opening of flights from new cities in Ukraine – Kharkiv and Donetsk. At the same time, in July 2013, Wizz Air Ukraine was pushed out of its last domestic route Kyiv-Simferopol in Ukraine due to unfair competition from Air Onix. Instead, in 2013 Wizz Air Ukraine focused on the development of its new base in Ukraine – Donetsk Airport. It received a new A320. The route network from Donetsk covered Bergamo, Dortmund, Kutaisi, Memmingen, London, Rome.

At the beginning of 2014, Wizz Air completely dominated the LCC market of Ukraine (61.6%), and the second and third positions were held by competitors with 3-5 times smaller niches: Pegasus Airlines (17.1%) and FlyDubai (11.6%).

The military aggression of the Russian Federation in 2014 forced Wizz Air Ukraine to significantly reduce business activity. The airline lost its base in Donetsk and significantly reduced the route network from Ukraine due to a sharp drop in demand. The airline also refused to receive the fifth aircraft to open a base in Lviv. It was decided to reduce the fleet from four to two aircraft. Finally, in April 2015, Wizz Air Ukraine suspended flights. The airline's fleet was completely disbanded. Part of the flights (only from Kyiv) was operated by Wizz Air Hungary, which opened a base with one A320 aircraft at Zhulyany airport.

On the promising route Ukraine-Italy Wizz Air in 2017 gave way to Italian Ernest Airlines. Nevertheless, Wizz Air has retained the status of the leader of the low-cost carrier in Ukraine. In 2018, it completely dominated (43.1%), and the second and third positions were held by competitors with four times smaller niches: Nordwind Airlines (12.9%) and Pegasus (12.5%). In 2018, Wizz Air received CESAAR award: the Company was named "The Best Low-Cost Airline of the Year in CEE region". In 2019, Wizz Air was named "Airline of the Year" by Air Transport Awards (Wizz Air, 2020).

The President of Ukraine Petro Poroshenko became the initiator and guarantor of the resumption of business activity in Ukraine of the leading EU low-cost airlines. He personally held talks with the leaders of Wizz Air Hungary and Ryanair and

convinced them of the political and economic feasibility of expanding the business of airlines in Ukraine after the adoption of a visa-free regime with the EU. In 2018-2019, more than 90 countries signed bilateral visa-free agreements with Ukraine.

So, Ryanair's success story in Ukraine began in 2018, ten years later than Wizz Air. The airline made its first flight on September 3, 2018 from Berlin to Kyiv with 100% loading. In 2019, Ryanair greatly increased the geography of flights from Kyiv and Lviv. Within a year, the company significantly pushed Wizz Air and won the favor of Ukrainians with convenient budget flights to London, Memmingen, Dusseldorf, Barcelona, cities of Northern and Eastern Europe.

The activity of LCCs in the London direction led to the fact that on October 3, 2019 British Airways after 23 years of flights was forced to cancel regular flights Boryspil-Heathrow due to falling profitability. A similar decision on November 17, 2019 was forced to take Brussels Airlines, closing the flight Brussels-Kyiv under pressure from low-cost competitors.

In F-2020 (from April 1, 2019 to March 31, 2020) Ryanair declared a plan to carry more than 1.5 million passengers on the 41 Ukrainian flight from Kyiv, Odessa, Lviv and Kharkiv, to increase the frequency of flights from Ukraine from 52 to 115 per week, and travel capacity – up to 42,714 seats in both directions per week (vs 19,656 in F-2019).

Ryanair's business activity in Ukraine has not gone unnoticed by its main competitor. In 2019, Wizz Air Hungary maximized the geography of routes from Ukraine and entered a fierce competition with Ryanair on most routes.

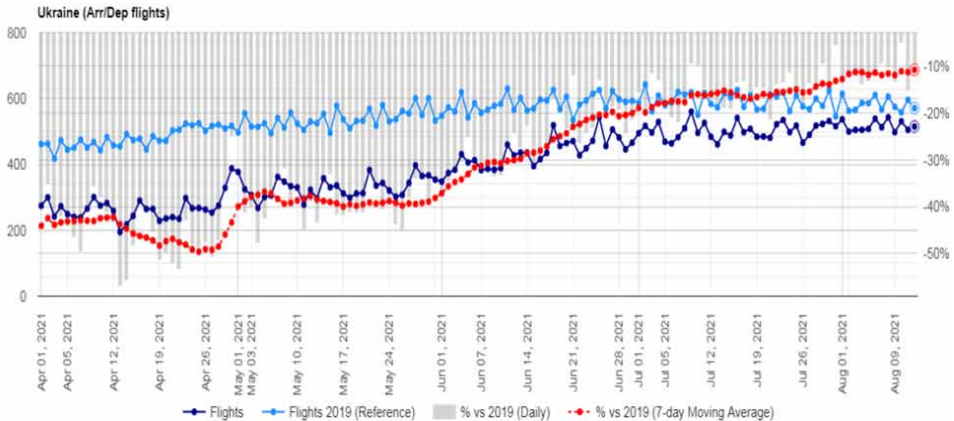
Ryanair's route network from Kyiv covered 25 destinations, 15 of which duplicated the Wizz Air network, which had been under construction since 2008. In particular, Ryanair and Wizz Air launched parallel routes from Kyiv to London, Vienna, Berlin, Frankfurt, Dusseldorf, Nuremberg, Athens, Vilnius, Warsaw, Gdansk, Katowice, Krakow, Poznan, Wroclaw, and Bratislava. In addition, Ryanair connected Kyiv with Barcelona, Madrid, Valencia, Dublin, Manchester, Stockholm, Karlsruhe, Bydgoszcz, Paphos and Sofia. This geography of flights exceeded Kyiv's Wizz Air route network by 40% (Figure 5). With such an extensive flight network, Ryanair in 2019 successfully won the brand's popularity among Ukrainians.

A similar situation has developed in the regions of Ukraine. For example, from Lviv duplication on the route network Ryanair and Wizz Air was 60%. Three of the five routes partially intersected: to London (Ryanair to Stansted, Wizz Air to Luton), to West Germany (Ryanair to Dusseldorf / Weeze, Wizz Air to Dortmund) and to Southern Poland (Ryanair to Krakow, Wizz Air to Katowice). In 2019, after a break of 11 years, Wizz Air returned to Odessa, where it opened 6 routes – to Berlin, Budapest, Wroclaw, Katowice, Gdansk, and Bratislava. It is noteworthy that the first five of these six directions of Wizz Air are strongly duplicated with similar

directions of Ryanair, which also in 2019 expanded its route network from Odessa from one to seven directions.

Figure 5. Comparison of LCC markets of Ukraine and its neighbors in 2019

Source: Eurostats, Aérogestion, 2021



In total, during 2019, 29 new routes were opened by foreign LCCs in Ukraine, including 21 new routes by Ryanair and Wizz Air Hungary. Nevertheless, Wizz Air has retained its long-standing status as Ukraine’s largest low-cost carrier: the route network from Ukraine included 45 destinations in 13 countries. Wizz Air increased its potential to 45.2% (the number one carrier), Ryanair – 30.7%, Pegasus – 8.1% of the LCC market of Ukraine. Taking into account all airlines operating to CEE, the second and third positions in the number of traffic in Ukraine after the national carrier UAI (37.3%) were won and held by the European LCCs Wizz Air (12.3%) and Ryanair (8.3%) (Wizz Air, 2020).

In 2018-2019, Ukrainian consumers watched the unprecedented price war of low-cost giants on routes duplicated on more than 60% in the top EU destinations.

Moreover, in 2019, the airline’s subsidiary, the British Wizz Air UK, also entered Ukraine for the first time, and in 2021 – the Wizz Air Abu Dhabi. Similarly, Ryanair is actively promoting its subsidiary brands on the Ukrainian market – Malta Air, Ryanair UK and Buzz. In 2019, Laudamotion, a low-cost subsidiary, launched flights from Ukraine to Vienna and Stuttgart.

On May 21, 2018, against the background of the success of foreign LCCs, the first flight of the first national low-cost airline of Ukraine SkyUp started.

On the eve of the global COVID-19 crisis, a number of other airlines have thoroughly studied the promising Ukrainian market and prepared projects to launch

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in Ukraine their own low-cost flights. In 2019, the Central Office of Air France-KLM announced the intention to launch flights to Ukraine of the subsidiary Transavia in order to develop a network of routes. Turkish Pegasus Airlines has initiated the opening of a subsidiary, Ukrainian-Turkish low-cost airline in Ukraine, etc.

### **Development of Flight Geography of European Low-Cost Airlines in the Struggle for the Ukrainian Tourist in the Pre-COVID-19 Era**

The number of LCCs in the Ukrainian market is constantly changing due to the severity of competitive and geopolitical risks (Oleshko & Heiets, 2018; Savych & Shkoda, 2020). However, the main group of top airlines that have earned the trust of consumers and actively compete for the maintenance of a market niche, formed in 2008-2012. Despite the COVID-19 crisis, from the beginning of summer 2021 it actively resumes its flight programs. Among them are the following:

- European giant airlines Ryanair and Wizz Air;
- European “medium” airlines easyJet, Norwegian Air Shuttle, Air Baltic, Vueling Airlines and AegeanAir;
- Turkish airline Pegasus Airlines;
- Arab airlines Air Arabia and Flydubai.

Each of these airlines has a different life cycle and business strategy for business development in the Ukrainian market. Some airlines have won well-deserved trust and loyalty in Ukraine. Others, for example, the Italian airline Ernest Airlines, in 2017-2019 “flashed” in the Ukrainian sky with a bright meteor. Ernest Airlines maintained the highest percentage of flights between Ukraine and Italy (precondition: the presence of a huge (about 0.5 million people) Ukrainian diaspora in Italy, its high air mobility, a significant amount of annual pendulum labor migration of Ukrainians to Italy, and the great popularity of Italian destinations among Ukrainian tourists).

In recent years, the geography of traditional scheduled and low-cost flights has been constantly diversified. Before the COVID-19 crisis, the main geographical vector of air services Ukraine-European Union was stable. Among the most popular communications was the dominance of flights to the capitals and cultural centers of Western Europe (Figure 6 and Figure 7).

Figure 6. Top 15 destinations served by all types of carriers in 2019 from Ukraine  
Source: Aérogestion, 2021



Figure 7. Top 15 locations dominated by LCCs in 2019 from Ukraine  
Source: Aérogestion, 2021



Since 2018, SkyUp and the national giant UIA have been actively involved in the competition with foreign LCCs. In 2018, SkyUp started its operations with only 10 charter flights. In mid-2019, scheduled flights expanded to 30 destinations, and

### **European Low-Cost Airlines in Ukraine**

at the end of the year to 50. Among the most popular destinations of SkyUp were Tbilisi, Barcelona, Larnaca, Poprad and Sofia.

In 2018, through the Amadeus Content Rail & LCC booking system, Ukrainians in the LCCs segment purchased tickets, usually from market leaders with recognizable brands, a reliable reputation and a wide geography of flights. Ryanair and Wizz Air became the leaders of trust of Ukrainian consumers with indicators, respectively, of 39.24% (+ 26% vs 2017) and 35.06% (+ 121% vs 2017) of all sales in Ukraine on flights of LCCs. The share of lesser-known carriers was as follows: easyJet – 7.5% (+55% vs 2017), Ernest Airlines – 7.37%, others – less than 3%. Amadeus Content Rail & LCC steadily increased the volume of customer turnover of low-cost passengers in Ukraine before the COVID-19 crisis. For example, only in the first half of 2018, the total number of tickets sold by agencies through this booking system increased by 51% (Amadeus, 2018).

The development of the domestic flight network of the Ukrainian SkyUp has revived in Ukraine such a concept as domestic passenger traffic on budget routes. For example, in November 2019, the launch of Kyiv-Lviv and Lviv-Kharkiv flights by SkyUp from Lviv Airport led to a jump (by 36.1%) increase in domestic passenger traffic at this airport.

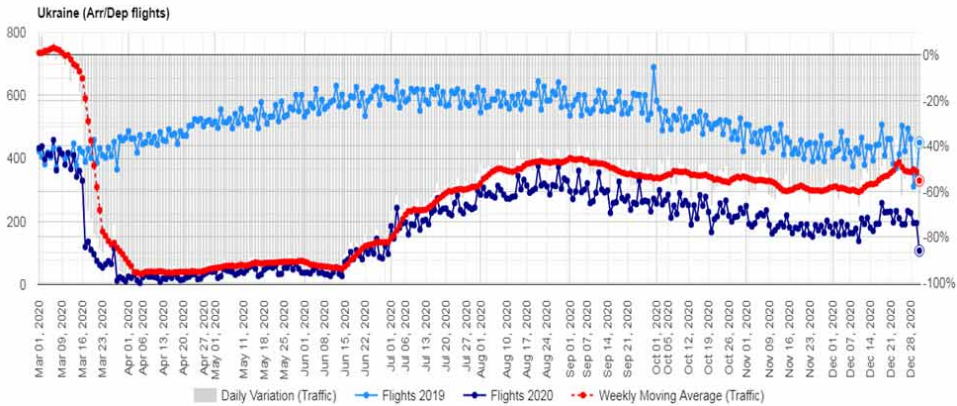
Successes of SkyUp and Turkish LCCs have led to ousting from the market and bankruptcy of the Ukrainian airline Atlasjet Ukraine (2014-2019), which specialized in flights to Istanbul.

### **COVID-19 Crisis: The Scale of the Collapse of the International Air Transportation Market and the Competitive Struggle for the Consumers**

In March 2020, the world imposed strict restrictions to counteract the COVID-19 pandemic. International air traffic “froze” for several months (there were only evacuation flights) (Figure 8).

Figure 8. Ukraine: dynamics of average daily flights for March-December 2020 compared to the same period in 2019

Source: www.eurocontrol.int



In 2020, Ukraine twice restricted the entry of foreigners into the country: the first time from March 17 to June 15, the second time from August 28 to September 28. Authorities argued that these were measures to counteract the spread of COVID-19. Only from September 28, 2020 in accordance with the government resolution N°757 foreigners were again allowed to enter the territory of Ukraine for tourism. Health insurance covering coronavirus treatment is mandatory for such individuals. However, with the global pandemic growing in the world, traditional scheduled and low-cost airlines have chosen a strategy to minimize flight programs by the end of 2020. The total lockdown also lasted in Ukraine from January 8 to 25, 2021, but the government did not restrict the operation of international flights.

The biggest unfavorable factor in the resumption of low-cost traffic was the ban on tourists entering Europe. This situation affected both the geography of flights (over 65% of routes were not resumed in 2020) and the flight schedule of airlines. On many flights that resumed in the summer of 2020, LCCs left one or two flights a week.

On the other hand, the vacated niche was filled by airlines operating on routes to popular countries of resort rest with a “softer” policy of COVID-19 formalities for foreign tourists: for example to Turkey, Zanzibar, Hispaniola, and the Maldives.

Ukraine is a strategically important market for generating tourists for Turkey. And its Boryspil airport is the main hub for sending tourists to Turkey not only from all regions of Ukraine, but also transit tourists from Belarus and the Russian Federation. Thus, in 2020, during the periods of easing of quarantine restrictions,

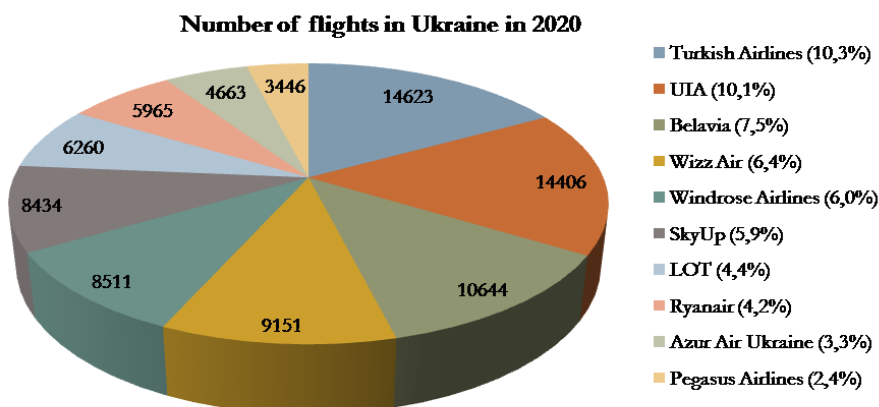


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the presence of the Turkish state airline Turkish Airlines and the private low-cost airline Pegasus Airlines, and the Ukrainian SkyUp, increased the most actively.

The top 10 airlines that dominated the number of flights in Ukraine in 2020 included 4 traditional scheduled, 2 charter and 4 low-cost airlines with commensurate market shares, in particular, Wizz Air Hungary (6.4%), SkyUp (5.9%), Ryanair (4.2%) and Pegasus Airlines (2.4%) of the total number of flights (Figure 9).

Figure 9. TOP-10 airlines that dominated the number of flights in Ukraine in 2020  
Source: State Aviation Administration of Ukraine, 2021



The leader of the Ukrainian market, the regular airline UIA, recorded in 2020 a huge loss of \$ 0.16 billion. In 2020, UIA served almost 17 thousand flights (-72% vs 2019), in the first quarter of 2021 the drop in passengers was -67% vs 2019, the number of scheduled flights decreased by 82%, while the number of charter flights increased 2.6 times. The volume of traffic has decreased four times: 1.8 million passengers in 2020 vs 8 million in 2019. Charter flights in partnership with tour operators to the resort airports of La Romana, Male, Mattau, Marsa Alam, and Kayseri provided profits for the airline.

Paradoxically, in the midst of the COVID-19 crisis, the small Ukrainian SkyUp even increased its market potential through skillful maneuvering (closing routes to closed Europe for tourists and increasing charters to resorts in Egypt and Turkey, available to unvaccinated tourists). On March 18, 2020, the newly established national low-cost airline Bees Airline made its first flight to Egypt. Both of these low-cost airlines have partially resumed flights, focusing business on servicing tourist flows to accessible resort countries (Egypt, Turkey). In August 2020, SkyUp set a new

record for the number of passengers carried in one month – 211,886 travelers vs 186,131 in 2019. In September, SkyUp carried 168,379 passengers vs 168,911 in 2019, including 29,689 on 232 scheduled flights and 138,690 on 772 charter flights.

On June 21-24, 2020, after a 3-month break, a number of leading scheduled and LCCs resumed flights between Kyiv and major cities in Europe and Asia. Subsidiaries Swiss Airlines, Austrian Airlines and Brussels Airlines of the German airline Deutsche Lufthansa AG, Turkish Airlines, and the largest European low-cost carrier Ryanair were the first to connect Ukraine and the EU. On July 08, 2020, Flydubai resumed flights on the Kyiv-Dubai route; on July 14, 2020, Air France resumed flights Kyiv-Paris 2 times a week vs 14 times in 2019; on August 18, 2020, SAS Scandinavian Airlines resumed the Kyiv-Oslo flight. On August 1, 2020 Turkish Airlines completely restored the pre-crisis route network from the largest airport in Turkey to six airports in Ukraine.

Fierce competition for dominance in the Ukrainian market between Ryanair and Wizz Air did not stop even in the midst of the COVID-19 crisis against the background of almost synchronous collapse of airlines geography and flight frequency.

In the summer of 2020, the competition between LCCs reached its peak in the direction of Italy. This is a promising market: the second largest diaspora of Ukrainians lives in Italy and this country is traditionally the leader among the destinations of budget travelers-Ukrainians.

In 2020, the authorities of Ukraine and Italy liberalized the flight market. LCCs Ryanair, Wizz Air, SkyUp and easyJet actively participated in the competition for a new niche. EasyJet soon left the competition due to price competition. And Ryanair and Wizz Air have implemented a policy of price war and direct duplication of more than 60% of routes. Ryanair was the first to embark on popular routes. But in August, it began to be actively pressed by Wizz Air, which opened its base in Milan. Parallel routes were launched from Kyiv to Rome, Milan, Bologna and Catania. In addition, Wizz Air has launched alternative routes to Venice and Naples. Also Wizz Air has launched parallel routes from Lviv to Rome, Milan, Verona and Catania. At the same time, Ryanair has already launched alternative routes to Venice, Naples, Pisa, Turin and Palermo, from Odessa – parallel routes to Rome, Milan and Bologna, from Kharkov – to Milan. Additionally, Wizz Air connected Venice with flights to Kharkiv and Odessa.

Thus, Ryanair resumed almost 50% of its Ukrainian routes during the summer navigation season. Flights between the cities of Ukraine and Italy were especially popular among Ukrainians. Ryanair's route network, with the permission of the Italian aviation regulator ENAC, in July-August 2020 was expanded to 11 destinations, in which the low-cost operated 28 flights a week. Some of these flights were given by Ryanair management to a subsidiary of Malta Air, acquired in 2019.

### **European Low-Cost Airlines in Ukraine**

In summer of 2020, Wizz Air, following its direct competitor in the Ukrainian market, resumed a flight program of 40% of the intensity before the COVID-19 crisis from the Kyiv and Kharkiv airports. Moreover, the Hungarian low-cost carrier opened a second base in Ukraine on July 1, 2020 with a location at Lviv International Airport, from where it launched 6 traditional (to Milan, Rome, Berlin, Gdansk, Katowice, Wroclaw, Pardubice, Bratislava) and 5 new flights to Lisbon, Billund, Tallinn, Hamburg and Szczecin. During the crisis of international air transportation, the airline has strengthened its popularity among a large segment of Ukrainian labor migrants.

The hard lockdown declared by Ukraine in September 2020 turned this page in the competition war. Due to the deteriorating epidemiological situation in the world since mid-September, Ryanair has reduced the flight network from Ukraine from 31 to 8 routes and reduced the frequency of flights. At the same time, Wizz Air has reduced more than 60% of summer navigation flights.

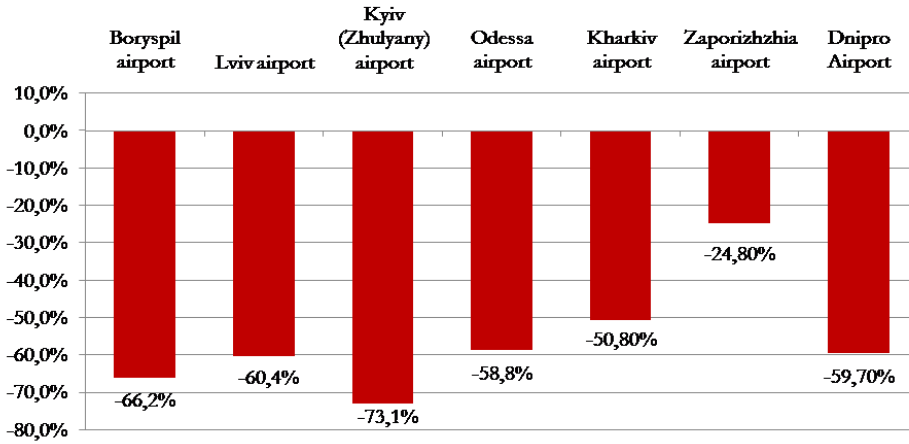
In general, from September 2020 to April 2021, European low-cost airlines re-reviewed flights and again reduced the number and geography of flights from Ukraine. For example, before the COVID-19 crisis, Ryanair operated 68 flights from Ukraine. In spring of 2020, the low-cost airline temporarily suspended flights. In summer, 26% of flights were resumed compared to 2019. And on October 15, 2020, Ryanair completely canceled 10 more flights from Ukraine, and postponed another 36 flights until March 2021. Cancellation of 46 flights out of 68 is a 75% reduction. In April 2020, the low-cost airline Wizz Air served only 6% of flights. In August, the Wizz Air resumed up to 80% of flights. In November, flights decreased to 21% compared to 2019 (Topalov, 2021).

### **Assessment of Post-COVID-19 Recovery of the Low-Cost Air Transportation Market in Ukraine in 2021**

Since May 2021, the international air transportation market of Ukraine shows a statistical trend of recovery of passenger traffic on average higher than in most EU countries. Ukraine is the only one in the EUROCONTROL Member State Area, which recorded a positive increase in traffic in 2021 (Figure 10). Ukraine's neighboring countries show more critical indicators: Poland (-40.3%), Slovakia (-37.5%), Romania (-17.3%), etc.

Figure 10. States (FIR) with the highest traffic growth in 2021

Source: <https://ansperformance.eu/traffic/>



In May 2021, the passenger air transport market showed a level of 60% of traffic in the same month of 2019. Such a high recovery rate took place even despite the fact that the powerful operator of the Belarusian and Russian markets Belavia came under sanctions and suspended flights in Ukraine.

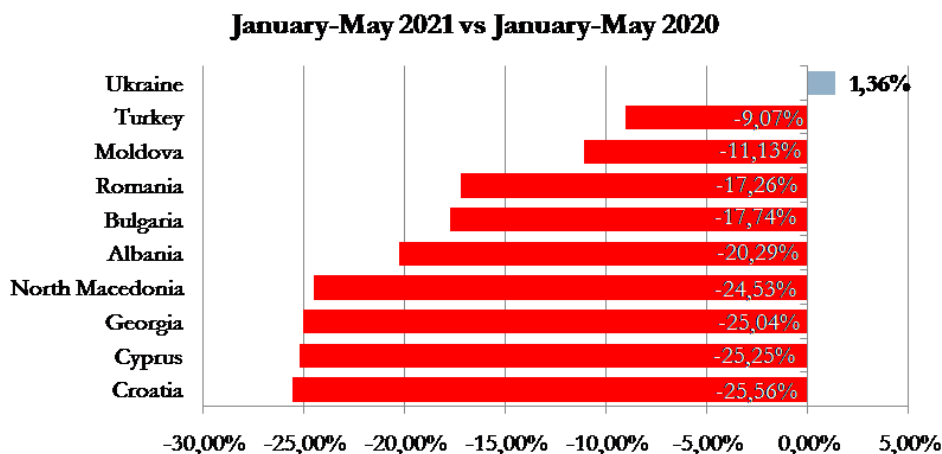
In June 2021, Ukraine practically reached the pre-crisis level in the number of domestic flights – 2,965, which is only 2.6% less than in June 2019. The number of international flights amounted to 11,469, which is 27% less than before the crisis. The policy of closed borders in the EU aimed at counteracting the spread of COVID-19 still impedes transit traffic. In June 2021, 6,679 airplanes flew in transit through Ukraine, which is 60% less than in June 2019. In order to resume international transit as soon as possible, in 2021 Ukraine decided in principle to reduce twice the tariff for the flight over the Black Sea – from 51.1 EUR to 25 EUR per 100 km.

Kyiv, Dnipro, and Odessa entered the top 10 ACCs in the EUROCONTROL Member State Area with the highest traffic growth in January-May 2021 (Figure 11).

## European Low-Cost Airlines in Ukraine

Figure 11. Area Control Centers (ACCs) with the highest traffic growth in 2021

Source: <https://ansperformance.eu/traffic/>

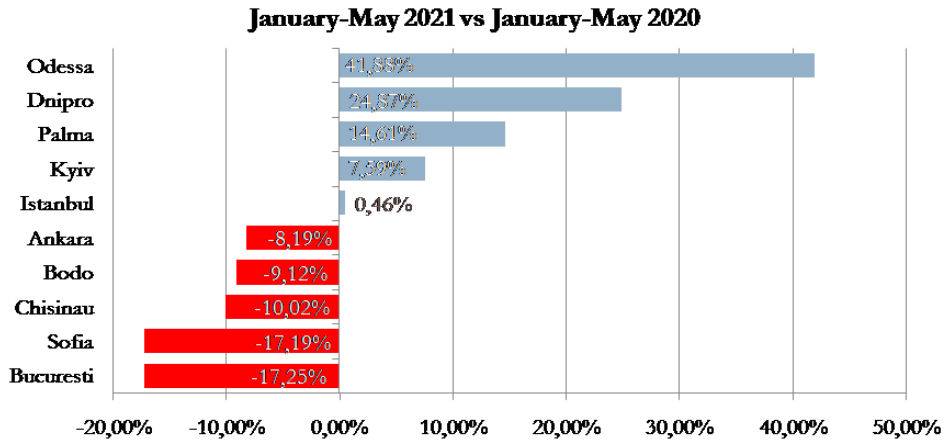


In 2021, Boryspil Airport began to restore passenger traffic through charters. In the first half of 2021, the hub served 3.4 million people (52% vs 2019). Given the restrictions on passenger traffic in a number of EU countries, the geography of flights from Boryspil has undergone significant changes. Thus, in May 2021, 65% or 460 thousand passengers went to Antalya, Sharm el-Sheikh, Hurghada, Istanbul, Ankara, Bodrum, Dalaman, Dubai, Tbilisi and Amsterdam.

Development of cooperation between the airport and airlines is the only guarantee of rapid post-COVID-19 recovery of business potential of partners. Lviv Airport is a good example of such cooperation. On June 22, 2021, the number of flights at Lviv airport exceeded the pre-crisis 2019 figure (Figure 12). Passenger traffic was restored by 62% vs July 2019.

Figure 12. Dynamics of the number of flights served by Lviv International Airport in 2019-2021

Source: <https://flightaware.com/live/airport/UKLL>



One of the vectors of Lviv Airport’s strategy is close cooperation with Ryanair and the development of Wizz Air’s geography of flights. The second vector is increasing the intensity of passenger traffic with Turkey by deepening collaboration with Turkish Airlines and Pegasus Airlines. The third vector is the opening of the destination Ukraine for passengers of airlines in the Arab region.

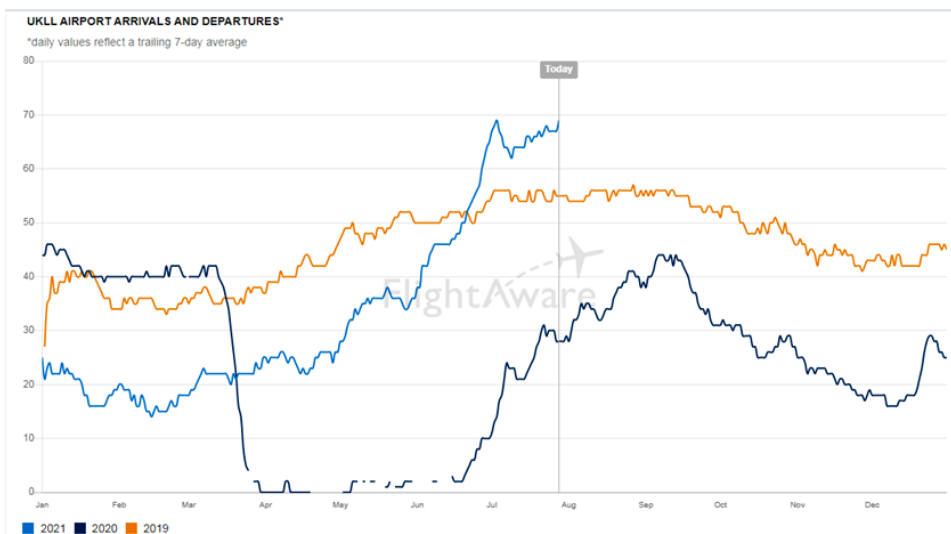
Before the crisis, the ratio between Ukrainian citizens and foreigners on traditional scheduled and low-cost flights was about the same – 50% to 50%. Currently, 73% are foreign citizens, 27% – Ukrainians who have a residence permit or citizenship of European countries. (Exceptions are flights to Italy: due to the large Ukrainian diaspora in this country, on these routes most passengers are citizens of Ukraine.) The ratio has been dynamically equalizing since the summer of 2021, which is due to the mass vaccination of Ukrainian citizens.

EUROCONTROL experts predict generally positive scenarios for resumption of air traffic in Ukraine after the COVID-19 crisis (Figure 13). The trend of traffic recovery in Ukraine in 2021-2022 is higher than the EU average. By 2023, Ukraine has a chance to return to the pre-crisis level of 2019. Charter and low-cost airlines will play an important role in it.

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Figure 13. En-Route STATFOR Forecast 2016-2024 in Ukraine

Source: [www.eurocontrol.int](http://www.eurocontrol.int)



The Top 10 aircraft operators in Europe on July 07, 2021 (daily flights) according to EUROCONTROL data included the most popular low-cost airlines, in particular, easyJet (+ 158% over 2 weeks), Wizz Air (+ 52%), Ryanair (+ 24%), Pegasus (+ 19%). European low-cost airlines are now operating 54% of 2019 flight volumes (Eurocontrol, 2021). European market leaders in 2021 take an active part in the competition for dominance in the airspace of Ukraine.

In 2021, COVID-19 restrictions on the access of air tourists to a number of countries in the world have made significant changes in the geography of flights of low-cost giants Ryanair and Wizz Air from Ukraine. For the period of winter navigation October 25, 2020 – March 28, 2021, due to the total lockdown low-cost flight programs were suspended for more than 60-70% of flights in a number of countries.

Demand market research has shifted vectors of business activity of air carriers from Western Europe to some countries of South-Eastern Europe, more accessible to unvaccinated tourists. At the same time, there is a tendency of competitive duplication of flights from Ukraine to a number of popular destinations in Western Europe. When launching new flights, the management of LCCs promptly monitors the situation with changes in the COVID status of countries (“red” or “green” zone).

In January 2021 Ryanair offered flights from Kyiv only to Berlin, Vienna and Valencia, in February – to London and Manchester, Madrid, Krakow, Poznan. Until

the summer season, the LCC did not fly at all from the regional airports of Kharkiv and Kherson, and it left only two flights from Lviv to London and Bologna.

With the start of summer navigation in 2021, Ryanair launched 18 routes from Ukraine (6 of them to Gdansk, Katowice, Krakow, Poznan, Warsaw, Wroclaw, Poland, and traditionally popular flights to Rome, Bergamo, London and Berlin), another 37 routes started in June or July 2021. Now the Ryanair group, in addition to the Irish low-cost carrier, also includes Laudamotion in Austria, Buzz in Poland and Malta Air in Malta. In 2021-2023, as part of a strategy to diversify its activities, the group declared its intention to attract subsidiary brands to increase its market presence in Ukraine.

Wizz Air served 11-14 flights in the winter of 2021 and only in March began to actively increase the frequency and geography of flights. Wizz Air has declared ambitious development plans in the Ukrainian market for 2021. The low-cost carrier restarted 12 routes from Kyiv and five each from Lviv and Kharkiv. May 2021 Wizz Air ended with a resumption of passenger traffic at 73% (vs 2019).

In the summer of 2021, LCCs synchronously restarted direct flights from Kyiv, Lviv, and Kharkiv to Cyprus – a popular beach and resort destination for thousands of Ukrainians. Ryanair flies to Paphos, Wizz Air – to Larnaca.

In 2021, Wizz Air holds 26.6%, Ryanair – 16.2%, SkyUp – 28.6% of the LCCs market of Ukraine (Wizz Air, 2021). The base for Wizz Air in Ukraine is the airport “Kyiv”. But on July 3, 2021, after a 10-year break, Wizz Air returned on a permanent basis to Boryspil Airport – the main aviation hub of Ukraine. Wizz Air Abu Dhabi, a subsidiary, has connected the capital of Ukraine with the UAE capital Abu Dhabi. Due to high customer demands for comfort, new Airbus A321neo aircraft are on the route. Wizz Air Abu Dhabi will compete with no less branded LCC Flydubai for customer loyalty in this direction.

By the end of 2021, the leaders of the low-cost airline market in Ukraine have declared their intention to open flights at a number of new airports in Zaporizhzhia, Dnipro, Vinnytsia, Chernivtsi, Uzhgorod, etc. (Ryanair, 2021; Wizz Air, 2021). In the conditions of crisis, an active phase of strategic redistribution between the European main low-cost airlines of the Ukrainian air transportation market begins.

Several well-known low-cost airlines in Europe and Asia in 2021 have declared their intention to enter and actively develop the Ukrainian market. Thus, from the summer of 2021, a new round of competition began in the Ukrainian sky between a group of leading players in the market (Ryanair, Wizz Air and Pegasus) and a group of novice airlines, which are just entering the market with quite attractive tariff strategies and flight geography. On June 1, 2021 Eurowings from Germany opened the sale of tickets for flights from Dusseldorf to Kyiv. Promo tickets are offered at a price of \$ 49.99 one way at the Basic rate. Therefore, the airline has declared its intention to launch flights from several major cities in Western Europe to Boryspil



airport by the end of 2021. On July 2, 2021, the Spanish Vueling resumed flights on the route Barcelona-Kyiv at a promo tariff of EUR 90 round trip.

In June 2021, SkyUp carried a record number of passengers since its inception, charter flights – 183,490, scheduled flights – 110,657. SkyUp also entered the Saudi market for the first time, where it competes with Flynas on flights to Kyiv and Lviv. In 2021, Bees Airline increased its fleet to four Boeing 737-800s. It operates flights from Kyiv, Lviv, Odessa, Kherson and Kharkiv. Along with regular flights to Bulgaria, Armenia and Georgia, Bees Airlines operates charter flights to the resorts of Antalya, Sharm el-Sheikh, Hurghada, Rhodes, Larnaca and others.

On 12 October 2021, Ukraine and the EU signed a Common Aviation Area (CAA) agreement. It will be a powerful positive impetus for market liberalization (Abate & Christidis, 2020) and a signal for all EU airlines to get involved in increasing traffic, and especially in the low-cost segment, between the EU and Ukraine.

## **CONCLUSION**

COVID-19 crisis is not over yet. New aggressive strains, such as Delta, from the fall of 2021 threaten another mass disease and strengthening of quarantine restrictions. However, market demand for low-cost transportation remains consistently high (Czerny, Fu, Lei, Oum, 2021) as governments in a number of tourist countries seasonally open borders, ease COVID-19 formalities and encourage the arrival of foreign tourists.

Low-cost airlines have become an ideal alternative to transportation in the global economic crisis. It is especially relevant for Ukrainians, because it allows to travel even to those who have a relatively low income.

In recent years, the demand for air transportation for employment in European countries has been increased in Ukraine. The introduction of a visa-free regime with the EU has contributed to this. In addition, it affected foreign airlines – they began to significantly increase their presence in Ukraine. Factors of their successful functioning include low prices, a competent policy of obtaining additional income, a unified fleet consisting mainly of new aircraft, and the integration of modern technologies. Ukraine has remained attractive for foreign low-cost carriers, which is largely due to the favorable geographical location and moderate pricing of airports with developed infrastructure of some of them.

Due to the scale of the COVID-19 pandemic in Ukraine, in 2020, the EU Council several times (every 2 weeks) extended the travel ban for Ukrainians on air travel in the EU. Continuation of the travel ban on January 30, 2021 canceled the business plans of Wizz Air and Ryanair for the resuscitation of the Ukrainian aviation tourism market in the first half of 2021.

In 2020-2021, the risks of business activity in the low-cost transportation segment increased the most. Investment risks of entering new markets in conditions of uncertainty are even higher. However, many low-cost airlines are willing to take risks. The reason is obvious: due to the COVID-19 crisis, new market niches of low-cost service have been vacated, which until recently were densely filled and distributed among the leading airlines with promoted brands. In such realities, the chances and potential benefits are commensurate with the potential threats. With the support of the government and the airports of a particular country, and given the conjuncture of its low-cost market, during the COVID-19 crisis for a number of airlines there were good chances to establish itself in the air transportation market of Ukraine and try to gain a foothold in this market.

In autumn of 2020 and winter of 2021, low-cost airlines maintained a minimal presence in the market of air services in the 4 largest cities of Ukraine – Kiev, Lviv, Odessa and Kharkiv. Thus, Ryanair has limited only 15 strategically important flights for its own business from Ukraine: from Kyiv to Vienna, Paphos, Malta (served by Air Malta), Berlin, London, Manchester, Krakow, Budapest, Valencia and Madrid, from Lviv to London and Bologna, from Odessa to Dusseldorf, Gdansk and Krakow.

In summer of 2021, traditionally, tourist activity intensifies. Low-cost airlines respond quickly to the COVID-19 pandemic in the world, monitor restrictions and situationally enter the market with new flights to countries that, in the hope of tourists, weaken the barriers of international air transportation.

Significant growth potential is concentrated on low-cost transit flights in the airspace of Ukraine. Their number decreased compared to 2013 due to the aggression of the Russian Federation, the temporary occupation of Crimea and hostilities in the east of the country. However, low-cost transit flights show a stable growth trend. For example, in recent years, the share of transfer passenger traffic at the main airport of Boryspil has been increased: 2015 – 21%, 2016 – 27%, 2017 – 28%, 2018 – 28%, 2019 – 29%. Prolonged political crises in the Russian Federation and Belarus leave the only comfortable transit corridor through Ukraine for a number of LCCs from Europe and Asia. Therefore, the intensity of low-cost traffic through Ukraine after the COVID-19 crisis will continue to grow steadily.

The success of foreign low-cost airlines in the Ukrainian market encourages national airlines to be more actively involved in this segment of international traffic. The first national low-cost airline SkyUp started its flight program in Ukraine, on the route Kyiv-Sharm el-Sheikh. On March 18, 2020, the newly established national low-cost airline Bees Airline made its first flight to Egypt. With the easing of international isolation restrictions and the relaunch of flights between individual countries on June 15, 2020, both of these low-cost airlines have partially resumed flights, focusing business on servicing tourist flows to accessible resort countries.

Signing of the Common Aviation Area Agreement between Ukraine and the EU opens the domestic Ukrainian market for European LCCs. It is one of the significant factors in reducing ticket prices. It will lead to more aircraft occupancy, which in turn will increase airport revenues. “Open Sky” is a powerful impetus to minimize the loss of the aviation industry due to the COVID-19 pandemic.

Thus, despite the COVID-19 pandemic, the instability of the military-political and economic situation in the country, forecasting of the future development of low-cost air transportation in Ukraine is optimistic. Ukraine’s passenger air transportation market has favorable preconditions for its recovery and successful development. First of all, it is due to the significant growth of popularity of passenger low-cost airlines, the entry into the airspace of Ukraine of new foreign low-cost airlines, the opening of new flights by Ukrainian low-cost carriers, a visa-free regime with EU, the modernization of the infrastructure of Ukrainian airports and their development taking into account modern ICAO requirements.

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## KEY TERMS AND DEFINITIONS

**Air Transportation:** A method of transporting goods, mail and carrying passengers by aircraft. Air transportation is classified by direction, cargo category, type of loading, class of service, etc.

**COVID-19 Crisis:** A global complex crisis caused by the COVID-19 pandemic. The outbreak began in December 2019 in Wuhan (Hubei, China), and was recognized by the WHO as a pandemic on March 11, 2020. Air transportation has faced huge financial losses due to international quarantine measures.

**European Common Aviation Area (ECAA):** A single market in aviation services. ECAA agreements were signed on 5 May 2006 in Salzburg between the EU and some external countries. On 12 October 2021, Ukraine and the EU signed an ECAA agreement, as part of the 23<sup>rd</sup> Ukraine-EU summit in Kyiv.

**Low-Cost Airline:** An airline that operates with an especially high emphasis on minimizing operating costs, offers generally low fares in exchange for eliminating many traditional passenger services.

**Low-Cost Carrier (LCC) Business Model:** An economic model of passenger air transportation according to the following business formula: “low costs – low fares – high demand – high incomes”. Key elements of LCC business model in today’s conditions there is one class of service, simple tariff structure with limited differential services and there is no practice of return money for an unused ticket and rebooking services.

**Pre-COVID-19 Era:** A period of stable dynamic development of the global (including European) air transport market by scheduled and low-cost airlines in the 21<sup>st</sup> century (except for the collapse of 2008 due to the financial crisis), which lasted until March 2020, that is, before the global COVID-19 crisis.


**Post-COVID-19 Recovery:** A period of recovery of the potential of the global and regional air transportation markets by scheduled and low-cost airlines after the lifting of quarantine travel restrictions imposed by governments around the world in 2020-2021 to counter the spread of the COVID-19 pandemic.

**Ukraine’s LCC Market:** One of the most promising markets for LCCs, given the number of the country’s economically active population, as well as the dominance of the destinations in the EU in the ranking of tourist and personal air transportation of Ukrainians.

## Chapter 7

# Transformation of Human Capital of Air Transport in the Post-COVID-19 Era

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### **ABSTRACT**

*Air transport traditionally plays a critical role in the maintenance of converting human potential benefits into significant social and economic effects. However, the COVID-19 crisis influences air transport reduction, causing losses of jobs and human capital capacities. Thereby, the main problems that need to be solved are air transport human capital management and financial support, providing background for its transformation in the post-COVID-19 era. Both theoretical and applied approaches to human capital and its role for air transport development are defined. The chapter is based on indicators and financial determinants of human capital development. The current research purpose is to consider the availability and potential for human capital of air transport transformation, considering the example of Ukrainian economy in the time of the COVID-19 pandemic crisis. Thus, this chapter provides a possible direction for further studying the post-COVID-19 impact on the transformation of human capital on air transport.*

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## **INTRODUCTION**

The COVID-19 pandemic has influenced both health and economic systems, causing a health and an economic crisis globally. Thereby, the world observes progression addressing losses of lives and jobs. The situation with the global COVID-19 pandemic demonstrated the unequal ability of existing social responsibility models to react timely on such global challenges. The human capital management system, which took the brunt of the pandemic, is one of the key elements of these models. In addition, in each country of the world, the crisis of the COVID-19 pandemic sharpened the existing problems of achieving the goals of sustainable development, including those related to human capital.

It is becoming increasingly important to define the particular challenges and possible ways for post-COVID transformation, faced by the main industries and sectors. The transportation industry plays a critical role in the maintenance of social and economic development worldwide. In particular, air transport is considered as a key enabler of many other economic activities. At the same time, the COVID-19 crisis provides a dramatic influence into air transport, causing about 43% reduction from pre-COVID levels (ATAG, 2020), including significant losses of jobs and human capital capacities.

Thereby, the research problem lays upon the potential of providing flexible system of human capital transformation to overcome the human capital divide in the Post-COVID-19 Era in order to improve the air transport capacity.

## **BACKGROUND**

The reports of research departments of international organizations examined the impact of anti-pandemic measures on a global scale (“How COVID-19 is changing the world: a statistical perspective” (UNCTAD, 2020); “World Bank Group Announces Up to \$ 12 Billion Immediate Support for COVID-19 Country Response” (World Bank, 2020); “Economics Dashboard - Impact on Jobs of Coronavirus Crisis, Fri 17” (Fitch Ratings, 2020); Shared Responsibility, Global Solidarity: Responding to the socio-economic impacts of COVID-19 (UN, 2020)). In particular, the international air transport organizations IATA and ICAO published their own reports reflecting the COVID-19 impact on air transport worldwide (“Meeting the COVID-19 challenge together” in IATA Annual Review (IATA, 2020); Effects of Novel Coronavirus (COVID-19) on Civil Aviation: Economic Impact Analysis (ICAO, 2021)).

The research is performed through review of the scientific articles, evaluating the trends of human capital management and the current tendencies of human capital transformation in air transport, including a deeper understanding of peculiarities

of human capital development in the Post-COVID-19 Era, digitalization influence into the air transport development, the role of human capital within the innovative development strategies of air transport representatives.

In particular, some studies are devoted to the problem of the impact of investing in human capital on the efficiency of airports (Sutia, Sudarma, Djumahir, Rofiaty, 2013) and airlines (Lopes, Gomes Rodrigues, 2007; Lopes, Ferraz, Gomes Rodrigues, 2016). Thus, Sutia, Sudarma, Rofiaty (2013) in their study showed that the greater the investment in human capital of airports, the higher the strategic orientation of these airlines. The research of Lopes, Ferraz, Gomes Rodrigues (2016) proved that human capital has a positive impact on the performance of the top major airlines as one of the most direct indicators of return. And human capital categories are considered as specific intangible assets that are indeed underlined for air transportation sector (Lopes, Gomes Rodrigues, 2007).

Researchers (Walther, 2020) also pay close attention to the transformation of digital strategies of air transport enterprises in connection with COVID-19, in particular their impact on changes in human capital of the air transport business entities. One of such strategies is de-centralization of work and growth of home offices that represent a bright example of the COVID-19 impact on human capital of airlines.

The local specifics of the Ukrainian air transportation market are represented mostly in the researches connected with assessment of competitive positions of the Ukrainian airlines (Ovsak, Liskovych, Nazarenko, 2021), high riskiness of the external market environment in Ukraine (Savych, Shkoda, 2020), regulation peculiarities of the European integration of air transport in Ukraine (Smerichevskyi, Gura, 2021), government support of the aviation industry due to COVID-19 (Stepanenko, 2020), etc. The questions of strategic human capital management at the example of the air transport enterprises in Ukraine are represented by the reflexive-knowledge paradigm (Shkoda, 2018), which has the imperative of human development as the core and provides the achievement of reflexive-preventive, social-commercialization and professional-creative directions of activity due to resulting harmonization. In this research as the indicators of such harmonization are established elasticity of a strategic management decision, added value, and art-effect. But, all these research works don't cover the Post-COVID-19 impact on human capital development of air transport enterprises in Ukraine. That's why it is important to study this problem issue and propose the appropriate ways of development.

## **MAIN FOCUS OF HUMAN CAPITAL OF AIR TRANSPORT IN THE POST-COVID-19 ERA RESEARCH**

The paper aims to provide scientific review of the following major research approaches: 1) the COVID-19 impact on the air transport development; 2) highlighting the special status of human capital and human potential, based on their specific characteristics, including network effects, the ability to convert human potential benefits into significant social and economic effects, hybrid and multiplicative, concerning the peculiarities of the air transport development in the Post-COVID-19 Era, identifying the causes of the situation and developing science-based proposals for possible improvement; 3) the potential of human capital management strategy implementation by focusing on the development and delivery of services that target their most important assets — employees; 4) growing ICT role in human capital transformation and the air transport capacity increase and progressive development within the global society.

The practical issue concerns the potential of providing flexible support to overcome the human capital challenges in order to improve the operating model that assists the main air transport representatives, including leadership, management and human resources, to take responsibility for effective human capital management.

The methodological support of the post-pandemic transformation of human capital of air transport in the study is based on the principle of unity of theory and practice, a system-synergetic approach, the fundamental works of foreign and domestic researchers and experts who disclose key features of formation and implementation of human capital management policies in the conditions of COVID-19.

The results section represents findings to determine innovative models of human capital development and financial profitability in air transport, considering global and regional initiatives to strengthen human capital transformation in the Post-COVID-19 Era, including growing interest in digitalization tendencies and their influence into human capital development and human capacity increase. Synergetic effect of human capital strategies implementation is considered within the strategical framework of boosting a talent-led breakthrough in air transport, considering the background of COVID-19 influence. A measure of theoretical and applied approaches are considering within the framework of the air transport organization's people-based programs, processes and technology implementation.

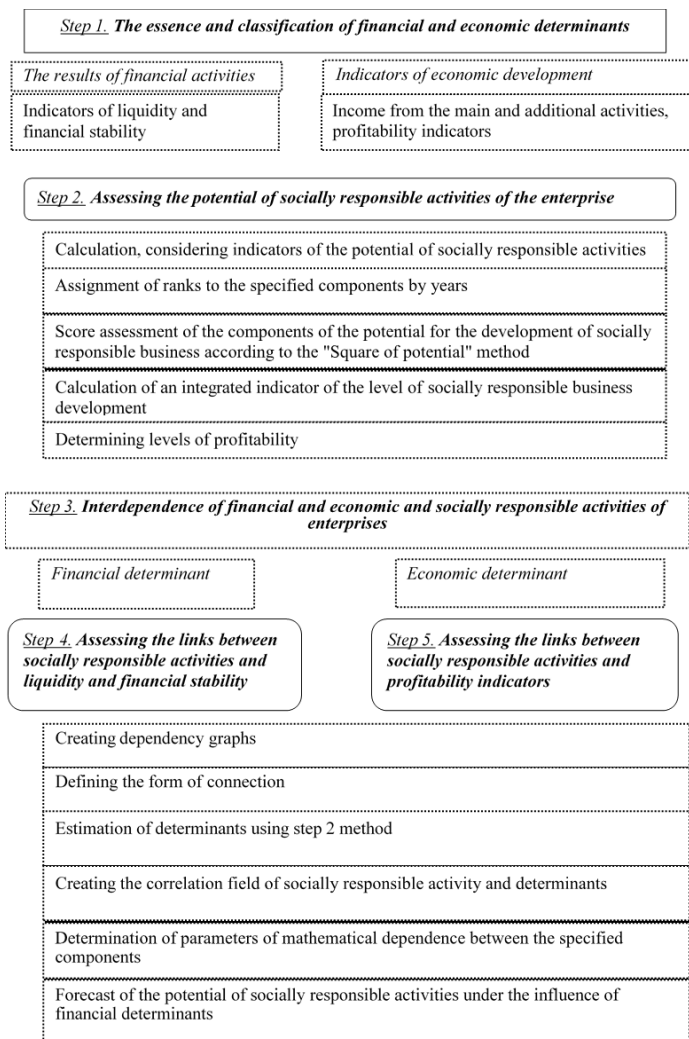
The study results can be used within programs for sustainable and social business development in air transport in the Post-COVID-19 Era. Further research on this topic requires the transition to the development of innovative measures to improve the management of social investment in human capital of Ukrainian air transport enterprises based on the principles of decent work.

## FINANCIAL DETERMINANTS OF HUMAN CAPITAL DEVELOPMENT: METHODOLOGY

The methodological part of our study is based on the analysis of financial and economic determinants of human capital development, which are a set of results of the enterprise, which serve as sources of improving the efficiency of human development potential (Figure 1).

Figure 1. Algorithm for assessing the possibility of increasing the human capital of air transport enterprises through the development of financial and economic determinants

Source: (Gernego, 2020)



## Transformation of Human Capital

In the context of our study, among the financial determinants, the debt ratio is separated, as well as the current and critical valuation ratios, and among the economic ones, the return on assets and equity.

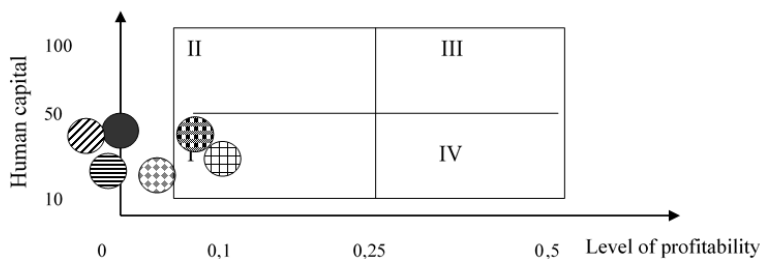
In the context of assessing the potential of socially responsible activities of the enterprise we use the matrix method, which allows to combine indicators of human capital and profitability in accordance with the method of step 2 of the algorithm.

## ESTIMATION OF AIR TRANSPORT HUMAN CAPITAL







The figure 2 shows the rating of human capital (R), and horizontally the level of profitability through the indicator of profitability of sales (P) in the form of a matrix vertically. The current research proposes to carry out typology by zones: with high (IV), stable (III), medium (II) and low potential of socially responsible business activity (I).

Figure 2. Matrix "human capital - profitability"

Source: composed by the authors in accordance with methodology (Gernego, 2020)



Note: Designation of enterprises in the matrix:

-  - PJSC "Aviation and Transport Enterprise" Artem-Avia "(P 1);
-  - PJSC "Columbus Airlines" (P 2);
-  - PJSC "Dniproavia" (P 3);
-  - PJSC Gorlytsia Airlines (P 4);
-  - PJSC "Airline" International Airlines of Ukraine "(P 5);
-  - PJSC "International Joint-Stock Aviation Company" URGA "(P 6)

**Transformation of Human Capital**

The assessment is based on the vectors of human capital and its financial determinants (Table 1)

*Table 1. Human capital, mln. UAH.*

№	Indicator	Standard	Enterprises estimation (P 1 – P 6)											
			P 1		P 2		P 3		P 4		P 5		P 6	
			I	R	I	R	I	R	I	R	I	R	I	R
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Number of employees, persons	567	3	1	14	4	101	3	7	2	2960	6	315	5
2	Salary fund	344976,56	510,67	1	1682,33	4	21515	3	1052,33	2	1990013	5	55086	6
3	Income	4332671,21	828,67	1	4533,57	4	143683,67	3	2133,00	2	25468577	5	376271,67	6
4	Net profit	-14757,92	-222,33	3	432,23	4	-57676,33	6	-951,17	2	-450597	1	12970,33	5
5	Salary fund / number of employees	188,91	116,89	3	101,43	2	206,56	5	106,77	1	472,68	6	129,11	4
6	Revenue / number of employees	1379,97	165,36	2	139,45	1	642,67	4	227,92	3	6287,51	6	816,93	5
7	Net income / number of employees	657,13	-75,88	2	6,98	4	4140,58	6	-93,01	1	-74,09	3	38,17	5
Total				36		16		17		33		13		32

Source: composed by the authors

I – indicator; R – ranking (from 1 to 6)

The assessment of financial component is represented within Table 2.



## Transformation of Human Capital

Table 2. Finance

№	Indicator	Standard	Enterprises estimation (P 1 – P 6)											
			P 1		P 2		P 3		P 4		P 5		P 6	
			I	R	I	R	I	R	I	R	I	R	I	R
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Current valuation coefficient	1-3	1,09	5	0,74	2	0,08	3	10,35	1	0,87	4	1,71	6
2	Critical evaluation coefficient	0,8-2	1,08	5	0,70	2	0,07	3	10,33	1	0,82	4	1,30	6
3	Profitability	> 10%	-0,27	3	0,10	6	-0,40	2	-0,45	1	-0,02	4	0,03	5
4	Return on assets	>10%	-0,24	2	0,23	6	-0,25	1	-0,21	3	-0,07	4	0,07	5
5	Return on equity	>20%	-2,86	1	-0,39	2	0,01	4	-0,07	3	0,10	5	0,14	6
6	Asset turnover	-	-0,22	2	0,10	5	-0,02	4	-3,98	1	-0,05	3	0,10	6
7	Debt coefficient	до 0,7	1,08	2	0,85	3	10,71	1	0,01	6	0,85	4	0,57	5
Total				29		20		26		18		16		28

Source: composed by the authors

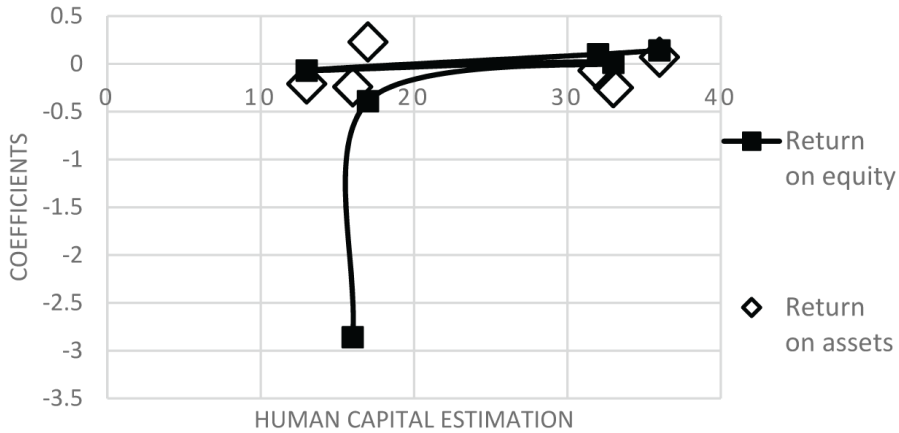
I – indicator; R – ranking (from 1 to 6)

Thus, there is a common trend for the represented enterprises, when the growth of human capital valuation correlates with a high level of profitability. Simultaneously, the lowest level of human capital is compared with a lack of profit. It is important for companies to continue implementing the strategy of strengthening human capital in order to create the preconditions for maintaining profitability at the appropriate level.

In the next step of the algorithm the research is conducted to define the interdependence of financial, economic and socially responsible activities. The analysis begins with the consideration of the coefficients of current and critical assessment in the coordinate system of human capital (Figure 3).

Figure 3. Coefficients of current and critical assessment in the coordinate system of human capital

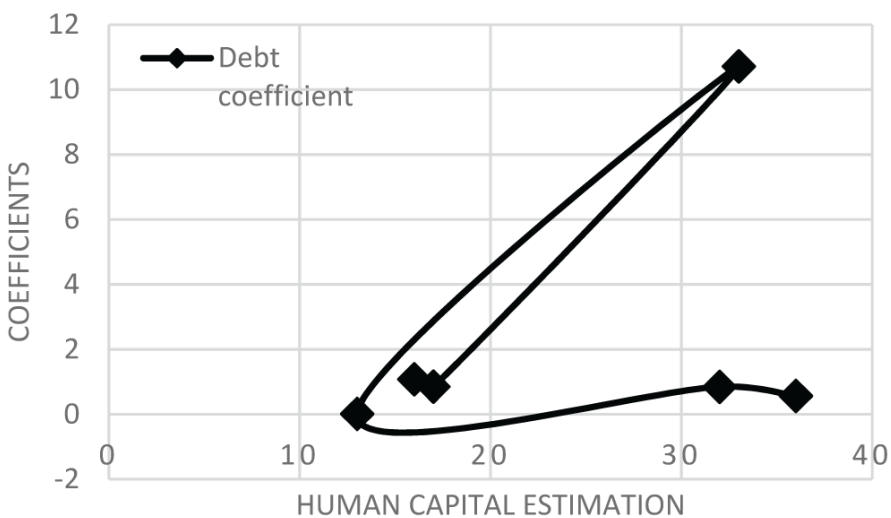
Source: composed by the authors



The coefficients of current and critical liquidity assessment have related trends, the dependence graph shows the linear nature of the relationship between them and the activities of socially responsible business in the coordinate system of human capital. In the context of our study, among the financial determinants, the level of debt is also considered (Figure 4).

Figure 4. Debt coefficient in the coordinate system of human capital

Source: composed by the authors



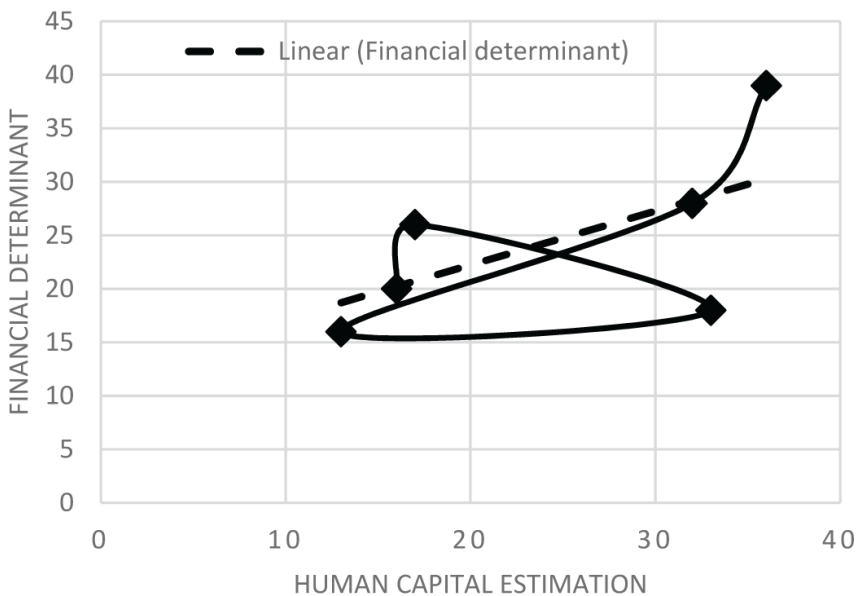
### Transformation of Human Capital

According to Figure 4 reduction of debt is typical for enterprises with a higher valuation of human capital.

In the context of financial and economic determinants of socially responsible business development, the generalized financial component is estimated, the actual impact of which on human capital is shown by constructing a correlation field (Figure 5).

Figure 5. The correlation field between the financial determinant and the human capital of enterprises

Source: composed by the authors



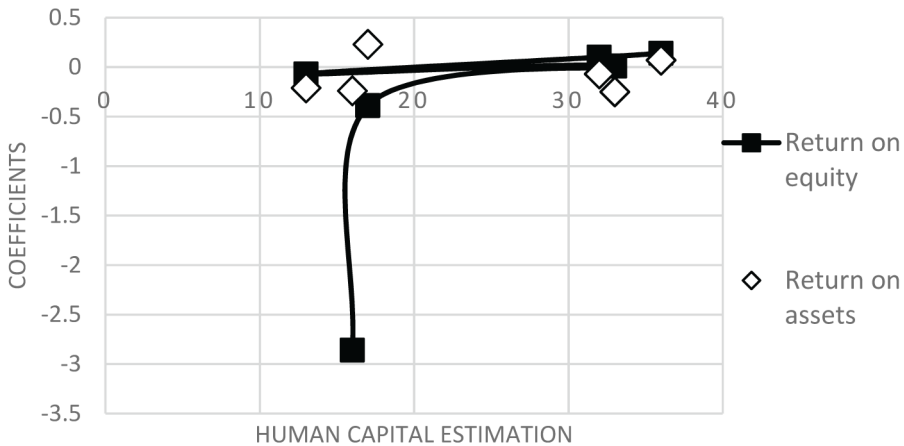
The obtained connection according to the trend line is evaluated as linear, which allows to determine the equation of the trend for the specified dependence:

$$y=0,65x+16,15$$

In the represented system under the resulting parameter  $y$  is considered as the assessment of human capital, parameter  $x$  characterizes the financial determinant. As a result, the forecast vector of human capital is observed due to the financial determinant.

At the stage of transition to the assessment of the economic determinant, the dependence of the level of potential of socially responsible business on the indicators of return on assets and equity is shown (Figure 6).

Figure 6. Profitability indicators in the coordinate system of human capital  
 Source: composed by the authors



The differences in the amplitudes of the values confirm the tendency of these relationships to be parabolic (quadratic).

Based on the study of the relationships between financial and economic determinants and indicators of socially responsible activities of enterprises, it is possible to conclude that there is a functional causal relationship between them. According to the calculations, this connection is characterized as a dense linear, which is explained by the specifics of the enterprises. During the analyzed period, the financial condition of the represented business entities has contradictory characteristics, there is a possibility of improvement by streamlining the strategic guidelines of socially responsible activities. Accordingly, there is a reserve for increasing the human capital of domestic research and educational institutions by strengthening cooperation with socially responsible businesses.

## FUTURE RESEARCH DIRECTIONS

The other possible direction for studying the Post-COVID-19 impact on the transformation of human capital on air transport is the CSR (Corporate Social Responsibility). The researchers (Bhattacharya, Good, Sardashti, 2020) consider

### ***Transformation of Human Capital***

it as a tool of decreasing the negative influence of recessions on the brand value. Besides, CSR is one of the important part of human capital development. In this context social investment in human capital as part of the CSR activities can be considered as the future research direction. It shows the effectiveness of the human capital management strategy of air transport enterprises of Ukraine. Such research will also provide an opportunity to identify the root causes of changes in one or another component of social investment in human capital in particular, and to study the impact of these changes on the overall human capital ratio.

The importance of social investment of air transport enterprises is growing due to the spread of the concept of decent work and its implication into the sustainable development concept (Gernego, Petrenko, Dyba, Onikienko, 2021). The main documents that should be used when working with social investment in the context of decent work are the Decent Work Program for Ukraine and the main thematic areas that reveal the principles of decent work.

## **CONCLUSION**

The COVID-19 brought dramatical changes into functioning of air transportation sector worldwide. All air transportation authorities paid attention to the solution of the issues created by the pandemic.

The theoretical studies of human capital management issues at the air transport are devoted to investing in human capital and its impact on the effectiveness of air transport enterprises, transformation of digital strategies of the air transport enterprises due to COVID-19, etc. But, there is a lack of researches dedicated to the Post-COVID-19 impact on transformation of the air transport human capital in Ukraine.

The scientific novelty of the chapter is as follows: in the study, both the financial and economic determinants of human capital development at the air transport enterprise level are considered as sources of improving the efficiency of human development potential on the basis of the proposed algorithm of assessment. With the help of the matrix “human capital – profitability” the appropriate assessment of the leading Ukrainian airlines was made in the study. The most common trend for the analyzed air transport enterprises is that the growth of human capital has correlation with the level of profitability. And the air transport enterprises are recommended to improve their strategy of strengthening human capital in the Post-COVID-19 times.

Social investment in human capital is proposed by the authors as one of the possible directions for the further studies of the human capital transformation of the air transport enterprises.

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# Chapter 8

## Airline Customer Complaints During the COVID-19 Pandemic: The Case of Turkey-Based Airlines

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### ABSTRACT

*The unforeseen emergence of the COVID-19 pandemic back in March 2020 made a huge impact both nationally and internationally in Turkey. One of the impacts of this disaster was on transportation services both for goods and passengers. Therefore, the focus of this study was determined to be on airline passengers' satisfaction and complaints in this bothersome period. The aim was to discover the problematic dimensions of the service provided and possibly minimize these incidents both for the sake of the airline companies and the passengers. The content analysis method was utilized, and 125 reviews containing 280 complaints were analyzed. It was discovered that the most criticized SERVQUAL dimension for Turkey-based airlines in the first year of the COVID-19 pandemic was reliability. These findings have the potential to guide professionals of passenger transportation services on which practices should be improved.*

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## **INTRODUCTION**

This chapter aims to investigate the reported customer complaints of airline passengers in Turkey during the COVID-19 pandemic. The mission is to highlight the challenges the passengers had faced during such a trying and unexpected time of uncertainty. It was expected to achieve in-depth understanding of the COVID-19 related customer complaints, the reasons lying underneath and what can be done to prevent the same service failures in the future via conducting a content analysis of online consumer complaints

The abrupt spread of corona virus (COVID-19) around the world “almost completely paralyzed” many industries (Dorofeev et al., 2020). The epidemic and pandemic outbreaks in the past and the present have intense influences on the society and consequently the economy- especially transportation of goods, passengers, and information due to supply chain disruptions (Loske, 2020). Service operations face many challenges on of which has emerged on a global scale under the COVID-19 outbreak disaster. The COVID-19 has caused significant disruptions to various business operations including service operations for travelling, ‘out of home entertainment and hospitality industries’ which in return became increasingly difficult to run in crowded cities (Sirkeci, 2021; Choi, 2020). In addition, COVID-19 has impacted the logistics industry enormously; more specifically airlines (Choi, 2020) Since Turkey has the 6th highest revenue for tonne-kilometres in the world for international air transportation (ICAO, 2020) the study focused on Turkey based airlines in hopes of providing insight regarding the airline transportation industry during COVID-19 pandemic period which may also generate managerial implications for various airlines as well.

The sample for this study was determined to be Turkey based airlines namely: Turkish Airlines, Pegasus Airlines, Anadolu Jet and Sun Express. Turkish Airlines is a flag carrier airline and is a member of Star Alliance. It has also been rated 27th on Skytrax World Airline Awards in 2019. Anadolu Jet is a Turkish Airlines trademark and provides low-cost flights. Sun Express is also a budget airline which is a Joint venture of Lufthansa and Turkish Airlines. Finally, Pegasus Airlines is one of the leading low-cost private airlines in Turkey. The aim is to highlight the incidents airline passengers have encountered during these trying times.

## **BACKGROUND**

### **Service Recovery and Complaint Handling**

Service literature represents that both service failure and service recovery strongly influence customer relationships (van Doorn and Verhoef, 2008). On the other hand, service providers attempt to decrease the negative emotions through effective recovery (Ozgen and Duman Kurt, 2012). Although service failure and service recovery are both crucial for the relationship between the company and its customer, the fact that customers are more dissatisfied with the company's failure to recover rather than the actual service failure must be stressed (Bitner et al, 1990; Berry and Parasuraman, 1991).

The most important factor for the service provider to consider when faced with a failure is to consider that the majority of the customers do not express how dissatisfied they actually are (Boshoff, 1997). Therefore, it is crucial for the service providers not to limit their recovery efforts to post-complaint instances but rather follow up on every failure in some manner. On the other hand, it must be noted that unreported service failures may also prolong relationships since people who do not report failures may be more tolerant (van Doorn and Verhoef, 2008). The service recovery is significant since, poor customer retention creates financial implications. Moreover, this financial implication due to customer retention increases over time (Brinsmead, 2007). In addition, service failures are not bound to create permanent negative outcomes if an effective recovery is carried out (Hart et al., 1990; Craighead et al., 2004). Written complaint data are real-life customers reporting actual service failures and recoveries which enable achieving large samples easily (Michel, 2001). However, it must be kept in mind that not all of the dissatisfied customers take the time to write complaint letters and complaint statistics tends to understate the frequency of dissatisfaction due to this shortcoming (Day et al., 1981; Bolting, 1989; Bearden, 1983, Gidener Ozaydin, 2016).

Consumer complaint behavior indicates behavioral and nonbehavioral responses generated due to dissatisfaction with a purchase (Singh, 1988). Even though it can be seen as a challenge for companies, they should embrace consumer complaints and encourage consumers to engage in compliant behavior. Complaints enable companies to detect critical flaws and fix them, which leads to turning dissatisfied consumers into satisfied and loyal ones (Bloggett et al., 1995).

Successful complaint handling and developing trust between both parties are crucial topics for companies that desire to establish long-term consumer relations (Morgan and Hunt, 1994). Restoring trust after service failure has the great priority to avoid consumers' exit behaviors and to rebuild the relations for re-patronage. Managing and resolving a complaint can bring several benefits to the company,

such as higher consumer retention rates, positive WOM, and satisfaction (Harrison Walker, 2001). Since non-complaining consumers have more tendency to stop doing business, in case of dissatisfaction, complaining consumers has a profound importance for companies (Fornell and Wernerfelt, 1987). It was stated that via effective complaint handling, 75% of the consumers who had been engaged in complaint behavior as a result of a bad experience can be won. Rothenberger et al. (2008) pointed out that when the first complaint is recovered well, and the process brings satisfaction, this satisfied consumer is more inclined to make future purchases than a consumer who has never received a service failure. A good recovery creates a positive attitude toward the service provider and increases the possibility of future purchases (Dewitt et al., 2009). Satisfaction with complaint recovery is also known for its influence on customer loyalty (Karatepe and Ekiz, 2004; Homburg and Fürst 2005; Komunda and Osarenkhoe, 2012). Studies focused on consumer complaints in airline transportation also found out that satisfaction with service recovery and consumer loyalty (Nikbin et al., 2015) and recommendation of the services to others (Rothenberger et al., 2008) are related.

## **Service Quality in Airline Transportation Industry**

Service quality is one of the main drivers of success for companies with operations in the services field. Acquiring a clear understanding of consumers' expectations is the most crucial element of delivering quality service (Zeithaml et al., 1990). In order to determine the service quality perceptions of the consumer, Parasuraman et al. (1985) offered a concept called "Five Gaps" framework. According to this framework, the following situations create an influence on consumer service quality perceptions; lack of understanding between consumer expectations and management perceptions of those expectations (Gap 1), the discrepancy between management perceptions of consumer expectations, and the firm's service quality specification (Gap 2), the difference between service quality specifications and the actual service delivery (Gap 3), the inconsistency between actual service and external communications pertaining to the service (Gap 4), the magnitude and the direction of the gap among expected and perceived service (Gap 5). In 1991, these factors were grouped under five dimensions which are accepted as the determinants of consumers' perceived service quality (Berry and Zeithaml, 1991).

Airline services have many interwoven processes that form service delivery as a whole. A profound comprehension of passengers' needs and expectations is a requisite for providing better services (Aksoy et al., 2013). A number of empirical studies focused on the service quality issue in the airline transportation domain. Tsaour et al. (2002) found out that the most influential service attributes were the courtesy of the attendants, safety, comfort, and cleanness of seats among fifteen

attributes. In their multinational study, Sultan and Simpson (2000) revealed that the reliability dimension of the service expectations was the most crucial one, regardless of the passenger nationality. Chen and Chang (2015) carried out a study in order to investigate the service quality expectations. Results revealed that tangibles are of fundamental importance for in-flight services while responsiveness and assurance for ground services. Service quality expectations are also known for their impact on satisfaction and purchase intentions (Park et al., 2004). Saha and Theingi (2009) have found that service quality is a successful determinant of consumer satisfaction, and satisfied consumers engage in positive word-of-mouth behavior. In a low-cost carrier setting, Curry and Gao (2012) indicated that the service quality of the service provider affects consumers' loyalty. Hapsari et al. (2017) explored the effects of service quality and consumer engagement on passenger loyalty and suggested that a high level of service quality is related to higher consumer satisfaction levels in the case of full-service carriers.

## **EMPIRICAL STUDY**

Consumer complaints have been used as a factor to assess companies' performance through consumer feedback which can also be called as a guide to determine weaknesses requiring correction (Yang & Fang, 2004). Successful companies embrace these feedbacks and use them as a tool to increase customer satisfaction.

The creation of Web 2.0 technology has enabled consumers to generate content independently and led to a significant increase in computer-mediated communication between individuals and companies, which was a one-way, static communication in the past (Costello et al., 2017). Therefore, turning the monologue into a dialogue. Consequently, electronic consumer forums have emerged, which paved the way for consumers to voice their complaints with an expectation of being heard and getting compensated (Lee & Hu, 2004).

This study adopted a qualitative research approach, which includes the analysis of e-complaints in [www.airlinequality.com](http://www.airlinequality.com) to better understand consumers' airline transportation experience during COVID-19 pandemic. The international air transport rating organization that owns the web page, Skytrax, was founded in 1989, which has no financial association or affiliation with any airline or airport, therefore, is unbiased. It consists of e-complaints for airlines and airports from all around the world. The qualitative research method was selected due to its immense value when the nature of the research is exploratory and when there is a need for a deeper understanding of a multi-dimensional phenomenon.

Content analysis was employed in order to identify consumer experiences with four Turkey-based airlines, including low-cost and full-service airlines. Since the

first COVID-19 case reported in Turkey was in March 2020, the reviews between the beginning of March 2020 and the end of March 2021 were included in this analysis. Reviews with solely favorable feedback and reviews written after March 2020 but concerning flights before that date were excluded from the scope of this analysis.

As a first step, all the reviews were categorized under different airline brands and then they were coded and classified under the corresponding service dimension. The coding process was conducted individually for all the customer complaints between March 2020-March 2021 on Turkish Airlines (THY), Pegasus Airlines (PGS), Anadolu Jet Airlines (ANJET) and Sun Express Airlines (SUNX) collected from the Skytrax website. Once the coding and classifying processes were completed, the result of two coders were compared in order to achieve inter-judge reliability. Moreover, the final draft of the coded and classified reviews was sent to two additional experts in the field which lead to general agreement.

After obtaining the consensus on coding and classification criteria, consumer complaints were assigned to service quality dimensions as shown in Table 1.

*Table 1. Distribution of codes under the SERVQUAL dimensions*

Service Quality Dimension	Complaints about...
Tangibles	• Seating
	• Food
	• In-flight entertainment
	• Aircraft condition
	• Lounge services
	• Web page and online application of the airline
Reliability	• Flight cancellation
	• Delayed flights
	• Refund process
	• Lost or damaged luggage
	• Reservation
	• Covid Measures
Responsiveness	• Unhelpful staff
	• Neglective staff
	• Inaccessible call center
Assurance	• Rude staff
	• Incompetent staff
	• Limited English proficiency
Empathy	• Lack of apology
	• Lack of understanding
	• Lack of individualized services

## **FINDINGS**

All four Turkey based airlines examined in this study namely: Turkish Airlines (THY), Sun Express (SUNX), Anadolu Jet (ANJET) and Pegasus (PGS) were analyzed in terms of review and complaint frequencies, average ratings, likelihood of recommendation, verification of the trip in question and complaint classifications with regard to SERVQUAL dimensions.

The total number of reviews on the website between the given period was 151 in total for all four airlines however the number of complaints was found to be almost the double that amount (280). Its due to the fact that dissatisfied customers had more than one dimension they were unhappy about and took the time to elaborate. As it is clear in the table below most of the reviews were about Turkish Airlines (125) because it is a Star Alliance member and in addition to being the most reputable and well-known Turkish Aviation brand it offers more flights to more locations than any other Turkish Airline.

*Table 2. Number of reviews and complaints*

	<b>THY</b>	<b>PGS</b>	<b>ANJET</b>	<b>SUNX</b>	<b>TOTAL</b>
# of reviews	125	17	2	7	151
# of complaints	240	26	2	12	280

When we examine the rating given by the passengers it comes as no surprise that the ratings are inevitably low, and this is most likely caused by the higher possibility of passengers expressing their dissatisfactions on this review website rather than positive remarks. On the other hand, one of the airlines we examined (Anadolu Jet) has an incredible average of 7,5 out of 10 which is probably caused by it having the least reviews (2) of all which are related to tangibles such as legroom, inflight entertainment, and crowded flights in the aircraft. One more underlying reason for this rating could also be explained by Anadolu Jet being a budget airline which influenced these passengers' expectations when compared to other airlines such as Turkish Airlines.

As mentioned above the ratings provided by the passengers are mostly low except Anadolu Jet, and a slight increase in business passengers' ratings for Turkish Airlines. Turkish Airlines was the only airline that got reviews from business passengers as well as economy passengers therefore, there is no data to compare for other airlines' business and economy passengers to conclude if the variation is dependent on the specific airline or the seat type and the costs related to it.

*Table 3. Average ratings*

<b>AVERAGE RATINGS</b>	<b>THY</b>	<b>PGS</b>	<b>ANJET</b>	<b>SUNX</b>
Economy class passengers	1,72	1,64	7,5	1,85
Business class passengers	2,84	n/a	n/a	n/a
Total	4,56	1,64	7,5	1,85

The possibility of recommending the airline in question was also examined and yielded a %11,2 for positive recommendation in total. The individual rates are as follows: THY %11,6, PGS %5,8, ANJET %100, SUNX %14,2. Once again Anadolu Jet gets the highest recommendation rate with %100 however it must be underlined that this outcome only relies on the two entries provided for that airline. Pegasus airline has the lowest recommendation possibility with %5,8 with 17 reviews and 26 complaints.

*Table 4. Recommendation of the airline*

<b>RECOMMENDATION</b>	<b>THY</b>	<b>PGS</b>	<b>ANJET</b>	<b>SUNX</b>
Yes	13	1	2	1
No	112	16	0	6

The verification of the trip was also a component that was examined, and it was found that out of the 151 reviews 109 were verified which makes at least %72 of these reviews outcomes of actual trips and experiences of actual people. Although 42 of these flights were not verified it should not automatically be considered false or invalid because trip verification requires additional effort on the passengers' who just might not have enough time or might have lost their tickets or most importantly did not get to fly due to reservation mistakes by the airlines.

The last analysis we conducted was complaint classification and we utilized the SERVQUAL dimensions by Parasuraman, Ziethaml and Berry as it was modified by Sultan and Simpson in a previous study on Airline service quality and passenger expectations. This classification was initially completed separately by the authors and following the %90 inter judge reliability was also brought to two other experts in the field and a consensus was formed.



**Airline Customer Complaints During the COVID-19 Pandemic**

*Table 5. Complaint classification*

SERVQUAL Dimensions	# of complaints				Total
	THY	PGS	ANJET	SUNX	
Tangibles	56	5	2	0	63
Reliability	94	8	0	10	112
Responsiveness	48	6	0	2	56
Assurance	34	6	0	0	40
Empathy	8	1	0	0	9
Total	240	26	2	12	280

Of all the 280 complaints most of them were issues related to reliability dimension which is “the airline’s ability to perform the promised service dependably and accurately” (Sultan and Simpson, 2000) a total of 112 complaints were classified under this dimension. Upon further investigation it was found that issues related with reservations, refunds, flight cancellations, coupons, covid restrictions and luggage are sub-categories of this dimension. Some examples of the aforementioned sub-categories are illustrated below:

*...once they take your money from card you are abandoned as no help you get from them. Flights have been cancelled, no email notification, no live information, no refund after 3 months! This is the last time I am using them*

*Worst airline ever, I paid for extra baggage and on the way back the check in service told me that they will charge me extra because they won’t count the sum weight of my two baggage which is by the way less than the extra that I paid for..*

*The coronavirus-related compensation programs announced by Turkish Airlines are there just to fob clients with empty promises. They refuse to apply them and do not follow ticket change/refund terms as advertised on their website.*

The second most incurred service failure was related with tangibles such as the physical aircraft attributes, in-flight meals and drinks, lounge, hygiene on board and websites of the airlines. Tangibles dimension is “the appearance of the airline’s ground facilities, aircraft, personnel and communication materials” (Sultan and Simpson, 2000).

*Seats recline at a small angle! Basic food, no fun!*

*..the plane was old and dirty, food was very bad, the plane overfull and the COVID protocols not being administered at all.*

*Seat pitch was incredibly tight and anyone over 1.85m won't fit in. There's no in-flight entertainment or Wi-Fi whatsoever.*

*... you pay a full ticket price assuming that since you're not on a low fare airline you would be served a snack or coffee..*

*There is no online check-in website in English. Mobile application won't download.*

*The award for the biggest deterioration in quality goes to Turkish Airlines. They blame covid for cutting every business class amenity - but every other tier 1 airline aren't having to cut service, this airline has crushed its standard - should be a 2-star airline now. If you can't deliver a quality product - don't reopen - but charging 4000 per person and then taking away all the quality elements is just bad*

The third most frequent SERVQUAL dimension incidents were related with responsiveness which is “the airlines willingness to help customers and provide prompt service” (Sultan and Simpson, 2000). The sub-categories for this dimension are unwilling staff, unhelpful staff and issues with call center employees and how it was virtually impossible to reach someone who is willing to help.

*Just made my 39th phone call attempt at trying to get refunded for cancelled flights. I can't even get speaking to someone. Keeping my money is obviously more important than keeping me as a customer.*

*Please do not book flights with Turkish Airlines. It's terrible. Turkish Airlines has been the worst nightmare. I have been calling them since April to reschedule my flight, canceled due to Corona, and here we are in August. The customer service is not helpful at all... After over 100 calls and emails I am exhausted and don't know how to get my money back.*

*Flight from Antalya was late due to technical error, and I asked to get off plane first because of timing for next flight (we were sitting in last rows) - something every decent company does and has understanding for when flight is delayed by the company. We had 30 minutes to get to next flight because of this delay. There was no understanding or help from flight attendants at all. In fact, all I got was rude comments from them. Worst client service ever. I will never use this airline again.*

### **Airline Customer Complaints During the COVID-19 Pandemic**

The next SERVQUAL dimension is assurance. Which is the “knowledge and courtesy of airline’s employees and their ability to convey trust and confidence” (Sultan and Simpson, 2000). The sub-categories were found as rude staff, incompetent staff and inadequate English proficiency of staff.

*... Worst was the manager where she does not have a clue when one of her check-in staff asked for more details (the check in staff also had no clue despite being at business check in counter - no training?). Sadly, let down by the airport and business class check in staff*

*The worst experience ever! Turkish Airlines made a mistake with the outbound flight (which they even recognized). Despite several feedback, tens of calls they were unable to rectify the mistake. Incompetent, unprofessional and with poor English the call center is a disaster. Terrible.*

*A few families were complaining about this prior to take off to which the crew responded very disrespectfully, (they went as far as name calling the passengers out loud) ...*

*Using the services of Pegasus Airlines - you do it at your own risk. I was able to make sure of this a few days ago, when from Istanbul, where I was in transit, I was not permitted to board on the flight to Manchester. According to UK regulations, the arriving in the country must fill out a form and pay for a COVID home test kit, for self-control after arrival. However, for some categories there is a formal exception to the rule. When boarding the flight, I presented all the necessary documents confirming that an exception to the general rule applies to me. However, the airline employees refused to let me on the flight due to the lack of the mentioned COVID home test kit. When the situation cleared up, my plane had already departed. I was not offered any compensation or a replacement ticket, the manager behaved rudely. I do not recommend using the services of this airline.*

Finally, the last SERVQUAL dimension is empathy; “the caring, individualized attention the airline provides its customers” (Sultan and Simpson, 2000). The sub-categories were not providing individualized attention and being understanding and showing empathy to special circumstances.

*My mom is flying back thru Istanbul and must wait 14 hours and fly the next morning when there are tickets available for earlier time that were never offered.*

*First of all, the ground staff at Karachi International Airport was so rude, requested a wheelchair for my wife as she is pregnant and due to some medical condition, she is not allowed to walk too long causing Edema, though wheelchair was free the staff asked for money. when we arrived in Istanbul we have requested a wheelchair again and the staff told me to take your baby and handbags with you for the boarding and we will bring your wife later, she waited for a wheelchair for 30 minutes and when she saw the last call message on flight board she picked up stuff and walked for around over a kilometer to reach the boarding gate and when I complained about it they simply ignored it. In-flight entertainment was dated and they served cold food in a box that included a tiny pouch of water, kids juice, a cold bun with cheese and a small piece of dry cake. when I have asked why not serving hot food they said due to the covid 19 we are not serving hot food but you can sit next to other passengers, the plane was packed without following SOPs. Do not recommend anyone this airline*

*I was after surgery, I tried to pay for water with my Netherlands card. Of course it is a problem if you don't have a visa. I needed to drink my pills after surgery but I couldn't pay so I didn't get any water. I thought I get could get one cup for free (I saw the cabin crew drinking from big bottles) but no. I felt very bad during the flight, but nobody came to me.*

*Never in my worst nightmares did I think I'd have an experience as horrifying as this one. This was my first time traveling with Turkish Airlines and after the experience I've had I pray it was my last as well. I was travelling with my family of four (me, my husband, and my 2 kids). We couldn't preselect the seats since the airline didn't enable the online check-in which I'm assuming was to a measure taken to ensure social distancing on the flight. They placed us all separately, when I asked why they said it was because of the social distancing measures that we were placed rows apart next to strangers. Me and my husband were placed towards the front while my kids were seated right next to each other at the very back of the flight. My husband was placed one seat apart from whoever was next to him, however I was placed right next to some strangers with an empty seat next to the three of us - my kids were placed directly next to a stranger who turned out to be the mother of one who was also placed away from her kid. Soon we found out that most families were separated this way, which to me is pretty pointless. I think if they were going to place people right next to each other they very well could've placed families AKA people of the same household next to each other instead. A few families were complaining about this prior to take off to which the crew responded very disrespectfully, (they went as far as name calling the passengers out loud) they kept on repeating this was ITA law, and they had to abide by it. They even called ground staff for one of the families. Thankfully the ground staff was way more reasonable and polite*

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*then the crew members. They shuffled a few people around including my kids very respectfully and without causing any more chaos. After the ground staff left one of the crew members returned to the family they primarily called the ground staff for and demanded they thank her because she “solved their problem” and proceeded to call the father an idiot once again. After witnessing all this my kids were terrified to move in fear of the crew disrespecting us in the same manner, despite the ground staff’s clearance. They were scared. Then came the flight from Istanbul to Manchester. This flight was fully booked there wasn’t a single seat that was empty. The cherry on top of this cake from hell was the food.*

As highlighted before, most reviews contain elements of various SERVQUAL dimensions within which is why 280 complaints were discovered from mere 151 reviews and this can also be seen in the quotes above. One thing worth mentioning is issues related to websites and online application of the airlines were classified under tangibles dimension even though these are not ‘tangible’ aspects. However, considering the recent developments it was decided that these online services fall under ‘communication materials’ of these airlines and should be examined accordingly. In addition, it must also be noted that these reviews originated from deeply dissatisfied customers and some occurrences are more severe than others.

## **DISCUSSION AND RECOMMENDATION**

Airlines should develop strong communication strategies to be able to protect their reputation in the case of a crisis such as COVID-19 pandemic. They should release the required information pro-actively before any of the consumer-generated information dominates the social media in order to prevent the possible negative outcomes. Providing a crystal-clear information about which steps will be taken and how the problem will be solved may increase the public’s trust level and it can help to avoid the negative word of mouth.

Airlines should focus on stepping up their IT and digitalization investments in order to provide more seamless customer experience for pre, during and post flight operations. Investments in direct sales and support services has a vital role in quick service recovery. In addition to that, to minimize the face-to-face contact, airlines may adopt new technologies for check-in processes such as drop-in kiosk or self-check-in kiosks. Digitalization and integration of technology in different steps of service delivery may lead not only to higher operational performance but also to lower operating costs. New negotiations are needed to be conducted between airlines and airports to decrease the fixed cost which can be achieved by digitalization, as well.

Airlines should be increase their agility and have the capability to adapt to changes in consumer expectations. Revising booking and cancellation policies depending on the Covid-19 conditions is of immense importance to establish consumer trust. Consumers should be provided the flexibility to do last minute amendments due to the uncontrollable travel restrictions. In addition, increased consumer participation in recovery process may lead to higher consumer satisfaction which is also related to consumer loyalty (Istijanto, 2021).

Price arrangement is another important topic that airlines should consider. Even though it is understandable to reflect the increasing cost and diminishing demand levels to the ticket prices, the created value should not be overlooked. Due to in-cabin COVID-19 restrictions, first class or business class passengers receive limited services, however this study showed that the price level remained same. In order to keep customer retention rate in the highest level for this lucrative passenger class, who has a vital role in airlines' profitability, new pricing techniques should be introduced.

Moreover, the increasing role of the government as a stakeholder cannot be ignored in this disruptive environment for airlines. The support of the government enables airlines to survive financially in the condition which includes skyrocketing debts and insufficient cash flows. Since most of the future projections demonstrates a long way to full recovery for the aviation industry and likelihood of other peak levels for pandemic, this support holds grave importance for the aviation industry.

Keeping in mind that international borders can be closed in any time, airlines should focus on domestic transportation and focus their promotional activities accordingly. More attention may be directed to loyalty programs providing demand stimulating offers. New promotion strategies may help airlines to keep their cash-flow at a satisfactory level.

In order to avoid the confusion over expected documents and quarantine applications in specific countries, clear explanation should be provided in airlines' web pages and there should not be any discrepancy. As for COVID-19 in-cabin protocols, all passengers should be informed in detail, all rules should be strictly applied, and the personnel should not overlook any attempt that can cause problems.

## **CONCLUSION**

Airline transportation is one of the sectors that felt the most disastrous impact of COVID-19 as it had a dramatic effect on several sectors. Cancellation of flights, a great demand for refunds, closed borders, ambiguity, new covid related in-cabin safety applications, and versatility of rules of different countries created a crisis for airlines, and they had to show incredible flexibility in order to comply with the rapid changes in the business environment as well as the physical environment.

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This study revealed that reliability is the most frequently criticized service quality dimension by passengers of both low-cost and full-service airlines. Cancellation of flight without prior notification and unclear/unstable refund policy lies at the heart of complaints related to this dimension. The dimension of tangibles was second only to reliability. Canceled in-cabin food service and small legroom were major topics for complaints regarding tangibles. Consumers' perception of unhelpful staff and the trouble with accessing the call center created the basis of complaints related with the responsiveness dimension. Rude staff and passengers' comments pertaining to airline employees' lack of knowledge to provide a proper service constitute the key concepts of complaints from assurance dimension. Last but not least, the lack of understanding passengers' needs and individualized service availability created the scope of complaints about the empathy dimension which may be less frequent but the impact on passengers' perception of the airline company was the most severe as evident from the passenger quotes above.

In terms of business-class services, the quality and the variety of in-cabin food service, as well as the closed airport lounges, were severely criticized by business-class passengers this is probably due to their expectations from the airline's business level service. The most frequent complaint was that these passengers felt like airlines used COVID-19 measures as an excuse to cut costs and save money even though ticket prices remained the same. Considering the effect of the virus is ongoing and ever-changing with new variations and the fact that long periods of lockdown and COVID restrictions are presumed to lead to inevitable shifts in consumer behavior (Sirkeci, 2021), customers may withdraw from purchasing business class tickets due to their previous experiences and dissatisfactions. Hence, it is why it is crucial for airlines to update and modify their business class services if they wish to continue charging price premium. Aforementioned service updates may be in the form of secluded lounge areas that require vaccination cards and CPR tests which provide all forms of foods and beverages like before the pandemic or cubicles inside the aircraft that passengers may remove their masks whilst seated. On the other hand, additional masks should be provided for all passengers with flights longer than 5 hours free of charge in order to create value for customers.

Previous research on airline service quality had demonstrated parallel and differing results to this study however it must be considered that this study focused on a never-before-seen pandemic. The present findings seem to be consistent with other research, which found reliability as the most critical dimension for service quality (Liou & Tzeng, 2007; Chou et al., 2011; Hussain et al., 2015). However, the results of the current study differ from Chen & Chang (2005) and Tsaur et al. (2002), which indicated that passengers' main concerns about service quality are responsiveness and tangibles, respectively. A possible explanation of these variation in findings may stem from aforementioned case of COVID-19 pandemic which may

have naturally impacted the passengers' perceptions and expectations. The findings of this study portray the importance of improving reliability, responsiveness and tangibles which is why it is expected for airlines to deliver their promises and form and announce compensation plans for specific situations regarding the pandemic whilst continuing to recruit, attract, motivate and educate their front line service employees in ways that will not further disappoint frustrated customers and cause them unrequited stress. Moreover, the tangibles such as seats and aircraft may be more challenging for airlines to update at once however, lounge, hygiene and websites could be updated and prioritized for creating customer value.

A large body of literature has focused on the crucial importance of successful complaint handling. It is suggested that managing and resolving a complaint is immensely beneficial for companies aiming for high consumer satisfaction (Blodgett et al., 1995); consumer retention (Harrison-Walker, 2011); consumer loyalty (Nikbin et al., 2015), and consumer's recommendation of the company to others (Rothenberger et al., 2008) which is also known as positive word of mouth. The fact that customers are more dissatisfied with the company's failure to recover rather than the actual service failure was previously mentioned, however, by taking into consideration that airlines may have provided a resolution which after a period of time, we found no evidence of a recovery attempt in most of the incidents.

Therefore, it became evident that automated, standardized and user friendly complaint handling systems should be developed and put into effective use of customers as soon as possible. The success for airlines utilizing such systems are inevitable, given the customer feedback. In addition, service failure recovery processes should also be developed and standardized considering the heterogeneity of services for maximizing customer satisfaction which in turn implies customer loyalty and positive word of mouth possibilities for the future. Mobile apps and websites could provide easy complaint processes for customers and live customer service in order to best accommodate the customers' complaints and needs.

This study is expected to provide practical guidance on critical issues which cause main source of problems associated with unpleasant consumer experiences in COVID-19 era. Since the problems experienced during the pandemic period for most airlines are similar according to the reviews on the Skytrax website ([airlinequality.com](http://airlinequality.com)) that were excluded from this study, the findings can be utilized not only by the Turkey-based airlines but also other international airlines. Therefore, as the issues faced are global, the findings of this study should draw attention to critical components of complaints which should be taken as salutary warnings. According to ICAO's recent report on COVID-19's economic impact on civil aviation, it is estimated that overall reduction of passenger numbers will be 60% and approximately 371 billion USD loss will occur in airlines' passenger revenues. In such a challenging atmosphere, having a detailed representation of consumer complaints about airline services during



COVID-19 may pave the way for national and international service providers to accelerate the recovery phase and improve their operations in an effort to increase consumer retention rate, customer loyalty and repurchase intentions in the future.

This study focused on the first year of COVID-19 pandemic and aimed to explore the aftermath on Turkey based airlines' service quality and customer satisfaction. Hence, future studies may also include after March 2021. In addition, future studies may collect primary data directly from customers rather than relying on secondary data which was not an option for this study due to COVID-19 restrictions in airports. Moreover, future studies may explore the possibility of focusing on alliances or other airlines. Finally, other customer review websites could be utilized for future studies if need be. The biggest limitation of this study in addition to the lack of opportunity to collect primary data, is the number of reviews on some of the airlines in question such as Anadolu Jet and Sun Express.

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## Section 3

# Various Fields

## Chapter 9

# Quasi-Experiment to Assess the Role of Real-Life Tests for the Acceptance of Technology for Mobility as a Service: The Case of Autonomous Vehicles as a Post-COVID Alternative for Tourism in Switzerland

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### ABSTRACT

*New technologies like autonomous vehicles (AVs), grouped under the concept of mobility as a service (MaaS), provide new experiences for users. To be considered as an innovation, these technologies must be accepted and adopted by users. AVs provide a public transport service in a new manner, without a service provider or driver. This kind of service is called self-service. For this research, the acceptance*

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*and adoption of AVs is investigated in a touristic ecosystem in the context of a post-COVID era. This chapter presents the result of a quasi-experiment conducted in Switzerland with students that testing an AV enhanced the user acceptance of this technology for the first and last mile of a journey (FMLM) in a touristic context. To this end, they used a revised model of the technology acceptance model (TAM) and administered the same questionnaire before and after the test of an AV. In the context of a post-COVID era, AVs could provide solutions for personal mobility for long distance as well. However, it will be necessary to provide a test-bench for these new services.*

## **INTRODUCTION**

In the mobility sector, digitalization and urbanization are mega trends influencing the development of new technologies and services (Bienhaus & Haddud, 2018; Vaz et al., 2015). This digitalization is supported by new information and communication technologies, such as big data, Internet of Things, 5G, and Artificial Intelligence. With digitalization, opportunities like Autonomous Vehicles (AVs) arise (Barreto et al., 2018). For users, AVs enable transit between points of interest without taking care of the logistical elements (traffic or parking). AVs should also bring safety, comfort, or the possibility of enjoying travel without driving; instead, talking with friends, reading, watching a movie, or even admiring a new tourist region (Schwartz et al., 2018). For public transport companies AVs should provide new services like on-demand travel, calling a vehicle when they need it, and first mile/last mile (FMLM) service between stations (bus, train, or airport) and the user's final destination (home, job, or restaurant) (Chen et al., 2020). Transport companies should also benefit from cost reduction by better energy efficiency and change in job allocation (Lu et al. 2019; Pettigrew et al., 2018).

Urbanization (more people moving into urban centers) will lead to problems such as more congestion, crowded public transport, noise, and confrontations between road users, pedestrians, car drivers, bikers, or scooter users (Han et al., 2018; Fuller et al., 2007). To fight these problems some cities have taken measures like introducing a fee to drive a private car in the city center or the reduction of the speed limit in traffic (Jia et al., 2017). In contrast, fewer people will live in rural areas. Thus, it will become difficult for public transport companies to ensure a public service that is economically viable. AVs could bring an interesting solution in this context.

Digitalization and urbanization support the concept of a Smart City (Ylipulli & Luusua, 2020). A Smart City can be seen as a network where all elements – machines, spaces (like parking), as well as humans – are connected. The elements can communicate and exchange information. For example, an AV can receive information



from a traffic light to know when it can cross the road. The traffic light analyzes who wants to cross the road and adapts the time to the ability of the person. The goal is to exploit all these connections to improve life in the city with technology.

AVs enable public transport companies to set up new services, like on-demand or FMLM transport (Chen et al., 2020). These services are grouped under the concept of Mobility as a Service (MaaS) (Becker et al., 2020). These services must be accepted and adopted by users to be considered innovations. Users reusing a service is particularly important (Park, 2019). As example, if inhabitants of a residential quarter do not adopt the AV for FMLM transport between the train station and their home, the service will not be considered a success or an innovation. Furthermore, AVs provide a self-service for mobility. Self-service is the most technology-intensive situation in which the user utilizes a technology without the physical presence of a server (Froehle & Roth, 2004). This situation is totally new for most public transport companies. Indeed, a mobility service traditionally provides transportation with the help of a driver who represents or personifies the company and ensures the co-production of the service with the user. In the absence of a driver, the co-production process of the service between the user and the AV must be totally redesigned. To do this, public transport companies could set up tests in real-life conditions. These living labs enable companies to perform research and development for services.

AVs have given rise to a great deal of global interest and the introduction of those vehicles is currently being tested. Those tests focus on technological aspects as well as the utility of AVs for cities and their inhabitants (Eden et al., 2017, May; Eden et al., 2017, September; Verma et al., 2019). Integrating AVs in the mobility policy of a city involves many stakeholders (passengers, authorities, manufacturers, public transportation companies, law enforcement officials, drivers, pedestrians, and merchants) and could lead to new problems, like a growing number of private vehicles if they are not reserved for public transportation and taxis<sup>1</sup> (Jones et al., 2021). To include AVs in the public transportation service system, the mobility policy of the city must take the whole customer journey into account, from door-to-door, especially the transition between touchpoints. Without this orchestration of the mobility service, AVs will bring little value for people, and perhaps even more problems.

In Switzerland, where this research is being conducted, AVs are not allowed to drive on public roads without a person present in the vehicle who can take control in case of emergency. The federal road office delivers special authorization for public transport companies to operate AVs at a test site. This is the case for the city of Sion. Between 2016 and 2020 AVs were tested on two roads, the first between the station and the old town and the second in the old town. As of April 2021, AVs are in now also in operation in a residential quarter of the city of Sion called Uvrier (see Figure 1). In this living lab, people discover the reality of a Smart City, especially the autonomous mobility part.

Figure 1. AVs for tourist purposes in Uvrier, Sion, Switzerland



In a tourist context, AVs could be a solution for the FMLM journey between the public transport station and the final destination. This is the case in Uvrier. The train arrives in a station located about one mile from the hotel. Since April 2021, to cover the final journey, tourists can use an AV available on demand. If the concept seems promising, it must be tested, and tourists must accept and adopt it.

To understand this, we conducted research on the user acceptance of AVs as a technology for FMLM. We would especially like to understand whether or not tourists who test AVs in real-life conditions for FMLM improve in their acceptance of AVs and their willingness to use it. Our research question is: Does testing of a public transport AV for FMLM journeys in real-life conditions improve its user acceptance of young tourists?

To this end, we conducted a quasi-experiment based on the One-Group Pretest-Post-test Design (Tyer, 2018, p. 43). Furthermore, in the context of the post-COVID era, as AVs could provide solutions for personal mobility for FMLM and long distance

journeys. However, they also bring new risks and fears. This quasi-experiment attempts to provide some answers.

Our paper is organized as follows. A brief literature review is done in section 2. Then the methodology is described in Section 3. Section 4 presents the main findings of this research. Finally, a discussion is done in Section 5 and directions for further research are considered.

## **LITERATURE REVIEW**

### **Research and Development for Mobility Services**

Research and Development (R&D) is defined in the Frascati Manual (OECD, 2015, p. 28) as “*creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge.*” In the new edition of the Frascati Manual an emphasis is put on R&D in the social sciences, humanities, and the arts (OECD, 2015, p. 44). Unlike in other industries, R&D for services is not well structured (Miles, 2007; Sundbo, 1997). The process of manufacturing innovation – research, R&D, and manufacturing – cannot be strictly used for service innovation. Indeed, unlike goods that are produced in batches, stored, and finally sold in markets (Fragnière et al., 2018), services are intangible, heterogeneous, instantaneous, and perishable (Lovelock & Gummesson, 2004). For example, if a passenger does not use the AV, no mobility service occurs.

A Service R&D Model based on the Service-Dominant logic and extended Moeller’s model is proposed by Sawatani and Fujigaki (2015, p. 166-168). In this model, “*service processes are divided into facilities, transformation and usage with three spheres, such as R&D, value co-creation and site*”. The success of service innovation depends on “*technologies and knowledge created in a R&D sphere integrated by the design methods at a value co-creation sphere*”. A value co-creation sphere, where researchers and customers collaborate, is the key element. In our research, the value co-creation sphere is the AVs test-bench of a FMLM journey in real-life condition.

Another aspect of service theory is important to consider in this context of MaaS. The interaction between a user and AVs can be considered a self-service. Froehle and Roth (2004) explain self-service as the absence of a server that leads to shared control between the technology, in our case the AV, and the customer.

## Mobility and Tourism

According to UNWTO, “Tourism is a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes. These people are called visitors (which may be either tourists or excursionists; residents or non-residents) and tourism has to do with their activities, some of which involve tourism expenditure.”<sup>2</sup> As tourism requires the movement of people, mobility is a prerequisite for this economic activity. In their customer journey, the mobility of tourists and their luggage occupies an unavoidable place. Grèzes-Bürcher et al. (2021) conducted research based on expert interviews on the potential of AVs in an Alpine Tourism Destination. Findings indicate that public electric AVs correspond to the need of customers in this touristic context. For tourism, AVs are especially suited for FMLM, the last part of a journey and considered the least efficient (Bucchiarone et al., 2020). AVs are part of the MaaS concept (Becker et al., 2020). The idea behind MaaS is to offer transport services adapted to the individual user’s needs through a co-operative and interconnected eco-system of transportation (Hietanen S., 2014). It is an alternative to the use of private vehicles. The goal is to provide an integrated and multi-modal door-to-door service for users. A technological solution, in particular the use of mobile phones, is used for reservation and payment (Lyons et al., 2019). Service is defined by Fragnière et al. (2017) as a problem resolution for the user. A new service must be designed and tested and its performance and perception must be measured.

## User Acceptance of Autonomous Vehicles (AVs)

Numerous studies try to understand the acceptance of autonomous vehicles. Among them, many use the Technology Acceptance Model (TAM) for Autonomous Vehicles, or its extension, the unified theory of acceptance and use of technology (UTAUT). The TAM (Venkatesh et al., 2003) was originally developed to assess the user acceptance of information technology.

Yuen et al. (2021) conducted a study based on the innovation diffusion theory (IDT) and the technology acceptance model (TAM). Based on 274 responses, their results confirmed that perceived usefulness and ease of use positively influence users’ intention for AV. They also found that perceived usefulness and ease of use “were influenced by the perceived characteristics of innovation (PCIs, i.e., relative advantage, compatibility, image, result demonstrability, visibility, and trialability)”. Lee et al. (2019) show that perceived ease of use and intention to use positively affects self-efficacy and that the intention to use is affected by psychological ownership but not perceived usefulness. Koul & Eydgahi (2018) found positive

correlation between perceived usefulness, perceived ease of use, and intention to use driverless car technology. However, years of driving experience and age are negatively correlated to intention to use driverless cars. Choi et al. (2015) showed that intention to use AVs is determined by perceived usefulness and trust. Nordhoff et al. (2016) created a model that linked the unified theory of acceptance and use of technology (UTAUT) and the pleasure–arousal–dominance framework.

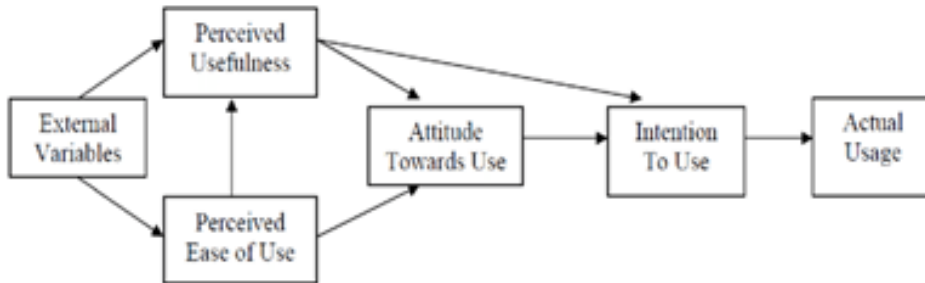
Other theories or methodologies are used to study the user acceptance of AVs. Seuwou et al. (2017) used the Actor-Network Theory (ANT) to analyze the technology acceptance of AVs. They show that ANT is useful in understanding the consumer’s behavioral intention of using Avs, especially that *“culture is a direct determinant of behavioural intention and social class is a very important moderating aspect”*. Chee et al. (2020) used Willingness to Pay (WTP) to understand why people would pay to use Avs. They found that safety, good ride, comfort, and competitive price are important, as are income level, existing travel modes for daily trips, familiarity with automated driving technology, and automated-bus ride experience. Pigeon et al. (2021) conducted a systematic literature review and identified 70 factors related to user acceptance of non-rail autonomous public transport vehicles. The most cited concern attributes of service were times, schedules, fares and safety issues. Luger-Bazinger et al. (2021) identified that, *“the most important factors influencing the perceived safety of passengers were the shuttle’s driving style and passengers’ trust in the technology”*.

Regarding the user acceptance of autonomous driving in shared taxis among young people, Li et al. (2021) found that more than half are skeptical. Dichabeng et al. (2021) identified service quality, trust, and price value as three of the three most prominent factors in understanding user acceptance of shared autonomous vehicles. Dai & Li (2020) show that experiencing AV has a positive effect on attitude, subjective norm, perceived behavioral control, and trust, and that intention to use AV is significantly predicted by attitude and perceived behavioral control.

## **METHODOLOGY**

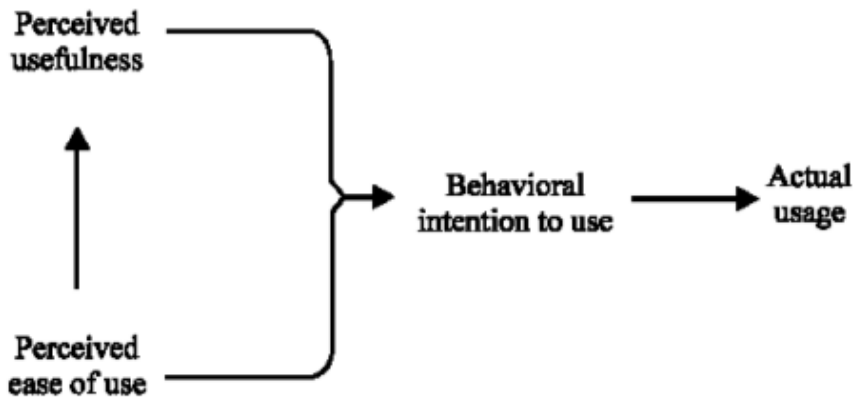
To assess the user acceptance of a technology, the Technology Acceptance Model (TAM) (see Figure 2) has been widely used since the 1990s (Davis et al., 1989; Venkatesh et al., 2003). This model is based on the basic assumption that a technology perceived as easy to use will have both higher perceived usefulness and higher adoption rates by users. Through questionnaires, these notions of perceived value are intended to be evaluated by users on Likert scales of 5 or 7 levels.

Figure 2. Technology Acceptance Model according to Davis et al. (1989)



The TAM model has undergone many adaptations. To construct our survey, we use the revised model (see Figure 3) proposed by Money and Turner (2004). This model enables identification of the relationships between *Perceived ease of use* and *Perceived usefulness* and their influence on *Behavioral intention to use* and *Actual usage* (see. Figure 2).

Figure 3. Revised model of TAM (Money and Turner, 2004)



In this revised model of TAM, Money and Turner (2004, p. 3) deleted the attitude construct as “*attitude was at best a partial mediator of the effect of perceived usefulness on intention to use, and that it added little causal explanatory power*”. We note that the questions on all three variables (Perceived ease of use, Perceived usefulness, and Behavioral intention to use) are attitude questions. As the *Attitude towards use* variable is somewhat redundant, it adds little causal explanatory power.

### **Quasi-Experiment to Assess the Role of Real-Life Tests**

To explain the dynamics of the TAM, we focus on its revised model (see Figure 3). Regarding the variable *Perceived ease of use*, we make the hypothesis that the user first perceives the ease of use of a technology. The variable *Perceived ease of use* then influences the variable *Perceived usefulness*, but the latter will make the user question the personal usefulness of a technology. The variable takes us to a behavioral dimension even though it is still an attitude variable. Thus, the two perception variables – *Perceived ease of use* and *Perceived usefulness* – influence the variable *Behavioral intention to use*. Unfortunately, this behavioral variable, which allows us to respond to the frequency of use of the new technology, is rarely addressed in traditional statistical studies. We will come back to this in the discussion of the results.

The One-Group Pretest-Posttest Design (Tyer, 2018, p43) was chosen as a research design for this quasi-experiment. First, the participants of this quasi-experiment answer questions solely based on their knowledge or pre-conception of the service they will test (O1), in this case a public transport provided by an AV. Then, users test the service in real conditions (X). For this quasi-experiment they had to travel from a train station to a hotel located about 1 mile away. When they arrive at the hotel, after experiencing the service, users must answer questions (O2).

O1 X O2

As stated in the introduction, our research question is: Does testing of a public transport AV for a FMLM journey in real-life conditions improve the user acceptance of young tourists?

The research hypothesis (H1) is: Testing an AV for public transport service in real-life has a positive effect on the user acceptance of young tourists.

Our survey was composed of 11 questions based on a Likert scale of 5 items (strongly disagree, disagree, neither disagree nor agree, agree, and strongly agree). As the number of respondents is small, we grouped the items strongly disagree and disagree and the items agree and strongly agree to perform the data analysis. Three questions concerned the *Perceived usefulness* (Thanks to the autonomous vehicle, the journey from the station to the destination was: 1. easy; 2. fast; 3. safe). Three questions concerned the *Perceived ease-of-use* (In general, the use of an autonomous vehicle is: 4. easy; 5. fast; 6. safe). Three questions concerned the *Behavioral intention to use* (In general: 7. I think using an autonomous vehicle is a good idea; 8. I think an autonomous vehicle is useful for me; 9. I have a positive perception of an autonomous vehicle). Finally, two questions concerned the *Actual usage* (If an autonomous vehicle is available: 10. I use the autonomous vehicle as a means of public transportation; 11. I use the autonomous vehicle instead of other means of transport (taxi, bus, walking, cycling, etc.). Users answer these 11 questions before

they use the AV. Then, with the help of a dedicated smartphone application, they book their AV to travel from the train station to the hotel. After using the AV for the FMLM journey, users answer the 11 same questions. At the end of the two surveys, users explained their perception of an AV before and after using it (free text box).

We used a free digital form to collect data. Users had to scan a code to answer the survey. To ensure we had the answers from both surveys (before and after) we asked users to identify themselves (surname and name or pseudonym). Data analysis was performed with the software Sphinx.

## FINDINGS

This quasi-experiment took place in June 2021 and was conducted with 57 students of a tourism bachelor’s degree program aged between 20- and 29-years-old. 43 students (10 men, 33 women) answered both questionnaires (before and after). First, we present the hypothesis tests that allow us to establish whether the precepts of the TAM model are well verified in our quasi-experiment. In this quasi-experimental set-up, users answer the same questionnaire before and after the use of an AV in a tourist context. Unfortunately, no change in perception was sufficiently significant. However, we illustrate one interesting result below.

For one item of the variable *Actual usage* (If an autonomous vehicle is available, I use the autonomous vehicle instead of other means of transport), the relation between the test of an AV and the answers is slightly significant (p-value of 13%) and a positive change in perceptions is noted (see Table 1).

Table 1. Statistical test between before-after related to one specific item of the variable *Actual usage*

If an autonomous vehicle is available, I use the AV instead of other means of transport	Before	After
Strongly disagree & Disagree	14	16
Neither disagree nor agree	11	4
Agree & Strongly agree	18	23
<b>Total</b>	43	43
p = 0,13 ; Khi2 = 4,01 ; ddl = 2 (PS). The relation is slightly significant		

This result shows that the *Actual use* of AV for transport service in a touristic context slightly increased for young people accustomed to adopting new technology



### **Quasi-Experiment to Assess the Role of Real-Life Tests**

by testing it. It especially seems that testing the AV convinces students who were uncertain before the test. By looking at the qualitative questions of the survey, some statements of students who change their appreciation from *Neither disagree nor agree* to *Agree & Strongly agree* seem to confirm this hypothesis: “very useful to book it to go where we want on demand”, “good idea for people who have difficulty walking”, “it was a nice experience and I would use it if there was one where I live”, and “it’s a useful tool for transportation”.

We see that only one test, not very significant, allows us to only partially answer our initial research question: Does testing of a public transport AV for a FMLM journey in real-life conditions improve its user acceptance of young tourists? We could interpret our results by saying that young people are used to adopting new technologies, especially digital ones, and therefore it is easier for them to adopt an AV without testing it, even if it is their first experience with it. Our question remains valid, but in future research we will look more specifically at the elderly population and a sociological problem associated with them called the digital divide.

## **CONCLUSION**

In this paper we focused our efforts on the development of a transportation service for the FMLM journey using AVs in a tourist context. In this post-COVID era, developments in artificial intelligence leading to autonomous driving benefit today from enormous means to equip vehicles, especially the electric ones. AVs have many advantages – ecological, low number of people in the vehicle, large panoramic windows to admire the landscape – that may help tourists adopt this technology for their journey. However, AVs for transportation services for tourist purpose are not sufficiently investigated or tested.

Through a quasi-experiment we wanted to verify the validity of the TAM model for the adoption of AVs for tourist transport services in the post-COVID era. The originality of the methodological approach was to “taste” this AV experience and, using a questionnaire derived from the TAM model, evaluate the change in users’ perception after using an AV for a tourist trip. Thus, a questionnaire that tests all the dimensions of the TAM model was completed before and after the AV experience by the participants.

Based on a small sample size composed of 43 students aged between 20- and 29-years-old, no change in perception is significant enough before or after the experience. This result seems coherent regarding previous research on the user acceptance of autonomous driving in shared taxis among young people where more than half are skeptical (Li et al., 2021). However, for one item in the Actual Use variable the relationship between testing a VA and the responses is slightly significant

(p-value of 13%); thus, a positive change in perception is found in the experiment. This result shows that the actual use of AV as a transportation service in a tourism context slightly increases among youth already accustomed to adopting a new technology by testing it. Specifically, it seems that the VA test convinces students who were uncertain about this given technology before the test. Therefore, it can be assumed that this category of youth will be more likely after the experiment to take up this mode of transportation in the future. This result, however, has no inferential value; it provides only a trend. Rather, we consider it from an exploratory perspective.

Indeed, the main research hypothesis we derive from this quasi-experiment is that it would be essential to offer the possibility to “taste” this new technology to get used to it before diffusing AVs in the tourism sector. However, as the p-value was not significant enough for the chosen sample, i.e., young people, this type of experiment should be reproduced for older people and see if the results are then more significant.

The contribution of this article is therefore methodological. We are convinced that technology and public transport companies should continue their efforts to provide test-bench for their new services in real conditions. In particular, they should focus their efforts on specific categories of users who are uncertain about the usefulness of technologies such as AVs for FMLM travel in the context of tourism experiences. In the context of the post-COVID era, AVs could provide solutions for personal mobility, even over long distances. However, it will be necessary to provide a test bed for these new services as they also bring new risks and fears.

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## **ENDNOTES**

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# Chapter 10

## Effects of the Pandemic on the Performance of Publicly Traded Companies Within the Baltic States

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### **ABSTRACT**

*During the coronavirus pandemic, the business and operating environment worsened rapidly in 2020, and effects lasted throughout the year. This chapter analyzed three countries of Baltic States and their publicly traded companies through longitudinal perspective (2010-2020). Examination is mainly made through revenue development, but profit and loss is briefly discussed. It is concluded that revenue declines were already in 2019 in many situations, reality and pandemic only accelerated this trajectory. The travel and service sector was of course in big trouble, but also textile production and sales were having similar effects as did also some energy industry actors. It could be said that apart of these branches, manufacturing was showing rather good performance. In general, banks in these countries also performed well during the pandemic. It is surprising that Lithuanian companies overall showed the highest profits of the examination period in year 2020, even in a situation that analyzed companies contained troubled sectors and the country was having worsening employment throughout the year.*

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## **INTRODUCTION**

World started to slow down in economic growth during 2019, and in the first quarter of 2020 was experienced the initial phases of the first wave of coronavirus pandemic. Virus infections started to spread from Asia and proceeded throughout the world in 2020. First wave was experienced in spring-early summer of 2020, and the second wave started in autumn-winter 2020. Pandemic continued as rather significant in the first quarter of 2021 as well. Rapid spread of virus had economic ramifications all over the world – in 2020 it was witnessed significant quarterly drops in GDPs (e.g. in USA, -31.4% in Q2 and in Q1 it was already -5%; Meyer et al., 2021) as well as unemployment (in India due to lockdown of spring 2020, unemployment rate grew to over 25%; Singh et al., 2020). Rapid economic worsening was caused due to response to virus as people were asked to stay home, keep distance on each other and were not therefore able to consume in old fashion products or services, and were also limited on their ability to travel and work.

Transportation, and especially passenger transportation as well as travel industry in general, has been mostly hurt during pandemic (Radic et al., 2020; Rodríguez-Antón & Alonso-Almeida, 2020). This is the situation world-wide. Only domestic travel is showing signs of some activity (incl. air travel; Garrow & Lurkin, 2021) as political decision-makers around the world all discovered country borders, and decided that these are the new fighting lines of pandemic. For smaller countries, with limited own population and being dependent on international travel, have mostly been hurt. Not only have travel industry suffered, but also different service sector and small and medium sized enterprises have paid rather high price (Juergensen, 2020; Hilmola & Lähdeaho, 2021; Sun et al., 2021). Bigger corporations, online shopping and information technology companies have been of great beneficiaries of the whole development (Donthu & Gustafsson, 2020). Around the world governments and central banks responded to crisis with loose fiscal spending, stimulus packages, lower interest rates and central bank debt purchases (Peterson & Thankom, 2020). These have saved economy somewhat, and in the late 2020 there were signs of overheating e.g. in global supply chains as freight rates climbed to very high levels in the short amount of time, and they have remained there in the first half of 2021 (Hellenic Shipping News, 2021). In 2021, first signs of inflation appeared as raw materials and components started to increase rather rapidly in price and availability issues appeared (Witkowski, 2021; Mutikani, 2021). It is still debated issue, how countries, regions and world will arise from this crisis – going further with globalization and lower custom tariffs is one option, but it could be doubted as countries and governments are in desperate need of income (Barlow et al., 2021).

## **BACKGROUND**

For all three Baltic States tourism, travel and logistics services are vital part of their economies. Typically, these three countries are having foreign trade deficits and having most of the trade made with nearby countries, where Germany and Russia play important role (Sineviciene & Krusinskas, 2018). Trade deficits are covered with active service sector having an emphasis to produce services for foreigners. However, in pandemic time economic structure and model has been on somewhat pressure, and in all three countries GDPs declined in 2020 (Table 1). This could be explained with major changes of tourism and travel – in total, nearly 7 mill. sea port passing passengers were lost during 2020 within Baltic States as compared to previous year. Decline was hardest in Estonia, where nearly 6.3 mill. passengers were lost. Although, Estonia is small country and having population of only 1.3 mill., its sea port is one of the largest in passenger volumes within the whole European Union area (it was in the third place during 2018, and its most important coupled sea port partner of Helsinki, Finland being the largest one; European Commission, 2020). High volumes in Estonia could be explained with significant interaction existing between Estonia and Finland (e.g. Anniste et al., 2017) – in labour market, foreign trade and within tourism. Also other nationalities have found this sea route in their travels. However, pandemic era has not been an easy time for air transportation either. In total three Baltic States lost 4.7 mill. passengers in 2020 as compared to 2019. In airports, the most of the lost travel was in Latvia (3.8 mill.) as it has developed as hub airport of Baltic States through serving as main airport of leading low cost Baltic carrier. Latvia's Riga airport reached in commercial air flights during 2018 in European level to the rank of 40 (European Commission, 2020).

During 2021 and in the first half of it, the situation has not changed for any better. In winter and spring 2021 virus spreading was great challenge and infection numbers increased rapidly in these countries. Therefore, tourism has been opened only in small parts during the early summer. It is somewhat surprising to find out from Table 1 that unemployment has not increased in that wide scale in this situation, even if tourism sector is going through tough times. Actually, in global financial crisis (2008-2009) unemployment increased in all of these countries to around 15-20%. Only Lithuanian situation now is worsen than back then. Estonia and Latvia have been more robust in this current economic turbulence. It should be noted that earlier crisis was dealt in all Baltic States with internal devaluations (declining salaries for some years; see Norkus, 2018) with the strength of currency and fiscal discipline, which might be the reasons for current robust performance of corona crisis (Anghel et al., 2014). If GDP declines are compared between corona virus crisis (2020) and to that of earlier global financial crisis (2009), it is clear

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that global financial crisis was much worse (GDPs declined from 15-20% in 2009 as reported in Hilmola, 2013).

*Table 1. Passenger transportation, unemployment and GDP in Baltic States during 2020 (sea port passenger transport in case of Latvia incl. only Riga). Sources: Statistics Estonia (2021), Central Statistical Bureau of Latvia (2021), Port of Riga (2021), Statistics Lithuania (2021), and Trading Economics (2021)*

	Estonia	Latvia	Lithuania
Passengers, sea ports	4451096	278800	260200
Change from 2019 (%)	-58.59%	-67.15%	-26.31%
Passengers, airports ('000)	134	1400	97
Change from 2019 (%)	-78.37%	-73.08%	-81.78%
Unemployment rate (%), 2020	7.40%	7.90%	16.10%
GDP (annual change, %)	-3.3%	-3.6%	-4.1%

*Table 2. Freight handling in three different transportation modes in Baltic States during 2020. Sources: Statistics Estonia (2021), Central Statistical Bureau of Latvia (2021), Statistics Lithuania (2021)*

	Estonia	Latvia	Lithuania
Sea port handling ('000 tons)	37687.6	44928.0	55299.9
Change from 2019 (%)	-0.01%	-27.98%	-1.17%
Road transports ('000 tons)	23298.0	75705.0	107041.6
Change from 2018/2019 (%)	-17.88%	2.64%	20.13%
Railway transports ('000 tons)	15799.0	24056.0	53429.7
Change from 2019 (%)	-25.97%	-42.02%	-3.22%

\* road transport volume comparison in Lithuania to year 2018 as 2019 is not complete; Estonia and Latvia compared to 2019 volumes

In freight transportation side situation in Baltic States was rather stable in 2020 (Table 2), if thinking about big changes in global trade. For example, sea port handling in Estonia and Lithuania was basically at the same level as compared to 2019. However, handling declined rather significantly in Latvia. This decline was

caused by raw material transit decline (mostly coal), which also had its effects on Latvian railway transportation volumes. In road transportation side (as measured in tons) both Latvia and Lithuania showed growing volumes, but Estonia in turn was experiencing a decline. Railway transportation volumes were robust in Lithuania in 2020, where Estonia (together with Latvia) experienced decline (this was also caused by raw materials). As most of the analyzed companies in the following are from non-coal and handling of energy materials, environment in 2020 was rather stable, and manageable, even if globally crisis was rather significant.

In coronavirus crisis it is important to highlight that not all sectors have done poorly. For example, export performance has been extremely good after global lockdown of spring 2020 – in Baltic States this means that larger companies are exporting more as they traditionally dominate the volumes (Cieřlik et al., 2015). In monetary terms exports have recorded in the late 2020 and 2021 highest monthly amounts ever in Estonia and Latvia (in Lithuania it is rather close to all time highs). Trade deficits have also eroded during the process, and in some months Estonian and Lithuanian trade accounts have even shown trade surplus (Trading Economics, 2021). Interestingly, wages in manufacturing and/or private sector have also increased during pandemic era. Situation reminds somewhat the early 1990s, when trade surplus was also present in these countries (although in minor extent), however, the role of manufacturing in formation of GDP was much more significant back then. Of course, all these countries are following general development, where banking, real estate and retail have gained interest in foreign direct investment flows during previous decades. However, it could not be said that manufacturing would not have done that poor either. Actually, manufacturing investments to these countries from abroad have been on constant increase during the previous decade time (Eesti Pank, 2021; Latvijas Banka, 2021; Bank of Lithuania, 2021).

## **DATA COLLECTION AND ANALYSIS**

This chapter contains analysis of publicly traded companies of three Baltic States, which have been listed on Nasdaq Baltic exchange. Analysis consist in total 60 companies, and they are rather equally spread in numbers with three countries (Lithuania having highest amount, 26 companies being listed). Analysed companies are varying in size and within branch quite much, which makes analysis important to complete as effects on smaller countries in pandemic times are evaluated. Average size of analyzed company in 2019 was 116.3 mill. EUR (st. dev. of 183.4 mill. EUR), and in 2020 it declined to 100 mill. EUR (st. dev. of 149. mill. EUR).

In this geographical region the role of travel and tourism as well as logistics services are both rather important, which give further motivation for this research.

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In the following analyses are completed at country level, and before publicly traded company performance, were macro economical, logistics as well as rough touristic indicators introduced in 2020 pandemic crisis. Comparison was also made to earlier global financial crisis (2008-2009). As was already concluded, tourism (passenger transport) has declined a lot in these countries, and in logistics freight movement of raw materials was in significant decline too. In other respects, freight volume in sea ports is rather stabile, and road transportation volumes are in general showing growth (of course exception exist, sea transportation volume decline of Latvia and Estonian road freight decline).

Publicly traded companies dataset is longitudinal, and comprehensive, and it consists observation period of 2010-2020. As is illustrated in the following, revenue decline in many cases already started in 2019, and it was significantly accelerated in 2020 by pandemic. However, as following analysis illustrates, pandemic time has not been that bad to all sectors, and in some clear benefits could be detected. For example, in 2019 within Baltic States the largest publicly traded company in revenue terms was Estonian sea transportation company (having revenue of 949.1 mill. EUR, which lost somewhat above half of this in the following year), but in 2020 it was retailing company originating from the same country (revenue of 741.9 mill. EUR, which grew 3.5% from previous year).

## **PERFORMANCE OF ESTONIAN PUBLICLY TRADED COMPANIES**

In Estonian sample of publicly traded companies (, which were traded in 2020, in total 19 companies) include four companies, which were listed to the exchange during the observation period (years 2010-2020), and do not have accounting records available from the entire period (see Appendix A for details). One gambling company left the exchange during this same period, and it is not included in this analysis at all. It should be noted that these four listed companies are all such sized that they do not have pose significant effect on revenue development – they are two banks, investment fund and small manufacturer.

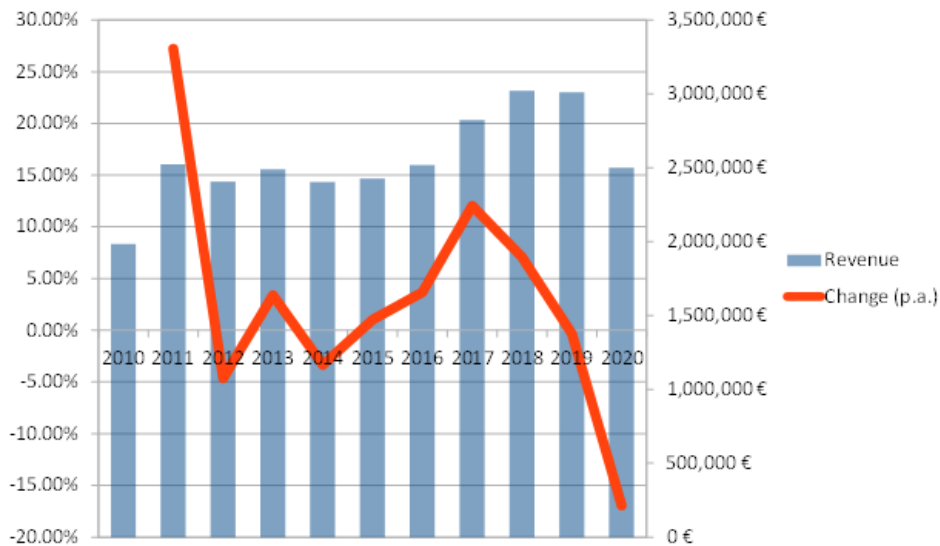
As shown in Figure 1, in typical, annual total revenue of these 19 publicly listed companies is between 2.5-3 bill. EUR. Most of the revenue is in the hands of small amount of companies as one sea transportation company, one retail corporation and two construction companies accounted in the observation period on the average year 75.9% from all revenues.

It could be detected from both overall sample (Figure 1) and out of manufacturing affiliated companies (Figure 2), that the first half of observed decade was troublesome with Euro crises. However, from year 2015 to 2017 there was a clear growth present

in revenues. This also concerned manufacturing. From 2018 onwards in both Figures 1 and 2 there is clear trend that annual revenue growth declines, and in year 2020 their decline was rather significant. In overall, sample shows drop of 16.94% in 2020, where manufacturing companies experienced decline of 13.33%. However, it should be emphasized that growth was already negative in 2019 – all companies together showed small decline of 0.32%, whereas manufacturing was already having revenue decline of 6.07%.

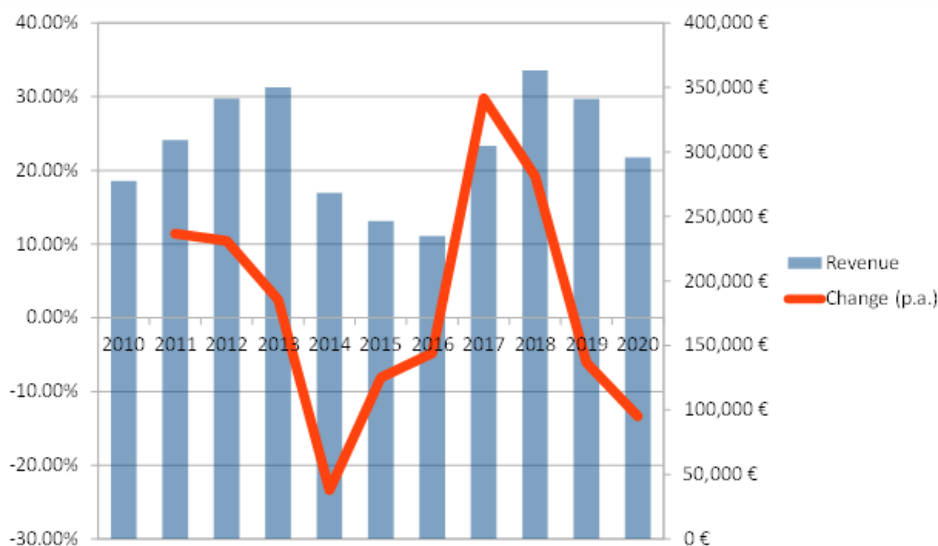
Companies causing most of the decline in revenues during 2020 were two actors representing sea transportation (-53.3%; passengers and services most important revenue stream) and sea port (-17.8%; in this sea port revenue stream both passenger transports as well as freight are important), and in manufacturing group, two textile industry actors (both losing half or more of their revenues). Not all companies suffered from shrinking markets – two banks grew also in 2020 (showing growth of 30-40%), and both in rather significant manner (although their effects on overall revenues is small as banks in general are asset intensive).

Figure 1. Revenue development ('000 EUR) in publicly traded companies of Estonia during time period of 2010-2020.



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Figure 2. Revenue development ('000 EUR) in publicly traded companies of Estonian manufacturing sector during time period of 2010-2020.



In the crisis year of 2020, profits were of course impacted in analyzed companies (not further elaborated with figure or table). In overall, profits dropped in the overall sample as slightly negative (prior to crisis profits were around 200 mill. EUR p.a., and in 2020 they were -13 mill. EUR), but this mostly due to high deficits of very few companies (like sea transportation company with deficit of 158 mill. EUR and commercial real estate actor having deficit of 28 mill. EUR), and in contrary within some companies, profits even increased (like in two banks, one construction company and in three manufacturing companies). Rather surprisingly, manufacturing companies together were able to show profits in 2020, and they also increased from previous year. This could be explained with profit related challenges in two years prior to coronavirus (as some companies went through serious restructuring).

## PERFORMANCE OF LATVIAN PUBLICLY TRADED COMPANIES

In total 15 companies were included in the Latvian publicly traded company sample, where three of these were listed to the exchange during the years of examination period (see Appendix A). These listed companies have rather marginal role in the development of revenues as largest one of them was in 2020 having 22.6 mill. EUR revenue (second largest 16 mill. EUR and last having no revenue at all). However,

during observation period of 2010-2020 there were number of companies, which left the market (in total six were delisted from exchange). This delisting is one reason, why total revenue of Figure 3 is much lower, for example as compared to Estonian revenue of Figure 1. For example, one pharmaceutical company left exchange in 2020, and it had revenues of somewhat above 140 mill. EUR. Also another company, which was delisted in 2020, was operating in manufacturing of electric machines, and was having revenues of around 60 mill. EUR. Other four delisted companies were much smaller in size. These delisted companies are not included in the analysis. Together with these, one ship repair and construction company was not able to supply annual accounting records of 2020 (situation in the end of May 2021), and it was as well excluded from the entire observation period.

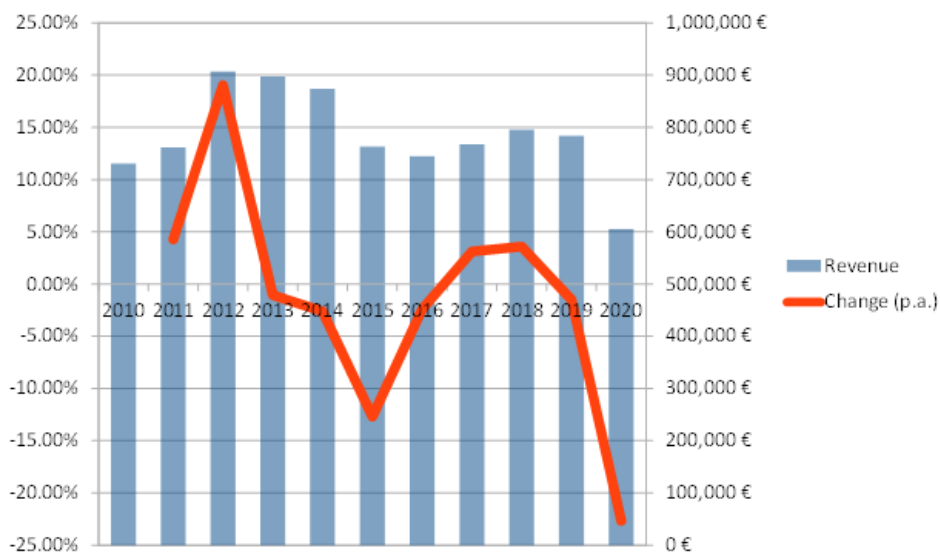
Overall revenue development of Latvian publicly traded companies (Figure 3) follows that of Estonia. First half of decade is challenging time for revenue growth, and then from 2016 onwards revenue growth period continues until 2018 to turn again in decline. It is notable that in 2019 overall revenue was on annual basis already 1.5% negative. However, year 2020 was further strongly accelerating this trend as revenues declined by 22.7%. Analyzed group of companies of Latvia are also very much concentrated in revenue terms to small number of companies, and actually three companies in this period account on the average of 78% from annual revenue. These companies are gas sales and distribution company, glass manufacturer and pharmaceutical manufacturer. All of these companies faced declining revenue in 2020, and particularly revenues declined in the two first mentioned (gas company losing 40.8% of their revenue as glass manufacturer lost 21.5%).

In Latvian manufacturing related companies development of revenue is in general much better during the observation period (Figure 4). Revenues are growing throughout the period, apart of year 2020. However, annual revenue growth is having slowing down trend in the observation period, and year 2020 is no exception to this trend. As in year 2019 within annual basis revenues grew 4.23%, they declined in 2020 by 10.26%. Only two companies clearly had growing revenues in 2020 from manufacturing group – one cosmetics producer and distributor, and one telecommunications equipment supplier.

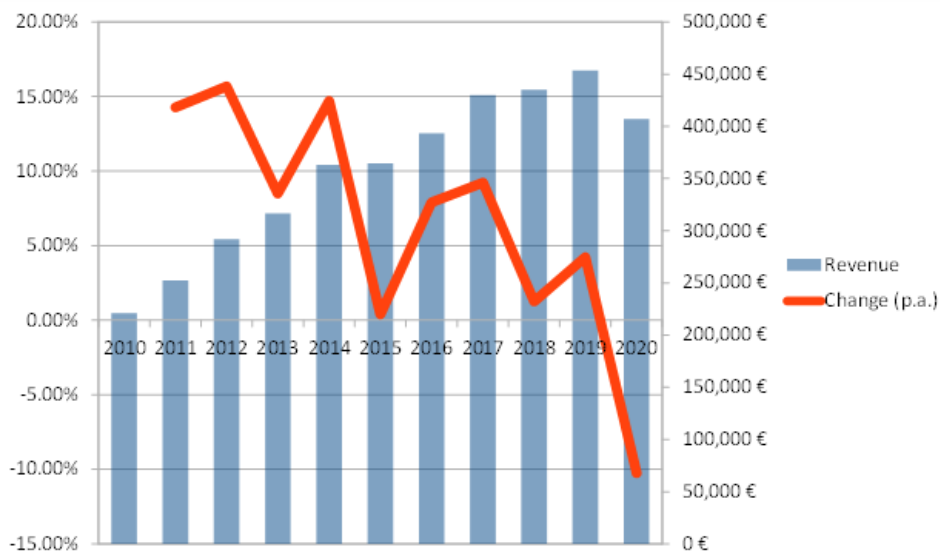


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*Figure 3. Revenue development ('000 EUR) in publicly traded companies of Latvia during time period of 2010-2020.*



*Figure 4. Revenue development ('000 EUR) in publicly traded companies of Latvian manufacturing sector during time period of 2010-2020.*



In profit terms, all Latvian companies together showed profits in 2020, profits also in overall improved from 2019. Development was the same among manufacturing companies as well, and they together also reached in improved positive result. This situation could be explained with the fact that Latvian group of companies does not include those branches, which were hardest hit by pandemic. Similarities to Estonian situation could also be drawn as some manufacturing companies were in deep troubles prior to pandemic, and needed to restructure their operations earlier.

## **PERFORMANCE OF LITHUANIAN PUBLICLY TRADED COMPANIES**

Largest amount of listed companies from three Baltic States exist in Lithuania, in total 26 at the year end of 2020. Seven out of these 26 were listed during observation period, so these companies are not part of data for the entire period. Largest companies from these listed seven are travel agency and travel organizing company as well as gas distribution company. At the end of 2020 gas distribution company had revenues of approx. 52 mill. EUR, and travel related company was at the level of 33 mill. EUR. In the earlier years gas distribution company was at these same levels (or slightly higher), however, travel company was much larger, having sales of around 180 mill. EUR (in 2018 & 2019). Other listed companies are still rather small, having revenues of 7 mill. EUR and below. During observation period two companies were delisted from stock exchange, and these are not taken into account in the analysis (energy sector actors with revenues of approx. 140 mill. EUR and 400-600 mill. EUR).

There is not that great concentration of revenues to few numbers of companies in Lithuania as it was in two earlier country analyses. Five largest companies account in typical year somewhat above half from the revenue – these are from diverse industries, like agricultural trade, telecommunication services, food industry, apparel retail and energy. Lithuanian companies also show most robust performance in year 2020 – decline in revenues of all publicly traded companies was 9.14%, and in manufacturing related 4.68%. Before this in both groups revenues have been growing consistently, however, the rate of growth has been on decline (having similarity to Latvian companies).

Most notable declines in revenues (in absolute and relative terms) were present in travel agency / travel organizing company (-81.6%), in construction company (-45%) and two energy industry suppliers (-21-23%) and apparel retailer (-16.5%). Highest growths in turn were present in smaller technology sector company (+370.6%), bank (+34.9%) and organic food producer (+16.8%). Many companies had only minor

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revenue changes in 2020, and this mostly for the reason that they operate in food production (e.g. dairies) and lower technology manufacturing.

Figure 5. Revenue development ('000 EUR) in publicly traded companies of Lithuania during time period of 2010-2020.

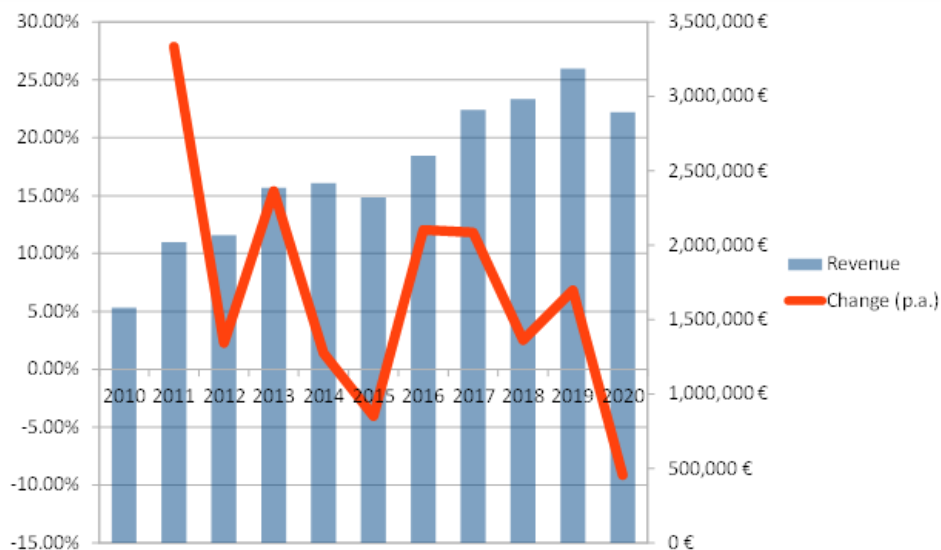
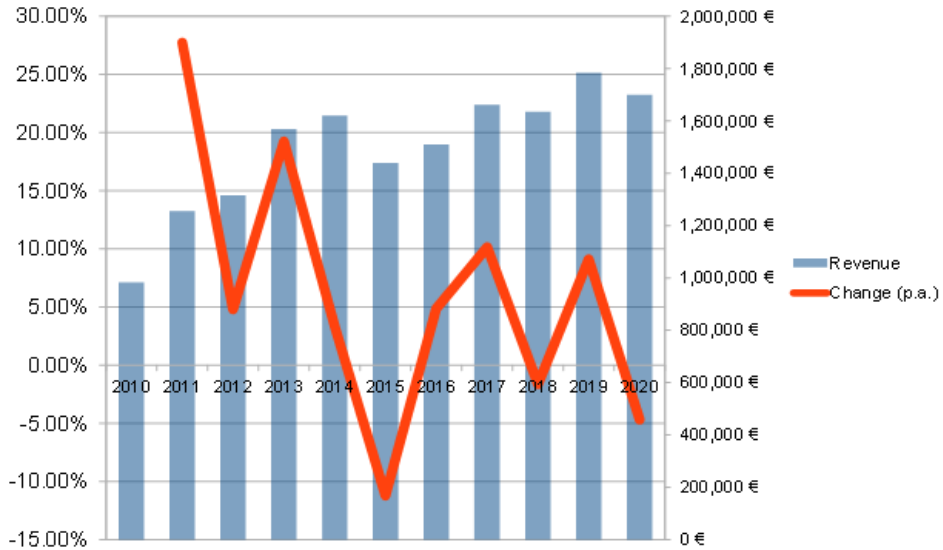


Figure 6. Revenue development ('000 EUR) in publicly traded companies of Lithuanian manufacturing sector during time period of 2010-2020.



It is surprising that pandemic year 2020 did not impact overall group of Lithuanian companies nearly at all concerning their profits. Actually, profits in total increased from 2019 in 2020, and they were also at highest level in the entire observation period (2010-2020). This could be explained with the flexibility and earlier profitability of high revenue declining companies – they were able scale-down operations as revenues dropped (like travel agency and construction company), and significant losses were mostly avoided (actually, construction company was able to deliver high profits). In manufacturing companies, development of 2020 was rather similar to overall sample as profits increased from 2019, and were actually the second highest in the observation period (only 2012 was having higher level).

## CONCLUSION

In coronavirus pandemic year 2020, service sector, commercial real estate (particularly, retail and office) and travel industry were huge losing parties, and this in world-wide. Despite the difficulties, manufacturing sector has been able to operate, and often with profits. As this book chapter illustrated that revenue loss of manufacturing companies in 2020 was much lower in magnitude in all Baltic States than what was the situation for all publicly traded companies as a whole. Manufacturing companies

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also showed profits. However, it should be emphasized that the state of manufacturing is of course industry specific – even among analyzed three countries textile sector was in troublesome position. In addition, energy raw material distribution and sales was also within troubles (although, countries do not have that much manufacturing in this regard), which is linked to low energy prices in the first half of 2020.

Analysis revealed that transportation and passenger transportation companies have been severely hurt during 2020. Highest revenue (proportional) loss was recorded in travel agency / travel organizing company, which was followed by sea transportation company. Both of these companies experienced deficits in 2020, and losses of latter company were rather substantial amount in absolute terms. In research sample there was also one sea port, which also experienced revenue decline, even if it serves both freight and passengers. This illustrates linkage of different actors within passenger and travel chains – long-term infrastructure is also being hurt. In the case of Baltic States, and based on this chapter, it is anyway relieving to note that local manufacturing survived year 2020, which provides basis for transportation sector revenue growth and profits, once pandemic eases its grip in passenger flows. It is also encouraging to note that local banks were performing rather well in the analysis, which is vital for sustainable recovery in forthcoming years.

It is somewhat surprising to find out that all analyzed countries and their publicly traded companies together were at adequate level in profits. For example, in Lithuania profits in total were highest in the entire observation period, and in Latvia they also improved in 2020 from 2019. Only in Estonia in total losses were recorded, but this mostly due to dependency on passenger transports at sea and tourism. So, in all Baltic States it could be said that pandemic time was rather well managed from the perspective of society and functioning of economy. It is of course so that in lockdowns and limited ability for people to travel, some companies are severely hurt, however, at least this analysis shows that these troublesome sectors were not having serious spillover effect on other sectors. It is also known from background analysis section that raw material transportation (mostly transit) through Baltic States experienced hardship in 2020, and this affected freight volumes of sea ports and railways. What is known from 2021, is that pandemic infection waves were increasing significantly in the late 2020 and in the first half of 2021. These meant more lockdowns, and even more significant travel restrictions. Therefore, it would be vital to follow development in 2021 and 2022 to make conclusions about the state of publicly traded companies in these countries. Actually, Baltic States hinder quite significant opportunity for economic strength and growth in the forthcoming years, when (and if) virus pandemic starts to ease further (or coronavirus just weakens and disappears). As most of the travel to these countries is from nearby countries, it will recover first from all travel businesses. Even if this travel recovery would not be immediately to the level of 2019 (it could take even number of years), current travel

activity is so low that growth rates shall anyway be significant. It is already known from autumn of 2021 that energy raw materials (especially oil and coal) are having high demand and prices. This ought to cause recovery in sea ports and railways, but also will help distribution and sales companies in the region. It also seems based on completed analysis that manufacturing sector shall do well in 2021 onwards no matter what the future holds. Challenges in international supply chains and their increased costs in 2021 are so huge that European economies and companies shall bring some manufacturing capacity closer to the main markets anyway.

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## **APPENDIX 1.**

### **Estonian Companies (M in Parenthesis Denotes Manufacturing)**

Arco Vara, Baltika (M), Coop Pank (from 2015 onwards), Eften Real Estate Fund III (from 2016 onwards), Express Grupp, Harju Elekter (M), LHV (from 2012 onwards), Linda Nektar (M; from 2012 onwards), Merko Ehitus, Nordecon, Nordic Fibreboard (M), Prfoods (M), Pro Kapital Group, Silvano Fashion (M), Tallink, Tallinn Sea Port, Tallinna Kaubamaja, Tallinna Vesi, Trigon Property Development

### **Latvian Companies (M in Parenthesis Denotes Manufacturing)**

Baltic Technology Ventures (from 2013 onwards), Ditton (M), HansaMatrix (M; from 2012 onwards), Kurzemes Atslega 1 (M), Latvijas balzams (M), Latvijas Gaze, Latvijas Juras, Madara (M; from 2017 onwards), Olainfarm (M), Pata Saldus (M), RAR, SAF (M), Siguldas (M), Valmiera glass (M), VEF

### **Lithuanian Companies (M in Parenthesis Denotes Manufacturing)**

Amber Grid (from 2013 onwards), Apranga, Auga (M), Grigeo (M), Ignitis (from 2016 onwards), Invalda, INVL Baltic Farmland (from 2014 onwards), INVL Baltic Real Estate (from 2014 onwards), INVL Technology (from 2014 onwards), K2LT (from 2013 onwards), Kauno Energia, Klaipėdos Nafta, Linas (M), Linas Agro Group (M), Litgrid, Novaturas (from 2017 onwards), Panevezio Statybos Trestas, Pieno žvaigždės (M), Rokiškio sūris (M), Šiaulių bankas, Snaige (M), Telia Lietuva, Utenos trikotazas (M), Vilkyškių pieninė (M), Vilniaus Baldai (M), Zemaitijos Pienas (M)

# Chapter 11

## COVID-19 and Its Effects in the Global Transportation System: Is This the End of Tourism, at Least as We Know It?

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### **ABSTRACT**

*At the end of December of 2019, the first cases of COVID-19 alerted the health authorities about the rise of a new pandemic. Although some voices have claimed that mass tourism as well as the public and private transport system are fertile ground for lethal virus propagation, governments systematically overlooked these alerts. In this respect, COVID-19 generated an unparalleled halt to the tourism industry and the transport system. The globalization world sets the pace to new fractured geography fraught with geopolitical tensions, chauvinist, and separatist discourses without mentioning the rise of global fears and anxieties. Having said this, the chapter discusses critically the effects of COVID-19 and the future guidelines of research for the next years. The chapter holds the thesis the world is being feudalized towards an atomized climate that marks a new form of production/consumption. Far from being a foundational event, COVID-19 reaffirms culturally and symbolically a trend initiated just after the War on Terror was declared during Bush's administration.*

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## **INTRODUCTION**

From its outset, tourism and transportation industries have faced serious and global threats (Bianchi 2006), some of which were potential of high destructive capacities for the services sector (Williams & Balaz, 2015; Becken & Hughey, 2013). The modern tourism industry derives from the technological breakthroughs applied over the transportation system, which facilitated physical movement. Dispersed geographical points were connected in hours (Cresswell 2008; Vannini, 2012; Korstanje 2018). To some extent, the modern transportation system and tourism are inextricably intertwined (Cresswell & Merriman, 2016). Over the recent years, some global risks such as terrorist attacks, natural disasters, and of course, global pandemic have placed the transportation system and tourism in jeopardy (Rack et al 2005; Kozak, Crofts & Law, 2007). No matter the nature of these risks, experts have reached a consensus that the turn of the century has brought many unseen dangers such as natural disasters, climate change and terrorism without mentioning lethal virus outbreaks which escaped the national controls of states (Ritchie 2004; 2008; Laws, Prideaux & Chon, 2007; Saha & Yap, 2014; Tzanelli 2016). This was precisely the case of H1N1, SARS, Ebola and today COVID-19.

As sounding as it may sound, a virus-like COVID-19 not only shocked the world, stopping the global transportation system as never before leading the tourism industry to an unparalleled agony (Higgins-Desbiolles 2020; Gossling, Scott & Hall, 2020). What is more than important to discuss is that any global state of emergency, as almost always, interrogates the medical and bio-security protocols of the industrialized nations in the North (Hoque et al 2020). As Quarantelli (2005) puts it, the nature of disasters precisely punctuates the lack of responsiveness of society to deal with new normality or problem experts were unprepared. When disasters take a hit, the security-related protocols simply fall short. Equally important, the effects of disasters can be divided into two great families: tangible and perceived effects. While the former signals to material losses, for example, after an earthquake, the latter refers to a much deeper emotional and psychological process framed in the subject's perception. In some cases, disasters are mediatically packaged and sold to be consumed 24/7. This was probably the case of COVID19, a virus (SARSCoV2) originally reported in Wuhan, China, which stopped literally the world. At the end of December of 2019, the media echoed on news speaking about the strange disease that affected elderly people. The symphony ranged from cough, fever, loss of smell or taste towards bilateral pneumonia and ultimately the death. Once the first cases were reported in Europe, governments started a set of restrictive measures oriented to contain a potential epidemic. Airspaces and borders were systematically closed, while a strict quarantine was domestically adopted. Lay-citizens were forced to stay at home, while security forces patrolled the streets. As a result of this, global

economies not only slumped down but also the global trade and sectors such as tourism, hospitality, and the transport system was seriously harmed. With the benefits of hindsight, COVID19 today has infected 243.617.779 persons. In lives, COVID19 has generated more than 5 million casualties worldwide. The most affected countries as the US (754.913 victims), India (453.723), Brazil (604.764), Mexico (285.669) and Russia (228.453) only to name a few (for further details see COVID World-odometer, 2021- consulted on 22 October 2021). The restrictive protocols put the government in a difficult prerogative, the prioritization of public health vs. the urgency to palliate the devastating consequences on the economy. To the economic problems, we must add some socio-cultural aftermaths that should be at least debated. The present book chapter interrogates furtherly the radical changes in travel behaviour and the transport system accelerated by the COVID19 crisis. This point raises some interesting questions: how do we study tourism in a world without tourists? What are the real impacts of COVID19 in the travel cosmologies as well as in the transport system? Is this the end of tourism, as least as we know it?

As the previous backdrop, the first section concentrates efforts in discussing the problem of tourist-centricity which is associated with mass tourism as well as the present high-mobilities societies. We are educated to esteem tourists as ambassadors of prosperous nations whose outlays help under-developed economies (Franklin, 2007). This position leads to the consolidation of a new academic paradigm known as the economic-based doctrine which postulates the tourist is not only the most valuable economic agent of the industry but also a source of valid information for the market analysts. COVID19 leads us to think about how to study tourism and the transport system in a world without passengers. The second section focuses on the sociology of mobilities, a newly emerging field that holds we live in mobile societies. The section stresses the contributions of two senior scholars, Urry (1992) and Harvey (1990). From different angles, both agree that tourism tends to be a process of virtualization determined by the hegemony of the sign. This section offers a complementary explanation giving a historical sweep on the tourism evolution. Lastly, the fourth and fifth sections are reserved to offer a diagnosis of the future of the transport system and the tourism industry in the years to come. Of course, let's clarify to readers that the tourism industry is an important part of the transport system, and for that, it is our main object of scrutiny in this piece.

## **COVID19 AND TOURISM RESEARCH: A WORLD WITHOUT TOURISTS?**

Since the SARS-COV2 (popularly known as COVID19) seems to be a new virus little research has been published by these days. However, earlier outbreaks of

SARS, H1N1 and Ebola have populated the leading tourism-related journals in the past years. In some perspective, the studies emphasize the risks of mobilities and tourism as natural carriers to disseminate the virus, as well as in the material losses pandemics represent for the tourism and hospitality industries (Henderson & Ng, 2004; Monterrubio 2010; Cooper 2006; McKercher & Chon 20004; Page, Song & Wu, 2012). To put this in bluntly, all the published literature in a few lines is an impossible task, but basically, these studies can be classified in three clear-cut families a) the economic effects of virus outbreaks and pandemics on the economy of tourism (Zeng, Carter & de Lacy, 2005; Dwyer et al 2006; Dombey 2004); b) the demographic and social aspects of tourists to correlate directly to risk perception (Reisinger & Mavondo, 2006; Seabra et al 2013) and c) the communication process and the organic image of the destination (Wall, 2006; Hall 2010; Dolnicar & Grabler, 2004). All these families have some commonalities to mention. The influence of the economic-based paradigm, as well as the urgency to measure the psychological impact of pandemics in the tourist' mind. The economic-based paradigm is a conceptual framework that prioritizes tourism business and profits over other issues. The economic-based paradigm not only valorizes tourists as a valid source of empirical knowledge but also introduced quantitative-led methodologies. This begs a more than the interesting question: how do we study tourism in a world without tourists?

To respond to the above-noted question, Wen et al (2020) call scholarship to coordinate efforts to find efficient protocols to placate the negative effects of tourism in the economy. From their viewpoint, they stress the importance of interdisciplinary research as a valid form to resolve the current health crisis. Authors enumerate the language differences and the previous methodological disputes –among disciplines– as the main barriers against multidisciplinary research. In this token, Ioannides & Gymothy (2020) speak of an opportunity –which if taken– can help reverse the negative effects of global tourism in the environment. Since any crisis opens the door to new opportunities for growth, Ioannides & Gymothy (2020) hold that the neoliberal agenda had new fewer problems to deal with the environmental issues and the current ecological crisis. The education on future tourism leaders and professionals, associated with a new synergy among stakeholders leads to overcoming deeper flawed market logic. Other epidemics have placed the industry between the wall and the deep blue sea, but in those instances, the status quo finally prevailed. Nowadays, COVID-19 should be seen as a foundational event to change the mainstream cultural values of global capitalism. In the same direction goes a recently published paper authored by Gossling, Scott & Hall (2020). In this conceptual work, these scholars highlight the inconveniences of researchers to measure the post-covid19 effects given the fact the tourism industry is fully paralyzed. Social distancing and the strict quarantine imposed in the world have ushered the industry to an inevitable collapse. Gossling, Scott & Hall (2020) not only elaborate analysis of the pandemics in the different

subsectors forming the industry but prognosticate the horizons of new tourism research. The pandemics mushroomed suddenly because of the global transport system and the densely overcrowded population cities in the industrialized world. Now, the tourism industry will mutate to a more slow form of consumption. As they firmly put the issue, “*the COVID-19 crisis should thus be seen as an opportunity to critically reconsider tourism’s growth trajectory, and to question the logic of more arrivals implying greater benefits. This may be with a review of the positive outcomes of the COVID-19 pandemic*” (Gossling, Scott & Hall, 2020: 13-14).

After further discussion, some comments are at least necessary. First and foremost, tourism research seems to face a methodological crisis time earlier than the outbreak of Coronavirus. This crisis was mainly associated with a lack of a negotiated object of study, accompanied by serious problems to understand the nature of tourism. To this Tribe (2010) adds, tourism research rests on a state of great dispersion and fragmentation, a situation aggravated by the lack of interest of the Academia to fix agenda. Secondly, the economic-centered paradigm has unilaterally set the pace incorporating an economic viewpoint of tourism while relegating other voices or definitions to a marginal position. As a result, the idea of measuring –which is based on quantitative-led methods- occupied a central place in the configuration of tourism studies. The tourist, as debated, is esteemed as the only scientific source of information, and of course, by paraphrasing Franklin (2007), the discipline adopts a tourist-centrism which today remains seriously questioned. Besides the opportunity Gossling, Scott & Hall claim, COVID-19 reveals the limitations for the discipline to find and develop alternative objects of study, expanding the horizon of research. COVID-19 not only shakes the industry accelerating its decline but offers a fertile ground towards the cultivation of new methodologies, and instruments. Digital technologies now interrogate even further the nature of tourism, promoting forms of consumption where travelers visit exotic landscapes and cultures without moving. In effect, virtual tourism allows the emulation of new realities where mobilities play a marginal role. The process confronts the classical definition of tourism without mentioning tourist-centrism (Korstanje & George 2021).

Last but not least, scholars will witness the rise of more virtual forms of tourism which are accompanied by more decentralized forms of production and consumption, as originally imagined by Lash and Urry (1992). This point will be developed with details in the next section. This begs the question to what extent COVID19 is a foundational event as tourism scholars overtly say?

## **High Mobilities Societies and COVID19**

Some studies emphasize that we live in a hyper-mobile world. Within the constellations of social sciences, mobilities are situated as a leading paradigm that explains the

nature of our society. The number of international flights, as well as travels has been multiplied in recent decades. Many different bodies which include tourists, businessmen, asylum seekers even terrorists seem to be on the move (Sheller & Urry, 2006). However, the mobilities of some groups entail the immobilities of others (Korstanje 2018). As Cresswell (2011) notes, mobilities theory is different respecting other theoretical paradigms simply because its centrality derives from the interconnection of different forms of movements, goods and bodies (all of them in constant negotiation and exchange). Having said this, whether the transport system (widely studied by cultural geographers) regulates the acts of moving, mobilities theory deciphers the meaning of behaviour. The author goes on to write:

*Transport geography has a lot to offer mobilities researchers when it comes to thinking about issues of infrastructure development and notions of accessibility, for instance, but less to say about the act of moving itself. Moving is about so much else besides, whether travelling in a car, on a bicycle or by foot (Cresswell, 2010: 554)*

Nonetheless of this fact, our current dependency on mobilities is stopped when a disrupting event takes a hit. A volcano eruption, a virus outbreak, or even a terrorist attack temporarily subverts the logic of mobilities. To some extent, disasters interrogate not only the human culture and its institutions but also the current means of economic production (Cresswell 2010). This point is well-illustrated in the seminal book originally authored by Lash and Urry. In this text, they hold the thesis that the globalization process rests on the exchange of cultures, identities, landscapes and experiences which are systematically commoditized within the borders of a marketplace. Industrialism started specific forms of capital accumulation which facilitated the rise of capitalism, but in so doing, paradoxically the capital escaped to the control of nation-states. The act of moving is today, at least for Lash and Urry, the urgency of emulating a state of happiness. Nation-states reinvented the sense of identities to develop the citizen's emotional commitment.

As they alert, the structure of the modern self is associated with a cultural matrix that indicates what can be gazed at or not (tourist-gaze). The subjective experiences are often orchestrated to transform daily citizens' lives. To put this in other terms, citizens' frustrations are not only sublimated in forms of cultural entertainment, but the process begins with a flux of capital which invariably leads towards a decentralized economy. Societies, on this planet, can be divided into two clear contrasting poles, high and low-mobilities societies. The former signals the rise of digital technologies to develop more rich societies, while the latter marks by traditional forms of human organization. In high-mobilities societies, citizens are subject to a climate of impotence and a much deeper powerless sensation of loss. What is more important, the trajectory of goods (trade exchange) emptied not only

human relations but geographical spaces transforming radically the geographical borders. In this vein, postmodern geographies are mainly marked by an economy of signs which subordinates history to the monopoly of globalized allegories and narratives. The standardization of emotions impacts directly on local economies as well as their respective transport systems. To set an example, risk plays a significant role in dividing what is a safe or unsafe destination. Tour Agents, as well as tour packages, are experts educated to locate and eradicate global risks making travels a memorable experience. Its legitimacy centers on the possibility of finding a solution to the problem of risk while traveling. The tourist gaze is characterized by a sentiment of re-enchantment of consumption that finally alters the space-time dimension. At a closer look, tourists (who are global consumers) are bombarded with images, advertising and visual stimuli to interpret the fictionalized landscape within specific frames. The dichotomy lies in the fact while the world is polarized in safe and dangerous destinations, the flows of capital mutates to a decentralized form of production where consumption dominates. The domesticated zones attract more portions of tourists while the wilder zones are eloquently depicted as uncivilized spaces of conflict (Lash & Urry 1992). Another trailblazing book which describes how mobilities impact the transport system and geography leads us to Harvey (1990). Per Harvey, the post-modernity condition is based on a question of constant fluctuation and change. It creates a state of fragmentation and ephemerality that ultimately blurb the tenets of the Enlightenment revolving around the sense of reality. Whether modernity signifies an abrupt break with the past, post-modernity goes to the future altering our sense of what is real. Universal concepts, which were originally, imagined by the Enlightenment, such as truth, love, and reality is only what the subject perceives. Harvey brilliantly argues that the sense of reality, as well as geography and transport system, is culturally enrooted in the means of production of society. The introduction of epistemological relativism, though 70s decade, coincides with the fragmentation of economic means of production which resulted from the Oil embargo implemented by the Arab League after the Arab-Israeli war (1972). This moment marked a rise of inflation which ushered Occident into a stagnant point baptized as “stagnation”. Without any doubt, this founding event not only accelerated an economic downturn in the Western countries but also probed developed economies have not sufficient energy resources to expand. While the notion of segmentation resonated in the economic circle as a valid instrument to offer tailored products to specific demands, the sense of reality was broken into thousands of pieces. As Harvey adheres, the notions of production, knowledge and geography are inextricably intertwined. Per his viewpoint, the Fordist scale model of production paved the way for the rise of a centralized world where the notion of reality was only one, immutable and beyond human grasp. For industrial cosmology, the reality is always there outside no matter than our perception. The postmodernity



ignites radical shifts that transformed the territory, the epistemology and economy of the West. The reality is now what everyone perceives or feels the reality finally is. Harvey's contribution notably shed light on the intersection of economy, geography and epistemology reminding that post-modernity exhibits a cultural change whose long-lasting effects are unquestionable to date. These two authors, John Urry and David Harvey—from different angles- say something similar respecting the importance of the economic system to mold our current travel behaviour and preferences.

As the previous backdrop, it is important to mention the modern tourism industry, as well as the current transport system, is a product of some socio-economic combined factors such as the struggle of worker unions to reduce the working hours in former centuries associated with the technological revolutions in the area of transports without mentioning the paid holidays (only to name a few). At the same time, travel behavior has been gradually altered according to the different means of production changed. We identify three stages or facets which need further discussion: a) classic tourism, b) sustainable tourism and c) morbid forms of tourism.

Classic mass tourism starts in the 30s decade (in what historians dubbed as the inter-war period) and ends in the 70s decade. This stage is chiefly based on a strong Fordist economic scale where economic production is standardized to a wider segment of consumers. Tourists are not willing to visit cultural spaces, but beaches and spas. The tourist demand is determined by the need of traveling to relaxing spaces of consumption. Experts agree that this period is mainly marked by the “bubble model”, conceptual planning that divides hosts from guests. The foreigner visitors travel to paradisiacal islands or beaches (employing mass means of transport such as airplanes or buses) but rarely interact with the local “Other”. What is more important, domestic tourism prevails over other forms of tourism.

As Harvey originally observed, the Oil war, which caused a deep fragmentation in the Fordist scale of production, prompting changes that led invariably to new decentralized forms of tourism consumption. This event showed the West the economy should be segmented while products packaged for specific ranges of consumers. The ecological crisis and problems alert on the importance to adopt new sustainable (cultural) forms of tourism. During this stage which ends in the 2000s, tourists develop the idea of “being there” to get unique experiences. The quest for authenticity plays a leading role during this facet. The old host-guest conflict is regulated by the state through the introduction of centralized planning.

Last but not least, the 2001s witnessed a set of radical changes which included the terrorist attacks perpetrated to the US accompanied with an unparalleled economic crack (2008) and an almost irreversible ecological crisis. Unlike the other stages, this period coincides with the importance of building global networks. Having said this, new morbid forms of tourism emerged. Dark, Prison, Thana tourism, Slum tourism or even War-tourism has the same in common: the enjoyment of the “Other’s

pain”. The notion of culture now sets the pace to death as the main commodity to exchange. The figure of destruction offers a dark sense of beauty which marks the quest for unique experiences. In this period, the tourism industry does not limit to physical displacement. While travels are virtually organized, digital technologies help tourists to have safer travels and experiences. Last but not least, the local “Other” is designed and consumed according to what the international demand asks for. The recent virus outbreak of COVID19 –far from being a foundational event- affirms the tendency that originated during the 2000s. This point will be developed in the next ultimate section.

## **Socio-Cultural Effects of Covid19 on the Global Transportation System**

The appearance of COVID-19 has brought devastating consequences for the tourism industry worldwide. Unlike in other cases (SARS or H1N1), where the virus outbreak was rapidly contained, there are no security barriers for COVID-19. Without a vaccine or an alternative health treatment, governments closed their airspace and borders limiting public circulation or imposing a strict lockdown (quarantine). The number of financial losses in the industry of international flights and the domestic transport system is incalculable. Anton Patlins (2021) holds the thesis that the consequences of COVID19 over the transport system assume a major challenge. This happens because authorities reduced the health security protocols in global travels over the recent decades. The international air companies, which prioritized their profits while minimizing their costs, were resistant to adopting health protocols at the airplanes despite the several alarms of health authorities. Hence, this lack of preparation ushered countries in a counter-defence tactic sacrificing their economies disposing of a general closure for their citizens. In addition, some studies suggest the most populated region in the world faced more devastating consequences in the transport system than rural zones (Arellana, Vazquez & Cantillo, 2020; Jennelius, Cebecauer, 2020; Atlins 2020).

The current global transport system seems to be the main carrier but at the same time the victim of COVID19 (Baum & Hai, 2020). Adey et al (2021) call attention to pandemic immobilities as an abrupt halt that reorganized the transport system. They coin the term “viral mobilities” as a global force that intensified a sense of loss that created different levels of empowerment.

*At the heart of many of these transformations are complex intersecting systems of mobilities and moorings, from everyday travel by households, to the provisioning of urban supplies, to the transnational mobilities of ships, airplanes and people across borders, to the planetary mobilities of viruses and ecological systems. Under*

*these exigencies to de-mobilize our lives, we were forced to adopt new routines, new habits, and new ways of stilling ourselves, our economies, and our social interactions. Millions of people have been thrown out of work, and suddenly we are all made aware of the fundamental premise on which modern societies are built: constant but unequal movement. (Adey et al 2021: 2)*

The COVID19 ignites a sentiment of distrust, if not hate, against potentially infected people. In some nations, the media echoed the health authorities' efforts to find the zero-patient. This opens the doors to impose some accusatory levels on foreign visitors which resulted in acts of aggression and intolerance (Adey et al 2021). As the act of moving was always seen as a sign of life and death, the nation-state sanctioned the right of free traveling. The COVID19 subverts this right making all potential travelers suspected to disseminate the virus (Adey et al 2021; Korstanje & George 2021; Laquinto 2020). In consonance with this, Mimi Sheller (2020) acknowledges the opportunity of COVID19 to find the new sustainable mode of production/consumption towards what she names as "a mobile justice". Low-mobilities societies are prone to adopt new more sustainable lifestyles that help policymakers to reverse the effects of climate change.

Doubtless, the COVID19 pandemic seems not to affect tourism, but the government's severe reactions to mobilities do so. Having said this, it is important to add that COVID-19 interrogate furtherly not only the industry but also the tourist-centricity, adhering to Franklin's thesis, which characterizes the current tourism research. Here two assumptions should be made. On one hand, tourism should be seen as a social institution that transcends the market or the figure of tourists. Many other actors, probably potentiated by digital technologies, are fertile ground for investigation. For example, virtual tourism, travel websites, travel writings, and other actors are interesting material to consult for next research. On another, the tourism industry and the global transportation system are being altered to a more decentralized (atomized) mode of planning. COVID19 has brought many socio-cultural consequences associated with geopolitical tensions, followed by riots, segregationist or chauvinist discourses, without mentioning the hostility directed against Asian tourists. Each nation adopts different health programs and steps struggling with neighboring ones to keep the lockdowns. At the same time, serious travel bans and restrictions are disposed to foreign tourists. It is not difficult to resist the impression that the globalized ethos has been replaced by a "fractured" (feudalized world) where tourists have become undesired guests (Korstanje & George 2021).

As debated in earlier sections, different impositions have been orchestrated to stop the virus dissemination, including the closure of borders and airspaces, accompanied by lockdowns and social distancing. Besides, different barriers have been erected to ban the entrance of foreign tourists. The health passport, as well as many other travel

bans, have been imposed on foreign tourists. While tourists were ambassadors of prosperity, democracy and civilization, they now are considered as carriers of lethal disease and mistreated as undesired guests. Without any doubt, the global world has set the pace to a feudalized world. Secondly, far from disappearing, the tourism industry has shown a great power of resiliency and of course, survived in the post COVID19 days. Resilience has been incorporated into post-disaster tourism over the recent years; it was borrowed by disaster studies, a new emerging discipline. Some interesting studies have emphasized the importance to adopt resilient methods to improve tourist destinations performance for guests (Korstanje & George 2021).

As the previous argument is given, we need to examine the problem from a historical perspective. In the past, European nations cultivated the interests of travels as well as colonial expansion. The European empires indexed overseas territories cultivating science and literature as main genres of knowledge. This means that the West was opened to control –but at the same time- domesticates the “Non-Western Other”. These days, the “Non-Western Other” was an object of curiosity that captivated the attention of European audiences. The European voyages paved the way for the rise of modern tourism. However, something has changed after 2001. With 9/11, the War on terror, and international terrorism, the “Other” was suspected to be a potential enemy who lives like us but can attack anytime and anywhere. Just after 9/11, all we are suspected to be potential terrorists (carriers of a lethal disease). This tendency fed back a culture of fear accelerating the closure of West to the “Non-Western Other”. Today, COVID19 far from reversing this tendency aggravates it becoming all in undesired guests! Tourists are suspected to be carriers of a lethal virus and for that; they should be monitored, and isolated. COVID19 continues the same trend originated by terrorism and the so-called War on Terror declared by Bush’s administration guests (Korstanje & George 2021).

## **CONCLUSION**

At the end of December of 2019, the first cases of COVID19 alerted the health authorities about the rise of a new pandemic. Although some voices have claimed that mass tourism, as well as the public and private transport system, are fertile ground for lethal virus propagation, governments systematically overlooked these alerts. In this respect, COVID19 generated an unparalleled halt to the tourism industry and the transport system. The globalization world sets the pace to new fractured geography fraught with geopolitical tensions, chauvinist and separatist discourses without mentioning the rise of global fears and anxieties. Having said this, the present book chapter discusses critically the effects of COVID19 and the future guidelines of research for the next years. The chapter holds the thesis the world is

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## **KEY TERMS AND DEFINITIONS**

**COVID-19:** Is a new virus outbreak known as SARS-CoV-2, whose first cases were originally reported in Wuhan China in 2019.

**Mobilities:** Are a set of theories which integrates a contemporary paradigm in social science that studies mobile societies.

**Pandemic:** Is an outbreak or disease which spreads through a whole portion of countries.

**Tourism Research:** Is a subdiscipline of tourism studies which focuses in tourism as its main object of study.

**Transport System:** Is a net of composed infrastructures, devices, institutions, people and terminals oriented to grant the citizens' mobilities.

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