

## Challenges for the sustainable development of air transport in Central and Eastern European countries

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**Abstract:** The sustainable development concept is promoted as a theoretical frame suitable to face the challenges of the air transport market. The task is to focus on the solutions for current and future air transport strategies to provide movement of people and goods in a sustainable, equal, inclusive and efficient way. This research aims to recognise sustainable development challenges and refer to the situation of Central and Eastern European countries. The challenges to the sustainable development of air transport were grouped into environmental concerns, infrastructural and labour problems, technological change, digitalisation and changing passenger behaviour. Even though Central and Eastern European countries are lagging behind Western countries in terms of the number of passengers carried by air, they face the same challenges to the sustainable development of air transport markets. Air transport companies on their path to sustainable development should search for new, innovative solutions. There is a call for institutional changes to support sustainable initiatives.

**Keywords:** air transport, sustainable development, innovative solutions, Central and Eastern European countries

## 1. Introduction

Sustainable development has become a signpost indicating the direction government actions and market participants should head towards. The increasing attention to climate change, promotion of social equality and contribution to economic development and growth are the pillars of sustainable development. In the meantime, new challenges related to increasing globalisation, technology and artificial intelligence, resources and energy constraints occur.

Air transport managers and policymakers are also facing a strong challenge to implement sustainable initiatives. The task is to focus on the solutions for current and future air transport strategies to provide movement of people and goods in a sustainable, equal, inclusive and efficient way. Aircraft is the most important means of transport for long-distance travelling. Still, its resource insensitivity and growing number of passengers have become some of the main challenges of sustainable transportation.



The air transport sector is important to the economy, ensuring connectivity and accessibility and facilitating trade. Over the last two decades, air transport has grown with unprecedented dynamics, an average of 5% per year on a global scale, according to the International Air Transport Association. At the same time, growing environmental problems raise questions about the further development of air transport, which is resource-intensive.

The global air transport industry is under increasing political and consumer pressure to reconcile global flight demand with commitments to improve sustainable performance. The actions that need to be taken are, among others, reducing carbon dioxide emissions by 50% by 2050 (Fetting, 2020); implementing a low-emission mobility strategy (EC, 2016); increasing the efficiency of the transport system thanks to the use of digital technologies or intelligent pricing policy; the need to report activities related to sustainable development (CSR and ESG) (Skouloudis, et al., 2012) or the need to calculate the carbon footprint.

Airports implement solutions aimed at eliminating the adverse effects on the environment through activities in the field of noise control, "green" infrastructure, waste management; environmental monitoring and control, including gas emissions; cooperation with partners, mainly airlines and agents in the provision of low-emission services; organisational learning and human resources management in the field of pro-ecological activities (Harley et al., 2020; Kumar et al., 2020; Santa et al., 2020).

The action taken by the airlines is mainly focused on the technological improvements of aircraft in terms of operational efficiency and lower gas emission (Akerman, 200; Daley, 2009) as well as the usage of sustainable aviation fuels (SAF) (Undavalli et al., 2023; Zhang, 2020).

Certainly, the potential for technological improvement in air transportation is significant. Actions that will increase the efficiency of companies operating in the air transport market in terms of energy use and improving the environmental quality of air transport are contributing to sustainability. However, the primary barrier to sustainable transport is institutional (Rietveld & Stough, 2005). The institutional environment plays an important role in the sustainable development of air transportation. It can support the sustainable activities of companies operating in the air transport market through appropriate instruments.

In the face of new requirements for sustainable initiatives that the companies operating in the air transport market need to implement, there is a call for recognition of sustainable development challenges. Therefore, this research aims to provide a comprehensive identification of sustainable development challenges, outline the conceptual signposts for the operation and growth of the air transport market, and refer to the situation of Central and Eastern European (CEE) countries. The distribution of air transport activity is uneven. Although CEE countries experienced strong air transport growth in the second decade of the XXI century, the air mobility index is far below the average of developed countries. The question arises of what actions need to be taken to provide sustainable development of air transport that will support the economic growth of Central and Eastern European countries. This study aims to fill the gap in the literature on the subject and identify actions taken by air transport market actors to minimise their negative impact, including the effect on the natural environment. The challenges and conditions for the implemented solutions are examined. The paper is structured as follows. Section 2 provides the literature review. Section 3 focuses on the situation of Central and Eastern European countries. Section 4 describes the challenges to the sustainable development of air transport. Section 5 explains the aviation challenges for sustainable development in CEE countries. Section 6 concludes and provides policy recommendations.

## **2. Literature review**

Due to the complexity of the research problem, there is no single concept to cover the topics discussed. Exploring challenges and implementing innovative solutions by airports and airlines to improve their environmental performance in the supply chain is included in the concept of ecological modernisation. While this theory has been used to analyse pro-environmental activities in airlines (e.g. Bruce & Spinardi, 2018), the ecological activities of airports have not been comprehensively discussed (Kumar et al., 2020).

The ability of airports to achieve competitive advantage thanks to key resources and competencies in the field of pro-ecological practices is included in the issues of resource-based theory

(RBV) (Sarkis et al., 2011). Institutional theory helps explain how institutional norms and global environmental regulatory pressures influence airports and airlines to adopt green practices throughout the supply chain (Jongsaguan & Ghoneim, 2017). According to the stakeholder theory, the airport maintains relationships with other stakeholders (airlines, handling agents) and coordinates joint pro-ecological activities on their path to sustainable development.

There are calls in the literature about whether air transport can be sustainable with its resource-intensive activity (Palmer, 2015). Ozturk et al. (2022) examined ten top worldwide airlines and concluded that none contributes positively to sustainable development. However, Forsyth (2011) argued that if efficient policies are adopted, financial and environmental sustainability can be achieved in air transport. This is in line with the considerations of Rietveld and Stough (2005), who highlighted the important role of institutions in providing sustainable solutions.

The sustainable development of aviation is significant because air transport plays an important role in economic development. The literature has widely described the link between air transportation and socio-economic development (Luke & Wlaters, 2010; Madden, 2004). However, the evidence is inconclusive, which motivates further studies.

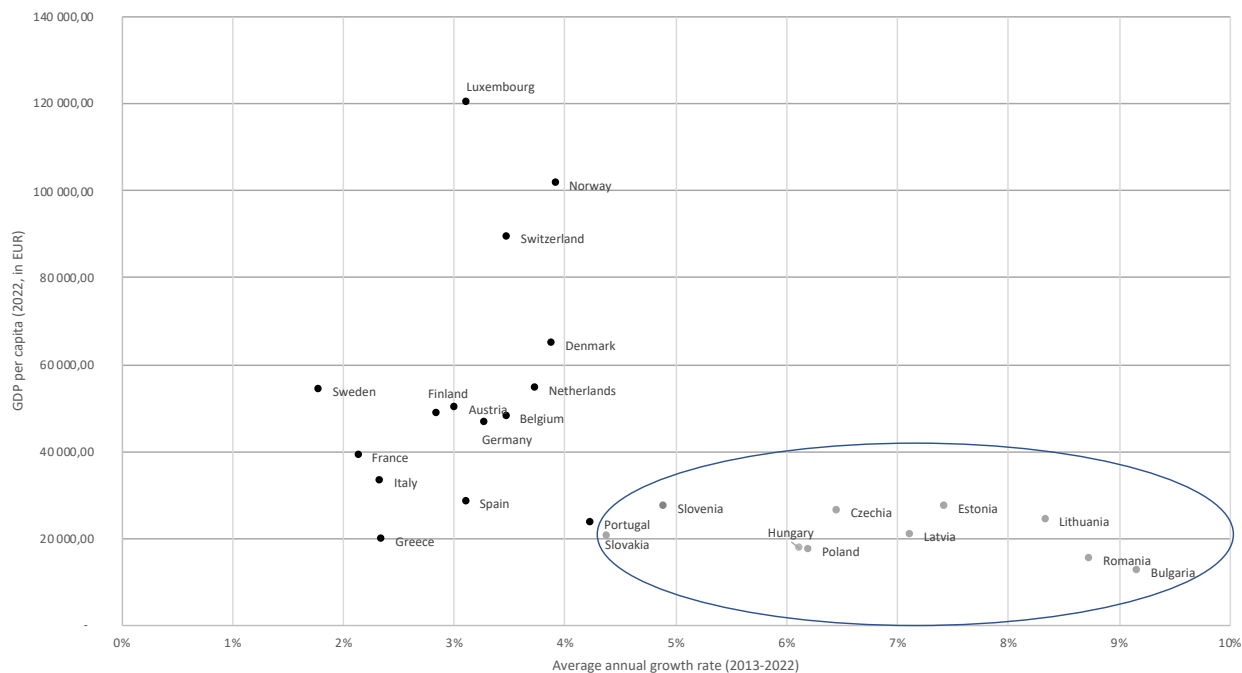
Overall, air transport affects a region's socio-economic situation with increasing resource consumption. The development of the air transport sector in a sustainable manner with consideration of social, economic and environmental impact is significant in immature markets with high growth potential like Central and Eastern European countries.

Nowadays, the socio-economic development of a country depends on a growing number of determinants and is limited by factors that show symptoms of deficiency or misuse. Currently, such a factor is the environment. Therefore, socio-economic growth and development sources should be considered through a holistic approach to sustainability, including social, economic, and environmental dimensions.

### **3. Air transport in Central and Eastern European countries**

Central and Eastern European (CEE) countries, namely Poland, Czechia, Slovakia, Hungary, Latvia, Lithuania, Estonia, Bulgaria, Romania and Slovenia, share a common history, economic system and geographical location (Huderek-Glapska, 2020). These countries are located close to highly developed economies, stimulating the flow of people, goods and capital (Jankiewicz and Huderek-Glapska, 2016). The economies and political systems of the CEE countries underwent transformation, which was accelerated by the accession to the European Union. The main components of the transition were the evolution from a centrally-managed and state-owned economic system towards a more privatised, market-driven economy, the elimination of barriers to trade and foreign investment and the guarantee of property rights (Burniewicz and Bąk, 2000). Hamilton (1999) added to the debate concerning transition and transformation in Central and Eastern Europe two other processes: first, the legacy and influence of structures, institutions and behaviours that have been inherited from the socialist times; second, the human, institutional and organisational reactions to the challenges created by the transformation process itself.

In the second decade of the XXI century, the CEE countries experienced strong economic growth compared to Western European countries. All CEE countries' GDP per capita growth rate was above 5%. These countries grow faster and, therefore, catch up with the Western European Countries. However, although three decades have passed since the collapse of the socialist system in CEE countries, they lag behind the highly developed economies in GDP per capita. The Figure below (Fig. 1) reflects the economic situation of CEE countries against the background of Western European countries.

**Figure 1: GDP per capita and average annual growth rate in European countries**

The changes in economic systems in CEE countries, being of structural, functional, technical, technological, fiscal, economic, organisational, social, and spatial nature (Huderek-Glapska, 2020), have also impacted the air transport markets. Aviation markets in CEE countries also have some common features. The air transport markets in CEE countries opened simultaneously in 2004 during the accession to the European Union. With the liberalisation of aviation, the new air transport companies (so-called low-cost carriers) penetrated CEE markets and now have a significant market share. The changes in the volume and structure of the demand were stimulated mainly by income growth and the opening of new possibilities to travel offered by the Low-Cost Carriers. In addition, external factors like the opening of the labour markets in Great Britain, Ireland, and Norway and the high level of unemployment in CEE countries also affected the demand for air travel. The air transport network in CEE countries mainly focuses on Western European countries with a small share of intra-CEE and long-haul flights. The air transport markets in CEE countries are still immature but have a high growth potential.

Table 1 presents the situation of air transport markets in Central and Eastern European countries against the background of other European countries. The number of passengers and cargo carried on board is still lower than in highly developed markets like Germany, France and Italy. An important parameter for a more accurate comparison of air traffic volumes between countries is the air mobility index, calculated as the number of passengers transported by air to the number of inhabitants of a given country. This parameter may have high values for high transfer traffic in large airports (Belgium) and tourist traffic (Spain, Portugal and island countries). Scandinavian countries are also characterised by a high value of the air mobility index due to low population density. The average air mobility index for the whole of Europe is 3.1. After almost two decades of dynamic growth in air traffic, CEE countries still achieve values lower than the European average. This means that the air transport markets are immature and will grow together with the economic development of CEE countries.

**Table 1: Air transport markets in Europe in 2022**

	Passengers	Air mobility index	Recovery rate 2022/2019	Cargo
Spain	199 571 203	4,21	87%	845 054
Germany	155 302 643	1,87	68%	5 030 463
France	136 560 938	2,01	81%	2 134 045
Italy	132 425 719	2,24	82%	1 028 209
Netherlands	61 289 771	3,48	75%	1 553 280
Greece	57 893 929	5,53	103%	116 739
Portugal	57 081 723	5,51	104%	207 577
Switzerland	42 424 182	4,85	74%	364 305
<b>Poland</b>	<b>39 347 542</b>	<b>1,04</b>	<b>84%</b>	<b>204 949</b>
Norway	32 562 643	6,00	81%	173 035
Ireland	32 405 890	6,40	85%	156 445
Belgium	27 873 892	2,40	79%	1 814 369
Denmark	26 649 573	4,54	77%	316 108
Austria	26 381 180	2,94	74%	253 322
Sweden	25 038 812	2,40	67%	147 091
<b>Romania</b>	<b>19 535 951</b>	<b>1,03</b>	<b>91%</b>	<b>47 636</b>
Finland	13 812 577	2,49	59%	160 444
<b>Hungary</b>	<b>12 393 512</b>	<b>1,28</b>	<b>74%</b>	<b>133 832</b>
<b>Czechia</b>	<b>11 532 650</b>	<b>1,10</b>	<b>61%</b>	<b>73 301</b>
Croatia	9 415 321	2,44	89%	9 661
<b>Bulgaria</b>	<b>8 807 502</b>	<b>1,29</b>	<b>75%</b>	<b>26 719</b>
Cyprus	8 613 471	9,52	76%	23 598
Iceland	6 463 479	17,18	85%	55 877
<b>Latvia</b>	<b>5 368 369</b>	<b>2,86</b>	<b>69%</b>	<b>20 324</b>
<b>Lithuania</b>	<b>5 333 890</b>	<b>1,90</b>	<b>82%</b>	<b>20 775</b>
Luxembourg	4 057 247	6,29	93%	969 705
<b>Estonia</b>	<b>2 731 365</b>	<b>2,05</b>	<b>84%</b>	<b>10 789</b>
<b>Slovakia</b>	<b>1 942 568</b>	<b>0,36</b>	<b>68%</b>	<b>18 061</b>
<b>Slovenia</b>	<b>968 811</b>	<b>0,46</b>	<b>56%</b>	<b>12 468</b>

Note: CEE countries are bold. Passengers are the number of passengers on board. The mobility index is the number of air trips per inhabitant per year. The recovery rate is the number of passengers carried by air in 2022 divided by the number of passengers in 2019. Cargo is the freight and mail on board in tons

Source: Own elaboration based on EUROSTAT data

The air transport infrastructural endowment in CEE countries is smaller than in other European countries. The airport density index, calculated as the ratio of the number of airports serving over 50000 passengers per year per 100000km<sup>2</sup> of the country's area, is, on average, 5.4 in Europe, while in CEE countries, it is approximately or below 3. The highest density of airports is in Italy (10) and countries serving large air traffic and having a small area: Belgium (9.8), the Netherlands (9.8) and Denmark (9.3).

The air cargo in CEE countries is low due to factors on the demand and supply side of the air transport markets. The demand for high-value and quick-delivery goods mainly transported by air is low in CEE countries. Similar to the demand, the supply is also limited due to the limited capacity of national carriers to transport cargo and the insufficient air cargo infrastructure endowment.

#### 4. Challenges for sustainable development of air transport

Due to its global character and high importance to the economy, air transport is enormously vulnerable to challenges in the air transport markets and the macroenvironment. The COVID-19 pandemic was the worst crisis in the history of commercial aviation. In 2023, air transportation has mostly recovered from the pandemic disturbance, but the existing problems persist, and new challenges emerge. The following challenges of air transportation were identified based on the literature review.

#### **4.1. Environmental concerns**

Air transport activity and development are highly resource intensive, depend on non-renewable energy resources, create noise, water and atmospheric pollution and occupy large land areas (Orhan, 2021). Air transport accounts for 10% of all transport energy consumption in the EU and is responsible for approximately 15% of all CO<sub>2</sub> emissions (Graham & Guyer, 1999). The limitation of air transport activity due to the COVID-19 pandemic was associated with a significant reduction in air pollution. A growing number of air transport services cause air pollution emissions again, and technological development is needed (Clarke et al. 2022). The main driving forces toward sustainable air transport are sustainable aviation fuels. Policy instruments can help decarbonise air transport by setting emission pricing and regulating the market. There are also calls for green airports and airlines with sustainable management and reporting (CSR, ESG).

Environmental concerns also include increasing air traffic disruptions due to weather conditions. Airports are closed due to unfavourable weather conditions that are becoming more frequent.

#### **4.2. Infrastructural problems**

The growing number of air passengers creates challenges for all actors operating in the air transport market. Airport infrastructure needs to be developed and upgraded to meet growing demand. Airport capacity restrictions can be offset by innovations in air traffic management and control (Graham & Guyer, 1999). The problem is that the distribution of demand for air transport is uneven in time and space, which causes congestion both on land and in the air. The congestion creates costs for airlines, airports, ATMs and passengers.

The problems with air transport infrastructure are also related to the financial situations of air transport companies, high fixed cost of infrastructure maintenance and restricted funding for development.

#### **4.3. Labor problems**

The COVID-19 pandemic seriously disrupted the air transport market and caused a significant loss of jobs. Even though air traffic has returned to pre-pandemic results, air transport companies still struggle with staff shortages. Moreover, there is pressure from existing employees and unions to change wages and working conditions. Air transport companies weakened by the pandemic and facing financial difficulties struggle to respond to employees' expectations. Employment concerns may pose a constraint on the ability of airports, airlines and ground-handling agencies to meet passengers' demands. The trained and skilled workforce shortage may create barriers to the development of the air transport industry, particularly in countries with low unemployment rates.

#### **4.4. Technological change. Digitalisation**

The evolving nature of digitalisation and the proliferation of mobile devices and internet-based technologies create opportunities for air transport companies to increase customer satisfaction, increase overall flexibility and efficiency, and improve security-related performance (Lutskyi, 2022). By implementing intelligent transportation systems, digital technologies can help optimise air traffic flow, reduce congestion, and improve fuel efficiency.

#### **4.5. Changing passenger behaviour**

Air transport passengers' attitudes and behaviours are evolving rapidly, with visible lifestyle changes. These changes also extend to travel and the choice of transportation modes (Bulchand-Gidumal & Melián-González 2021). Due to growing environmental concerns, changes in passenger behaviour are observed. Passengers want to reduce their negative impact on the environment and resign from air travel. This trend is called flight shame and, in the future, may seriously affect the demand for air travel (Gossling et al. 2020). The other issue is related to over-tourism, the situation in which the presence of

tourism can create adverse effects like crowding out (Avond et al., 2019). Overtourism is one of the effects of low-cost carriers' proliferation of air connections and penetration of tourist destinations.

**Table 2: Challenges for sustainable development of air transport**

Challenge	Sustainable aviation		
	Social	Economic	Environmental
Environmental concerns	Direct effect on society, which bears the costs of adverse environmental effects	Technological improvements need investments but, in the long run, can be a competitive advantage	Direct negative effect on the environment in terms of noise, water, air and land pollution
Infrastructural problems	Passengers bear the cost of delays	Air transport infrastructure maintenance and development is costly. Aircraft orders are unstable and affect the airline's development strategies	Delays and congestion create adverse environmental effects.
Labor problem	Skilled workforce concerns can raise safety issues	Shortage of workforce affects the efficiency and performance of air transport companies	Lack of workforce can indirectly affect the environment through the inefficient air transport company's operation
Technological change. Digitalisation	Lower cost, higher air transport security. Greater choice of air transport services	Lower cost, higher efficiency and performance of air transport companies. Higher cost of data gathering and processing	Technological innovations can provide an environmental improvement. Data gathering and processing are highly energy-consuming
Changing passenger behavior	New trends among passengers. Increase in environmental awareness	There is a need to monitor the demand and adapt services to customer needs	New trends: Flight shame or over-tourism may limit air travel, which will have a positive environmental effect

Source: Own elaboration

Table 2 summarises challenges for the development of air transport and their impact on pillars of sustainable development: social, economic and environmental. Each of these challenges directly or indirectly affects a given area of sustainable development. The table presents the most important comments. Only technological change can positively affect all areas of sustainable development of air transport.

## 5. Aviation challenges for sustainable development in CEE countries

### 5.1. Method and data

This research examined the challenges of sustainable development and outlined the conceptual signposts for the operation and growth of the air transport market in Central and Eastern European (CEE) countries. The situation in CEE countries is observed against the background of the described challenges. Direct interviews were conducted with nine top- and middle-level managers of different companies (airports, airlines, ground handling agencies and air traffic control) operating in the air transport markets in Central and Eastern European countries. The semi-structured questionnaires with descriptions of challenges were used and different data collection methods (CATI or CAWI) were applied. The interviews were conducted during March 2023. Due to some degree of sensitivity regarding the data collected, it was decided to present the results of the research in an anonymous way in the form of an aggregated table.

### 5.2. Results

The results of the research are summarised in Table 3. The characteristics of air transport markets in CEE countries about the challenges described in Section 3 are presented based on the data gathered

during the interview with air transport companies' managers. The other concerns that managers reported were the economic efficiency and stability of the financial situation as well as the importance of market regulation and institutional framework.

**Table 3: Challenges for sustainable development of air transport in CEE countries**

Challenge	Air transport markets in CEE countries
Environmental concerns	There is increasing pressure on the adoption of environmentally friendly solutions. Air transport companies mainly cover the costs of these solutions. With the lack of public funds, air transport managers find it challenging to improve environmental efficiency.
Infrastructural problems	Public ownership. The most developed airports are Warsaw, Prague and Budapest. Warsaw airport is at its capacity limits. A New Central Airport for Poland is planned to be built. Half of the airports in CEE serve more than 1 million passengers per annum. Small airports experience volatile development; some even struggle with a lack of regular flights. The difficult economic situation negatively affects the level of infrastructure investments.
Labor problem	The labour market is not as tight as in Western Europe. However, it is becoming competitive. New workers with new competencies, creativity and innovation are needed due to the implementation of innovative solutions.
Technological change. Digitalisation	Implementation of innovation and several new initiatives. This applies to both new services and processes and the implementation of new technologies—diversification of revenues and activities to be prepared for various scenarios.
Changing passenger behavior	It is not observed. There is still potential for demand growth. The air mobility index is far below the EU average. The younger generation will probably be the first to adopt the over-tourism and flight shame trend.

Source: Own elaboration

## 6. Conclusions

The Central and Eastern European countries, despite lagging behind the Western countries in terms of the number of passengers carried by air, face the same challenges to the sustainable development of air transport markets. The COVID-19 pandemic deteriorated airports and airlines' financial situation due to a lack of revenues from aviation and non-aviation services and higher safety and security costs. The distribution of government financial support was uneven and depended on individual airport's market share, which means that small airports were in a difficult situation. The harsh financial condition hinders the implementation of sustainable solutions. The funds must be provided to make the companies more environmentally efficient.

Several new innovative initiatives that apply to new services and processes are implemented in companies operating in the air transport market in Central and Eastern Europe. This creates demand for a skilled and creative workforce; therefore, shifts in the labour market can occur.

On their sustainable development path, air transport companies should be orientated towards learning and searching for new, innovative solutions. Cooperation with partners may assure stability during volatile times. There is a call for institutional changes and cooperation between countries to support innovative initiatives.

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## Conflicts of interest

The author declares no conflict of interest.



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