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THE CONNECTION BETWEEN AN AIRPORT TYPE AND REVENUE STRUCTURE AT BALTIC STATES AIRPORTS

Kristine UZULE [1, 2*], Irina KUZMINA-MERLINO [1]

[1]*Transport and Management Faculty, Transport and Telecommunication Institute, Riga, Latvia*
[2]*EKA University of Applied Sciences, Riga, Latvia*

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Abstract. Airports are not only engines of transportation of passengers and cargo, but also commercial enterprises offering services far beyond transportation, which is why their revenues are formed by both aeronautical and non-aeronautical sales. Aeronautical revenues of some large European airports are higher than non-aeronautical revenues, whereas some regional and secondary European airports demonstrate the opposite trend. The aim of this research was to determine if there is a connection between an airport type and the ratio of aeronautical and non-aeronautical revenues at Baltic States airports in way that is consistent with the previous research. The aim was attained in three stages. The first, the definitions of the main and secondary airports were constructed via discourse analysis. The second, the structure of airport revenues of the selected Baltic States airports was analysed. The third, conclusions were made regarding a connection between an airport type and the revenue structure of these Baltic States airports. On the one hand, the research results suggested there might be a connection between an airport type and the revenue structure although this question requires further research, and on the other hand, the financial analysis showed that airports with a higher share of non-aeronautical revenues than aeronautical revenues were more resilient to crises.

Keywords: airport types, discourse analysis, financial analysis, aeronautical revenues, non-aeronautical revenues.

Introduction

Commercial airports aim to increase revenues to ensure further development and sustainability. Revenues are used as an indicator of financial performance (Paraschi et al., 2019), the efficiency of operations and sustainability of the airport strategy, all of which form airport competitiveness on the aeronautical market (Pacagnella Junior et al., 2021). There might be certain constraints on obtaining aeronautical revenues or cutting costs, which is why Airport Council International encourages airports to raise the share of their commercial (non-aeronautical) revenues (Airport Council International [ACI], 2019), which leads to greater efficiency of airport operations if non-aviation services do not impede aviation services (Fasone et at., 2016).

The pattern of distribution of aeronautical and non-aeronautical revenues indicates airport priorities in acquiring financial gains, which are set in the airport strategy, business model (Rotondo, 2019) and which are affected by low-cost airlines (Fasone et al., 2016), airport capacities, e.g. traffic volume (Breindenbach, 2020), and exogenous factors. The literature review has shown that aeronautical revenues tend to be higher than non-aeronautical revenues at main and large airports and tend to be lower at small and regional airports at airports in the USA (Choo, 2014), UK, Netherlands, Germany and France (Battal & Bakir, 2017; Fasone et al., 2016; Fuerst et al., 2011). It might be possible that there might be some connection between an airport type and the revenue distribution patterns.

The aim of this research work is to verify the existence of a connection between an airport type and the distribution structure of airport aeronautical and non-aeronautical revenues for airports with different characteristics comparing to earlier research. The selected group of airports includes Baltic States airports. The study filled in three research gaps. Firstly, it provided more information to decide if this line of research is scientifically sound to later pursue the development of a model of interaction of an airport type and the distribution of aeronautical and non-aeronautical revenues. The creation of such a model required significantly more data than the one that was currently available online for a few key airports in Europe. This data needed to include more components into the airport topology and the mechanisms of their interaction with airport revenues. Without the consideration of

*Corresponding author. E-mail: *kristine.uzule@eka.edu.lv*

airports that were considerably different, it was impossible to construct a reliable model even for European airports. Secondly, hardly any research included airports of the three Baltic States – Lithuania, Latvia and Estonia. The search of the database Science Direct on papers on "Baltic, Latvian, Lithuanian and Estonian airports" did not yield any paper with the title containing any of these concepts. In the same database, the search of papers containing information on "Estonian airports" produced just one paper (Nommik & Antov, 2017). Similarly, the search of papers on airport revenues and types did not generated papers containing data on Baltic States airports. Thus, there were grounds to suggest that Baltic States airports were the airports that did not receive proper attention in scientific literature, yet.

The attainment of the research aim was constrained by the lack of financial data available in online open access. For example, the data on "Lithuanian Airports", an enterprise managing Vilnius, Kaunas and Palanga airports (Lithuanian airports, 2022), had annual open source reports available in Lithuanian and English only for the years 2018–2020. The issue with the availability and quality of financial data of airports did not pertain only to Baltic States airports. For example, Fuerst and Gross (2018) claimed to have such issues in their research on non-aeronautical revenues of airports.

One contribution of this research related to the fact that the selected topic of the connection between an airport type and airport revenue distribution patterns were not extensively studied. Typically, the distribution of the airport revenue structure was mentioned in connection to large and small airports but this topic has not been found to be the focus of the paper, except for one study of Battal and Bakir (2017). Another contribution relates to the discourse analysis of literature on types of airports.

1. Literature review

Airports are no longer merely aeronautical service providers but rather complex operators of aeronautical and non-aeronautical services (Pacagnella Jr. et al., 2021). This has been attributed to the pressure of airports' commercialization and privatization which require more effective financial and business performance (Paraschi et al., 2020) as well as processes of globalization and liberalization of airport operations (Florido-Benitez, 2021). The distinction into aeronautical and non-aeronautical services has created two groups of revenues – aeronautical and non-aeronautical revenues. Aeronautical revenues are gained from activities directly related to aviation, such as airline charges, ground handling (Fuerst et al., 2011), whereas non-aeronautical revenues are generated by activities unrelated to aviation, such as shops, parking fees, etc. Airport Council International reported that in 2018 almost 56% of global airport revenues were aeronautical (Airports Council International, 2020).

To increase profits, airports have been advised to increase the share of non-aeronautical revenues (ACI, 2019; Fuerst & Gross, 2018; Puls & Lentz, 2018). One reason why non-aeronautical services can produce more sustainable revenues is because non-aeronautical services can be used not only by passengers but also local residents, staff members, businesses in the vicinity of the airport (Fuerst & Gross, 2018). The increase of non-aeronautical revenues is particularly important for small and regional airports, which might have a lower share of international passengers and traditional airlines, higher share of low cost airlines, fewer and shorter runways, less intense air traffic, etc. All of these factors limit such airports' capacity to obtain revenues from aeronautical services. Therefore, to increase profits, such airports need to develop a strategy to increase profit margins through non-aeronautical services.

Although the advice to increase the share of non-aeronautical revenues is particularly important for smaller regional airports, it should be considered by main and large airports, too (ACI, 2019). However, some research has shown that main and large airports continue to increase aeronautical revenues. For example, Battal and Bakir (2017) studied the ratio of aeronautical and non-aeronautical revenues of Heathrow, Charles de Gaulle, Frankfurt and Schiphol airports over the period of 2008 and 2015 and concluded that aeronautical revenues continuously exceeded non-aeronautical revenues at these airports. The authors of the paper reviewed the annual reports of these airports over the period of 2016–2020 and found similar trends. For example, in 2020, aeronautical revenues of Heathrow Airport exceeded non-aeronautical revenues by more than £400 million, while in 2016–2019, this difference reached more than £1000 million (Heathrow, 2020; 2018, 2017).

The differences in the share of aeronautical and non-aeronautical revenues of main large airports and small regional airports suggest that there are some factors affecting such revenue distribution structure. In their study of airport revenues, Fuerst et al. (2011) and Paraschi et al. (2020) considered the size of the airport as an important factor. Therefore, it might be possible that one of key factors affecting the ratio of aeronautical and non-aeronautical revenues is the size of an airport. According to Karanki et al. (2020), revenue losses might result from inappropriate balance of aeronautical and non-aeronautical revenues in the context of specified airports. For example, high aeronautical charges might limit operations of airlines from the airport, thus, leading to the airport's losses in aeronautical revenues (Karanki et al., 2020). To be able to sustain aeronautical revenues at the level exceeding non-aviation revenues, it might be necessary to have a proper size. In this case, the proper size means having large airport capacity and intense traffic. Further support for the powerful effect of the airport size on the revenue structure was obtained from the components of aeronautical revenues that found the most profitable ones. According to the International Civil Aviation Organization [ICAO] report of 2015, the highest financial margins of aeronautical revenues produced by passenger handling and aircraft landing charges (ICAO, 2015). The research of other aspects of airport activities, for example, digital transformations, has

indicated the airport size as one of the key factors affecting specified operations (Halpern et al., 2021). In order to determine other factors that might affect the ratio of aeronautical and non-aeronautical revenues, it was important to conduct the literature review on airport performance, capacity and connectivity.

As a result of the literature review, various factors were identified regarding the airport performance, capacity and connectivity. The summary of these factors is provided in Table 1. Factors related to airports' business model and exogenous factors were excluded from this list because they were not the focus of this research. Obviously, the list in

Table 1. Factors affecting airport performance, connectivity and capacity (created by the authors)

Factors affecting airport operations	Based on the authors
Airport size: 1. Number of passengers 2. Overall territory 3. Size of commercial areas 4. Runway size 5. Gate size: 1) small airports with 1 ≤ gates ≤ 15 2) medium airports with 15 < gates ≤ 45 3) large airports 45 < gates ≤ 90 4) very large airports with more 90 < gates	Adikariwattage et al. (2012), Cervinka (2019), Eurocontrol (2019), Fuerst and Gross (2018), Harley et al. (2020), Hotle and Mumbower (2021), Kazda et al. (2020), Remencova and Sedlackova (2021)
Airport connectivity: 1. Total connectivity (airport scale) 2. Direct vs. Indirect connectivity 3. Hub vs. Point-to-point connectivity 4. Mesh connectivity 5. Domestic vs. International 6. Regional vs. Basic vs. Peripheral 7. Schengen vs. Non-schengen flights 8. Core vs. Bridge connections 9. Airport seasonality	Debyser (2016), Federal Aeronautical Administration of the USA (Federal Aviation Administration, henceforth – FAA, 2022), Kazda et al. (2020), Klophaus et al. (2021), Lordan and Sallan (2017), Wong et al. (2019)
Airport location: 1. Urban vs. Rural airports 2. Secondary airports 3. Periphery, remote airports 4. Agricultural-area airports 5. Natural-area airports 6. Destination airports 7. Feeder airports (hub-spoke connections)	Cervinka (2019), Kazda et al. (2020), Mashhoodi and Van Timmeren (2020), Nommik and Antov (2020), Remencova and Sedlackova (2021)
Airport status: 1. Primary vs. Nonprimary airports (general aviation, relievers) 2. Hubs vs. Nonhubs 3. Main vs. Secondary airports	Hotle and Mumbower (2021), FAA (2022), Wong et al. (2019)
Airport's network: 1. Belonging to an airport group 2. Not belonging to an airport group	Kazda et al. (2020), Pagliari and Graham (2019)
Airport ownership: 1. Country ownership 2. State ownership 3. Local regional government's ownership 4. City ownership 5. Airport authorities' ownership 6. Private ownership 7. Blended (joint) ownership (public-private ownership)	Ballart and Guell (2015), Choo et al. (2018), Kazda et al. (2020), Kutlu and McCarthy (2016)
Low cost airlines (LCC): 1. Peripheral airports with low demand for flights 2. Secondary airports connecting to major centers, LCC hubs 3. Regional, secondary, hub airports with LCC minimum presence of 15% 4. Airports with LCC presence below 15%	Kazda et al. (2020)
Combination of factors: 1. Large airports with more than 10 mln. passengers 2. National airports with 5–10 mln. passengers 3. Large regional airports with 1–5 mln. passengers 4. Minor regional airports with less than 1 mln. passengers	European Commission (2005), Kazda et al. (2020)

the Table 1 is incomplete, but it provides an overview of common factors.

There is no one airport topology because a topology is created for specific purposes and needs (Suau-Sanchez et al., 2015). Therefore, the factors listed in Table 1 can be grouped in various ways to form an airport topology. Typically, topologies include multiple factors. The review of factors of Table 1 suggests the creation of an airport type based on the airport's status of a main or secondary feature. There are other important factors that can be incorporated into this feature – the airport size, geographic location and connectivity. Factors that are not particularly important can be excluded, because a topology and type are created for specific purposes. In the case of Baltic airports, they are the airport ownership, LCC and networks because the selected Baltic State airports are public companies, have LCC and only Lithuanian airports belong to a network of Lithuanian airports. The creation of an airport type based on the airport status requires the understanding of the concept of the main and secondary airports. Understanding is based on interpretation, which can be created as a result of discourse analysis of a text corpus. To construct the definition of an airport type useable in this research, the authors have conducted the discourse analysis of airport concepts described in the research methodology section.

Overall, the review of literature on the ratio of aeronautical and non-aeronautical revenues has shown two tendencies. First, main and large airports obtain more revenues from aeronautical than non-aeronautical activities. Second, non-aeronautical revenues are higher than aeronautical revenues at smaller and regional airports. Does the same trend apply to Baltic State airports? The answer to this question was obtained by answering the following research questions:

1. What is a main airport type?
2. What is a secondary/regional airport type?
3. What airports are the main airports in the Baltic States?
4. What is the ratio of aeronautical and non-aeronautical revenues of these airports?
5. Do aeronautical revenues exceed non-aeronautical revenues of these airports?
6. Is there a connection between the (main) airport type and the ratio of aeronautical and non-aeronautical revenues consistent with earlier findings on other airports (when aeronautical revenues exceed non-aeronautical revenues)?

2. Definition of the airport types

2.1. Construction of the airport type concept

To understand the concept of the main, large and secondary, smaller airports, which were a part of the research question, it was important to create a definition of these concepts. Definitions were formed by lexical concepts, specifically their theta or thematic role relationship. Davis (2019) defines such a relationship by establishing a connection between participants and situations in a specified event by mapping semantic arguments to their syntactic counterparts. Concepts are retrieved from the depository of knowledge accumulated in a specified field of research. This depository is called a text corpus. The discipline that creates and analyses text corpora is linguistics. A research tool that is used to analyse text is discourse analysis. Both quantitative and qualitative research methods were applied to discourse analysis. This section of research provides an overview of the research methodology that was used to create a definition of the main and secondary airports applicable for the study of the connection between an airport type and the ratio of the aeronautical and non-aeronautical revenues.

2.2. Creation of the text corpus

In total, the created corpus included 92 scientific papers and professional reports. Most papers were published in 2018–2021 and covered the topics related to this research – various aspects of airports' operations and business performance. The range of covered countries included Europe, Asia, South and North America and Australia. A representative sample of the selected papers is available in Table 2, but the full list in Uzule (2021).

Table 2. A sample of sources selected for discourse analysis (created by the authors)

№	Authors	Paper title
1	Airport Council International (2019)	Annual Report 2018.
2	Airport Council International (2018)	World Report December 2018.
3	Albayrak et al. (2020)	The determinants of air passenger traffic at Turkish airports.
4	Alves et al. (2020)	Towards an objective decision-making framework for regional airport site selection.
5	Bergantino et al. (2020)	Modelling regional accessibility to airports using discrete choice models: An application to a system of regional airports.
6	Breindenbach (2020)	Ready for take-off? The economic effects of regional airport expansions in Germany.
7	Cattaneo et al. (2018)	The impact of intercontinental air accessibility on local economies: Evidence from the de-hubbing of Malpensa airport.

End of Table 2

№	Authors	Paper title
8	Chaouk et al. (2020)	The impact of national macro-environment exogenous variables on airport efficiency.
9	Choo et al. (2018)	Joint impact of airline market structure and airport ownership on airport market power and profit margin.
10	Christensen et al. (2020)	Optimizing airport infrastructure for a country: The case of Greenland.
11	Eurocontrol (2019)	Comparison of air traffic management-related operational performance: U.S. / Europe.
12	Fernandes et al. (2019)	Regional change in the hierarchy of Brazilian airports 2007–2016.
13	Fragoudaki and Giokas (2020)	Airport efficiency in the dawn of privatization: The case of Greece.
14	Fuerst and Gross (2018)	The commercial performance of global airports.
15	Gao and Sobieralski (2021)	Spatial and operational factors behind passenger yield of U.S. nonhub primary airports.
16	Halpern et al. (2021)	Ready for digital transformation? The effect of organizational readiness, innovation, airport size and ownership on digital change at airports.
17	Han et al. (2018)	Airport shopping – an emerging non-aviation business: triggers of traveler loyalty.
18	Huang et al. (2019)	Modeling and predicting the occupancy in a China hub airport terminal using Wi-Fi data.
19	Jiang et al. (2020)	Determinants of wave-system structures of network airlines at hub airports.
20	Jimenez and Suau-Sanchez (2020)	Reinterpreting the role of primary and secondary airports in low-cost carrier expansion in Europe.
21	Kazda et al. (2020)	Airport typology for LCC policy changes: A European perspective.
22	Liu and Liao (2018)	A case study on the underground rapid transport system (URTS) for the international airport hubs: Planning, application and lessons learnt.
23	Lordan and Sallan (2019)	Core and critical cities of global region airport networks.
24	Martin et al. (2019)	The role of travel patterns in airport duty-free shopping satisfaction: A case study from an Australian regional airport.
25	Mashhodi and Van Timmeren (2020)	Airport location in European airport regions: Five typologies based on the regional road network and land use data.
26	Matsumoto and Domae (2018)	The effects of new international airports and air-freight integrator's hubs on the mobility of cities in urban hierarchies: A case study in East and Southeast Asia.
27	Mueller and Aravazhi (2020)	A new generalized travel cost based connectivity metric applied to Scandinavian airports.
28	Niewiadomski (2020)	Agentisation of airports and the pursuit of regional development in Poland.
29	Nommik and Antov (2020)	European regional airport: Factors influencing efficiency.
30	Pagliari and Graham (2019)	An exploratory analysis of the effects of ownership change on airport competition.
31	Plitz et al. (2018)	A comparative analysis of hub connections of European and Asian airports against Middle Eastern hubs in intercontinental markets.
32	Reece and Robinson (2018)	Airport ownership and regulation.
33	Soylu and Katip (2019)	A multiobjective hub-airport location problem for an airline network design.
34	Sydow et al. (2020)	Strategy emergence in service delivery networks: Network-oriented human resource management practices at German airports.
35	Takebayashi (2018)	Managing airport charges under the multiple hub network with high-speed rail: Considering capacity and gateway function.
36	Zhang et al. (2019)	Impacts of high-speed rail on airlines, airports and regional economies: A survey of recent research.

The scientific papers were retrieved from 28 scientific journals registered in the database *Science Direct,* which is a reliable source of scientific information. The quality of scientific journals was good as the average impact factor of the selected journals was 3.029.

2.3. Methods of analysis

Two research methods were used in this discourse analysis – the quantitative method, which addressed the frequency of use of concepts in the corpus, and the qualitative method, which studied concordances, or lexical chunks, of concepts. The window size for each concordance was set at 120. The concordance analysis was run to select concepts that could be used to define the key concepts of the main and secondary airport. The threshold for the selection of airport type concepts was set at 10% in the overall context of airport concept occurrence.

Both analyses were carried out by the discourse analysis software *AntConc*.

3. Summarizing of quantitative analysis

The discourse analysis showed that the created corpus contains 891,499 lexical items or tokens. Consistent with the theoretical discussion, the following concepts were analysed: (1) the main and primary airports; (2) regional, secondary, local, peripheral and nonprimary airports, airports; (3) hubs and nonhubs. The summary of the quantitative analysis is provided in Table 3.

Overall, the results displayed in Table 3 indicate a very low occurrence of the airport type concepts in the corpus. This research outcome might point to the importance of the current research revealing a research gap in factors affecting airport revenues. The lack of such research might tap into the possibility of an assumption of the lack of connection or relationship between the factors of airport revenue and airport types. However, such an assumption should be scientifically proven to be discarded from scientific consideration, which is yet to be accomplished. It might also be possible that earlier research mostly focused on traditional factors affecting airport revenues, such as business models, other financial indicators, etc.

Consistent with the results of Table 3, the airport concepts were grouped into three categories based on concept meaning. The hub category included hub and nonhub airports, whereas the category of the main airport encompassed main and primary airports consistent with their lexical connotations. The remaining concepts were grouped into the category "other than the main airport" which was assigned the label of the "secondary airport" in order to avoid the confusion that might be created by the label "regional" which might refer to an airport which is still the main / hub airport in a specific region. The concept of the secondary airports included airports that are regional, secondary, local and peripheral based on similarities in lexical meanings. The summary of the usage of the concepts is presented in Figure 1, which shows that there was made a difference in this research between "All concepts related to airports in the corpus" and "All concepts of airport types". This difference was caused by the need to determine the frequency of occurrence of the concepts of airport types in contrast to other airport-related concepts, such as airport funds, airport development, in the context of research on airport revenues. This frequency is expected to indicate if airport types were considered important concepts and factors in earlier research on airport revenues because the more frequently a concept is used, the more important it is.

Table 3. Distribution of airport types in the corpus (created by the authors)

Airport categories	Specific airport types	Occurance in the corpus, %
Hub	Hubs	0.07
	Nonhubs	0.01
Main	Main	0.02
	Primary	0.01
Secondary	Regional	0.09
	Secondary	0.02
	Local	0.02
	Peripheral / remote	0.001
All of the above concepts		0.24

The results displayed in Figure 1 lead to the following conclusions. Firstly, the concepts of a type of airport were used in the literature. Therefore, it is possible to postulate an airport type based on the concept of the main vs. secondary airport. Secondly, however, is that such concepts are not sufficiently addressed in research because the total amount of the frequency of use of the selected concepts constituted only 0.002% of the total amount of concepts in the corpus. One implication of the conclusion is that the area of research needs further development because the meaning that is created for a particular concept might vary across users of the concept. Concept users might suppose they converse about the same content, but it might not be entirely so. In fact, this research showed that the meaning of these concepts was not always straightforward if earlier research findings were applied to a new context. Specifications of these concepts might be required for each new context. Thirdly, the concepts of the secondary airport were more frequently used than those of the main airport, which points to the higher level of interest in the development of secondary airports, perhaps, due to more sustainable development of main airports in comparison to secondary airports.

The summary of the results of the qualitative analysis is provided in Table 4.

To sum up, the qualitative analysis of concordances has supported the outcomes of the quantitative analysis. The first, the classification of airports into two major groups –

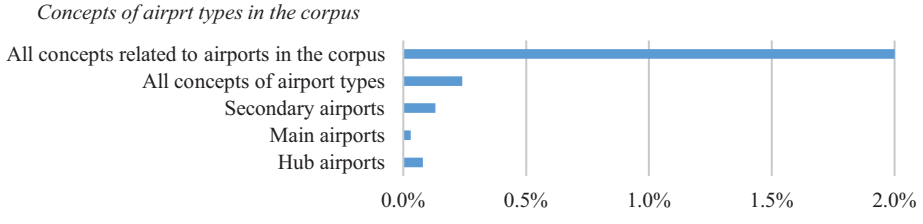

Figure 1. Summary of distribution of airport types in the corpus (created by the authors)

Table 4. Summary of the selected concepts for airport definitions (created by the authors)

No.	Airport type	Selection of identified concepts	Examples of authors	Definitions of airport types
1	Main airport	Central position	Dobruszkes (2013)	The main airport is an airport with a central, non-regional, non-peripheral location and heavy air traffic at the national level.
		Non-regional/non-secondary position	Dobruszkes (2013), Tveter (2017), Jimenez and Suau-Sanchez (2020)	
		Heavy air traffic on national/ supranational levels	Eurocontrol (2019)	
2	Hub airport	Primary airport	Kazda et al. (2020)	The hub airport is an airport, offering a base to an airline, with well-developed connectivity and high traffic intensity. The size was not included into the definition because the concept of the size was found irrelevant since airports of any size can become hubs.
		Non-local/non-secondary airport	Fageda (2014), Keumi and Murakami (2012)	
		Heavy air traffic	Albayrak et al. (2020)	
		Any size	Gao and Sobieralski (2021), Kutlu and McCarthy (2016), Malighetti et al. (2009)	
3	Secondary airports	Non-main/non-central airports	Christidis (2016)	The regional airport is the opposite of the main, central and hub airports and is a relatively small airport, having lower air traffic connectivity and intensity. *The concept of the secondary airport was used in the context of concepts similar to those of the regional, local and remote airport. Thus, the secondary, regional, local and remote airport concepts are synonymous in the created corpus.
		Nonhubs	Gutierrez and Lozano (2016)	
		Low air traffic	Minato and Morimoto (2011), Postorino and Pratico (2012)	
		Drivers of regional development and connectivity	Debyser (2016)	
		Smaller than large airports	Nommik and Antov (2020)	

Table 5. Checklist of the key concept of the main and secondary airport (created by the authors)

Factor	Main airport	Secondary airport
Hub	+	–
Large	+	–
Smaller	–	+
Large connectivity	+	–
Lower connectivity	–	+
Heavy air traffic	+	–
Less-intense air traffic	–	+
Central location	+	–
Regional, remote location	–	+
Driver of regional development	–	+

main and regional airports – has been confirmed. Second, main and hub airports have been confirmed to belong to one group because of their common features of location and connectivity. Second, secondary, regional and local airports have also been found to form one category based on their location, connectivity and size. The produced definitions can be further specified; however, they are sufficient for the analysis of the Baltic States airports.

Overall, this section of research aimed at producing a definition of an airport type that could be used in research on a connection between an airport type and the distribution pattern of aeronautical and non-aeronautical revenues. The produced airport type of the main vs. secondary airport is a binary concept of opposite features. The visual representation of the main airport type vs. secondary airport type is provided in Table 5.

4. Research methodology: aeronautic and non-aeronautic revenues of Baltic States airports

4.1. Selection of Baltic States airports

The Baltic States are formed by Lithuania, Latvia and Estonia. Each country has several airports. Some examples of Baltic States airports include Riga and Liepaja airports in Latvia, Vilnius and Kaunas airports in Lithuania, and Tallinn and Parnu airports in Estonia. The selection of airports for this research was constrained by the availability of financial data on airport revenues in online open access, including regional airports, which, therefore, were not considered in this analysis. Therefore, the research question was narrowed down as follows: do aeronautical revenues exceed non-aeronautical revenues at the main Baltic States airports?

4.2. Airport types of the selected Baltic States airports

Although Riga, Vilnius and Tallinn Airports were referred to as main and large airports, it is important to prove that they have features consistent with the main and large airport type. Riga, Vilnius and Tallinn Airports are the largest airports in their countries. Riga Airport served 7 mln (RIX, 2018), Vilnius Airport 5 mln (Vilniaus oro uostas, 2018) and Tallinn Airport 3 mln passengers in

2018 (Tallinn airport, 2018). In comparison, the turnover of passengers at Liepaja Airport in Latvia was about 9,000 (Airport Liepāja, n.d.), at Kaunas Airport 1 mln (Kauno oro uostas, 2018), whereas at Tartu Airport – 26,092 people (Tallinn airport, 2018). The connectivity and the number of airlines are also the highest on the national scale with Riga Airport having 100 (RIX, 2018), Vilnius Airport 19 (Vilnius airport, 2021) and Tallinn Airport 16 destinations (Tallinn airport, 2018). Additionally, Riga Airport is a hub for AirBaltic, Vilnius Airport is a base for GetJet Airlines, whereas Tallinn Airport hosts Nordica. Thus, the selected Baltic States airports are indeed the main and large airports in their nations.

4.3. Revenues of Baltic States airports

The financial data were taken from the annual consolidated reports of the selected airports published in online open access (Tallinn airport, n.d. …; Riga airport, n.d. …; Lithuanian airports, 2020…; VĮ Lietuvos oro uostai, 2020…; UAB "Auditas", 2017). The open source financial data for Vilnius Airport were unavailable until the year 2017, and the data of 2017 contained gaps for the cross-Baltic comparison. Therefore, the most recent data that were available for the cross-Baltic analysis spanned the period of 2018–2020. Within the framework of the financial analysis, the 3-year data were considered sufficient to determine a short-term financial trend.

The research method used in this study was the method of comparison and calculation of financial ratios. Using the comparative analysis of the revenue structure, it is possible to identify financial trends and their change, whereas the calculation of the main financial ratios helped to assess the impact of the change of the revenue structure on financial performance. The main financial indicators were not chosen by chance: ROA indicators characterize how skillfully and efficiently companies manage their assets, and ROE characterizes the return on invested capital of shareholders. The indicators of profit margins, assets turnover and financial leverage made it possible to explain the reasons for the change in these performance indicators. Financial ratios for Riga and Tallinn airports were calculated by the authors, who took these data from annual reports for the analyzed period. However, the data for Lithuanian Airports were taken from the 2020 annual reports prepared by the Lithuanian Airports. When reviewing the data for Vilnius Airport available in the annual report of "Lithuanian Airports", it was noticed that the direction of the trend was similar for Vilnius Airport and Lithuanian Airports overall. Therefore, it was possible to use the calculated financial indicators from the consolidated annual reports of Lithuanian Airports with reference to Vilnius Airport.

5. Results of revenue research

The summary of the revenue data analysis and impact of the revenue structure on financial performance provided in Table 6. In addition to the structure of airport revenues, Table 6 shows the main performance indicators of airports, which were rated in the assessment of the aviation industry.

Until 2020, Riga and Lithuanian Airports had aeronautical revenues exceeding non-aeronautical revenues by about 25–30%. However, the ratio changed in 2020 for both airports. While the direction of the revenue ratio remained the same for Vilnius Airport, the difference between aeronautical and non-aeronautical revenues decreased. The share of the aeronautical and non-aeronautical revenues of Riga Airport became almost equal for Riga Airport. The Covid-19 pandemic had a significant impact on the decline in aviation revenues in total operating income for both airports. As for Tallinn Airport, non-aeronautical revenues were higher than aeronautical revenues throughout the period, and in fact, the share of non-aeronautical revenues slightly increased. Thus, the ratio of aeronautical and non-aeronautical revenues differed across Baltic States airports. However, there is clear tendency for the decrease of the share of aeronautical revenues, which could be attributed to COVID-19 pandemic.

Airports strive to optimize the structure of operating revenues. By analyzing the data in Table 6, it can be

Table 6. Revenue structure and airports' financial performance (created by the authors)

Indicators	2018			2019			2020		
	RIX	Tallinn	LOU	RIX	Tallinn	LOU	RIX	Tallinn	LOU
Aeronautical revenue, %	62.7	36.9	68.3	62.9	37.1	65.0	50.5	32.0	57.9
Non-aeronautical revenue, %	37.3	63.1	31.7	37.1	62.9	35.0	49.5	68.0	42.1
Return on Assets, ROA, %	6.0	4.0	4.6	12.9	4.4	6.9	–9.9	–0.8	–5.0
Return on Equity, ROE, %	18.4	8.7	7.4	29.9	10.2	10.3	–27.2	–2.1	–7.5
Profit margin (EBIT/Sales), %	17.7	17.5	26	35.5	21.1	33.0	–51.6	–9.7	–5.1
Profit margin (NI/Sales), %	16.5	17.1	4.6	34.07	20.6	6.9	–53.2	–9.3	–5.0
Assets Turnover	0.34	0.23	0.23	0.36	0.21	0.25	0.19	0.09	0.12
Financial leverage (Assets to Equity)	3.31	2.21	1.53	2.40	2.37	1.46	2.68	2.45	1.22
Operating cash flow to Sales ratio	0.21	0.35	0.50	0.38	0.37	0.40	–0.31	0.20	not avail.

concluded that the structure of revenues in which non-aeronautical revenues prevail over aeronautical revenues is less sensitive to crises, which is consistent with Fuerst and Gross (2018). This conclusion was supported by the positive operational flow at Tallinn Airport. These data also indicated a connection between the structure of revenues and the indicators of the effectiveness of the use of capital.

The outcomes of the revenue analysis suggested that revenues at Riga and Lithuanian Airports are consistent with the literature review because aeronautical revenues exceeded non-aeronautical revenues at these main airports. However, the pattern of the revenue distribution at Tallinn Airport was the opposite, which was why it is inconsistent with earlier research. In an attempt to reconcile the research outcomes with earlier findings, the indicator of the scope was subsequently introduced. The scope could be national, supraregional and European. The supraregional scope covers a few nations in one region, which is the three Baltic States in this paper. The introduction of the supraregional scope was consistent with the existence of the common regional air space, which allows for the divergence of flights in emergency situations to the nearby airport in a neighboring country. However, the introduction of this parameter did not reconcile the data, either, because at least one airport continues to be an outlier (see Table 7). In Table 7 "+" indicates the consistency with the statement that aeronautical revenues exceed non-aeronautical revenues, which is consistent with earlier findings; "–" indicates inconsistency with the statement.

The information in Table 7 can be explained in the following way. Regarding the national scope, the data is consistent with earlier findings on aeronautical revenues surpassing non-aeronautical revenues at main airports due to the Latvian and Lithuanian airports' displaying such trends. As for the supraregional scope, the data is consistent because Riga Airport, being the main airport in the region, has aeronautical revenues exceeding non-aeronautical ones, whereas Tallinn Airport as a secondary airport in the region has non-aeronautical revenues outperforming aeronautical ones. In pertinence to the European scope, only the revenue distribution pattern of Tallinn Airport is congruent with earlier research as all Baltic airports might be viewed as secondary ones.

As for inconsistencies, the revenue structure of the Estonian airport is incongruent with earlier research on the national scope because this specific airport is the main national airport, yet its non-aeronautical revenues surpass the aeronautical ones, which should not have been the case. If the data is considered on the supraregional level, the outlier is the Lithuanian airport because it is a secondary airport in that region and its aeronautical revenues should have been surpassed by the non-aeronautical ones. As for the European scope, the outliers are Riga and Vilnius Airports due to their secondary status despite which their non-aeronautical revenues are lower than aeronautical counterparts.

Table 7. Application of research findings on air scope (created by the authors of this paper)

Airport	Air scope		
	National	Supraregional	European
Riga	+	+	–
Vilnius	+	–	–
Tallinn	–	+	+

Conclusions

In the context of continuous economic and political changes, the development of an optimal revenue structure ensuring the long-term sustainability of operations becomes vital for any airport. The authors using a methodology resulting from studying and summarizing international scientific publications, tried to find if there is a relationship between the type of airport and the structure of its revenue for three Baltic States airports.

The authors concluded that due to different regulations, there was no single common definition of the type of airport in the scientific and professional literature, and this aspect complicated the analysis conducted in this paper. In each case, the concept of an airport type was formed due to certain factors affecting airport operations and was created for specific purposes and needs.

The identified factors were grouped according to the following airport characteristics: size, connectivity, location, status, network, ownership, cost factor, and combination of factors. The definitions of the main and secondary airports were constructed via discourse analysis. Using this scientific approach, three possible categories of airports were identified: hub, main and secondary airports. The classification developed was based on the selection of the identified concepts existing in scientific literature and was accompanied by definitions of each of the three airport types. The resulting definitions were used to analyze the Baltic States airports.

Each of the analyzed Baltic States airports was the largest airport in each particular country. However, taking into account the intensity of traffic and the level of connectivity, Vilnius and Riga Airports are more in line with the main airport type, while Tallinn Airport is more consistent with the secondary airport type.

As for the analysis of the revenue structure, it has revealed the following:

1) the predominance of the aviation revenues over non-aviation revenues in the revenue structure of the main airports; at the same time, the structure of Tallinn Airport showed a steady predominance of non-aviation revenues over aviation revenues;
2) the trends in the structure of revenues at the main airports show a decrease in the share of aviation revenues in a crisis;
3) the revenue structure affects the airport's financial performance; the revenue structure, dominated by non-aeronautical revenues, is less sensitive to the

crisis, which confirms the positive operating flow at Tallinn Airport.

Thus, it can be assumed that there is a relationship between the type of airport and the structure of its revenues, in which case the results of this study may correspond to earlier findings discovered in other scientific publications. The subject of future research might be a factor analysis of the impact of the revenue structure on airport performance.

Disclosure statement

The authors of this paper do not have any competing financial, professional, or personal interests from other parties.

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