Aviation market in Poland in 2000-2017

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Abstract. The changes that have taken place over the last 3 decades on the market of air services in Europe have had an impact on the markets of individual regions. The paper presents short introduction to the issues of transformation on the European aviation market. The main purpose of this article is to present the development of the aviation market in Poland over the period 2000-2017. The data presented in the article comes from the reports of the Civil Aviation Office in Poland and International Civil Aviation Organization. Aviation market in Poland is becoming more and more popular and its further development is expected in the coming years. There is a great potential for small regional airports that are increasingly operating on the transport services market.

1 Introduction

Transport plays a crucial role in economy bringing goods and services to customers as well as transporting passengers to work or acting for pleasure purposes [1]. One of the fastest growing modes of transport is air transport. The development of this sector is dictated by the increasing mobility of societies around the world. The fast passenger movement in comfortable conditions for relatively little money is a major factor in the popularity of air transport. At the world's largest airports departures are held even every few tens of seconds. The aviation sector in Europe has undergone various changes over the last 20 years, not only in terms of technology and technical sphere, but especially in the legal one.

From a safety point of view, air transport remains the safest. This can be seen in the statistics published by various organizations dealing with the safety of air transport. Public and private agencies in Europe, the United States, and elsewhere are implementing many substantive changes to air transportation operations [2]. These changes seek to address challenges posed by increasing air traffic, increasing diversity of air traffic (for example due to the emergence of small Unmanned Aerial Systems), aging infrastructure, and ongoing efforts to make air transportation safer and more efficient [2]. As its primary indicator of aggregate safety in the global air transport sector International Civil Aviation Organization (ICAO) studies the accident rate based on scheduled commercial air traffic

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with a Maximum Take-off Weight (MTOW) above 2250 kg [3]. The global accident rate (accidents per million departures) over the years 2005-2016 was presented in Figure 1. Aircraft accidents are categorized using the definition provided in Annex 13 to the Chicago Convention-Aircraft Accident and Incident Investigation.

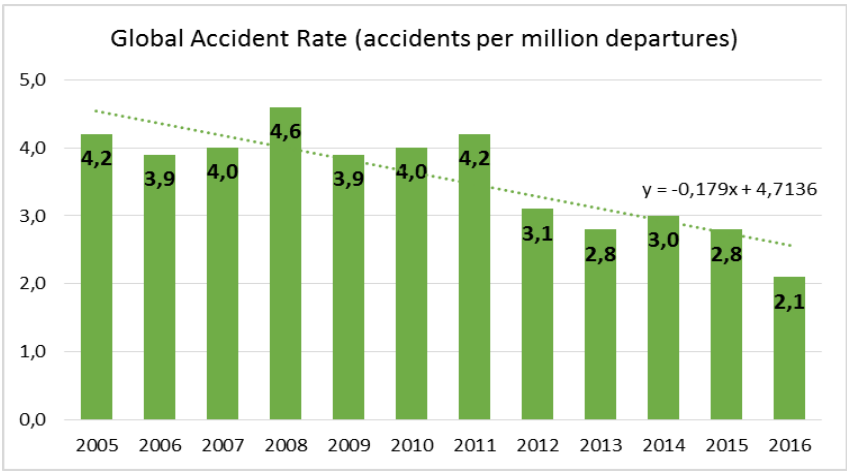

Fig. 1. Global accident rate (accidents per million departures) over the years 2005-2016 (developed based on [3, 4, 5]).

The total elimination of aviation accidents and serious incidents is a desirable goal, but clearly unachievable [6]. In air transport it is very easy to make a mistake. The improvement in safety during flight has led to increased attention to on-ground risks in the industry – hazards that occur before take-off and after landing – as the quest for improving commercial aviation continues. Risks that may occur involving the safety of the crew operating the aircraft, apply to the management of flight organization. The process of safe flight focuses on a human work and systems but also contain events which include the risk of mistake at the same time resulting in an accident. The idea of risk-free systems has evolved in recent years towards a perspective centred around safety management, aimed at supporting resource allocation processes in which a balance between "production" and "protection" is attained [6]. In this context, [7] defines safety as the state in which the risk of harm to persons or property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management. Aviation safety management is articulated according to different levels and affects both the aviation service providers (airlines, airport operators, etc.) and the regulators of aeronautical services [6]. This point of view is supported by ICAO through the regulatory framework of Safety Management Systems (SMS) [6]. More information on various aspects of air transport safety can be found in the following literature [8-12].

2 Transformations on the European market

In recent years, the European aviation sector has gone through drastic change on both the supply and the demand side [13]. Airports are two-sided markets that bring together (and make revenue from) airlines on one side and passengers on the other [14]. As a result, the extent of airport market power depends on the ability and willingness of airlines and passengers to switch to other airports, and this particular feature complicates the standard competitive assessment since the joint constraints on the airport coming from both sides of the market need to be assessed [15]. Legal and institutional aspects have clearly affected the

structure of the market, while cultural forces have influenced leisure mobility over space and its characteristics [13]. On the supply side, only a few industries have faced changes as deep as those that have occurred in the airline industry in the past two decades [13].

We also observe important changes on the demand side. In general, the process of internationalization and globalization has increased the mobility not only of goods but also of people [13]. Trade agreements and the expansion of cargo transport have contributed to an increase in – or are related to – the high mobility of business travellers [16, 17]. Travelers nowadays tend to prefer multiple and short holidays as opposed to traditional long stays, while also the loss of the glamor associated with flying – and hence the supply of lower service levels – is accepted by many travellers [18, 19]. These changes bring benefits in the form of a larger number of operations and therefore higher profits, but they are not without some problems. Market factors, such as demand fluctuations, consumer heterogeneity, and uncertainty about the travellers' departure date or even destination, combined with a limited aircraft capacity and the very perishable nature of the product (the unsold seats cannot be used as soon as a flight departs), make the setting of airfares and the allocation of aircraft seats a complex decision process [13]. In recent years, carriers have adopted a set of techniques to allocate limited and highly perishable resources among differentiated consumers [13]. These techniques are known as 'yield management' (or 'revenue management') [20, 21]. Although these issues are particularly important in aviation, similar problems also occur in other transport sectors (a.g. postal services [22, 23].

The liberalisation and extension of the European aviation market stand out as one of the clearest success stories of the single European market. During the 1990s three phases were used in order to fully deregulate the European airline industry and, by 1997, airlines that belonged to member states of the European Union were allowed to fly freely within the boundaries of the single market [24]. For Europe, Pitelis and Schnell [25] have shown with their survey that European airline managers perceived substantial barriers of entry as late as 1998 (so after the full deregulation). However, since then there have been further deregulation and also some substantial developments of the aviation industry, which may have changed the contestability of this market. New airline business models have developed, while airports have become more commercially focused and are often privately owned or run at arms-length from government [26]. Furthermore, the Schengen Convention has ensured free movement of people in Europe. The European Commission amended several key regulations, for example those related to slot allocation, competition and computer reservation systems (CRSs) [24]. Furthermore the number of member states of the European Union has increased to currently 27 states, which has widened the market but also increased the number of competing players on many routes [24].

Currently, the three largest airlines in the European market are: Lufthansa, International Airlines Group (formerly British Airways), and Air France / KLM, with significant market share (especially on long-distance routes).

3 The development of the aviation market in Poland

In Poland over 2 decades there have been significant changes in the aviation sector. Firstly, there were changes in the number of transport companies associated with the liberalization of the air services market. Another issue is the development of regional airports. Some of the airports ceased to exist (e.g. Szczytno) for the development of new ones (e.g. Modlin, Lublin, Radom) (this tendency can be seen in Table 1 and 2). There are currently 15 functioning civil airports in Poland. Supplementing the data in Table 1 and 2, the locations of currently existing airports in Poland are presented in Figure 2. Finally, there is also a huge increase in passenger service in this transport sector. The situation described is confirmed by aviation market data presented in Figure 3.

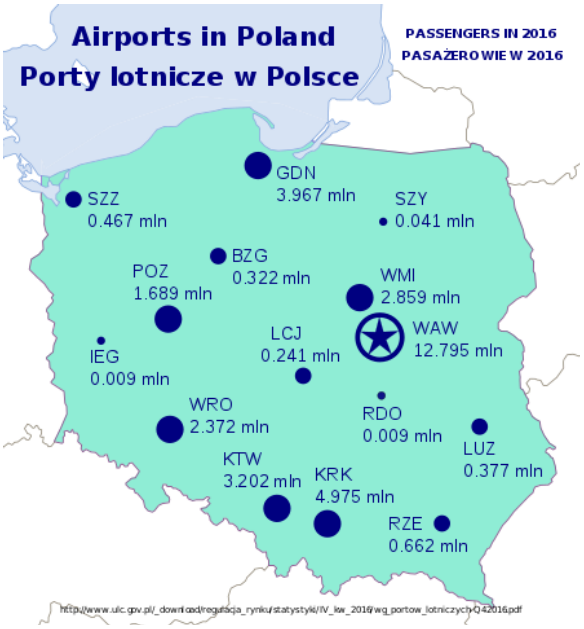

Fig. 2. Locations of airports in Poland [27]

Table 1. Air operations in Poland over the considered years (developed based on [27])

Year	Warsaw-Chopina	Kraków-Balice	Katowice-Pyrzowice	Wrocław-Strachowice	Poznan Ławica	Łódź	Gdansk	Szczecin-Goleniów
2017	157044	44188	27295	22899	15773	1740	36504	4781
2016	138909	39566	23368	20506	15236	2909	34211	4254
2015	124691	33570	23391	20004	14436	3099	32714	3462
2014	121913	32618	20687	20245	14633	2030	31336	2691
2013	123981	34867	20841	19973	14247	2762	28788	3448
2012	118320	35093	24310	21681	19146	3835	32871	4992
2011	119399	28990	22096	18331	16612	3044	26645	3196
2010	116691	29706	20446	17975	16738	3265	25006	3235
2009	115934	29150	20186	17260	15980	4176	22524	3765
2008	129728	31438	21165	18781	16236	4185	23139	4193
2007	133116	34253	17545	15439	12069	3782	20412	3731
2006	126534	28912	14979	25002	10722	3256	17672	3137
2005	120271	21951	11316	20556	8983	1456	12658	3002
2004	108255	14322	9089	18509	9202	1633	10394	3139
2003	94314	15086	9357	12384	14174	1551	12880	7362
2002	92403	14115	8362	6594	13007	1252	12104	6425
2001	95877	14274	9441	7430	15397	1164	12686	6415
2000	75979	13128	8710	11858	13225	851	11434	5939

Table 2. Air operations in Poland over the considered years (developed based on [27])

Year	Bydgoszcz - Szwederowo	Rzeszów - Jesionka	Zielona Góra-Babimost	Warsaw - Modlin	Lublin	Radom-Sadków	Olsztyn - Mazury	Szczytno
2017	2397	6361	529	17279	3249	480	680	0
2016	2315	6211	520	17543	2574	659	882	0
2015	2536	6324	672	16288	1997	110	0	0
2014	2584	6533	632	11148	1874	0	0	0
2013	3147	6499	712	2415	1348	0	0	0
2012	3500	5925	602	6379	42	0	0	0
2011	2812	5226	328	0	0	0	0	0
2010	2091	4863	675	0	0	0	0	0
2009	3980	4263	640	0	0	0	0	0
2008	4790	3446	614	0	0	0	0	0
2007	2697	3000	715	0	0	0	0	0
2006	2685	2740	1107	0	0	0	0	0
2005	1359	2091	163	0	0	0	0	305
2004	2359	2019	400	0	0	0	0	346
2003	3378	5895	1237	0	0	0	0	418
2002	2342	2362	681	0	0	0	0	516
2001	1969	3628	615	0	0	0	0	928
2000	1254	3804	36	0	0	0	0	788

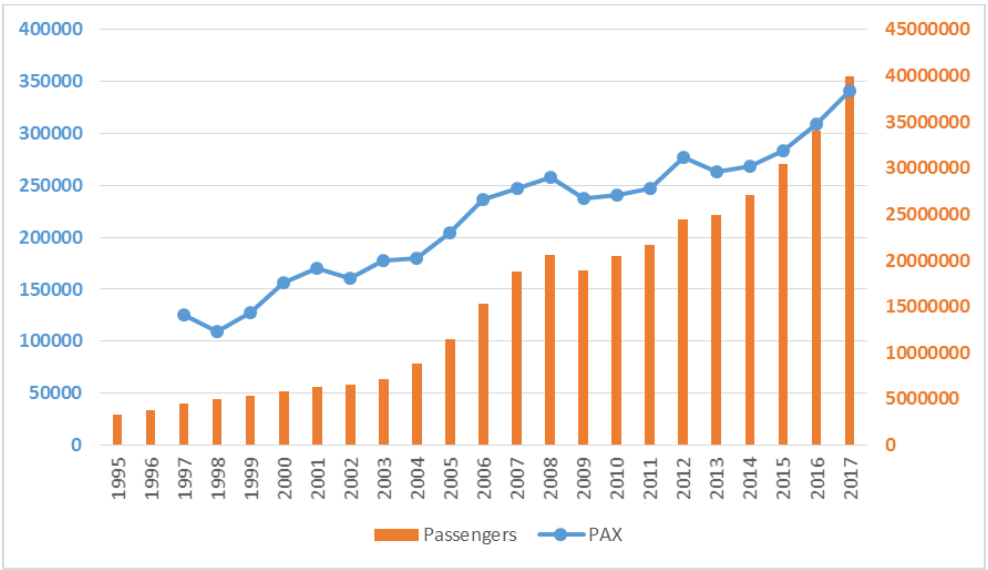

Fig. 3. The development trend of air services in Poland over the period 1995-2017.

Analysing the data presented in Figure 3, it can be concluded that since 2003 there has been a systematic increase in passenger service at Polish airports. On the other hand, an increase in PAX operations is visible throughout the entire period. In 2017, nearly 40 million passengers were served at Polish airports (39,972,294). Most passenger check-in (15,730,330) and PAX operations (157,044) were made at the largest airport in Poland - Chopin airport in Warsaw.

The answer to the increase in the demand for passenger traffic is the construction of further airports in Poland (e.g. Lublin-Świdnik Airport). Existing airports are also subject to constant modernization and expansion to accommodate more and more passengers. Figure 4 shows the number of passengers served on the three youngest airports in Poland from 2012 to 2017.

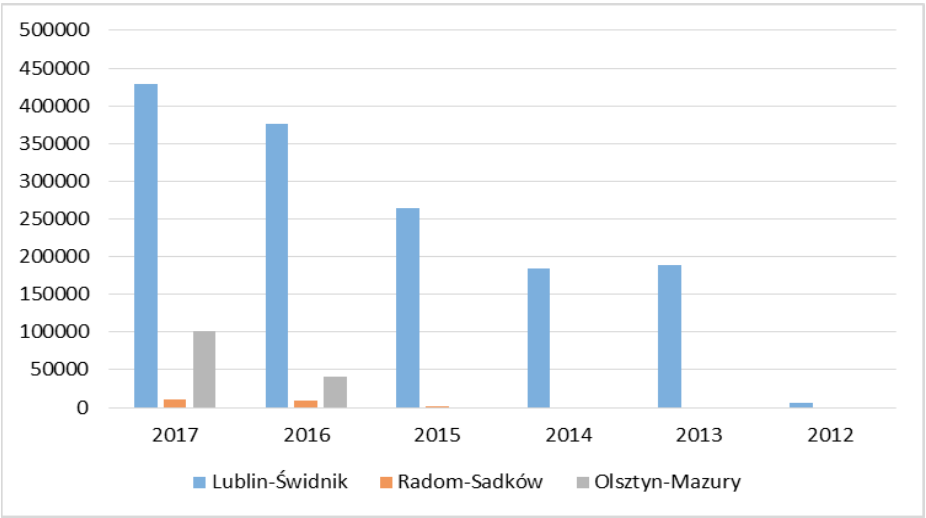

Fig. 3. Number of passengers on the three youngest airports in Poland

Many factors influence the success of the airport. Among these factors, we can list the location in a relatively large population cluster at larger urban agglomerations [28]. Another is the macro-economic situation of the region in which the airport is located. The age structure of society and the expectations of the population of the region in relation to mobility. The attractiveness of connections offered by carriers and competitive ticket prices.

Based on the data presented (Fig. 4), it can be concluded that the Lublin-Świdnik airport is experiencing quite stable increases in the number of passengers served. The worst in this list is the airport in Radom, which has small increments and number of passengers served. The Lublin-Świdnik airport is located in a region with a relatively large number of inhabitants, and the main city of the Lublin region is a student city with a rich history, often visited by tourists. These factors affect the popularity of air transport, which is reflected in the data presented [29].

4 Conclusions

The changes that have taken place over the last 3 decades on the market of air services in Europe have had an impact on the markets of individual regions. In Poland, a lot of political changes took place at that time, also affecting the country's economic system. In addition, changes in the transport sector in the early 1990s contributed to the development of

population mobility. The geo-political stability of the region is also a factor that is conducive to the increasing mobility of the society [30].

These factors in turn have influenced the development of air transport in Poland over the last 20 years. The largest airports in Poland recorded an increase in the number of passengers checked in and this trend remains unchanged. There has also been development in smaller airports and new ones have emerged, where Lublin-Świdnik airport are dealing better and better on the market. The data presented in the paper show that air transport in Poland is becoming more and more popular and its further development is expected in the coming years. Small and medium regional airports become important for the whole aviation market.

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References

1. A. Mačiulis, A.V. Vasiliauskas, G. Jakubauskas, Transport, **24**, 2 (2009)
2. K.D. Kuhn, Transport. Res. C-Emer. **87** (2018)
3. State of Global Aviation Safety. ICAO (2011)
4. Safety Report, Edition 2015. ICAO (2015)
5. Safety Report, Edition 2015. ICAO (2017)
6. D.R. Insua, C. Alfaro, J. Gomez, P. Hernandez-Coronado, F. Bernal, Reliab. Eng. Syst. Safe, **179** (2018)
7. Safety management manual (Doc 9859 AN/474). International Civil Aviation Organization (ICAO), Montreal, (2006)
8. E.A. Lofquist, Safety Sci. **48**, 10 (2010)
9. C.V. Oster Jr., J.S. Strong C.K. Zorn, Research in Transportation Economics, **43**, (2013)
10. J. Pytka, J. Laskowski, P. Tarkowski, Scientific Journal of Silesian University of Technology-Series Transport, **95** (2017)
11. P. Tarkowski, J. Pytka, P. Budzyński, Ł. Kaznowski, Eksploatacja i Niezawodnosc – Maintenance and Reliability, **15** 3 (2013)
12. D. Tłoczyński, Scientific Journal of Silesian University of Technology. Series Transport. **95** (2017)
13. M. Alderighi, A. Cento, P. Nijkamp, P. Rietveld, J. Transp. Geogr. **24** (2012)
14. M.H. Thelle, M.C. Sonne, J. Air Transp. Manag. **67** (2018)
15. D. Evans, The Antitrust Economics of Two-sided Markets, 2002, working paper. http://www.cprsouth.org/wp-content/uploads/2015/08/Evans.pdf.
16. D.S. Hamermesh, The Economic Record **82** (2006)
17. J.P. Poole, Business Travel as an Input to International Trade, Mimeo. (2009)
18. E. Martínez-Garcia, J.M. Raya, Tourism Manage. **29**, 6 (2008)
19. J.C. Martin, C. Roman, R. Espino, Transport Rev. **29** (2008)
20. L.R. Weatherford, S.E. Bodily, Oper. Res. **5** (1992)
21. Talluri, K.T., van Ryzin, G.J., *The Theory and Practice of Revenue Management.* (Springer, New York 2005)
22. P. Droździel M. Wińska, R. Madlenak, P. Szumski, Transport Problems, **12**, 3 (2017)

23. P. Drożdziel M. Wińska, R. Madlenak, P. Szumski, 12th International Scientific Conference Of Young Scientists On Sustainable, Modern And Safe Transport, Edited by: Bujnak, J; Guagliano, M., Procedia Engineering, **192** (2017)
24. J.W. Kappes, R. Merkert, Transport Res. E., **57** (2013)
25. C.N. Pitelis, M.C. Schnell, Rev. Ind. Organ. **20** (2002)
26. H. Bush, D. Starkie, J. Air Transp. Manag. **41** (2014)
27. www.ulc.gov.pl
28. M. Decky, E. Remisova, M. Mecar, L. Bartuska, J. Lizbetin, I. Dreveny. In situ Determination of Load Bearing Capacity of Soils on the Airfields. In Procedia Earth and Planetary Science, vol. 15 : The World Multidisciplinary Earth Sciences Symposium, WMESS 2015. Amsterdam: Elsevier. s. 11-18, 8 s. ISSN 1878-5220. (2015)
29. J. Lizbetin, M. Hlatka, L. Bartuska. Issues concerning declared energy consumption and greenhouse gas emissions of FAME biofuels. Sustainability (Switzerland), 10(9). (2018)
30. L. Bartuska, V. Biba, R. Kampf. Proceedings of the Third International Conference on Traffic and Transport Engineering (Scientific Research Center Ltd. Belgrade, 2016)