THROUGHPUT OF POLISH AIRPORTS ACCORDANT TO THE OBJECTIVES OF EU PROJECTS APPLICATIONS

GÓRECKA Aleksandra

Warsaw University of Life Sciences - SGGW, Warsaw, Poland, EU
aleksandra_gorecka@sggw.pl

Abstract

From 2004 to 2013, a number of projects aimed at the development of transport infrastructure in Poland were completed. Some of them were aimed at supporting trans-European transport (TEN-T) network, as well as at increasing regional development by creating investment areas, growing life standards by better inhabitants' mobility, decreasing unemployment rate, and so on. 81 projects were accomplished that were directly concerned with the development of airport infrastructure with financial support from European Union (EU).

In this paper, I aimed to describe the projects supporting the development of airports in Poland. I focused on the increasing passenger throughput that was assumed when applied for EU founds. This assumption was compared with current (2015) use of airports and the potential possibilities for increasing demand. Based on this hypothesis, herein the investments are presented.

Keywords: Airport market, airport throughput, demand, EU projects, Poland, NUTS-2

1. INTRODUCTION

Air transport is currently a significant component of transport net. Without any doubt, it can be said that it influences the development of countries, regions, unions, and World. There are three main elements that cause air business to operate: airlines, air control system, and airports. Each of them is a very interesting field for research. Airports can be examined from both economic impact and technical solutions point of view. For example, numerous studies concerned with airport throughput have been conducted. Majority of them present case studies from different airports around the World and present the current challenges with the throughput from technical point of view. The analysis covers passenger throughput including building terminals and inside processes such as check-in, security, boarding, passport control, and so on; traffic and parking system; ground handling and airside throughput [1, 2, 3]; and environmental throughput [4, 5, 6, 7]. These studies present the solutions to throughput problems of operating airports, examine various mathematical and statistical models for throughput forecasting; however, it is also crucial to investigate the estimated potential airport throughput when planning, building, and opening new airport. It seems to be extremely important if the idea of airport construction or rebuilding is supported by EU funds. It should be noted that transport infrastructure planning and financing are controversial political topics at national and increasingly at international level [8].

2. LITERATURE REVIEW

All kind of measures that lead to introduce the airport infrastructure throughput are based on the forecasting of passenger and cargo flow and number of operations. When a new airport is designed, the forecasting based on past data is not possible; therefore, a very detailed potential demand analysis should be introduced. The first step is to clarify the factors influencing the air passenger demand. According to the literature and some business reports [9, 10], these factors can be grouped as local, national, and global levels. First, the local factors influencing air passenger demand consist of population, economic activity, and air carrier service and market strategies. Second, the national factors influencing air passenger demand consist of economy, cost of air travel, and technological advances in communications. Finally, the international factors influencing air

passenger demand consist of economic growth indexes and cost of air travel. Lyneis [11] claimed that the air travel demand can be affected by external and internal factors. Assumption about future demand and performance are essential for business decisions. He considered airfare as the internal factor and gross domestic product (GDP) and population as the external factors. People play a dominating role in the city life; the scale of population will determine the air travel demand [12]. Regardless of the distribution and names of variable groups, there are similar indicators mentioned and used for modeling.

Based on his matrixes, Jankiewicz [10] confirmed the strong correlation between the number of passengers and GDP, the average salary, industrial production, and population. Bafail et al [13] have developed a model for forecasting the long-term demand for domestic air travel in Saudi Arabia based on several variables such as total expenditures and population to generate model formulation. Another study for air travel demand forecasting was conducted by Grosche, et al. [14] According to them, there are some variables that can affect the air travel demand, including population, GDP, and buying power index. They considered GDP as a representative variable for the level of economic activity. Suryani et al. [15] utilized system dynamics for air travel demand indicating that airfare impact, level of service impact, GDP, population, number of flights per day, and dwell time play important roles in determining the air passenger volume, runway utilization, and total additional area needed for passenger terminal capacity expansion. They also claimed that the forecast of air travel demand should support long-term planning to meet the future demand during the planning horizon.

Forecasting of air travel demand is also one of the element to be considered when applying for a financial support for airport development / rebuilding or construction. A particular example of such support is EU funds. European Commission assumes that airports have a central role in the connectivity provided by airlines to passengers and freight customers within the EU, and further afield and are also increasingly regarded as engines of economic growth in their own right.

Despite of the fact that the research on airport throughput are common, it appears that there are few studies linking the issues of effective use of money allocated for the development of airport capacity equipment and its current and future bandwidth.

3. THE AIM AND METHODS

In this paper, I aim to present the ranking of capacity throughput of regional airports in Poland after 2014 and make a hypothesis that the throughput is enough for current and forthcoming demand. I used secondary dataset for simple statistical analysis that was collected from airports management. It covers data from 2004 to 2015 and consists of the number of passengers and the maximum passenger capacity throughput of the airports. Moreover, data collected from Main Statistical Office and Ministry of Infrastructure and Development allowed to include number and value of EU projects completed until 2014 into analysis. To present the trend of passenger number increase, I used the logarithmic trend line. The curved line that is most useful when the rate of change data quickly increases or decreases and then stabilizes is described as optimally fit. Moreover, it may be used for the negative and / or positive data.

Although 13 Polish airports have been studied, because information on the amount of financial support of “operational” and “regional” programs was available for the regions (NUTS-2) only and not for airports themselves, the passenger throughput in the regions is presented. There are two key reasons: (1) simple spatial analysis (**Figure 1**) confirms that the time availability for the airports in Poland covered area of the NUTS-2 in which airport is situated and (2) the regional authorities for NUTS-2 were decision-making units, which decided about building / expansion of the airports. The only exception was support for Warsaw Chopin Airport (WAW) and Modlin Airport WMI airports in Mazowieckie region. Radom airports were excluded from the analysis, as they had not received EU support until 2014.

In this study, I hypothesized that the use of EU funds for expansion of airport facilities in Polish regions has contributed to the stabilization of the level of passenger throughput for the long term.

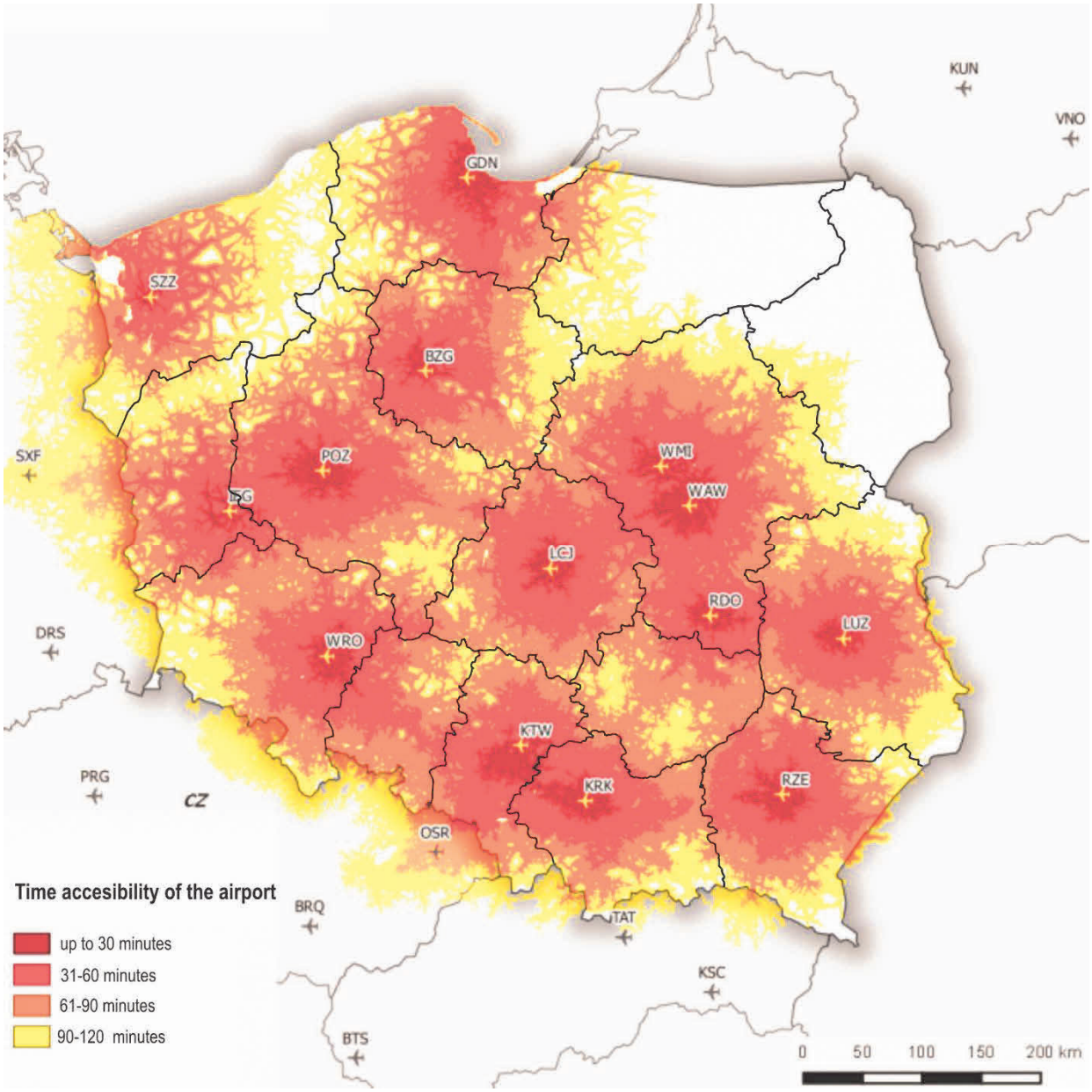

Figure 1 Time accessibility of Polish airports with country division on NUTS-2 [16]

4. AIRPORT ENLARGEMENT PROJECTS IN POLAND FROM 2004 UNTIL 2014

From 2007 to 2014, 69 airport projects supported by EU funds had been implemented in Polish regions. Their aim was improve the quality of air transport in Poland by both the construction of new infrastructure as well as the expansion and modernization of those that existed. Direct actions of the projects included purchases of the equipment necessary for airport operations. Project financing came from two main streams of assistance: operational program “Infrastructure and Environment” (37% of founding of total projects expenditure) and regional operational program (42% of founding of total projects expenditure). Twelve regions, (NUTS-2) where currently the airports are located, have been benefited. The largest number of projects was implemented in Podkarpackie region, and the highest value of total investments was in Mazowieckie region, whereas the highest share of EU founds in eligible costs was in Lubuskie region (**Table 1**).

Table 1 Number of the projects and expenses for the projects concerning airport infrastructure development in Poland due to NUTS-2 division

NUTS-2	Number of projects	Total expenses (in PLN)	Eligible expenditure (in PLN)	EU financial support (in PLN)	% of support in total expenses
Dolnośląskie	2	398 496 577.62	290 903 762.90	139 835 960.79	35%
Kujawsko-pomorskie	11	70 474 493.02	54 282 064.92	41 695 243.26	59%
Lubelskie	3	476 014 362.54	210 678 464.70	144 439 823.53	30%
Lubuskie	3	4 753 237.79	4 749 561.29	4 037 127.08	**85%**
Łódzkie	4	215 743 240.18	156 415 587.02	124 323 491.84	58%
Małopolskie	7	679 106 661.91	512 896 670.61	271 168 390.62	40%
Mazowieckie	5	**1 301 700 206.44**	835 420 426.08	366 464 884.03	28%
Podkarpackie	**15**	394 411 183.31	311 520 314.52	198 000 731.36	50%
Pomorskie	7	483 469 202.83	363 015 197.11	204 140 972.57	42%
Śląskie	4	460 256 459.29	366 252 905.29	186 095 763.53	40%
Wielkopolskie	5	384 447 966.84	299 991 674.61	139 774 050.57	36%
Zachodniopomorskie	3	146 120 707.39	110 989 912.72	61 092 309.39	42%
Total	**69**	5 014 994 299.16	3 517 116 541.77	1 881 068 748.57	

In total, Poland has benefited from over 1.881 billion Polish zloty of EU funds for the development of air transport infrastructure.

5. AIR PASSENGER THROUGHPUT IN POLAND

The implementation of all projects determined the increase level of air passengers' throughput of Polish airports and regions (**Figure 2**).

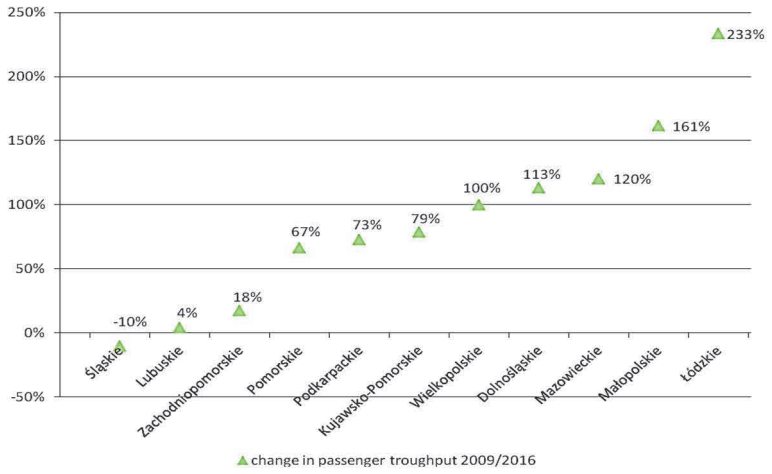

Figure 2 Change in passenger throughput 2009 / 2015

As for percentage change of passenger maximum throughput (**Figure 2**), the capacity of 4 out of 13 airports was doubled (Dolnośląskie-113%, Mazowieckie-120%, Małopolskie-161%, and Łódzkie-233%). Three airports can service 67%-79% more passengers (Pomorskie, Podkarpackie, and Kujawsko-Pomorskie). Lubuskie and Zachodniopomorskie recorded a slight increase of capacity possibilities (4% and 18%). According to the data, in Śląskie region, the possibility of passenger capacity has decreased by 10%. Nevertheless, one should bear

in mind that the declared capacity has also its drawbacks. These figures are declared by the airport authority, which are often subjective.

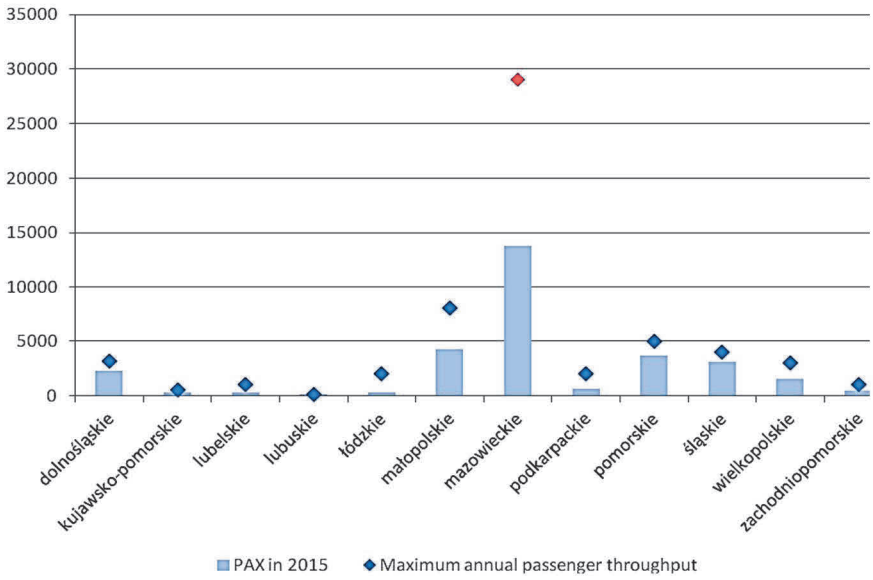

Figure 3 The maximum annual passenger throughput and number of passengers in 2015 in Polish NUTS-2

With respect to the number of passengers (**Figure 3**), currently, Mazowieckie region can handle the largest number of passengers. This could be because there are two airports in this region including WAW, which is the biggest one in Poland. In other regions, the annual throughput level does not exceed 5000 passengers. This confirms that all investments but one were to support the mobility for local inhabitants. WAW airport seems to be the only example of investment for increasing whole national air market.

Expansion of projects and gaining on their financial support, should contribute to increasing their possibility of passenger service in long term (approximately 10-15 years). Therefore, full or almost full bandwidth utilization in 2-3 years after upgrading airport indicates a bad project planning and ineffective use of funds.

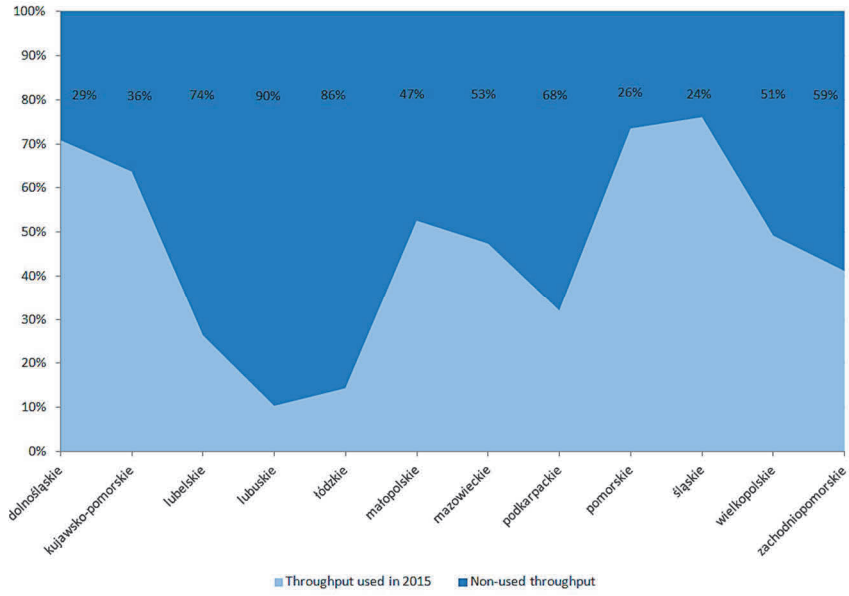

Figure 4 The gap in possible annual air passenger throughput and throughput used in 2015 in Polish NUTS-2

If the assumption is that the maximum annual throughput for each NUTS-2 is 100% it is possible to count the gap that allows to describe the level of free terminal capacity (**Figure 4**). The highest utilization of possible passenger throughput in 2015 was in Śląsk region in Katowice (KTW) airport (76%), Pomorskie region (74%) with airport in Gdańsk (GDA), and Dolnośląskie with Wrocław Airport (WRO 71%). In turn, the lowest use of airport capacity was recorded in Lubuskie (Zielona Góra-Babimost - IEG 10%) and Łódźkie region (LCJ - 14%).

Table 2 Trends in yearly change of the number of passengers in the period 2004-2015 with the forecast trend until 2025*

* in case of Lubelskie region the forecast could not be done as the data covered only two years from the future - Lublin airport started to operate on Dec 2013.

Some remarkable conclusions can be drawn from **Table 2**. Based on simple logarithmic trend line, it is possible to notice that in all regions but Mazowieckie, the tendency in yearly changing of the passengers' number has declined. The forecast for the next 10 time units is that this trend will continue. In four regions (Kujawsko-Pomorskie, Lubuskie, Łódzkie, and Małopolskie) the trend line declined below 0% during the next years. It means that in those regions, the number of passengers will drop. In the remaining regions, yearly number of passengers will increase, however, from one year to another, the level of this growth will be lower and lower.

Table 3 Assumption of passenger throughput given by yearly actual capacity / available capacity, 2015

Rank	NUTS-2	Free capacity in 2015	Projects value (in PLN)	Trend for the next 10 time units	Assumption
1	Śląskie	23.90%	460256459.29	Decreasing	
2	Pomorskie	26.46%	483469202.83	Decreasing (+)	
3	Dolnośląskie	29.09%	398496577.62	Decreasing (+)	
4	Kujawsko-Pomorskie	36.24%	70474493.02	Decreasing (-)	
5	Małopolskie	47.39%	679106661.91	Decreasing (-)	
6	Wielkopolskie	50.76%	384447966.84	Decreasing (+)	
7	Mazowieckie	52.58%	1301700206.44	Increasing	
8	Zachodniopomorskie	58.78%	146120707.39	Decreasing (+)	
9	Podkarpackie	67.94%	394411183.31	Decreasing (+)	
10	Lubelskie*	89.63%	476014362.54	-----	------
11	Łódzkie	85.62%	215743240.18	Decreasing (-)	
12	Lubuskie	89.63%	4753237.79	Decreasing (-)	

* in case of Lubelskie region the forecast could not be done as the data covered only two years from the future - Lublin airport started to operate on Dec 2013.

The top-ranking airports are not these with the highest financial support. The Pearson correlation between free capacity (x) and project value (y) is rxy = −0.168, which confirms the lack of linear dependence. Considering the level of free capacity (**Figure 4**) and the trend lines (**Table 2**), I could point out some additional conclusions. In the regions marked as green, there seems to be a stable situation about the airport passenger throughput. Although Śląskie, Pomorskie, and Dolnośląskie regions have a high capacity bandwidth, declining annual growth in passenger numbers will make the throughput not to exceed in the long term. In Mazowieckie region, the growth in the number of passengers will contribute to higher utilization of airports; however, the current throughput secures sufficient space for new passengers in the future. In those cases the financial support for airport capacity exceeded was reasonable and well spent.

The second conclusion which can be drawn is that in the regions marked as orange, the problems with capacity might appear. First (Zachodniopomorskie and Podkarpackie), decreasing growth of passengers is not enough for optimal utilization of capacity. Moreover, in Kujawsko-Pomorskie, there will be a problem with the declining number of passengers and increasingly non-use capacity.

The third group of regions marked as red is the most problematic one. It seems that, in Małopolskie, Łódzkie, and Lubuskie regions, airport capacity was clearly overinvested. In addition to the current very low usage of capacity, there will be a drop in the number of passengers in the nearest future. This may cause the problems with the maintenance of buildings and facilities of airports.

6. CONCLUSION

The primary aim of this study was to present the possibilities of passenger throughput of Polish airports after extension supported by EU founds and its assumption for the long term. Without any doubt, it can be said that, with the help of EU funds, the total airport capacity in Poland has increased. Nevertheless, the basic results appear not to support the hypothesis that the use of EU funds for expansion of airport facilities in Polish regions

has contributed to the stabilization of the level of passenger throughput for the long term. It seems that the decision of capacity enlargement in some regions was not preceded by detailed analysis.

Although this paper approaches the topic of passenger throughput and expansion of capacity, a number of open questions remain calling for more detailed investigation. First, a good seasonality measure should be incorporated into the analysis to deliver more consistent and better results. The dataset used in this study consists of regions with different throughput structures. On the one hand, there is the biggest airport in Poland and the passenger stable traffic growth over the years, and on the other hand, it includes regions with traffic only in a specific period within the year. Using Gini Coefficient to determine the seasonality coefficient of airports and adjusting the capacity utilization rates accordingly could be a possible solution to this problem.

Second, we must bear in mind that as presented in literature review, the number of variables can influence the air passenger demand. Therefore, together with simple forecasting analysis, it would be advisable to measure the factors that are significantly important for the future demand with the help of regression analysis.

Finally, the airside was ignored in this analysis. Even though this paper suggests that the airside and terminal side will be analyzed separately, it would give a good idea on the efficiency and interdependency of the whole airport system.

REFERENCES

[1] SKORUPSKI J., UCHROŃSKI P. Managing the process of passenger security control at an airport using the fuzzy inference system. Expert Systems With Applications, 54, 2016, pp. 284-293.

[2] TSUI W.H.K., BALLI H.O., GILBEY A., GOWA H. Forecasting of Hong Kong airport's passenger throughput. Tourism Management, 42, 2014, pp. 62-76.

[3] GÓRECKA A. Airport throughput the case of Frederic Chopin international airport in Warsaw. Carpathian Logistics Congress, Jeseník, Czech Republic 2012.

[4] IRVINE D., BUDD L., ISON S., KITCHING G. The environmental effects of peak hour air traffic congestion: The case of London Heathrow Airport, Research in Transportation Economics, 55, 2016, pp. 67-73.

[5] KRSTIC SIMIC T, BABIC O. Airport traffic complexity and environment efficiency metrics for evaluation of ATM measures, Journal of air transport management, 42, 2015, pp. 260-271.

[6] KWASIBORSKA A., STELMACH A. Analysis of airport traffic in the context of environmental throughput. Transport Problems, Vol. 9 Issue 1, 2014, pp. 129-140.

[7] SHORT J., KOPP A. Transport infrastructure: Investment and planning. Policy and research aspects. Transport Policy ,12, 2005, pp. 360-367.

[8] GORECKA A., ROKICKI T. The significance of transportation in agribusiness companies. CLC 2013: Carpathian Logistics Congress - congress proceedings, pp. 24-30.

[9] Austin-Bergstrom International Airport Master Plan Update - Final Report, City of Bergstrom, Department of Aviation, 2003.

[10] JANKIEWICZ J. Analiza i prognozowanie popytu pasażerskiego na przykładzie wybranych portów lotniczych w Polsce in: Regionalne porty lotnicze w Polsce - charakterystyka i tendencje rozwojowe, red. Rekowski M., Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu, Poznań 2011, p. 132-163.

[11] LYNEIS J. System dynamics for market forecasting and structural analysis. System Dynamics Review, 16, 2000, pp. 3-25.

[12] JIFENG W., HUAPU L., HU, P. System dynamics model of urban transportation system and its application. Journal of Transportation Systems Engineering and Information Technology, Vol. 8, Issue 3, 2008, pp. 83-89.

[13] BAFAIL A. O., ABED S. Y., JASIMUDDIN, S. M. The determinants of domestic air travel demand in the Kingdom of Saudi Arabia. Journal of Air Transportation, World Wide, 5(2), 2000, pp. 72-86.

[14] GROSCHE T., ROTHLAUF F., HEINZL A. Gravity models for airline passenger volume estimation. Journal of Air Transport Management, 13, 2007, pp. 175-183.

[15] SURYANI E., CHOU S-Y., CHEN C-H. Air passenger demand forecasting and passenger terminal capacity expansion: A system dynamics framework. Expert Systems with Applications, 37, 2010. pp. 2324-2339.

[16] http://www.pasazer.com/news/26444/slaby,zagraniczny,zasieg,polskich,lotnisk.html (online 10-11-2016).