

# Benchmarking of airports from Central and Eastern Europe

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**Abstract**—Benchmarking became a powerful management tool to assist in identifying new approaches for increasing efficiency and for continuously monitoring ongoing strategic success. Applied properly, benchmarking can help reinforce an organization's vision, mission and strategies, as well as it helps create a new corporate *esprit de corps* by building employee focus, competencies and attitude.

Our external benchmarking is focused on the performances concerning airport connectivity, passenger traffic and the relationships airport – airliners of airports from 8 countries of Central and Eastern Europe.

The target group of the airport development analyze in Central and Eastern Europe is represented by the first 20 airports from the connectivity point of view, regarding the following EU countries: Bulgaria, Croatia, Czech Republic, Hungary, Poland and Romania and 2 non EU countries: Moldova and Serbia whose traffic represents 4.1 % of passenger European traffic. The analyze concerns the macroeconomic parameters and airport operational parameters: airport connectivity, passenger traffic, aircrafts movements and also the strategy of airports in routes development.

As conclusion, some axes for politics in air transport, for a common airport-airliners strategy are presented: concentrating the airport investments according to the economic potential of the region correlated with the foreign investor's interest and the existing infrastructure of the airports in that region and the improvement of the intercontinental connectivity.

**Keywords**— *airport development; benchmarking; Central and Eastern Europe; passenger traffic; airport connectivity.*

## I. INTRODUCTION

The air transport brings a major contributor to global economic prosperity. The air transport system provides jobs, trade, connectivity, tourism, vital lifelines towards many remote communities and also rapid disaster response.

Every day, airlines transport 8.6 million passengers within 99,700 flights and carry \$17.5 billion worth of goods. In 2013, nearly 3.1 billion passengers arrived on and departed from the 3864 airports of the world, 49.8 million tones of cargo and 36.4 million commercial flights were processed. Consequently, aerospace industry represents overall a major direct generator of employment and economic activity, creating 8.7 million direct jobs and 9.9 million indirect jobs in 2012. The ACI Report from February 2015 reveals that during 2014, passenger traffic at Europe's airports grew by an average of +5.4%.

Less tangibly, but as well important, a better connectivity increases passenger traffic and trade. This, in turn, can lead to a

more favorable environment for foreign firms to operate in — greater links to the outside world often drive a more conducive global business environment. A better connectivity together with a bigger number of passengers lead to the development of national, regional and global economy.

## II. AIRPORT BENCHMARKING

Benchmarking became a powerful management tool to assist in identifying new approaches for increasing efficiency and for continuously monitoring ongoing strategic success. Applied properly, benchmarking can help to reinforce an organization's vision, its mission and strategies, as well as it can help to create a new corporate "*esprit de corps*" by building employee focus, competencies and attitude.

Airport benchmarking is a component of an airport's strategic planning process. It is a statistical and an accounting process used to monitor and compare airport economic, operational and service performance. Benchmarking assesses the implementation of an airport's strategic planning objectives to measure the performance of discrete airport functions and identifies best practices for possible incorporation into the organization's procedures to increase efficiency, quality and customer satisfaction. Thus benchmarking links day-to-day operations and management with an airport's short and long-term strategic initiatives and action plans.

The airport benchmarking presented in this paper groups measurable parameters according to area of airport activity: economical context, operational activity and quality of community airline service. The parameters for economical context are GDP for the period 2004-2014, the number of airports of the country, the number of passenger traffic per country, the average of passenger per airport. For the operational activity, the parameters consist in the passenger traffic per each airport, the rate of passenger traffic growth and the total, direct and indirect airport connectivity and also the hub connectivity. Regarding the quality of community airline service, the parameters are: the number of airlines, airline routes and frequencies and the type of airlines.

## III. THE TARGET GROUP OF ANALYZE

In our paper, we achieve an external benchmarking, which compares performance across the 20 airports of 8 countries from Eastern and Central Europe during the last 10 years and for some performances only the results for 2014. In the last 10 years, in the mentioned region, there has been recorded a very important increasing in traffic and in airport connectivity, by this way, the aviation brings its contribution to sustaining

economic growth and the involvement of the countries above in the global economy.

The target group of the airport development analyze is represented by the first 20 airports ranked from the connectivity point of view from the following EU countries: Bulgaria, Croatia, Czech Republic, Hungary, Poland and Romania and from 2 non EU countries: Moldova and Serbia whose traffic represents 4.1 % of passenger European traffic.

In figure 1, we present the number of airports of the analyzed countries. Romania comes first having a number of 16 airports, followed by Poland with 14, while all other countries have less than 10 airports. In total there are 61 airports with 70 806 899 passengers in 2014, representing 4.1 % from European passenger traffic.

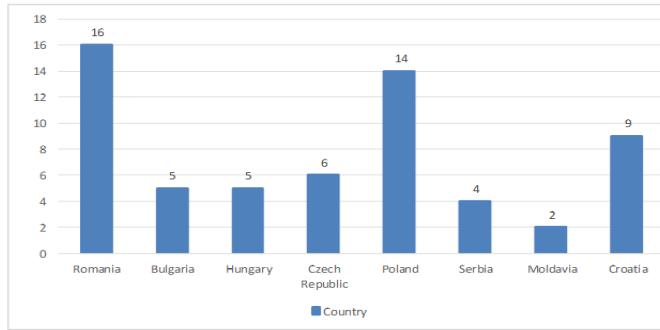


Figure 1 Number of airports per country

If we go further with our analyse and we calculate the average surface from the country which correspond to an airport, we notice that the bigger average surface is in Poland 22,335 km<sup>2</sup>, followed by Bulgaria with 22,180 km<sup>2</sup>, Serbia 19,363 km<sup>2</sup>, Hungary 18,606, Moldova, 16,923 km<sup>2</sup>, Romania 14,900 km<sup>2</sup>, Czech Republic 13,144 km<sup>2</sup> and Croatia with 6288 km<sup>2</sup>. In term of the average of passengers per airport, the situation is presented in table 1 and on the graphic from figure 2.

Table 1 The average of passengers per airport by country

Country	Average of passenger per airport	
	2013	2014
Czech Republic	1981969	2028776
Poland	1662441	1944590
Hungary	1691803	1867792
Bulgaria	1415659	1567304
Serbia	330232	1168228
Moldova	660618	893009
Romania	671588	728856
Croatia	635781	531566

The bigger average number of passenger per airport in 2014 was recorded by Czech Republic with 2028776, while the lowest average is that of Croatia with 531 566. Regarding the dynamic of this parameter, the most important growth was

achieved by Serbia which passed from 330 232 in 2013 to 1 168 228 in 2015. Romania is placed on the last but one with an overage of 728 856 passengers per airport.

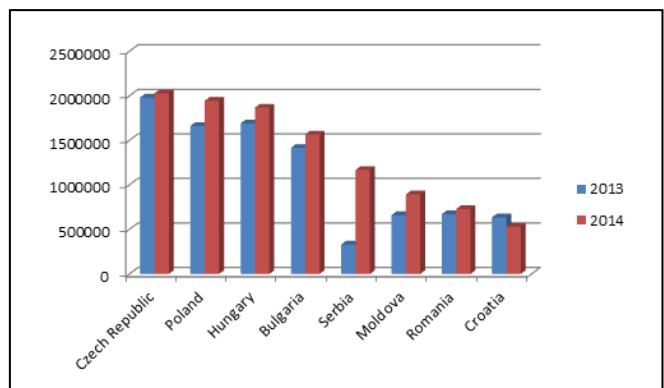


Fig. 2 The average of passenger per airport by country

The best efficiency in using airport in 2014 was obtain by Czech Republic with the bigger average number of passenger per airport 2 028 776, falledow by Poland with 1 994 590, while the lowest average is that of Croatia with 531 566.

Regarding the dynamic of this parameter, the most important growth was achieved by Serbia which passed from 330 232 in 2013 to 1 168 228 in 2015, having a growth of 253.8%. Romania is placed on the last but one with an overage of 728 856 passengers per airport, the growth of 8.52% reporting to 2014.

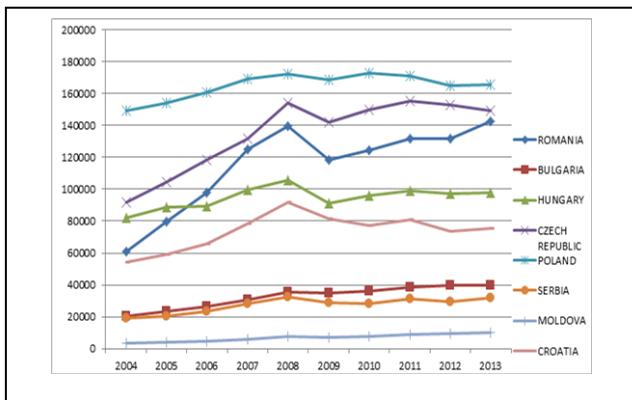
The top 10 airports, having in view the airport connectivity criteria are: 3 from Poland, 1 from Romania, 1 from Bulgaria, 1 from Croatia, 1 from Czech Republic, 1 from Hungary, 1 from Serbia and 1 from Moldova. Passing to top 20 airports, capitals and other regionals, from connectivity point of view, the repartition by countries is the following: 6 in Poland, 4 in Romania, 3 in Bulgaria, 3 in Croatia, 1 in Czech Republic, 1 in Hungary, 1 in Serbia and 1 in Moldova. According to the ACI airports classification [1], the analyses airports are placed as follow: Group 2: Prague and Warsaw; Group 3: Budapest and Bucharest and Group 4: Belgrade, Sofia, Zagreb, Krakow, Wroclaw, Chisinau, Poznan, Dubrovnik, Katowice, Bourgas, Varna, Timisoara, Warsaw Mlodin, Cluj and Sibiu.

#### IV. THE ECONOMICAL CONTEXT

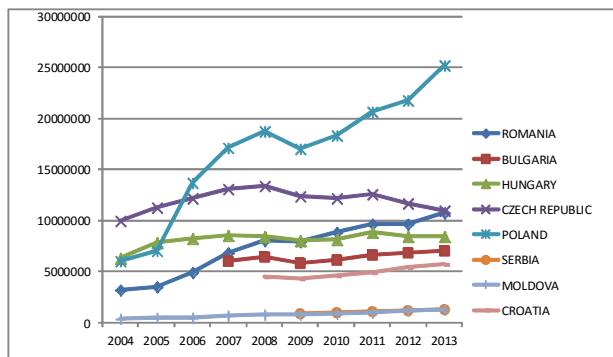
In the figure 3, we present the evolution of GDP during the period 2004 – 2013. The highest value is recorded by Poland for all period, followed by Czech Republic and Romania.

Gross Domestic Product positively influences the Gross Domestic Product positively influences the connectedness of a country and shows also a heath economy which is able to attire new foreign investments with an important influence on the increase of passenger and cargo traffic and foreword an important airport development.

On the figure 4, we can see the evolution of passenger traffic in the 8 analyzed countries.



**Fig 3** The GDP's evolution in Eastern and Central Europe



**Fig. 4** The passenger traffic evolution during 2004-2013

The highest passenger traffic was registered in Poland, followed by Czech Republic and Romania. From the figures number 2 and 3, we can observe how the important growth of the Poland's GDP is in concordance with the highest traffic level from all the compared countries. The evolution of the traffic follows the GDP's evolution of each country. Poland is an exception. Although Poland didn't register a drop of the GDP's value in 2009 and 2010, the passenger traffic is still affected by the worldwide crisis.

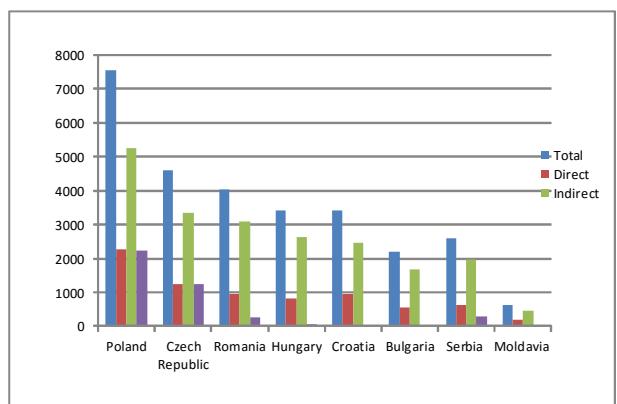
**Table 2** Connectivity in Central and Eastern European Countries in 2015

Country	Connectivity							
	Absolute in 2015				Average annual growth 2004 - 2014			
	Total	Direct	Indirect	Hub	Total	Direct	Indirect	Hub
Poland	7539	2280	5260	2242	5%	4 %	5 %	5 %
Czech Republic	4595	1262	3363	1246	3 %	1 %	4 %	-3 %
Romania	4044	962	3082	261	6%	4 %	7%	6%
Hungary	3427	814	2613	77	1 %	-2 %	2%	-21%
Croatia	3424	964	2460	9	7 %	7 %	8 %	1 %

Bulgaria	2205	542	1663	27	8 %	7 %	8%	8 %
Serbia	2595	634	1961	301	9%	5%	11%	18%
Moldova	638	191	446	30	9%	5%	11%	17%

Concerning the evolution of connectivity in 2015, the highest growth was obtained by Hungary by 9.8%. In regard to non-EU countries, during 2004- 2014, the most important growth of connectivity Y-o-T, by 9%, was achieved by Moldova and Serbia. Serbia keep also for 2015 the best growth of the group in relative terms, by 37.5% (fig. 5).

By correlating the values of the airport connectivity (Table 2), the passenger traffic (fig. 4), the evolution of the GDP (fig. 3) and the number of airports from the analyzed countries (fig 1), we can observe that the essential element which generates the traffic's growth and the connectivity is the growth of the GPD, meaning the economic growth and not the number of airports.



**Fig. 5** The airport connectivity for Eastern and Central European countries

## V. OPERATIONAL ACTIVITIES

For the operational activities, the parameters analyzed consist in the number of passenger traffic per each airport, the rate of passenger traffic growth and the total, direct and indirect airport connectivity and also the hub connectivity.

Europe's connectivity grows in 2015 over past year with +8.9%. This trend is reflected in direct connectivity which has grown by +4.6% this year. The most important value being obtained by United Kingdom, 54981, with a growth of 10,38 %, keeping the first position in Europe as in 2014.

In 2015, as between 2004 and 2014, all groups of airports recorded an increase of connectivity and of the passenger traffic. The different size categories of airports registered significantly higher year-on-year growth in direct, indirect and total airport connectivity. In 2015, the group 1 obtained an increase of total connectivity by 8.7% while during the period 2004 – 2014, the average was only of 3%. The highest growth in relative terms continues to be recorded in 2015 by group 4 by 9.5%, more than a double value reported to the average growth Y-o-Y, during 2004-2014. In 2015, the group 1 obtained the best growth of direct connectivity by 4.8%, while

the group 4 due the increase of total connectivity to the growth of indirect connectivity by 12.5%. The airports from Eastern and Central Europe also significantly building up their connectivity which could be an important premises for an economic growth.

The Traffic report for December, Q4 and Full Year 2014 of ACI Europe [4] reveals that during 2014, passenger traffic at Europe's airports grew by an average +5.4%.

#### A. Airports by groups

The analyze by groups of airports, of the evolution of performances shows the following:

- GROUP 2:** The group average of the passenger traffic growth in 2014 is + 7.4% compared with 2013 and the airport connectivity recorded in 2015 an increase of 8 % versus 2014. The studied airports belonging to this group recorded the following results: in terms of passenger traffic, Prague got in 2014 a growth of +1.6%, under the average of the group, while Warsaw had even a decrease of – 0.9%. From the connectivity point of view, Prague arrived in 2015 on the first position with a growth of 7% over the past year.
- GROUP 3:** The group average of the passenger traffic growth in 2014 is + 2.8 % compared with 2013 and the airport connectivity recorded in 2015 an increase of 9.4% reported to 2014. In this group, in 2014, Bucharest OTP has an important growth in terms of passengers traffic, over the average of the group, recording an increase of +8.8% followed by Budapest with an increase of 7.5%, which is also over the average. In terms of airport connectivity, Budapest has the best increase of 10%, while the Bucharest's airport connectivity rose only by 5%.
- GROUP 4:** The group average of the increase passenger traffic in 2014 is + 6.3 % compared with 2013 and the airport connectivity recorded in 2015 an increase of 9.5% versus 2014. In this group, in 2014, Chisinau has an important growth in terms of passengers traffic, over the average of the group, recording an increase of +34.8%

fallowled by Belgrad with an increase of 30.9% and Sofia with 8.9% which are also over the average.

Among the capitals, in terms of airport connectivity, Chisinau keeps the position of the leader with an increase of 18% in 2015, while the highest airport connectivity in the group 4 was achieved by Bourgas with 38%. The situation of passenger traffic for the others airports analyzed of the group is shown on the figures 6 and 7.

#### B. The airport connectivity and the passenger traffic in East and Central European Countries

In the table 4, we present the situation of total airport connectivity for 2015 and the evolution of connectivity during the period 2004 – 2015 and also the passenger traffic for year 2014 and in fig. 6, its evolution for 2004 – 2014 for airports of the analyzed countries capitals.

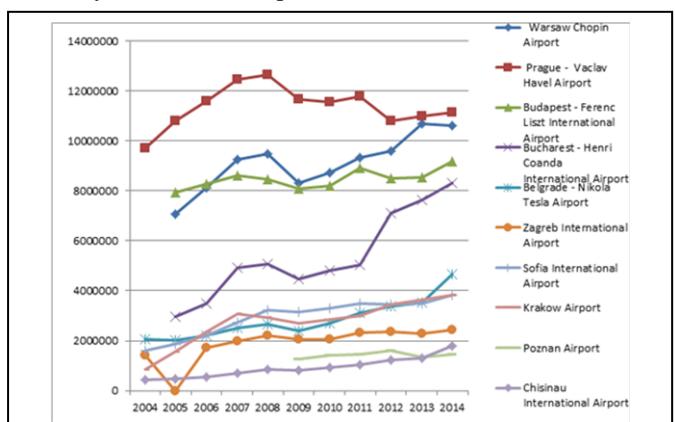


Fig. 6 Passenger traffic for top 10 airports for 2004 – 2014

Concerning the position from connectivity point of view, in 2015, Prague, Belgrade and Zagreb recorded a better position, while Warsaw and Bucharest lost 3 places. The ranked of airport from capitals, regarding the connectivity, in 2015 is the same as the classification from passenger traffic in 2014,

TABLE 4 CONNECTIVITY AND PASSENGER TRAFFIC FOR CAPITALS

Airport	Total connectivity 2014/2015	Growth of total connectivity 2004 – 2014/2015 vs 2014	Connectivity position in European classification 2014/2015	Passenger traffic in 2014	Traffic position	Traffic evolution 2014/2013 2014/2004
Prague	4162 / 4437	29 % / 7%	31 / 29	<b>11.149.926</b>	38	+ 1.6% + 14.9%
Warsaw	<b>4265 / 4161</b>	31 % / -2%	30 / 33	<b>10.590.473</b>		- 0.9% + 49.7 %
Budapest	3121/3427	11 % /10%	41 / 41	9.146.723	48	+ 7.5% + 15.4 %
Bucharest	3083/3231	82 % / 5%	40 / 43	8.316.705	54	+ 8.8% + 179 %

<b>Belgrade</b>	1887/2011	<b>144 % / 7%</b>	61 / 60	4.640.879	79	+ 30.9% + 126.7 %
Zagreb (IV)	1694/1923	59 % / 14%	67 / 64	2.425.889	109	+ 5.7% + 72.6 %
<b>Sofia (IV)</b>	1596/1725	<b>84 % / 8%</b>	68 / 68	3.815.192	94	+ 8.9% + 136.3 %
<b>Chisinau (IV)</b>	538/638	136 % / 18%	122 / 115	1.781.169	122	<b>+ 34.8%</b> <b>+ 323.4 %</b>

excepted Zagreb Airport which is much better situated from connectivity point of view.

Concerning the total airport connectivity, Praga Airport becomes the best performer with a total connectivity of 4437, this means an increasing by 7% reporting to 2014. Vaclav Havel Airport recorde also the highest passengers traffic of 11 149 926 in 2014. In term in hub connectivity, Warsaw keep the position of leader absolute with 2217, with a decrease of – 4% reporting to 2014.

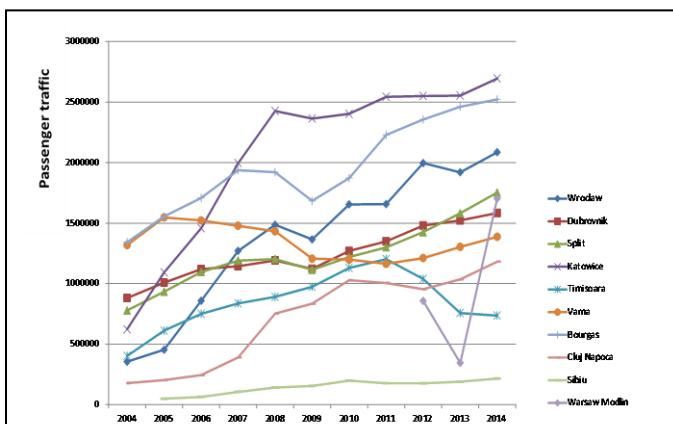


Fig. 7 The passenger traffic for top 11 - 20 airports

The performer in terms of the dynamic of passenger traffic, it is Henri Coanda Airport from Bucharest which recorded in 2014 the highest increase in passenger traffic by

8.8%. Between 2004 and 2014 there was also the highest growth by 179 %, with a good dynamic of total connectivity, recording a growth by 6%. In terms of traffic growth from non-EU countries, the best is Chisinau Airport with an increase by 323,4% between 2004 and 2014 and by 34,8% during 2014. In figure 6 and table 5, we present the situation of total airport connectivity for the next top 12 airports excepted capitals.

TABLE 5 AIRPORT CONNECTIVITY AND PASSENGER TRAFFIC FOR TOP 12 AIRPORTS EXCEPTED CAPITALS

No.	Airport	Connectivity position 2014/2015	Total Connectivity in 2014/2015	Pasenger traffic 2014	Traffic Pозition	Traffic evolution 2014/2013 2014/2004
1	Krakow (Po)	81 / 83	1188/1298	3817792	93	+ 4.6 % / 353.9%

Krakow Airport from Poland recorded the best position both in total airport connectivity, 1298 and in passenger traffic, 3 817 792. Wroclaw had also a good evolution in connectivity in 2015 arriving in the second position, wining 12 position in the general ranking of European airports, having also an important passenger traffic. In 2015, airports with a good evolution in connectivity are Split, Bourgas and Warsaw Mlodin. They have also important passenger traffic in 2014.

In terms of passenger traffic, the most important **evolutions between 2004 – 2014** are those of the following airports: Cluj Napoca 564%, Wroclaw 486 %, Krakow 353 %, Sibiu 341 % and Katowice 332%. In general it is a concordance between the position in terms of connectivity in 2015 with the position in the ranking from volume of passenger traffic in 2014.

#### C. Intercontinental connectivity

From the point of view of intercontinental connectivity, the most important absolute values were obtained by Poland, Czech Republic and Romania .

**From the total direct connectivity in the case of the analysed countries, the intercontinental connectivity still a small percentage as follow:** Serbia 7.14% ( Etihad), Poland 3.03% (4 continents), Hungary 2.86% (2 continents), Czech Republic 2.46% (4 continents), Romania 1.55% , Bulgaria 1.27%, Moldova 1.2%, Croatia 0,6%.

One can notice that the intercontinental connectivity of the majority of the countries, such as Serbia, Romania, Bulgaria, Moldova and Croatia, is made only with Middle East. The most significant intercontinental connectivity is that of Poland and Czech Republic which are linked to 4 continents. The superior connectivity between Serbia and Middle East could be explained by the fact that Etihad Air Company holds the majority of shares and the management of Air Serbia.

#### D. Quality of community airline service

Low cost companies are the main actor in the increasing traffic in countries from Central and Eastern Europe. For the majority of capitals of analyzed countries, the number of

2	Wroclaw (PO)	123 /111	534/663	2085638	117	+ 8.61 % / <b>486.8%</b>
3	Split (Hr)	125 / 113	522 / 660	1752657	125	+10.9 % / 125.1%
4	Poznan (PO)	120 / 119	554 / 596	1445350	131	+6.7% / 13.6%
5	Dubrovnik (Hr)	124 / 125	532/570	1584471	129	+ 4.1 % / 79.8%
6	Katowice (PO)	152	340/455	2695732	103	+ 6.0 % / <b>332.9 %</b>
7	Bourgas (BG)	204/189	177/224	2522319	105	+2.0 % / 87.9 %
8	Varna (BG)	201 / 192	187 / 230	1387494	133	+5.2% / 5.2 %
9	Timisoara (RO)	190 / 194	240/224	736191	154	-2.76 % / 82.6 %
10	Warsaw Modlin (PO)	229 / 201	144/214	1703324	124	+394.4% / 98.8%
11	Cluj Napoca (RO)	206/ 210	175/194	1182047	138	+ 14.0 % / <b>564.6 %</b>
12	Sibiu	207 / 221	175/172	215941	185	+ 12.4% / <b>341.6 %</b>

destinations operated by LCC is bigger than the number of destinations operated by legacy companies (LC). The situation is the following:

TABLE 6 NUMBER OF COMPANIES ON AIRPORTS CAPITALS

Airport	Total air companies	Low cost companies (LCC)		Legacy companies (LC)	
		Number	Destinations	Number	Destinations
Prague	65	38	120	27	83
Warsaw	45	24	120	21	63
Budapest	37	14	74	23	27
Bucharest	33	15	78	18	53
Belgrade	28	16	27	12	51
Zagreb	25	9	16	16	34
Sofia	25	7	28	18	33
Chisinau	18	9	13	9	35

On the airports with the biggest passenger traffic and the best connectivity, **as for example, Vaclav Havel Airport – Prague** and Chopin Airport – Warsaw, the number of destinations operated by LCC is about 5 times bigger than the number of destinations operated by legacy companies.

We have a similar situation, a much bigger number of destinations operated by LCC, on the smaller airports which have the most important growth in terms of passenger traffic during 2004 – 2014. In this situation there are the following airports: Cluj from Romania : 2 LCC with 19 destinations and 3 LC with 6 destinations; Wroclaw from Poland: 3 LCC with 29 destinations and LC 3 with 4 destinations; Krakow from Poland: 6 LCC with 45 destinations and 9 LC with 11 destinations; Sibiu from Romania : 2 LCC with 3 destinations and 3 LC with 3 destinations; Katowice from Poland: 3 LCC with 32 destinations and 2 LC with 2 destinations.

On Katowice Airport, for example, which has the bigger passenger traffic in 2014, we can observe that the number of destinations operated by LC is totally insignificant in comparison with the 102 destinations operated by LCCs.

## VI. CONCLUSIONS

In the last 10 years, one can notice a very important increasing in passenger traffic and in airport connectivity in Central and East Europe. In 2014, the majority of airports from Central or East European countries had an increasing traffic. Thanks to this increasing, there are created the premises for an important economic growth and a world wider opening of these countries, bringing a more considerable contribution to the global economy. At the same time, this improvement in connectivity is appealing for foreign investments in the area. The growth of traffic in the region is due especially to the low cost companies. The airport connectivity is very sensitive to the evolution of dominant companies. The case of Budapest and Timisoara airports, stresses the effect caused by disappearing of the two dominant companies Malev and respectively Carpatair, which led to an important decrease in connectivity.

The **development airport investments** have to be concentrated according to the **economic potential** of the region, the foreign investor's interest in that region and the existing infrastructure of the airports. There are good practices in this regard, such as the airports Bourgas and Varna from Bulgaria, developed and managed by the German company Fraport, which invested in the mentioned airports, after the important investments made by other German companies in the tourism of the region. Another similar case is that of the airport Cluj from Romania, where there has been an excellent correlation between the investment both in the airport and the one made by foreign and national investors in the region. The results of these good strategies are mirrored in the important rate of passenger traffic growth.

One of the priorities of East and Central European countries could be **the improvement of intercontinental connectivity**.

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