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SOUTH EAST EUROPE HUB AND SPOKE AIR NETWORK RECONFIGURATION

ABSTRACT

The paper presents the passenger and cargo historical traffic data analysis at the Zagreb Airport, at certain airports in the wider region and globally for a period of half a century. The war during 1990s and the disintegration of Yugoslavia had as a consequence the breakdown of air transport based on hub and spoke system with three airports as a hub: Zagreb, Belgrade and Ljubljana. During and after the war, the domestic airliner in the region and a foreign airliner implemented primarily point-to-point system. Hub airports have become origin-destination airports with mainly local passengers and insignificant ratio of transfer and transit passengers. The causes of slow passenger and cargo traffic growth at the Zagreb Airport and of passengers at certain airports in the narrow region have been analysed and the results are lower growth of air traffic at capital airports of the new countries and greater air traffic growth on the capital airports and others in the countries of a wide region comparing with the global passenger transport growth. The paper indicates the possible measures to increase the share of transfer passengers and cargo traffic at the Zagreb Airport and certain airports in the immediate region.

KEY WORDS

case study; air transport historical data analysis; hub-and-spoke reconfiguration; point-to-point system; Zagreb Airport;

1. INTRODUCTION

Air transport has been growing significantly after World War II. International Civil Aviation Organization (ICAO) has taken the statistics of the world total revenue traffic on airlines scheduled services of ICAO member states, passengers and cargo.

In 1950 about 31 million carried passengers were recorded; in 1960 about 106 million passengers (until then excluding USSR, China, and a part of other countries mainly from the Eastern Block); in 1970 about 386 million; and in 1980 about 734 million passengers [1]. In 1990 about 1.165 billion passengers were transported; in 2000 about 2 billion and in 2010 about 2.7 billion. In 2014 about 3.3 billion passengers were transported [2]. At airports this means about twice as many passengers since on one flight every passenger departs from one airport and lands at the other airport, or in 2014 about 6.6 billion passengers.

Tourism contributed most to the passenger air transport growth. From about 25 million international tourists in 1950, when a minor part was transported by air, over time the share of international tourists carried by air increased and in 2014 reached 54%. Out of 1.133 billion international tourists in the world in 2014 about 612 million travelled by plane [3] which means in both directions about 1.2 billion passengers and at airports in the world about 2.4 billion passengers. Along with international tourists as passengers in air transport there are also domestic tourists, who multiply outnumber the international ones (depending on WTO source 5 to 10 billion a year) [3] but who use air transport to a much lesser extent.

In 1980 the cargo transport by air recorded about 10 million tonnes, and in 2014 about 50 million tonnes [2]; that is, at airports in the world in that year about 100 million tonnes of cargo were handled.

Zagreb Airport had been until 1991 the hub, transfer and transit airport. The Croatian national flag carrier Croatia Airlines was founded in 1989. The concept of flying was primarily point-to-point. The consequence of this flying concept of the domicile carrier to Zagreb Airport was the loss of transfer passengers. The majority of passengers in 2014 were local which means that Zagreb Airport became the origin-destination airport.

2. ZAGREB AIRPORT TRAFFIC DATA

The City of Zagreb founded the Company for Airport Services Zagreb Airport in 1961. After Yugoslavia opened its borders to tourism in the second half of 1960s air traffic started to grow suddenly.

Figure 1 gives an overview of passenger traffic at the world airports based on the statistics of the carried passengers in the first phase of every tenth year, and

since 1980 per years for the period between 1960 and 2014 in billions [1, 2] and the passenger traffic per years at Zagreb Airport from 1962 to 2015 [4] in millions. The data show that the share of passenger traffic at the Zagreb Airport in 1979 was about 1.3-1.4‰ of traffic at world airports, and that the share fell in 2014 to 0.37‰.

Figure 1 indicates mainly a continuous growth of passenger traffic in the world in the given period except for minor falls during the Gulf War in 1991, terrorist attack on the USA on 11 September 2001, which caused a fall in those and next two years, and in 2009 due to global economic crisis. It can be seen that there was intensive passenger traffic growth at Zagreb Airport from 1968 to 1979 (except in 1974 due to the closure of the Zagreb Airport for a period of 2.5 months because of the reconstruction of the manoeuvring area and extension of the runway), far greater than the growth in the world. The political crisis emerged after the death of President Tito in 1980, when there was a decline in turnover and it continued for a whole decade with fluctuations in traffic. At the end of 1991 with the intensification of the armed conflict in Croatia there was an interruption of air traffic and the closure of the airspace of the western part of Yugoslavia. Zagreb Airport was opened on 1 April 1992. The armed conflicts in Croatia stopped in 1995 when less than half of the passenger traffic from 1979 was realized. In 2007 the passenger traffic from 1979 was reached, and in the following years it grew much slower than the traffic at the world airports. In comparison with the world, the passenger traffic at Zagreb Airport grew much faster from 1968 to 1979 and much slower from 1979 onwards.

The cargo traffic at world airports from 1980 to 2014 based on cargo transport per years in the world [2] and at the Zagreb Airport per years from 1962-2015 [4] is given in *Figure 2*.

Cargo traffic at world airports shows mainly a continuous growth with minor declines, similar to passenger traffic. Zagreb Airport realized in 1979 about 0.7‰ share in cargo traffic at world airports, and in 2014

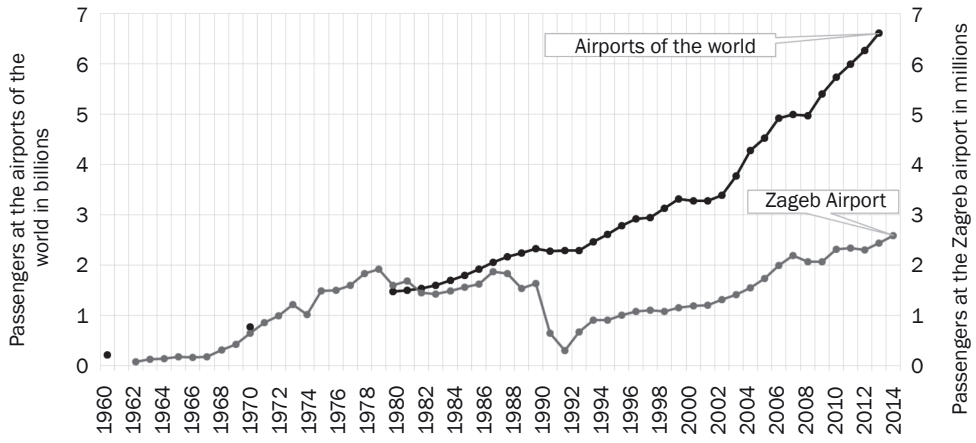

Figure 1 – Annual passenger traffic at Zagreb Airport and the world airports for the period from 1960 to 2015

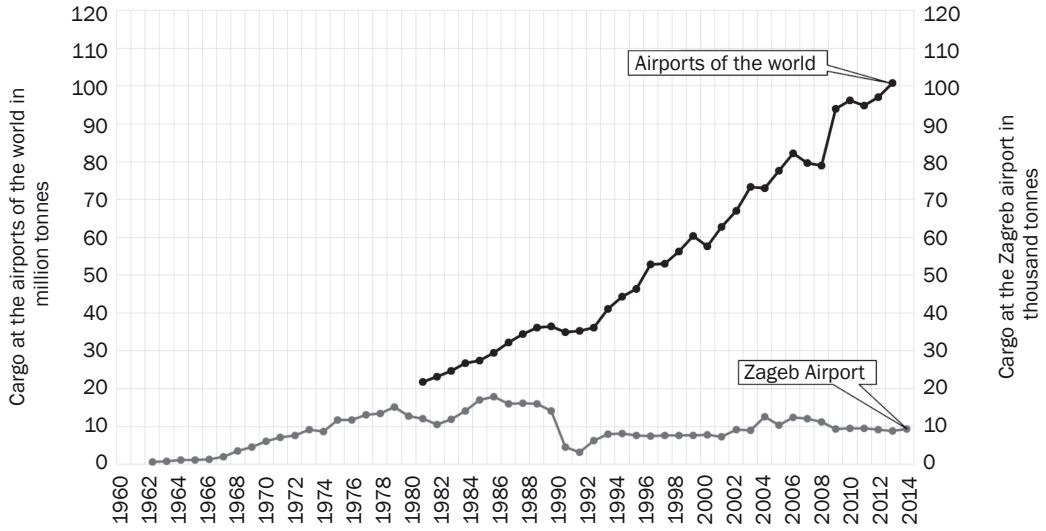

Figure 2 – Annual cargo traffic at Zagreb Airport and at world airports from 1980 to 2014 for the period from 1962 to 2015

about 0.09‰ of global traffic was realized, which is an extreme decline in the share. Cargo traffic at Zagreb Airport was realizing a significant growth from 1967 to 1979 followed by several years of decline in traffic and growth until 1986 when the highest traffic was reached, 18 thousand tonnes. In the period from 1986 to 1991 there was a trend of slight fall in the cargo traffic and a significant fall in 1991 caused by the beginning of the war. In 1995 about 8.2 thousand tonnes was realized and until 2002 cargo traffic was slightly falling to about 7.3 thousand tonnes. Then follow the growth and decline, fluctuations and in 2014 reaching the level of 8.9 thousand tonnes or less than a half of the quantity of cargo from 1986. Cargo traffic growth at the Zagreb Airport was significantly greater from 1967 to 1979 than the average in the world and greater from 1983 to 1986, whereas from 1987 to 2014 it was falling.

2.1 Zagreb Airport passenger traffic analysis

Due to the geo-traffic location of the city of Zagreb and the significant demand generator in passenger and cargo air transport, two domestic air carriers up to 1991 performed operatively the hub-and-spoke concept of flying in which they used Zagreb Airport as the hub airport for the flights from Yugoslavia to Western Europe and vice versa: Jugoslavenski aerotransport (JAT) and Adria aviopromet (AA). The JAT flying concept was collecting of passengers on domestic flights in the morning in Zagreb and forwarding them to their international flights from Zagreb to Europe. On the return in the afternoon these flights carried, apart from passengers with destination in Zagreb, also those for transfer to coast cities and those on the continental part of Yugoslavia. A certain number of JAT international flights in the morning were in transit from Belgrade via Zagreb to a number of destinations in Western Europe which returned in the afternoon and were in Zagreb in transit to Belgrade. AA connected on Wednesdays and Saturdays the whole day the so-called commuter flights from five cities in Yugoslavia (Belgrade, Priština, Sarajevo, Skopje, Split) using five aircraft via Zagreb with six airports of the then West Germany and vice versa. In 1979 JAT and AA realized 84% of total passenger traffic at Zagreb Airport.

Zagreb had direct regular flights to New York, Chicago, Los Angeles, Montreal and Toronto by domestic and foreign carriers.

The split-model showed at Zagreb Airport in 1979 about 40% of local passengers, 40% of transfer and about 20% of transit passengers. According to ICAO an airport with more than 30% of passengers in transfer and transit is a transit-transfer airport [5].

When Croatia gained independence in 1991, the former domestic air carriers became foreign carriers and according to international air law they could not use Zagreb Airport as a hub airport for their flights. The new domestic air carrier Croatia Airlines (CA) organized traffic mostly on the point-to-point concept which is usually applied in case of low-cost carriers. Regular carriers usually use the hub-and-spoke concept which mostly means that the hub airport is the domicile airport of that air carrier since this concept allows higher passenger load factor and higher probability of positive business operation.

The passenger load factor of CA aircraft in 2014 was 69.2% [6] whereas the European air carriers realized the passenger load factor on domestic and international flights of 80.8% and 81.6%, respectively [7]. There is a great difference in the CA passenger load factor and the one of the European air carriers. Low passenger load factor on CA flights is one of the main reasons of realizing significant losses in the last 25 years of operation.

The war in Croatia ended in 1995 but not east of Croatia (Bosnia and Herzegovina and later Kosovo). Because of war activities and caution of the CA management, a part of airports from which once transfer passengers used Zagreb Airport were not connected by flights of this airliner with Zagreb. The carriers such as JAT, AA, Austrian, Lufthansa and others entered this market and they carried passengers from these cities to their hub airports (Belgrade, Ljubljana, Vienna, Frankfurt, Munich ...). After CA opened lines to these airports only a few passengers used Zagreb as transfer airport to Europe and back.

After Croatia gained independence, there was a complete change of the split-model of passengers at Zagreb Airport. In 2014 out of 2,430,971 passengers there were 88% local passengers and 12% were transfer passengers. This means that from 1979 to 2014 the number of local passengers grew from about 800,000 to about 2.1 million; the number of transfer passengers fell from about 800 thousand a year to about 300 thousand and a number of transit passengers fell from about 400,000 to practically zero. Zagreb Airport lost the status of transit-transfer airport and became an origin-destination airport.

In 2015 CA realized 54% of passenger traffic out of the total at Zagreb Airport or a bit more than 1.3 million passengers; out of this CA realized almost 100% of domestic traffic and 46% of international.

The ICAO data show that the passenger traffic at airports in the world from 1979 to 2014 increased by 371%, which is much more than at Zagreb Airport where passenger traffic between 1979 and 2014 increased by 27%. The loss of transit passengers and a significantly lower number of transfer passengers are the main reasons of such large decrease in the share of passenger traffic at Zagreb Airport in relation to the airports globally. A far smaller growth of local passengers in this period, about 160% compared to the total in the world, about 371%, is the consequence of war,

destruction and extinction of industry, unemployment and impoverishment of the population as well as the construction of highways in Croatia [8]. After the opening of the highway the flights Zadar-Zagreb and vice versa realized 53% of the passenger traffic before the opening of the highway, mainly of transfer passengers via Zagreb continuing their travelling on air routes. The local passengers mainly switched to road transport. The number of local passengers was also reduced on the Split-Zagreb flights by about 22%, mainly local passengers.

It can be summarized that important reasons for slow growth of passenger traffic at Zagreb Airport was caused by:

- the death of President Tito in 1980 and the political crisis in Yugoslavia during 1990s which culminated in the war starting in 1991 and closing of Zagreb Airport and other airports in Croatia and Slovenia;
- the loss of transfer and transit passengers in Zagreb Airport of ex-domicile air carriers who lost their air rights (JAT and AA) in Croatia, and
- the decision of the flag carrier CA to perform the point-to-point flying concept which excluded Zagreb as the hub airport on a substantial number of lines.

The cities from the region that had been connected with Europe via Zagreb before the war were connected by lines of local, domestic air carriers and foreign air carriers directly in a significant part with the hub airports of foreign carriers.

2.2 Zagreb Airport cargo traffic analysis

Cargo means goods and mail. The share of postal items by weight in the world is today lower than 5%. From 1980 to 2014 the total quantity of the air carried cargo in the world increased by about 400% and the traffic at Zagreb Airport in the almost same period was reduced by about 42%. In 1979 Zagreb Airport realized about 0.7‰ of global cargo traffic, and in 2014 about 0.09‰. The reduction of share of cargo traffic at Zagreb Airport compared to the world is extremely high in that period.

Before the independence of Croatia there had been significantly higher cargo flows i.e. quantities in export than the flows in import, and after gaining independence there came to a reverse trend: import was significantly increased and export decreased. Before 1991 there were several cargo lines from Zagreb Airport to Western Europe using mid-range jet planes. These lines were cancelled in 1991 and in 2016 there are six mainly integrated carrier flights a week in transit. For passenger traffic from Zagreb to closer destinations, and even to some medium-distant destinations, smaller regional airplanes with relatively modest volumes and capacities even for luggage, were introduced. In conditions of higher passenger load factor e.g. passenger transport from the USA via hub airport such as Vienna to Zagreb, such a plane cannot accommodate even complete luggage of the passengers on that flight, not to speak about possible cargo.

The reasons for the reduction of cargo at Zagreb Airport have been researched at the Faculty of Transport and Traffic Sciences and it has been found that the significant part of air cargo from/to Zagreb Airport has been switched to road transport [9], and especially after accession of Croatia in the EU. The requirements to reduce transport costs in the overall costs of goods manufacturers that are usually carried by air, were achieved by the logistic companies by transporting shipments by trucks, as road deliveries, to the closer airports for handling and further transport by air. Only one foreign logistic company forwards every day a truck with 5-10 tonnes of cargo from Zagreb to the Vienna Airport and returns the same day with 10-15 tonnes to Zagreb. The same company sends every other day a truck with shipments to Graz Airport where cargo is collected for some air carriers (KLM, Lufthansa ...), every other day to Ljubljana Airport and twice a week to Liege Airport where cargo is collected for overseas transport to the USA, etc. It is estimated that all logistic companies together carry by trucks from Zagreb to neighbouring and other airports about 80,000 to 150,000 t of road shipments annually.

The possible reason for road transport of cargo from Zagreb to close airports includes the prices of cargo handling at Zagreb Airport and of air transport to close airports that probably repel the senders and logistic experts and make them use truck transport (but not as air shipments), of fast and inexpensive transport to close airports at which cargo is collected for certain air carriers and integrated carriers (Austrian, Lufthansa, KLM, ... DHL, UPS, FedEx ...).

2.3 Zagreb Airport aircraft operations analysis

Regarding the number of operations (landings and takeoffs) Zagreb Airport realized in 1979 in the part of civil aircraft 37,424 operations and in 2014 there were 38,348 operations, i.e. 2.5% more. Small growth can be partly attributed to restrictions in general aviation aircraft operations which have appeared in the last few years. Before Croatia gained independence, the general aviation operations were performed without restrictions at Zagreb Airport. Apart from Zagreb Airport general aviation used also from spring to autumn the grass airfield Lučko. In the period from autumn to spring general aviation used Zagreb Airport. In the recent years there have been restrictions i.e. bans on landing and takeoffs for several hours a day for general aviation at Zagreb Airport, and the airfield Lučko had administrative restrictions and even interruptions in the work of air traffic control. The closure of Zagreb Airport for general aviation redirected these aircraft to other airports around Zagreb, which are actually not in

the close vicinity, and the planned ones have not been constructed [10, 11]. From the viewpoint of general aviation operations the City of Zagreb has no solution for the airport issue.

3. PASSENGER TRAFFIC ANALYSIS AT CERTAIN NEIGHBOURING AIRPORTS

The passenger traffic in 1979 and 2014 was analysed and the growth trends at airports of capital cities of certain neighbouring countries as well as countries that were formed by the disintegration of Yugoslavia.

3.1 Analysis of passenger traffic at capital city airports of Austria, the Czech Republic and Hungary

Table 1 and *Figure 3* give an overview of the passenger traffic at Zagreb and airports of the capitals of the countries in the closer region: Austria, the Czech Republic and Hungary and at airports in the world in 1979 and 2014

Whereas in 1979 the number of passenger traffic at Zagreb Airport was greater than the one in Budapest, and somewhat smaller than the one in Prague, Vienna Airport realized 44% more passengers. In 1979 there were no regular flights between Zagreb and Vienna, and Zagreb and Budapest [12]; Zagreb and Prague were connected by a regular line a few days in a week from Belgrade with transit in Zagreb and about 13 thousand passengers were carried between Zagreb and Prague and vice versa.

The passenger traffic in 2014 at the mentioned airports indicated that all airports except for Zagreb saw a greater growth (385-713%) than the global passenger growth (371%), and Zagreb Airport a much smaller growth (27%). One of the reasons for a major increase in the number of passengers at the mentioned neighbouring airports are direct air connections of the capital cities of the countries formed by disintegration of Yugoslavia by air lines of carriers from these countries in their hub airports in order to carry passengers to these cities and those for transfer (Austrian to Vienna Airport, Malev until bankruptcy to Budapest Airport, ČSA to Prague Airport ...). In the countries formed by disintegration of Yugoslavia in which there are local air carriers, those are flying most frequently on the lines to Vienna (Croatia, Adria, Air Serbia ...) as well as other hub airports of Star Alliance members to which they belong through Lufthansa (Munich, Frankfurt).

Soon after Croatia gained independence the air transport between Croatia and Austria and Croatia and the Czech Republic were opened. The Vienna Airport traffic data show that in 2014 the traffic with Zagreb of 78,636 passengers [13] was realized on five pairs of flights daily by Croatia Airlines and Austrian, which is the biggest number of flight pairs daily from Zagreb, following by Munich and Frankfurt with four pairs of flights daily. Later, the Hungarian national air carrier

Table 1 – Passenger traffic at airports of Vienna, Budapest, Prague and Zagreb and airports in the world in 1979 and 2014 and growth

City, State	Passengers 1979	Passengers 2014	Growth (%)
Vienna, Austria	2,765,416	22,483,158	713
Prague, the Czech Republic	approx. 2.3 million	11,149,924	approx. 385
Budapest, Hungary	approx. 1.7 million	9,155,961	approx. 439
Zagreb, Croatia	1,917,971	2,430,971	27
airports of the world	approx. 1.4 billion	approx. 6.6 billion	approx. 371

Sources: [2, airport statistics]

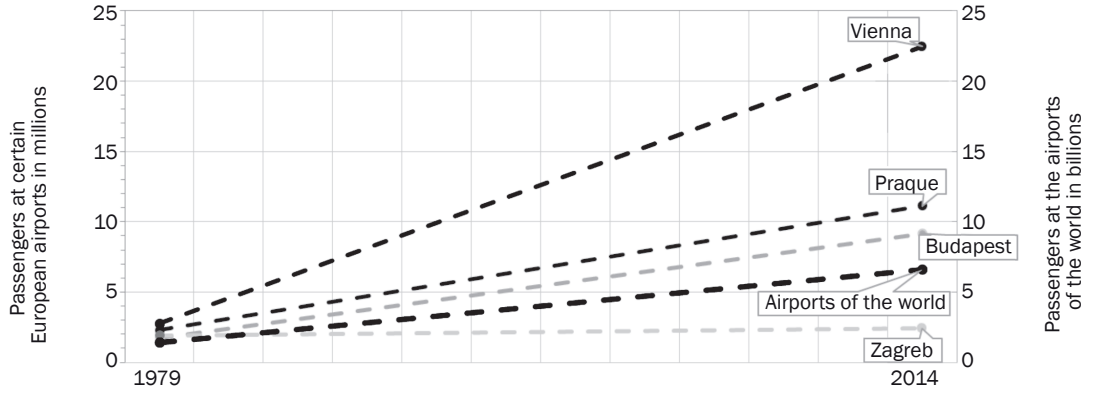

Figure 3 – Passenger traffic at airports of Vienna, Prague, Budapest and Zagreb and airports of the world in 1979 and 2014 and growth trends

Malev opened the lines Budapest-Zagreb-Budapest three times a day on workdays until Malev went bankrupt. About 85% of passengers in Budapest were in transfer.

3.2 Passenger traffic at capital city airports of the countries formed by disintegration of Yugoslavia analysis

Table 2 and *Figure 4* give an overview of passenger traffic at capital city airports in the countries formed by disintegration of Yugoslavia and the world. It can be seen that even at airports of these cities the growth of passenger traffic was smaller than the one in the world but greater than in Zagreb.

In the group of airports with the smallest passenger traffic growth from 1979 to 2014 is Zagreb Airport, 27%, and Belgrade Airport, 66%. Belgrade Airport was the capital of Yugoslavia with strong domestic traffic that started gradually losing these passengers because of expansion of the war and the gaining independence of former republics. The group with the transport growth from 100-200% includes Ljubljana and Sarajevo Airports. Ljubljana Airport is at the same time the domicile airport of the air carrier AA which after Slovenia gained independence was the first to re-open the lines for the majority of the state capitals formed after the disintegration of Yugoslavia and took over a part of passengers from these countries to Europe via Ljubljana Airport and back. Due to transport distances and worse land connections with Western Europe, Sarajevo Airport realized within the mentioned period about 134% increase of the passenger traffic. The biggest increase in passenger traffic was realized at Skopje Airport, 300%, and the most important reason is the large distance from Western Europe.

The majority of airports on the territory of former Yugoslavia were origin-destination for domestic flights to/from Belgrade and somewhat less to/from Zagreb and to/from Ljubljana. Today, they are still origin-destination airports but their direct flights are to a smaller measure for Belgrade and Zagreb, and the majority mainly to closer West-European airports (Vienna, Munich, Frankfurt...), hub airports of air carriers operating flights to/from these airports. The war and destruction as well as impoverishment of the population are the reasons for smaller growth of passenger transport at airports of the closer region than globally.

Recently, the Serbian national air carrier Air Serbia has been successfully organizing a concept of hub-and-spoke connection of airports from the area of the former Yugoslavia via Belgrade Airport to the mainly

Table 2 – Passenger traffic at the capital city airports of the countries formed by disintegration of Yugoslavia and airports of the world in 1979 and 2014 and growth

City, State	Passengers 1979	Passengers 2014	Growth (%)
Belgrade, Serbia	2,839,995	4,658,577	63
Ljubljana, Slovenia	611,574	1,338,619	119
Podgorica, Montenegro	202,107	701,320	247
Priština, Kosovo	NA	1,404,775	
Sarajevo, Bosnia and Herzegovina	303,612	709,901	134
Skopje, Macedonia	301,823	1,208,359	300
Zagreb, Croatia	1,917,197	2,430,971	27
Airports of the world	approx. 1.4 billion	approx. 6.6 billion	approx. 371

Sources: [2, 13, Airport statistics]

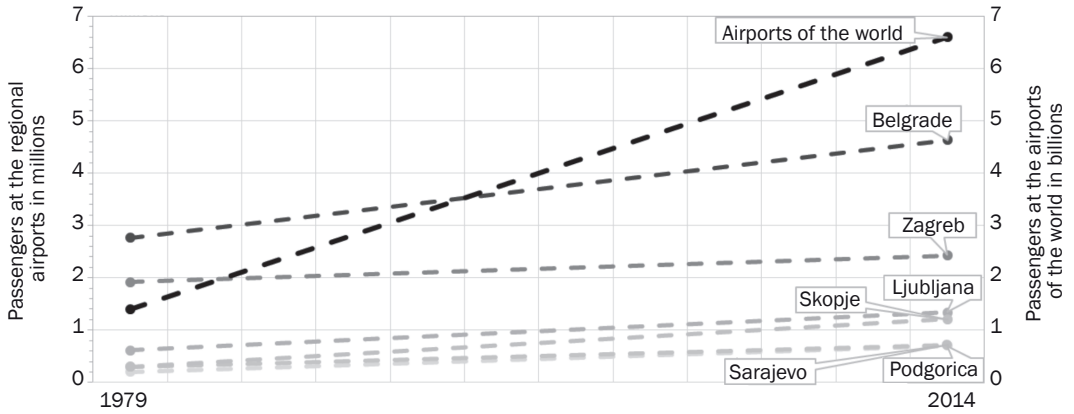

Figure 4 – Passenger traffic at capital city airports of the countries formed by disintegration of Yugoslavia and airports of the world in 1979 and 2014 and growth trends

European airports and back. This is indicated by the increase in passenger traffic of 31% at Belgrade Airport in 2014 compared to 2013. This increase of passenger traffic certainly exceeds the growth of transport demand in Serbia itself and can be assigned to intensive marketing of Air Serbia in the region of the greater part of former Yugoslavia by attractive tariffs for transfer passengers via Belgrade. Very often these tariffs via Belgrade are lower than on direct flights from the new countries so that a part of passengers chooses the air carrier that is most affordable regarding price.

In 2014 Belgrade Airport recorded 4,658,577 passengers out of which 488,463 passengers in transit and transfer [14] or approximately 20% of arrival passenger as well as approximately 20% of departure are in transfer. In 2014 Ljubljana Airport recorded 1,338,619 passengers out of which 27,548 transit (2%) and 100,467 transfer passengers or about 15% of arrival passengers and the same number and percentage in departure) [15]. In the same year Zagreb Airport realized 2,430,971 passengers out of which about 298,500 transfer passengers or 24.6% of arrival passengers and the same figures of transfer in departure [16]. The data show that all three airports are today origin-destination airports with 17-25% passengers in transit and transfer.

4. DISCUSSION

The war and disintegration of Yugoslavia broke down also the air transport system at that time. The result was seven states and seven capital cities. The result were seven independent transport policies in conditions of war, and the process of gaining independence of some of them has not been completed yet. The most important foreign air carrier regarding traffic (Lufthansa, Austrian) and local air carriers (Croatia, Adria, Air Serbia) as Lufthansa partners in Star Alliance connected the airport primarily of the capital cities in regular traffic with hub airports of the Star Alliance members (Austrian: Vienna, Lufthansa: Munich and Frankfurt) for further transport of transfer passengers. Thus, hub airports on the territory of former Yugoslavia lost a significant number and share of transfer passengers, and hub airports for the states formed after the disintegration of Yugoslavia became neighbouring European airports, Star Alliance member hub airports: Vienna, Munich and Frankfurt.

The growth in traffic at an airport depends primarily on the policy of the Airport Management and air carrier(s). According to traffic demand and the available aircraft fleet the air carrier determines the flight schedule adopting the hub-and-spoke flying concept as a rule for the regular carriers and point-to-point for low cost carriers. Literature [17] says that, in order to ensure sufficiently high passenger load factor and thus profitable operation, regular carriers are oriented to the hub-and-spoke flying concept. “Linear traffic of point-to-point connecting on account for a smaller number of frequencies, questionable profitability and non-systematic structures of bound flights has been substituted by the model of multiplication network structure (hub-and-spoke), i.e. system of big traffic hubs. Traffic point-to-point connection is characteristic for the period before deregulation, and during 1980s the big, strategically well positioned airports in the world profiled into the traffic hubs thanks to the adaptation of the route network of air carriers” [18]. “The hub airline's ability to consolidate traffic from many different O-D (origin-destination) markets on each flight leg into and out of the hub allows it to provide connecting service even to low-demand O-D markets that cannot otherwise support non-stop flights” [19]. Low-cost air carriers fly as a rule on lines with high traffic demand (e.g. tourism) that results in high passenger load factor and therefore they usually fly point-to-point.

One of the main reasons for the loss of air carriers is low passenger load factor and it may result from inadequate flying concept. In case of applying the hub-and-spoke concept by regular air carrier and usage of hub airport, bigger passenger transport is realized and the air carrier can achieve better traffic effects with smaller number of flights i.e. aircraft.

In order to increase the number of passengers at potential hub airport it is necessary to negotiate with air carriers, offer certain commercial concessions for the application of the hub-and-spoke concept (by reducing airport charges for transfer passengers, reducing of certain airport fees, etc.). Apart from the agreement with domicile air carrier it is appropriate to negotiate as well with the local air carriers from countries formed after the disintegration of Yugoslavia for the transport of local passengers and those who continue travelling to Europe via potential hub airports.

In contrast to the condition before the disintegration of Yugoslavia, when only three cities, Belgrade, Ljubljana and Zagreb, were connected by daily lines with London, Frankfurt, Munich, Vienna, etc. today almost all airports of the capital cities of the newly formed countries after the disintegration of Yugoslavia are connected by daily lines with these and other airports. The passenger load factors are not such as could be achieved by unifying the traffic demand via hub airports such as e.g. Belgrade, Ljubljana and Zagreb.

In cargo transport it is necessary to re-study the commercial conditions in airport cargo handling and adapt them to the market so that there would be no switching of cargo from air onto road transport. It is necessary to find common language with the air carriers who in case of substantial increase in the quantity of cargo from and to a certain airport by air could find interest in introducing bigger passenger aircraft in

relation to the current ones with adequate capacities for cargo, or in introducing cargo flights.

5. CONCLUSION

Before 1991, Zagreb Airport was a transit-transfer airport for two domestic carriers, JAT and AA that realized up to 85% of the total number of passengers at Zagreb Airport and carried passengers from Yugoslavia towards West, Central and North Europe and back. The passenger traffic at Zagreb Airport was about 1.3-1.4‰ of the global passenger traffic at airports of the world and about 0.7‰ of cargo traffic. In 2014 about 0.37‰ of global passenger traffic at airports of the world were realized and about 0.09‰ of cargo at Zagreb Airport.

When Croatia gained independence Zagreb Airport became the airport of the capital city of the country, domicile airport of the flag carrier Croatia Airlines (CA) and the main airbase of the Croatian Air Forces. JAT and AA as foreign air carriers had no right to use Zagreb as a hub airport for their flights. CA did not take advantage of the excellent geo-traffic position of Zagreb and did not introduce hub-and-spoke flying concept. The airport is usually used by regular carriers and it enabled the growth of passenger load factor and reduced the number of lines (or increased the number of lines with the same fleet). Croatia is the only country of the former Yugoslavia that has a greater number of airports and a substantial domestic passenger air transport. CA has introduced mostly point-to-point concept, used as a rule by low-cost carriers and realized low passenger load factor which certainly contributes to making losses in the operation of the air carrier. At the same time Zagreb Airport also loses in this way passengers and the total unrealized effects for air industry of Croatia are far greater. By adopting the hub-and-spoke flying concept with the hub in Zagreb and by adjusting the flight schedule that suits the transfer passengers, CA could increase passenger load factor and achieve the average of the European air carriers and with a lower number of flights it could improve substantially other traffic effects as well. CA could probably turn from a loser to a profitable airline.

In cargo transportation there has been significant switching of transport demand from air to road transport. From a commercial and marketing aspect, airports should win over through some commercial concessions the air carriers and users of cargo transport. Creating transport demand for air transportation of cargo would result in the introduction of bigger passenger aircraft that would have additional capacities for cargo transportation or even of cargo aircraft.

Regarding the fact that in the countries formed by disintegration of Yugoslavia the participants in air industry are public companies that are mainly also the loss makers, the ministries of transport should take responsibility for the business policy by their instruments, producing thus optimal results to the benefit of air carriers and airports.

In recent years Air Serbia has been introducing the hub-and-spoke concept on the air connections of airports mainly of the capital cities of the countries formed by disintegration of Yugoslavia via Belgrade Airport, mainly to the European airports and back. Zagreb Airport has the advantage in the fact that Croatia has six airports that gravitate towards Zagreb. The geo-traffic position of Zagreb Airport is very favourable for connecting of the majority of newly formed states on the territory of ex-Yugoslavia with Western Europe, where the majority of passenger transport demand of the region would be realized. Ljubljana Airport also has the chance to increase the share of transfer passengers since it has a domicile air carrier that already uses the hub-and-spoke concept.

In any case, there are potentials to create hub airports with significant share of transfer passengers on the territory of ex-Yugoslavia with a better cooperation of local air carriers and the Civil Aviation Authorities. The advantages of the hub-and-spoke concept on the territory of the states formed after the disintegration of Yugoslavia should be used for the benefits of the resources of local air carriers and increase of traffic at its capital city airports. Such a concept would have for the same transport effects as additional result, a reduced number of flights, lower consumption of fossil fuels and lower amount of exhaust gases from aircraft engines, i.e. it would contribute to the reduction of global pollution.

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SAŽETAK

REKONFIGURACIJA HUB AND SPOKE ZRAČNE MREŽE U JUGOISTOČNOJ EUROPI

U radu je provedena analiza razvoja prometa putnika i tereta Zračne luke Zagreb, određenih zračnih luka u široj regiji i globalno u razdoblju od pedeset godina. Tijekom devedesetih godina prošlog stoljeća, rat i raspad Jugoslavije rezultirali su promjenama u mreži zračnog prometa te uzrokovali rasformiranje tri čvorne zračne luke: Zagreb, Beograd i Ljubljana. Tijekom i nakon rata, domaći i strani prijevoznici u regiji prvenstveno su koristili point-to-point koncepciju letenja. Čvorne zračne luke postale su početno-završne zračne luke s pretežito lokalnim putnicima i neznatnim udjelom transfernih i tranzitnih putnika. Analizirani su uzroci niskoga rasta putničkog i teretnog prometa na Zračnoj luci Zagreb

te putničkoga prometa određenih zračnih luka u užoj regiji. Rezultati su niži rast zračnog prometa u zračnim lukama glavnih gradova novonastalih država i veći rast zračnog prometa u zračnim lukama glavnih i drugih gradova država u široj regiji u usporedbi s globalnim porastom prijevoza putnika. U radu se ukazuje na moguće mjere za povećanje udjela transfernih putnika i teretnog prometa Zračne luke Zagreb i određenih zračnih luka u užoj regiji.

KLJUČNE RIJEČI

studija slučaja; analiza podataka o ostvarenom zračnom prometu; hub and spoke rekonfiguracija; point to point; Zračna luka Zagreb;

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