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SPATIAL ASPECTS OF AIR TRANSPORTATION LIBERALIZATION – CHANGES IN EUROPEAN AIRPORT HIERARCHY

ABSTRACT. Liberalization of air transportation opens the European market to low cost carriers. Offering cheep flights to main centres of economic and social development, this group of airlines considerably influences the role of this branch of passenger transportation, making it accessible a wider range of society. Using cheaper airports offering lower costs, these carriers change the airport hierarchy. Local airfields or regional airports become important European transportation nodes. These processes influence some spatial changes. Developing airports need more space for rebuilding terminals and enlarging service centres. Beside this spatial growth of air transportation infrastructure, changes also concern land use in their neighbourhood, because new economic activities appear in the vicinity of these 'new' airports.

KEY WORDS: airports, liberalization, low cost carriers, air transportation.

INTRODUCTION

In the beginning of 2007, there were 276 airports serving international scheduled connections in Europe according to airport internet site data. Over the last few years, air transportation development has been correlated mostly with a growth of low cost carriers in Europe. This process, connected with the idea of an 'open sky', backed by Central European countries, causes important spatial changes on different levels. Spatial changes concern those of hierarchy i.e. that of regions with airports showing considerable development as well as changes of spatial management and land use close to these airports.

The author's aim is to show what kind of factors influence the directions and dynamics of airport hierarchy changes in Europe, what is the influence

of liberalization of air transportation, and where is its impact most visible on different levels of space.

AIRPORTS HIERARCHY CHANGES AS A RESEARCH FIELD

Changes of airport hierarchy is a popular research field among air transportation researchers as well as geographers. The basic problem contains two main aspects of air transportation system functioning: changes of this system from HUB-and-SPOKE to FULLY CONNECTED (Fig. 1) and the impact of deregulations on the quality of services offered by low cost carriers.

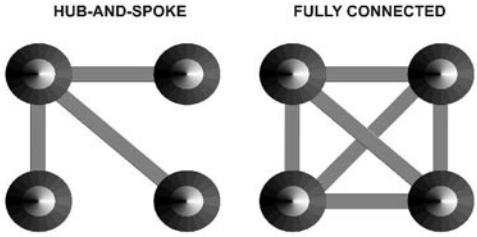

Fig.1. Air transportation systems

Source: Bryan, Kelly, 1999.

The concept of air transportation systems is based on the relations between the central airport (the main one, usually serving the capital city and with which regional airports are connected) and regional airports, all analyzed in their quantitative (Nijkamp, 1996) and qualitative aspects. The competition within defined size groups of airports is also an interesting topic (Dennis, 1998).

More detailed studies deal with the problem of the exceeding capacity of larger airports. A gap between planned passenger traffic and existing passenger traffic with its spatial and environmental consequences (aircraft noise impact) is also a popular field of research nowadays (Schipper, Rietveld, 2001). From this point of view, airport hierarchy is recognized through relations between the level of hierarchy and the idea of sustainable development.

The role of liberalization processes for airport hierarchy is analyzed together with its economic aspects (Borenstein, 1990; Janic, 1999). Liberalization of air transportation connected with its deregulation is also treated as an impact factor on qualities of airlines services (Button, 1991; Schipper, Rietveld, 1997). The impact of legal conditions on air transportation systems and airport hierarchy changes was also analyzed for particular airports (Barbot, 2006).

The econometric framework of airline functioning (Doganis, 1992; Bhadra, Texter, 2004) and air transportation changes forecast methodology are developed mostly by American research institutes like the Centre for Advanced Aviation Systems Development.

Air transportation also shows strong relations with geopolitical conditions on a global, regional and even local scale. The global impacts of the political situation on air transportation has been researched especially since the 11th of September 2001 attacks. The damages caused by terrorists were analyzed mostly from the point of view of particular airlines (Harumi, Darin, 2005) as well as from that of airports.

AIRPORT HIERARCHY CHANGE FACTOR REVIEW

The hierarchy of European airports is influenced by numerous factors. One of the basic factors is the liberalization of air transportation. Low cost carriers, in order to minimize costs, search for the cheapest airports possible. For this reason, they avoid the larger HUBs, like London Gatwick or Paris Orly, and concentrate their activity on smaller airports often situated far from the centres of the served agglomerations (i.e. London Luton, London Stansted or Berlin Schönefeld). Development of a former local airfield to international airfield reduces the development of larger airports and changes their position, stopping rapid development (like that of London Gatwick). Nevertheless, the rank of the whole agglomeration as a transportation node is not reduced (the total volume of London airports traffic is still growing). Besides spatial development barriers, 'external' new airports generate new spurs for external zones of urban areas. The growth of airport systems serving the larger metropolitan areas in Europe also changes the general system of transportation infrastructure (i.e. roads connecting the airports with the agglomeration's centre). The airports as large-scale objects also cause large-scale investments. Making a small airfield or airport the base of a cheap carrier fleet can cause its development. The airport as an enterprises location factor can operate as a factor for local or/and regional development. This situation can cause considerable changes in land use directions, particularly in urban zones.

The age of liberalization acts is also an important factor. Central European countries joined the 'open sky' idea relatively late on the eve of the 21st century. Previously before accepting low cost carriers in their skies only the central airport serving the capital city and the main urban area in countries like Poland, Czech Republic or Slovakia had continental meaning. The others were only local, usually connected only with central airport (domestic routes). There were some exceptions – Kraków and Gdańsk had international connections soon after receiving their civil aviation function. Many Central European airports were managed by the army, and thus there were considerable barriers for their spatial development.

The functions of cities or regions served by airports are also a factor of airport hierarchy changes. Beside airports served by low cost carriers, develop also those, which serve region of tourism function. Therefore, the important airports of Southern Europe (especially those in Spain and around the Adriatic Sea region) showed the fastest increase of passenger numbers. However, this factor doesn't have equal influence throughout the entire Mediterranean region.

In countries which had belonged to the Warsaw Pact (1955–1991), many airfields or airports were managed by the Soviet Army. Theoretically, they could be used in the future as new, potential airports for further development. But their manner of air transportation infrastructure use caused serious damages and is generally irreversible, which limits their potential. In some cases, the military function of an airport was the factor of development for the city nearby. For example, at Goleniów, a city in north-western Poland, an important part of its urban structure was built to create housing areas and services for the population connected with the air base. Today, the Goleniów Airport, localized in a thinly populated area, has great potential for spatial and traffic development.

An important political factor operating since the beginning of the transition process in Central Europe was the development of connections between airports. Capital city airports were usually the only ones with international scheduled flights in national airport systems. Central European capital cities were basically connected with each other and with the centre of the Warsaw Pact – the city of Moscow. Most of those connections still exist and are served by national carriers – like Polskie Linie Lotnicze 'LOT' or Czech Airlines. Central airports in this part of Central Europe have small global relevance in the meaning of outer continental connections share. They all have connections with European HUBs, like Amsterdam – Schiphol, Paris Orly, London Heathrow or Fraport (Frankfurt am Main's airport). The main difference between a central airport and the better developed regional airports in Central Europe, in the meaning of international destinations, rely on not serving the connections with other Central European countries central airports by regional ones. Kraków Balice Airport has transcontinental connections, but doesn't have connections with Sofia, Bucharest, and central airports of former Soviet republics. Nowadays, the regional airports in Central Europe try to enlarge the number of scheduled connections with airports serving highly socio-economic developed regions.

LIBERALIZATION OF AIR TRANSPORTATION

The opening of air transportation markets, making them accessible not only for national carriers, has American roots, where the first low cost carriers began

their activity (Goetz, Sutton, 1997; Francis, Humphreys, Ison, Aicken, 2005). Since the early 1990s, European countries have allowed low fares to serve air transportation connections. After spreading the idea of the 'open sky' in Western European countries, on the eve of the 21st century, new members of the European Union adopted these legal regulations of air transportation. Deregulated markets function all over the world. The liberalization and deregulation of aviation let airlines with a specific business format to operate on main air transportation routes. Cutting the cost of functioning of particular connections relies on limitations of services available to customers as well as on choosing the right airport with the cheapest fares. The liberalization of air transportation markets is a factor of specializing airports (Frenke, van Terwisgam, Verburg, Burghouwt, 2004; Franke, 2004; Francis, Fidato, Humphreys, 2003). Some are served mostly by low cost carriers (or their share shows the dynamic growth), others only (or mostly) by 'traditional' carriers, like British Airways, Lufthansa or Air France.

LIBERALIZATION AND GEOGRAPHICAL STRUCTURE OF CIVIL AIR TRANSPORTATION MARKET CHANGES

The more developed countries of Western Europe still hold the top position in the civil air transportation market (Fig. 2). Germany, France, Spain and Great Britain together control over 50% of the air transportation market. The development of Central European airports, connected with low fares serving

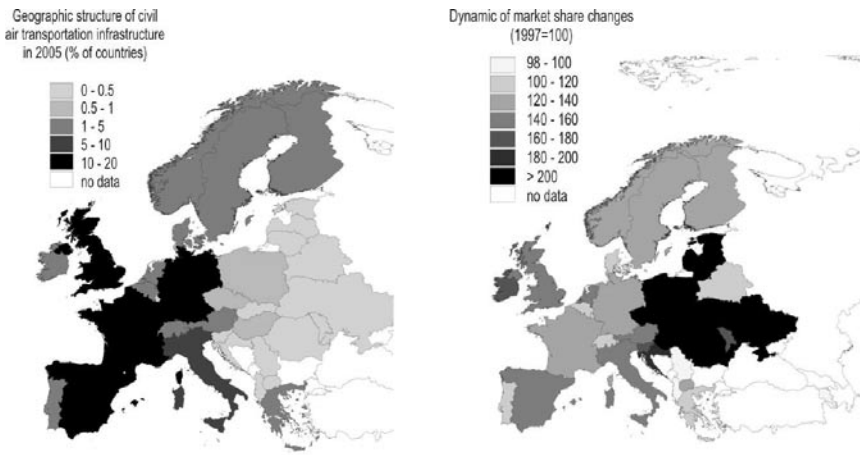

Fig. 2. Geographical structure of civil air transportation and its changes in 1997 and 2005 in Europe

Source: airport data obtained from airport internet sites.

main connections, leads to a change of the geographical structure of the air transportation market. Central Europe has doubled or even tripled the share of particular countries. In the Baltic Republics, Hungary and Romania, this development is connected mostly by that of passenger traffic in the capital city airports (central airports). Ukraine didn't join the 'open sky' agreement, but Kiev's airport development also shows the same dynamic growth. In other countries, this growth is also linked with the development of their regional airports. It causes the reduction of the role of the central airport, i.e. the central Polish airport in Warsaw decreased its share from 76.7% in 1998 to 61.5% in 2005 (according to data from the Civil Aviation Office in Warsaw).

LIBERALIZATION AND GROWTH OF SMALL- AND MEDIUM-SIZED AIRPORTS

The number of international airports in Europe (those with scheduled international connections) is stable – since 1997, it has increased only by 1% – from 277 in 1997 to 288 in 2005. During this period, some airports lost their international standing – like some Scandinavian airports (e.g. Sweden's Örebro), which closed to scheduled international flights. The general growth of passenger traffic in Europe is connected not with the growing number of airports, but mostly with new connections offered to a wider group of potential customers of air transportation services. New airlines offering low fares look for such airports where the cost of operation can be limited. These are small- or medium-sized airports (often local airfields adjusting to functioning as airports) in the larger urban agglomerations. This changes the size structure of size airports serving civil aviation.

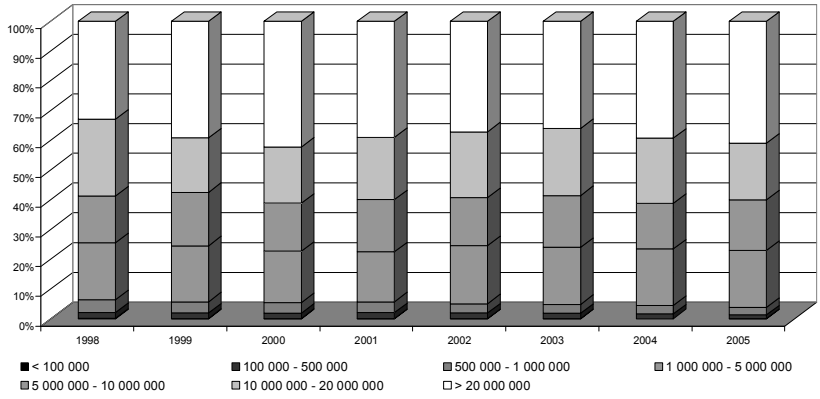

Fig.3. Airport size structure in 1998–2005

Source: author's research based on airport data from airport internet sites.

The importance of airports by size (passenger traffic level) has changed during the last few years, but one cannot find a visible trend (Fig. 3). The general trend has been a decrease in the role of greater airports, especially in 2002 and 2003. Small- and medium-sized airports are more important, being the regional airports in the new 'open sky' countries or as the new airports serving those agglomerations where HUBs are overcharged (fighting with congestion), and their spatial development is blocked due to urban development nearby (e.g. housing).

AIRPORT SIZE – CITY SIZE RELATIONS

An airport's size, measured by passenger traffic, and a city's size, represented by the number of its inhabitants, has changed drastically over the past few years. Cities of all size showed development of their airports size between 1997 and 2005, which reflected general civil air transportation development. This process was mostly connected with the appearance of low cost carriers serving connections between central and peripheral regions of Europe. The level of passenger traffic development is also connected with the opening of the job market in the European Union for new member-states.

But airport size is not always directly proportional to the size of the city served. Analysis of this kind of relation leads to a simple typology of those relations (table 1). A type of size-oriented relation is important from the spatial point of view and can be useful for describing a particular airport's developmental potential. There are four types of size-oriented city – airport relations (between the number of the population of the main city served and the number of passengers serving the airports). The first type is that of small cities with small airports, where the only impact factor is that of tourism or agglomeration need factor (second airport development need).

Table 1. Size-oriented airport – city relations typology

	Small city	Large city
Small airport	X	X
Large airport	X	X

Source: author's research.

The second type (small airport – large city) rarely exists in European space (Fig. 4). In Eastern Europe, with countries which did not join the 'open sky'

agreement, there are often underdeveloped airports in comparison with cities of the same scale in other parts of the continent.

The third type is that of the large airport – small city, which is especially observed in tourist regions (airports on Mediterranean islands, in the mountains, pilgrimage centres).

The fourth type of size-oriented relations is that of the greater agglomerations and greater airports popularity in Western and Northern Europe. In this case, the size of the airport reflects the socio-economic and sometimes geopolitical position of the given city, and the size of the airport can be used as an index of its rank in the urban network hierarchy.

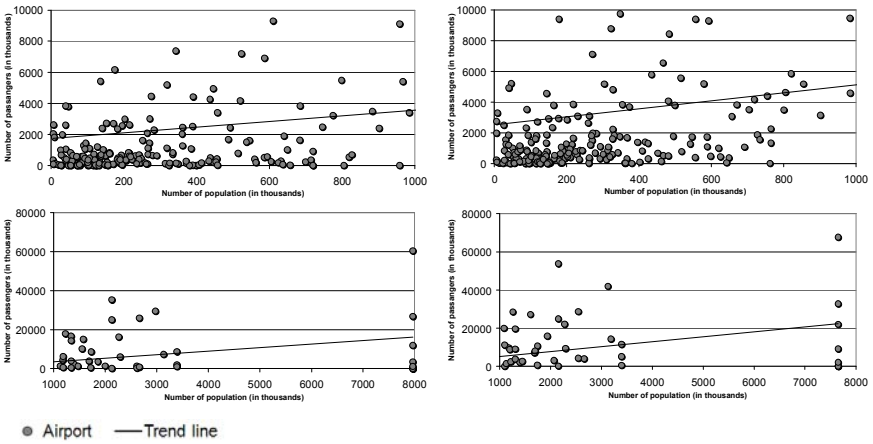

Fig. 4. Relations between the sizes of airports and cities in 1997 and 2005

Source: author's research based on airport data from airport internet sites.

SPATIAL DIFFERENTIATION OF AIRPORT SIZE HIERARCHY

In Europe, there are visible disparities in airport localization, especially if one considers the particular levels of airport size. The spatial differentiation of airport size hierarchy is correlated with the size hierarchy of the cities and, generally, with political and economic importance (that of their regions).

The main urban zones of Western Europe generate considerable streams of passengers, which impacts the necessary airport capacity. The density of the population and the size of cities determines the location of the greater airports. Also, the presence of important management and financed institution headquarters (particularly those which present continental or even global meaning) impacts large airport's existence need.

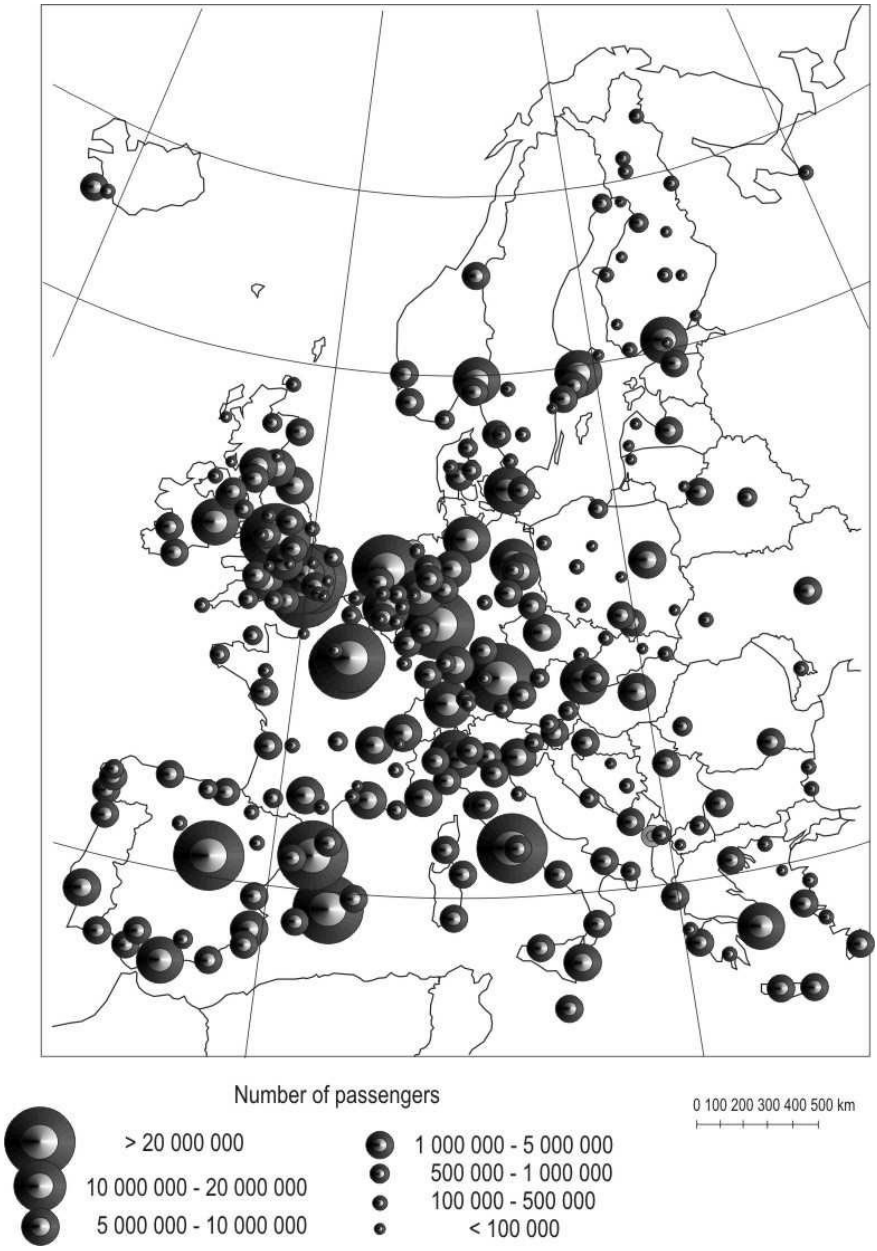

Fig. 5. Airport size hierarchy in Europe in 2005

Source: author's research based on airport data from airport internet sites

The second zone of greater airport concentration, but showing a smaller density, is the Mediterranean region (Fig. 5). There are two groups of urban areas with such airports (with passenger traffic numbers over 10 million yearly) – capital city regions and tourist centres. In Greece, Italy or Spain, national airport networks are developed and the number of international airports is relative in comparison with the population number. In tourist regions, international airports also serve the traffic for local or regional airports close to particular holiday resorts.

Also, the main Scandinavian airports belong to the greatest airports in Europe. Their rank is given due to the high level of economic development in those countries, where the cost of air transportation is not a barrier for most of society, unlike in other parts of Europe. Another factor influencing Scandinavian airports are close inter-Scandinavian relations. Passenger traffic is connected with political, economic and social relations between countries of the region. Many Swedish international airports serve scheduled international flights only to neighbouring countries – mostly with Copenhagen. Localization of Scandinavian international airports showing the greatest number of yearly traffic is very unequally. There is a visible concentration mainly in coastal areas of the more important objects of air transportation infrastructure with their important position in the hierarchy. The internal parts of these countries present a different model of air transportation infrastructure localization – a model with a dominant central airport.

Central and Eastern Europe airport networks are less developed than those in Western Europe. The number of international airports is smaller here. In some countries, there is only one international airport – the one serving the capital city (Belarus or Moldavia, for example). New member-states of the European Union have airport networks still determined by central airports. In fact, their European position is rather limited – larger Eastern European airports do not belong to the greater airports of the whole continent.

DYNAMICS OF PASSENGER TRAFFIC AS A REFLECTION OF AIRPORT NETWORK SPATIAL CHANGES IN EUROPE

Local and regional airports are reducing their distance from the leading group of airports (in the meaning of passenger traffic). The reach of capacity in greater airports is used by smaller ones, which intercept some operations. The greater airports do not belong to the group of the fastest growing airports. Their dynamics of development are still visible, but the scale of development is decreasing. Dynamics of passenger traffic growth presents a significant level of regionalization. The British Isles, the Rundstedt area, the Iberian Peninsula, the Adriatic Sea coastal zone and Central European countries (Poland, Hungary, Czech Republic and Slovakia) are regions of the highest rates of traffic

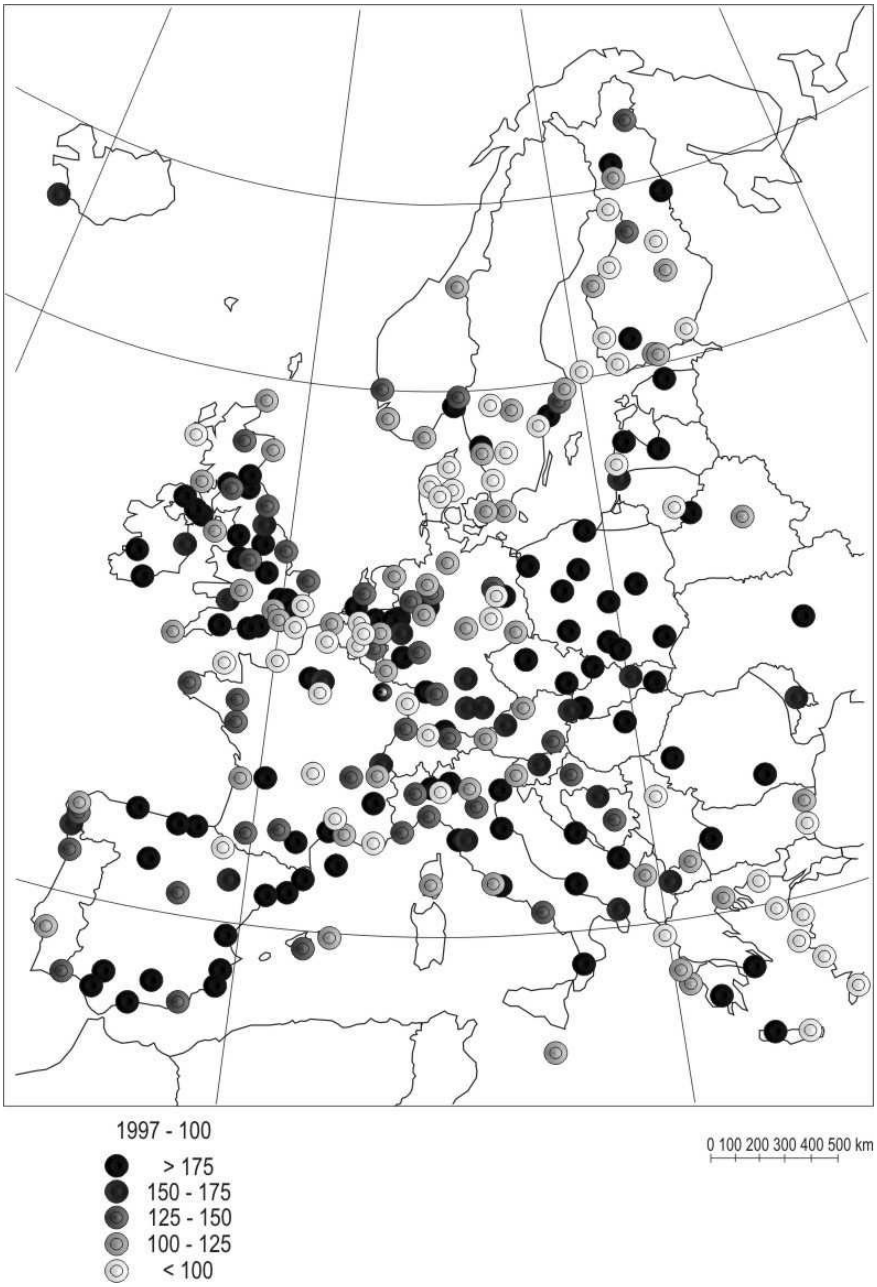

Fig. 6. Dynamics of traffic changes in European airports – 1997 and 2005

Source: author's research based on airport data from airport internet sites.

development (Fig. 6). The reasons of this situation vary. Low fare operations connected with liberalization processes serve as an important part of the connections between the regional airports of Europe (Central and Western) with the tourist regions of Southern Europe and the economically strong Western Europe. In this case, both factors (economical and functional) are an influence.

LIBERALIZATION AND DEVELOPMENT OF AIRPORT SYSTEMS FOR MAIN EUROPEAN METROPOLITAN AREAS

The larger urban agglomerations in Europe are often served by more than one airport, i.e. London (Heathrow, Gatwick, Luton, Stansted, London City Airport), Belfast (Belfast City Airport, Belfast International Airport), Paris (Orly, Charles de Gaulle, Pointouse), Berlin (Tegel, Schönefeld, Tempelhof), Rome (Fiumicino, Ciampino), Milan (Linate, Malpensa, Bergamo) and Stockholm (Arlanda, Skavsta, Bromma). The necessity of possessing a second airport, or even more, results from different factors. The main factor is the size of traffic – which is greater than an airport's capacity. This situation often leads to the airport's further spatial development – enlarging the terminals and developing a runway system. But often such a solution is impossible to carry it out. Suburbanization in many cases blocks airport expansion. Air transportation infrastructure objects are surrounded by housing areas. Such a relation influences the level of safety and is an important barrier for the spatial development of an airport. Such development also means changes in an airport's surroundings. Greater traffic needs more parking-spaces with the necessary infrastructure. Larger airports serving transcontinental connections need hotels in their neighbouring areas for those who change planes. Development of business- and VIP-aviation opens up other types of demands. From this point of view, airports as transportation nodes also need congress and conference centres. Often such facilities are localized in terminal buildings or in close proximity. The growth of particular airports also enlarges the number of airport related services. Developing services can lead to terminal enlargement. But in some cases, this solution cannot be implicated. In this case, the area around the airport terminal functions as a zone for the localization of service centres – i.e. shopping malls. The processes of developing an airport itself and of these objects can create special a settlement unit like an 'aero-ville', which is spatially and functionally dominated by air transportation objects.

LONDON'S AGGLOMERATION CASE

In larger European agglomerations, rapidly growing passenger traffic is connected with the higher position of their airports in the world hierarchy.

Global cities like London need global airports, which can be defined as an air transportation infrastructure with scheduled transcontinental flights, connecting such a city with cities and regions with the same economic relations. Spatial barriers of airport development cause a necessity for entire airport systems development to serve such agglomerations. Especially those agglomerations with global importance show considerable demand on air transportation services (transcontinental in particular). But only in a few European agglomerations are there multi-airport areas. One of the zone examples is the London agglomeration, which is nowadays served by 5 international airports: London Heathrow, London Gatwick, London Luton, London Stansted and London City Airport (Fig. 7). Southend airport is a sixth potential international airport of London. These airports play different roles in this system. Also, their dynamics are different.

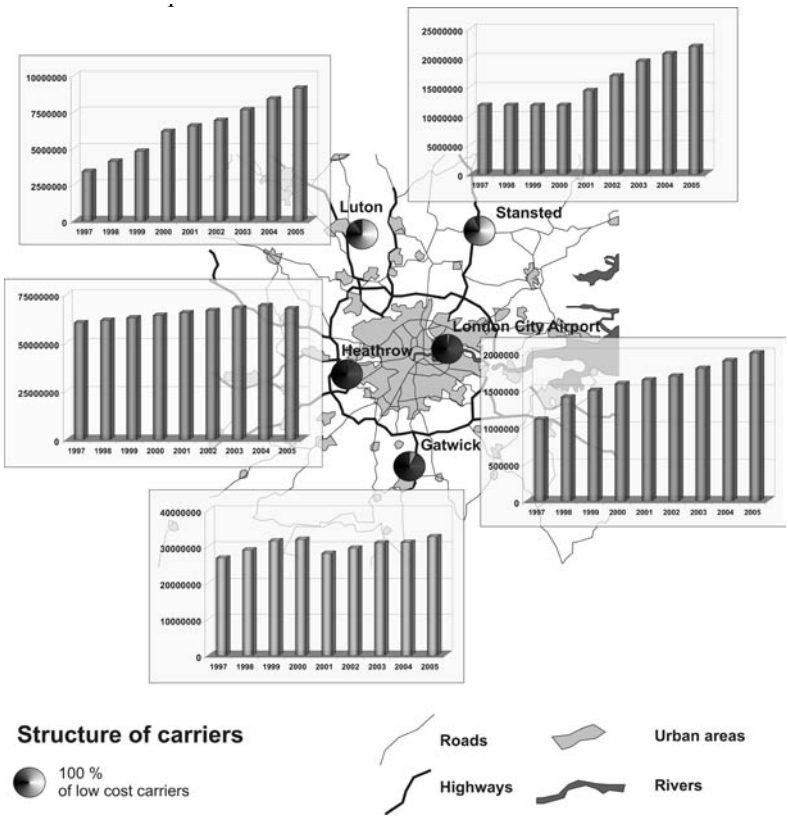

Fig. 7. Airport system of the London agglomeration and its development over the 1997–2005 period

Source: author's research based on airport data from airport internet sites.

Heathrow and Gatwick are 'traditional' airports in the meaning of attending those connections which make them European HUB airports with a global meaning as well. Connections between London and other urban centres of this rank are attended by the national carriers in these two airports. Other London airports specialize in connections of low cost carriers. Since the spread of the 'open sky' zone on Central Europe, airports like Luton, Stansted and London City Airport have developed rapidly. This development is correlated with the opening of many new connections between London airports and regional ones in Central Europe.

A division of airports into these, present in the network of operations attend by low cost carriers (like Ryanair or Central Wings), and those where the operations are dominated by national carriers is due to the costs of using particular airports by carriers. Smaller airports are pulling in low cost carriers, and thus cheap airports are used by cheap airlines.

CONCLUSIONS

The impact of the legal aspects on air transportation market functioning causes visible spatial changes. They are not only concentrated on the moving of the gravity centre of air transportation to Central Europe, but also on the activation of airports in this part of the continent. The dynamics of passenger traffic growth is the largest here and changes the position of its airports in the continental hierarchy. Most Polish (as well as Czech and Slovakian) airports are now higher in this hierarchy, from small-sized, country oriented airports to transcontinental ones (like Rzeszów-Jasionka in south-eastern Poland, which has opened scheduled connections to the United States). Many regional airports of Central Europe serve connections with larger metropolitan areas in Western Europe with airports specializing in low cost carrier activities.

The growing popularity of low cost carriers has a spatial impact. It changes the airport hierarchy by cumulating a greater and greater part of the air transportation market of the served agglomeration, and it also influences local economic activity (as an enterprise localization factor) and land use structure (new logistic centre localization, parking space, etc.).

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