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# Airport City as a major contemporary element of a communal-transport hub for strategic flows in macro-regions. Analysis of the main assumptions in the context of functioning examples

## Airport City jako główny współczesny element węzła komunkacyjno-transportowego do przepływów strategicznych w makroregionach. Analiza głównych założeń w kontekście funkcjonujących przykładów

Abstract

Airport City is part of a concept derived from the Aerotropolis concept developed in the mid-1980s. The assumptions adopted at that time determine the current functioning of large airports and their economic foundations. The development of the aviation market has led to a new approach to the design of airports and their surroundings. Due to their commercial attractiveness, areas around airports are particularly vulnerable to investment pressure, which is not always consistent with airport development policy.

Keywords: Airport City, Aerotropilis, aviation region, transport hub

Streszczenie

Airport City jest częścią koncepcji wywodzącej się z idei Aerotropolis, opracowanej w połowie lat 80. Założenia przyjęte w tamtym czasie determinują obecne funkcjonowanie dużych portów lotniczych i ich podstawy ekonomiczne. Rozwój rynku lotniczego doprowadził do nowego podejścia do projektowania portów lotniczych i ich otoczenia. Ze względu na atrakcyjność komercyjną obszary wokół lotnisk są szczególnie narażone na presję inwestycyjną, a nie zawsze jest zgodna ze strategią rozwoju lotniska.

Słowa kluczowe: Airport City, Aerotropolis, region lotniczy, węzeł komunikacyjny

## 1. INTRODUCTION

The modern Airport City concept is a component of a broader assumption derived from the Aerotropolis concept developed in the mid-1980s of the previous century. The assumptions of that time determined the current functioning of large airports and their economic basis. In the last two decades, the aviation market has undergone many revolutionary changes, from the emergence of low-cost airlines to changes concerning the operation of airports. The high growth rate of the aviation market has created a new approach to the form of their design as well as the environment around airports. Today, large airports are one of the main elements of global strategic flows. The aim of this paper is to present the main factors determining the development of Airport City, as well as to assess the scale of this phenomenon. To indicate the role of strategic planning for the development of areas around large airports as a fundamental activity in creating the economic development of a given macro-region. To create supporting and supporting functions for the functioning of the airport in order to best position it in the global communication network. Planning its development process based on interactions between the transport hub and the economic potential of the region. Optimising links and integrating transport and communication infrastructure with spatial conditions as the main factors influencing the development and operation of the airport. Areas around airports, due to their high commercial attractiveness, are particularly exposed to investment pressures that are not always in line with the airport's development policy. Airport Cities play a significant role as major elements in the structure of large air transport hubs, while being linked to the global air transport network and influencing strategic flows in the economy.

Adaptation to climate change and dynamic changes in geopolitical and economic factors in the modern world strongly affect air transport, which is a fundamental pillar of passenger transport and rapid transit services, are causing changes that have undoubtedly already begun to affect the functioning of modern aviation cities.

Contemporary large airports are major hubs in today's air transport network. They are massive magnets for new business formation and are leading economic accelerators for the metropolitan regions in which they are located. We can compare their current functioning to

the central railway stations of our urban past. Today, airports are more often and increasingly attracting and catalysing economic activity. They generate employment for more workers and commercial development of services in the areas around the airport as well as outside the airports. But their impact is much greater and more significant on the spatial planning and functional development of the region. In the case of very large airports, we can already speak of macro-regions subordinated to the functioning of the airport and the centralisation of services around the airport.

The function of a large airport already in itself often includes thousands of acres of real estate, often commercial. Today's airports include a variety of functions ranging from retail and leisure services in terminals to office buildings, hotels and convention and exhibition centres to customs and free trade zones with high-tech assembly and logistics as value--added along with biomedical, perishable products and e-commerce distribution. This commercial development of airports has played a key role in modern non-airport revenues. Very often, non-aeronautical revenues exceed those core revenues resulting from passenger service for a growing number of airports. This is one element that significantly influences the creation of other functions in the airport area and the expansion of the Airport City function. As major airports have taken on new metropolitan centre functions such as cultural attractions and leisure destinations – epitomised, for example, by Singapore's Jewel Changi – they have become cities (Airport City).

These investments in new functions in the peri-airport zone feed off each other, and their accessibility to the airport gives rise to a multi-purpose multimodal, commercial and logistics core. As the process deepens and the Airport City structure expands, we are already beginning to speak of a form whose theoretical foundations were defined in the 1980s by John D. Kasard – Aerotropolis. The structure of an aviation metropolis constituting a nodal centre for strategic economic flows and a key element in the global transport network.

## 2. RESEARCH MATERIALS AND METHODS

The research carried out was focused on crystallising a functional and spatial scheme for the Aviation Region based on an analysis of current aviation areas, the literature on the subject and own expires on the formation of Airport City areas. Spatial research in order to find answers to the questions of the role played by airports in city- and region-building functions, Systematising, on the basis of contemporary literature on the subject, the current concepts of airport city realisation and presenting the principles of correct strategic design of peri-airport zones. To examine the current functioning of Airport City in the context of the COVID-19 pandemic period. The key rationale for the development of airport cities and the benefits for their users are also analysed. The paper presents the key issues and rationale for the targeted development of peri-airport areas, with a particular focus on the

planned implementation of a so-called airport city in the immediate vicinity of the airport. A functional-spatial diagram of the aviation region (Aviation Region) is developed Detailed considerations were based, among other things, on an analysis of the functional-spatial development of the airport area in South Korea, Seoul Incheon -Incheon Aerotropolis.

The application of qualitative methods in a case-by-case analysis of airport elements, areas around the airport and the macro-region confirmed by the analysis and observation of the process of transformation of the spatial structure of aviation areas, deepened by the analysis of strategies for the development of airports, transport systems and the functioning of regions. The structure of the study and the research methodology adopted were mainly based on studies of planning documentation, in particular concerning airport development, transport systems and regional development strategies. In addition, a review of the literature on the subject and a critical analysis of the theses contained in the literature review were carried out. The feedback between the airport and airport zone spatial development on a per-airport and macro-regional scale was examined and observed. It concludes by presenting the development directions of airport zones depending on the location, characteristics and potential development of the airport itself and the region in which it is located. The case studies of airport areas are: Seoul Incheon in South Korea -Incheon Aerotropolis, Dallas-Ft. Worth International Airport (DFW) in the United States. Worth (DFW) in the United States, and many others. This formed the basis for deriving theses and trends in the application of the airport city model that are currently being implemented at other airports around the world, taking into account good practices and principles for the proper design of existing airport cities/aerotropolises.

## 3. RESEARCH RESULTS – ELEMENTS SHAPING AIRPORT CITY

### 3.1. THE FUNCTIONAL STRUCTURE OF THE AIRPOT CITY AND AVIATION REGION AROUND THE AERODROME

The fundamental function of an airport is the transport function, realised through the provision of air services for passengers (and their luggage), cargo and mail. Often, however, the airport is also a city- and region-forming hub, influencing the directions of spatial development within its structure. It influences the creation of a differentiated space both territorially and procedurally. Distinct urban areas of cities, agglomerations and metropolises are transformed, i.e. areas with compact, intensive development and high population density and spatial cohesion due to transport and communication links (Rucińska, Ruciński, Tłoczyński, 2012). The region-forming function for the aviation area, on the other hand, is expressed by the supra -local range of the airport's connections with non-urban areas differentiated in terms of the structure of the settlement network, population density or development of centres. The range

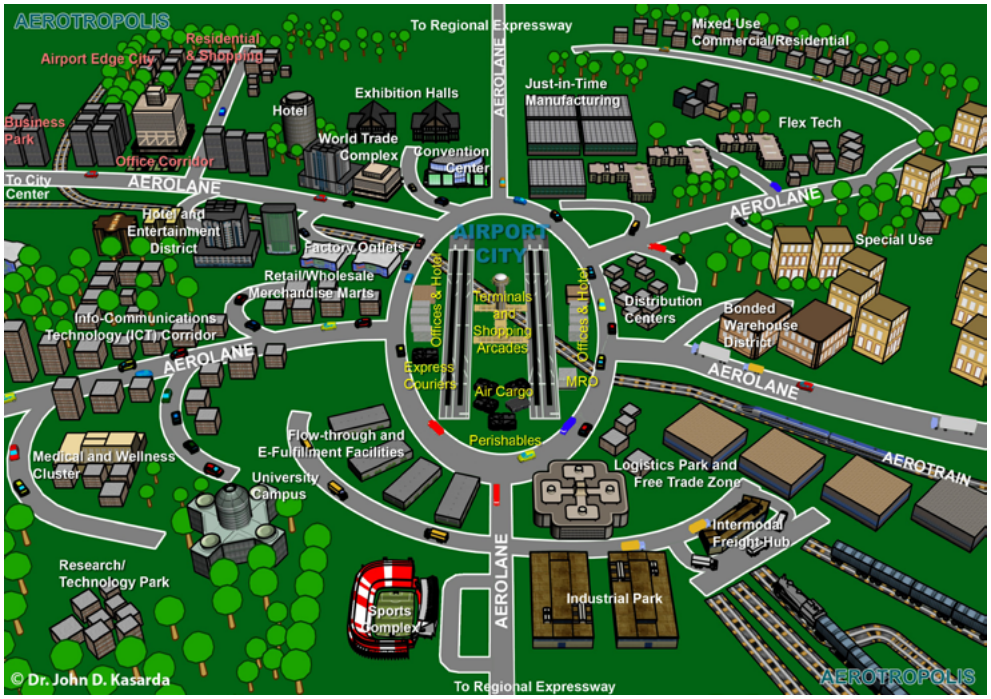


Fig. 1. Compressed aerotropolis schematic with airport city core (Kasarda, 2008)

of regional impact areas for airports is determined by the range of services offered by the airport, over and above the network of complimentary links and the time needed to reach the airport. There is a high degree of airport competitiveness, which is determined primarily by the transport accessibility of the airport, which determines the attractiveness of the hub. Another element is the economic development of the immediate surroundings and the region as a whole. As Rucińska and Ruciński point out in their research, systems of linear and point transport infrastructure facilities are therefore an important stimulator of the development of regional spatial structures (Rucińska, Ruciński, 2017).

It should also be noted that airports, as well as land-use structures, are characterised by interdependent development objectives resulting from the efficiency of the use of urban, regional, social and economic potential. Airports are spatial structures that attract investment, labour, modern transport solutions, increase mobility, etc. The attractiveness of urban areas, urbanised structures in which airports are located, contributes to a significant increase in air transport and the quality of their services. Therefore, supporting strategic measures derived from local and regional authorities, which drive aviation infrastructure development initiatives, are interested in the further development of the airport in question, its better positioning in the global network of connections. The strength and scale of the

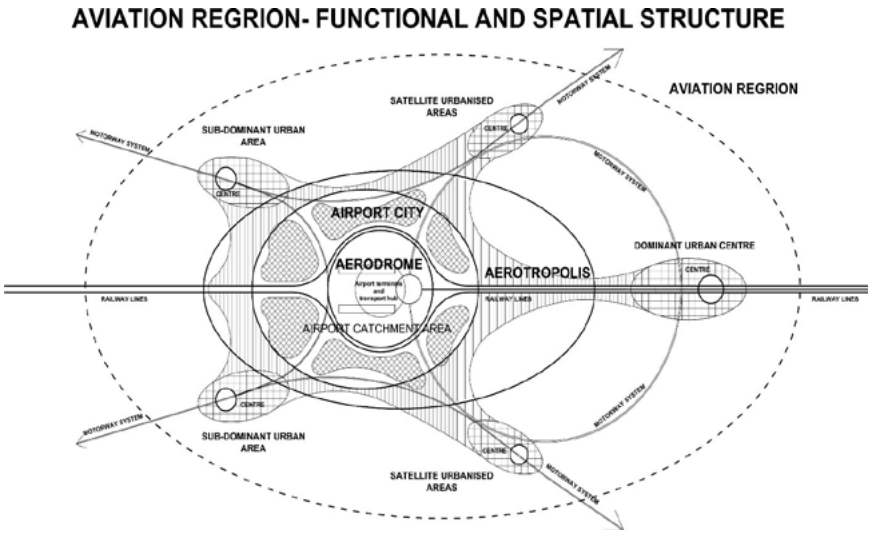


Fig. 2. Aviation Region – diagram functional and spatial structure. By J. Błachut

impact of airports on the development of cities and regions depends on the degree of activity and performance of air transport.

The results of the research show that, over the centuries, the emergence of new modes of transport has resulted in a significant increase in the size of settlement regions and the range of influence of their central centres. This principle applied to every mode of transport. In the post-war years, air transport was limited to reinforcing the specialised function of cities as central hubs, mainly in the areas of its most intensive development, due to the relatively small amount of passenger air transport in the world. The change in perception of air transport changed with the clear upward trend in air traffic. In the 1970s and 1980s, there was a period in which the interdependence of air transport and agglomeration development intensified, but the small amount of air transport only favoured the development of the world's largest cities (ICAO Digest of Statistics, 2017).

During this period, theories about the dominance of aviation functions in the metropolitan structure emerge. The process of expansion of peri-airport functions and the formation of Airport City begins, particularly at large airports of global importance and with a major airline operator.

### 3.2. MECHANISMS FOR THE FORMATION OF LARGE INTERCHANGE HUBS, THE DEVELOPMENT OF AIROPT CITY AND AEROTROPOLIS

The difference between an airport city and an aerotropolis is the latter's similarity to an actual metropolis or urban area. The airport and its surrounding hotels, stores,

distribution centers, light industrial parks, etc. serve as the central business district, employing tens of thousands of workers. In the case of an aerotropolis, development can stretch for 15 to 30 km, including additional development such as office and research parks, purpose-built districts, foreign trade zones, entertainment and conference facilities, and even housing estates – all anchored by in the Airport City function. Currently, this concept seems to be still fresh in the world – aerotropolis projects already exist or are being implemented all over the world. This is done both at existing airports or airport cities such as Denver International, Hong Kong International, Seoul Incheon, Paris Charles de Gaulle and Ontario in California, as well as those currently in the planning and development phase – Suvarnabhumi in Bangkok and expansion of Beijing International Airport. Spatial research of Schiphol Airport in Amsterdam, employing 58,000 people, was the basis for developing guidelines to create the main assumptions for the functioning of the Aviation Region. This spatial arrangement is probably the closest to a mature aerotropolis. In addition to being a major international passenger and freight facility, it offers intermodal transport, including rail services to Amsterdam city center and all major cities in Western Europe. In addition, retail is an important element of the facility's economic production, and pre-security shopping is available on weekends when other stores in the area are closed. Schiphol Airport is home to major logistics centres and flower markets, as well as corporate headquarters and other business centres. Outside the airport, on two highways, there are numerous logistics parks, office parks, shopping centres and hotel and entertainment complexes. Another spatial example analysed is one of the clearest examples of an aerotropolis taking shape in the United States. This is anchored at Dallas-Ft. International Airport. Worth (DFW), which itself covers 7,300 hectares, Euless on the southwest side of DFW, and to the east in Irving – particularly Las Colinas. Spatially, the airport area is connected with the area around the airport via the I-35 state highway to Dallas, and the main investments are located on the road. Las Colinas. These are a development of 4,800 hectares, including 2 million square meters of office space, 790 K square meters of light industrial space, 121 K square meters of commercial space, over 13,000 single- and multi-family homes, over 3,700 hotel rooms and over 75 restaurants. This multifunctional spatial development is not everything. Just east of Las Colinas is Dallas Love Field, the original airport serving Dallas and the home base of Southwest Airlines. There is an example of the development of the entire I-35 corridor between DFW and Dallas, which is not the only such development in the USA. Similarly, the development of the corridor between Dulles International Airport in northern Virginia west of Washington, D.C., and the US capital functions similarly. Two major shopping centres are located in the I-35 corridor: Infomart and Market Center, which attract hundreds of thousands of exhibitors and visitors from around the world. Just north of Fort Worth is the Alliance Airport logistics and cargo complex, which serves as a sub-hub for the DFW--based aerotropolis. Additionally, several other U.S. airports give commercial, non-aviation activities a high priority in development planning. These include airports in Denver (Colo.),

Detroit (Mich.), Las Vegas (Nev.), Minneapolis-St. Paul (Minn), New York (JFK) and Pittsburgh (Pa). It is worth noting that, internationally – apart from airports in the United States, such plans are implemented by airports in Frankfurt am Main in Germany, Barcelona, Dubai, Helsinki Ventaa, Singapore Changi, Stockholm Arlanda, Milan Milpensa and others.

As the airport area grows as a brand, it attracts investors and companies that want to be part of the brand. Modern large airports now have an image that acts like a magnet. Even if the companies located there do not directly facilitate the flow of passengers or cargo, locating in an airport city or aerotropolis is associated with brand building. demand for transport and logistics services. This trend shows how important an element of the global system of strategic flows airports are becoming and how much influence they have on generating reconstruction of the regions in which they are located. The increasingly critical role of logistics also affects the increase in the value of areas around airports, therefore AMB Property Corp., a San Francisco-based investment fund, recently acquired International Airport Centers' portfolio of 37, 315,860-square-meter air transportation buildings at seven international airports in the United States, where it is expected that air travel activity will remain strong, including New York JFK, Los Angeles International and Seattle-Tacoma International.

### 3.3. GOOD PLANNING PRINCIPLES FOR AIRPORT CITY, AEROTROPOLIS AND AVIATION REGION DEVELOPMENT

In the last decade, the concept of Airport City or Aerotropolis as a business model has been widely adopted around the world. The examples cited above indicate that modern large airports efficiently implement the principles of shaping Airport City. The rapid development of areas around airports indicates the great economic potential of airports. It should be noted that there was very little discussion about the failed examples or how to obtain reliable results regarding the above investments. This means that these projects are usually successful and profitable in the long term. However, the question arises as to the basis for further development of large airports with the increasing scale of competitiveness and geopolitical changes and the control of strategic flows. Based on already built and implemented examples of the airport city concept, general principles favouring the success of such a project have been defined (Table 1). The proposed rules for creating an Airport City were the basis for verifying the spatial assumptions for the functioning of large airport areas and the creation of Aviation Region structures. The primary reason for implementing an airport city project for an airport is usually to increase non-aeronautical revenues. But for broader development, the involvement of local and regional authorities is necessary. To achieve the scale of regional development, several other aspects not included in the table are necessary. It seems that in the coming period, the dominant influence on the development of the Aviation Region will be primarily the factor of the geopolitical location of the aviation area. The economic context of the region, demographic factors and investment

Table 1. Principies of Good Planning for Airport Cities
(Wiedemann, 2018, za: Wach-Kloskowska, 2020)

| No. | Principle | Description |
|---|---|---|
| 1 | Strategic planning | Just like airports, which regularly implement plans and make updates, airport cities require a long-term strategic vision and planning; depending on the size and scale, a huge number of stakeholders from very different backgrounds and with different priorities should be involved; the goal is to develop a long-term master plan that will be supported by all stakeholders in favor of future lessees and will be attractive to investors; an accurate strategic plan also helps to gain the trust of financial institutions and support from within the organization |
| 2 | Stakeholder management | Early and consistent stakeholder management is crucial, especially for spatially extensive projects; it is vitally important to gather all the groups involved at an early stage so that all problematic aspects can be identified in advance |
| 3 | Detailed market research into demand | Acquiring specialized knowledge of regional economic development and urban planning is crucial to examine the preferences of potential lessees as well as to ensure and adapt the infrastructure being built to the needs of future lessees; research clearly shows that companies of different size and sectors have different needs in terms of location selection; a company' sdecision about location is a complex process and has changed in the globalized world; most often the idea of 'if you build it, they will come' does not pay |
| 4 | Adaptation to air transport planning | An airport city must be strategically adapted to the airport itself; it is important to have a thorough understanding of future possibilities and limitations related to the development of routes to adapt them to the needs of companies to be located in the airport city; before allocating land for commercial development, one should also carefully examine whether the land will be needed for future air transport or other business functions that must be located near the airport |
| 5 | Changing the local plan | It is a long-term process for many airports; sometimes convincing a local planning authority that commercial investment increases revenues from non-aviation activities can be a difficult or impossible process. |
| 6 | Integrated spatial development plan | It describes the future vision and use of space and ensures that the overall urban plan supports economic growth and regional well-being; a unanimous approach by stakeholders, such as the airport, spatial planning departments of all municipalities involved and the main transport providers in the region, is necessary to define the future vision |
| 7 | Financial planning | The early start of a dialogue with financial institutions, investors, potential lessees helps to develop banking projects; a clear definition of the target market, return on investments and general strategic goals help to attract investors and companies |
| 8 | Professional consultants | Qualified specialists have knowledge and experience in urban, economic, transport, infrastructure and real estate planning, and ensure systematic project management and project coordination. |

security are also important. Planning analyses and development patterns of modern aerotropolis areas show that communication conditions and an intermodal transport node are an element of the main development of the airport. To ensure the development of

Aerotropolis, it is necessary to expand the airport's catchment area and create new unique functions for further expansion. It is necessary not only to expand the scale of territorial but, above all, functional impact. Engaging new centres to expand the scale of the airport's impact area. An example of this could be subordinating smaller regional airports and limiting their function of direct connections with other regional airports. In-depth feasibility studies should demonstrate what is best suited for the airport and region, taking into account local conditions. Target markets, size, brand, function and design should be different from other airport cities if a unique, individualized and tailored strategy is developed.

## 4. DISCUSSION. SPATIAL ISSUES ON THE WAY TO AIRPORT CITY

The issue of spatial development and planning is an interdisciplinary issue and is primarily of interest to urban planners, architects, geographers, economists, sociologists and representatives of some technical sciences, and the publication achievements in this field are impressive. These problems are also solved by representatives of government, local government and public administration centers, planners and decision-makers. The first researchers of these issues drew attention to the unquestionable and interdependent process of development of settlement, production and transport systems, pointing to market relations between production and distance (von Thünen, 1826), the location of industrial cities and the costs of transport, labor and the dis/benefits of agglomeration (Weber, 1909), development trends of cities based on the communication principle (Christaller, 1933) and the problems of regional balance (Lösch, 1944). Edgar Malone Hoover (1962) presented methods and techniques of regional analysis focusing on transportation costs, spatial transformation and types of agglomeration benefits. Basic knowledge in this field is also provided by studies by Gustav Cassel, Andreas Predöhl, Bertil Ohlin, Tord Palander, Christoph Pitrath (1949), Walter Isard (1965), and others. In Polish literature, mention should be made of the publications of Bolesław Malisz (196), Władysław Czarnecki (1965), Kazimierz Dziewoński (1972), Piotr Eberhardt (1977), Ignacy Tarski (1963), Juliusz Goryński (1966), Ryszard Domański (1967), Andrzej Piskozub (1967), Czesław Bielecki (1974), Jerzy Jan Parysek (2006) (no year) and others. The authors of currently published studies are representatives of various academic communities, scientific and research institutes, urban planning and architectural studios, and design offices. Noteworthy is the study by Jarosław T. Czochański (2013) regarding regional monitoring, an instrument supporting regional development policy. The pioneer of research and publications on the interdependent development of air transport, cities and regions was the American sociologist William Fielding Ogburn (1886–1959). He presented their results for the USA, where the processes of spatial changes took place at a faster pace compared to Europe:

- in the times of non-mechanized (horse-drawn) transport in the USA, there were 210 regions served in terms of trade;
- during the period of dominance of rail and road transport in the 1850–1950 distinguished only 60 regions, but their size increased approximately 3.5 times, and the remaining 150 central centers lost their functions;
- the next stage of transformations in spatial development in the 1950s was the creation of the so-called plane regions, and in most of them the largest American cities, which had previously reached 500,000 inhabitants, became the central centers. inhabitants.

Although the research effects concerned the regions of the plane in the period before the existence of air transport, Ogburn pioneered in pointing out its potential importance for the development of large cities and the most important connection between these two elements of civilization (Ogburn, 1959). The problems of interdependence between the development of air transport and spatial development structures, including the impact of branch infrastructure on the development of metropolitan agglomerations and world cities, were described in more detail by Joachim Heinrich Schulze (1959). The issues of development of airport-proximate zones appeared in English-language literature at the beginning of the 21st century. It is no coincidence that the concept of Airport City and Aerotropolis was initiated in the USA, a country with the most developed air services market in the world (Kasarda, Lindsay, 2011). Publications by American authors dominate the knowledge market in this field, but in the last decade, studies by authors and practitioners representing countries where the idea of developing Airport Cities has a practical dimension have increasingly appeared (China, Korea, Great Britain, Germany, the Netherlands). In Poland, the issue of developing airport-proximate zones is new and relatively little attention is paid to it in the literature. This is the result of the lack of practical experience, the limited scope of theoretical research and, until recently, the inability to translocate foreign experience. Publications by Michał Stangel (2014), Piotr Wróbel (2012), Andrzej Ruciński (1968; 1971; 2008), Elżbieta Marciszewska (2010), and research workers from the Poznań University of Economics are available. Airport Cities reports and projects prepared for Polish airports by architects, engineers and urban planners for commercial purposes are also available. However, this topic is becoming more and more attractive for research, as evidenced by scientific studies and recommendations for the effective development of airport-proximate zones.

## 5. CONCLUSIONS

Over the last few decades, air transport has become the basic form of passenger transport over distances exceeding 1,000 kilometres. Modern air transport is a pillar of the process of globalization and socio-economic integration. If we look at the effect of eliminating barriers to the flow of goods, people and capital, currently only air transport meets the

needs of a globalized economy and global society. Modern airports are the largest passenger transfer hubs in the world, and some of them serve 50–80 million travellers a year. They are also some of the largest spatial structures created to serve users and passengers. Such a large scale of social, transport and economic activity could not remain without impact on the areas surrounding airports – cities, large-city agglomerations, metropolises and their regions. There is a certain analogy here to the influence of previously established modes of transport (water, rail, road), but each of them, due to technological differences, left its mark on urban civilization in a different way. The primary source and factor of the processes presented in the study for achieving modern structures for the development of space around airports is demography, including the unprecedented population growth in history. Its dynamics from 2.5 billion in 1950 (9 million passengers served by air transport) to 7.43 billion in 2016 (3.7 billion used air services) confirms the unique impact of air transport on space development and development. airports, generated on the basis of the needs and usefulness of only one mode of transport. Also the concepts and structures of Airport City, Aeropolis, Aerotropolis, Airport Corridor, Airport Region, Aviation Region, are the first derivative of the development of aviation activities. Airport-related zones, incubators of know-how, the latest techniques and technologies, and economic processes have been created and are developing, contributing to the increase in the attractiveness of industries, the competitiveness of cities and the increase in the wealth of their inhabitants. The phenomenon is quickly becoming popular and even small regional airports effectively initiate the socio-economic development of the immediate surroundings.

### 5.1. NOTES

Modern catchments airport areas around airports and airport City are transformed from point elements of the spatial structure and transport nodes into multifunctional structural, spatial and economic facilities. By functioning, they activate the socio-economic potential of the area in which they are located. Airports have become focal points for combining global trends, technological, spatial and demographic achievements and the formation of new socio-economic relations. As places of increased concentration of population flows and investment locations, they strengthen the competitiveness of modern urbanized areas. They generate new jobs and innovative and often prestigious activities in their surroundings. Their global importance determines the direction of strategic flows throughout the world. The position they occupy in the global world is a reflection of the economic position of the region. Around modern airports, airport-proximate zones are being created, areas with new space usability. They are carriers of modern, targeted development of contemporary urban and regional structures. Airport-proximate zones, based on feedback, strengthen the importance and development of airports. Airports and their surroundings are characterized by synergistic development interdependencies and benefits achieved.

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