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Contents

37-46
v.10 (2021)
https://smart-scm.org

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POTENTIAL OF SECONDARY AIRPORTS' RENEWAL IN TERMS OF DEVELOPMENT OF THE NATIONAL ECONOMY

Olena Volovyk, Sophia Zhigula, Oleh Harmash. "Potential of secondary airports' renewal in terms of development of the national economy". *The article outlines the classification of airports, the role of secondary airports in the infrastructure of the country, understanding the need of the secondary airports' renewal. The aviation industry plays a crucial role in the development of economy of the country and international economic relations, as it generates incomes, job places, and opportunities for growth. Every country has both primary and secondary airports, regional (secondary) airports are a vital part of the aviation infrastructure. They are engines of local development and allow accessibility to certain locations, in particular those that are remote or not well served by other forms of transportation. They are enablers of free movement of people, goods and services, as well as of social and territorial cohesion. Furthermore, regional airports stimulate incoming tourism and employment, as well as facilitate access to essential services. They can also help to reduce congestion at major hub airports. Unfortunately, in Ukraine secondary airports are not cultivated enough, thus the air transportation is the neck place in most cases, but this situation may be solved with renewal of secondary airports' work, the importance of which is described in this article.*

Keywords*:* secondary airport, traffic, cargo, economy, infrastructure, aviation, airlines, modernization, transportation, development.

Олена Воловик, Софія Жигула, Олег Гармаш. «Потенціал відновлення другорядних аеропортів з точки зору розвитку національної економіки». *У статті описано класифікацію аеропортів, роль другорядних аеропортів в інфраструктурі країни, розуміння необхідності оновлення другорядних аеропортів. Авіаційна промисловість відіграє вирішальну роль у розвитку економіки країни та міжнародних економічних відносин, оскільки збільшує доходи, генерує нові робочі*

37-46
v.10 (2021)
https://smart-scm.org

місця та можливості для зростання рівня держави у світовій економіці. У кожній країні є як первинні, так і вторинні аеропорти, регіональні (вторинні) аеропорти є важливою частиною авіаційної інфраструктури. Вони є двигунами розвитку та забезпечують доступ до тих місць, які є віддаленими або погано обслуговуються іншими видами транспорту. Вони сприяють вільному переміщенню людей, товарів і послуг, а також соціальної та територіальної єдності. Крім того, регіональні аеропорти стимулюють в'їзний туризм, а також полегшують доступ до основних послуг. Вони також можуть допомогти зменшити затори у великих аеропортах-вузлах. На жаль, в Україні вторинні аеропорти розвинені недостатньо, тому повітряні перевезення в більшості випадків є вузьким місцем, але цю ситуацію можна вирішити відновленням роботи вторинних аеропортів, важливість яких описана в цій статті.

Ключові слова: вторинний аеропорт, трафік, вантаж, економіка, інфраструктура, авіація, авіалінії, модернізація, транспорт, розвиток.

Елена Воловик, София Жигула, Олег Гармаш. «Потенциал обновления второстепенных аэропортов с точки зрения развития национальной экономики». *В статье очерчена классификация аэропортов, роль второстепенных аэропортов в инфраструктуре страны, понимание необходимости обновления второстепенных аэропортов. Авиационная промышленность играет решающую роль в развитии экономики страны и международных экономических отношений, поскольку она генерирует доходы для государства, создает рабочие места, предоставляет возможности для роста страны в разрезе мировой экономики. В каждой стране есть как основные, так и второстепенные аэропорты, региональные (второстепенные) аэропорты являются неотъемлемой и особо важной частью авиационной инфраструктуры. Они являются локомотивами развития и обеспечивают доступ к определенным местам, в частности к тем, которые находятся в отдалении или плохо обслуживаются другими видами транспорта. Они способствуют свободному перемещению людей, товаров и услуг, а также социальной и территориальной сплоченности. Кроме того, региональные аэропорты стимулируют въездной туризм и занятость, а также облегчают доступ к основным услугам. Они также могут помочь уменьшить загруженность в крупных узловых аэропортах. К сожалению, в Украине развитие второстепенных аэропорты проходит медленными темпами, поэтому авиатранспорт в большинстве случаев является узким местом, но эту ситуацию можно решить, возобновив работу второстепенных аэропортов, важность которых описана в данной статье.*

Ключевые слова: второстепенный аэропорт, движение, груз, экономика, инфраструктура, авиация, авиакомпания, модернизация, транспорт, развитие.

Introduction. Airport development has undergone a long history starting from simple airfields as sites and installations for take-offs and landings-on aircrafts up to complex contemporary mega-hubs providing a variety of services. The globalization has significantly affected the transportation system in general and aviation transportation specifically. With the development of new types of aircrafts that required technical modernization of existing airfields into airports, the concept of airports has changed too as well as general system of classification. With regard to their size and processed traffic flow, airports are categorized as primary and secondary both comprising a multi-airport system [1]. They complement each other meaning that large metropolitan regions are served by several airports - one being the primary airport with the largest share of metropolitan traffic, and the rest are secondary, which absorb the traffic spill from the primary or focus on lower yielding or specific traffic categories, particularly when mandated by government regulations[2].

Ukraine inherited from the USSR fifty-plus airports and a broad network of runways that covered the entire territory of Ukraine linking both large cities and small towns [12]. However, in the 1990s, the system fell apart and the majority of local airfields and runway strips are abandoned and neglected as they have lost their importance in the country-wide transportation infrastructure.

The current research justifies the importance of reviving the long-lost airfields through their modernization into secondary airports and further including them into the regional multi-modal transportation infrastructure as well as finding new uses for former prosperous and currently neglected commercial structures.

Analysis of the latest research. The issues of rising demand for secondary airports have been justified by Richard de Neufville [1], Jimenez E., Claro J., Pinho de Sousa J. [2], Marcin Dziedzic [13], Graham A. [3], Knipp N. [6] and others. The majority of the previous research emphasizes that the rapid development of low-cost carriers has increased the demand in secondary airports, which nowadays have undergone significant modernizations compared to the past [6].

Graham A. states that secondary airports are currently thriving in most developed countries. In the past, smaller airports meant secondary services and facilities, but not today. Low-cost carriers (LCCs) are streaming into secondary airports, and they provide the latter with significant traffic flow [3]. Non – primary airports are included into the National Plan of Integrated Airport Systems (NPIAS) in the US and account more than 3300 public-use facilities which function according to their roles outlined in the report provided by US Federal Aviation Administration [6]. Changes to LCC business models are affecting secondary airports across Europe and their evolution increases competition between primary and secondary gateways [14]. However, the authors indicate that the tendency may vary from country to country and refers to the small airports which have undergone significant modifications and meet the requirements of the market.

Sara Favargiotti explores the problems of abandoned airports in Europe and stated that out of 2000 European airports, 750 ones are currently abandoned, uphold or underutilized [15]. The author admits that the conversion of an abandoned airfield is a complex design process and there are different ways of reviving such infrastructure apart of converting into a secondary airport and including into general nation-wide air transportation infrastructure.

Formulation of the purpose of the study. The purpose of this article is to explore airport classification suggested by Federal Aviation Administration (USA) and International Civil Aviation Organization (ICAO) as related to their characteristics. The paper analyses the structure of air traffic in Ukraine in 2020 and 2019 in order to identify the perspectives of airport system loading in the nearest future. The importance of regional airports has been explained through identifying the services that they can provide. With the purpose of justifying the necessity of renewal of abandoned airports and their converting into secondary ones, the airport structure in Ukraine and the tendency in its development have been explored. The factors influencing the success of the implementation infrastructure projects are identified. The benefits of developing regional airports and their impact on the growth of the country's economy are specified.

To ensure the realization of these goals, the following research methods were used: empirical studies, data analysis and synthesis, expert assessments, and generalization.

The main research. The common understanding on the definition of airports as to primary and secondary categories has gradually evolved into the concept of multi-airport system. Such system acknowledges that large metropolitan regions are served by several airports, one being the primary airport with the largest share of metropolitan traffic, and the rest are secondary, which absorb the traffic spill from the primary or focus on lower yielding or specific traffic categories ([1]). Moving to those airports outside a multi-airport system is more complicated and depends on particular national perspectives or national institutional frameworks. For example, regional airports are sometimes associated with peripheral regions, or any airport not serving country capitals ([16]).

The importance of regional airports has grown in the last decades as they have become the main ones for low cost airlines, as the latter often prefer to use regional airports where airport fees are lower, turn-round times shorter and capacity higher, due to low traffic congestion. At the same time, low cost airlines may also establish themselves in major airports.

Then regional airports facilitate the daily operations of general aviation, which includes all aviation other than commercial and military flights, such as training flights, law enforcement flights, medical flights, private business flights, and recreational flights that fall under the category of general aviation.

The benefits of general aviation cannot be overstated. Regional airports facilitate air ambulance flights and medical evacuation flights for local patients and hospitals. Moreover, organs for local organ transplant candidates can be flown into a regional airport located close to home. In addition, it can provide a base of operations for law enforcement search and rescue operations.

In international practice, the FAA (Federal Aviation Administration, USA) and ICAO (International Civil Aviation Organization) classification for airports is widely used [4].

The FAA classifies airports by their type of activity into the following categories:

1. Commercial airports - state-owned airports serving regular flights with the number of departing passengers of at least 2,500 people per year.

2. Airports of general aviation: all aviation, except military and commercial, operating on a regular basis.

In turn, commercial airports are divided into primary and secondary ones. Table 1 summarizes general characteristics of commercial airports.

Table 1 - Classification of commercial airports

Type of airport	Characteristic
Primary airports	more than 10,000 departing passengers per year
▪ Large	1% or more of the total number of departing passengers served
▪ Medium	from 0.25% to 1% of the total number of departing passengers served
▪ Small	from 0.05% to 0.25% of the total number of departing passengers served
▪ Not nodal (Nonhub)	less than 0.05% of the total number of departing passengers served
Secondary airports	from 2500 to10,000 departing passengers per year
Minor airports	
▪ National airports	airports with an average of about 200 aircraft, including 30 jet aircraft
▪ Regional airports	airports with an average of about 90 aircraft, including 3 jet aircraft
▪ Local airports	airports with an average about 33 propeller-driven aircrafts
▪ Base airports	airports with an average about 10 propeller-driven aircrafts

The passenger traffic of Ukrainian airports in 2015 amounted to 10.7 million passengers, 98% of which was provided by the airports Boryspil, Zhulyany (Kyiv), Odessa, Lviv, Dnipro, Kharkov and Zaporizhzhya. Almost all flights use primary airports as the place of departure or destination with the number of flights variation from 130000 to 335000 per

year (in the last 5 years). Table 2 summarizes the structure of air traffic in Ukraine as related to the year of 2020 (updated from [5]).

There is a significant decrease in the number of flights in 2020 and this trend is observed in the world-wide scope as the COVID-19 situation significantly affected the transportation sector. However, the passenger demand for air travel is projected to double in the next 20 years and nowadays the national primary airports are clogged with increased traffic. In response, domestic and international LLCs are turning to secondary airports [6].

Table 2 - Structure of air traffic in 2020 versus 2019

Classification of flights	Number of flights			Deviations (in %) in 2020 versus 2019
	2019	2020	Share of the total number of flights in 2020	
Ukrainian airlines	109777	49733	35,0%	-54,7%
Foreign airlines	225630	92314	65,0%	-59,1 %
Internal flights	30790	21102	14,9%	-31,5%
Departure flights	162937	68870	48,5%	-57,7%
Transit flights	141680	52075	36,7%	-63,2 %
Total	**335407**	**142047**		**-57,6%**

The ACI Europe report on European regional airports indicates that, between 2005 and 2017, the number of flights (direct connectivity) at regional airports grew twice as fast (+39.1 %) as at major hub airports in Europe (+19.7 %). When looking further back in time, the overall traffic growth in regional airports is even more significant: between 1993 and 2015, air traffic at regional airports in Europe increased by +173 % [7].

To determine the required number of airports for the country, it is necessary to identify the factors that affect the success of such infrastructure projects.

Today almost every regional center of Ukraine has an airport at its disposal. Mostly, all the airport complexes were built in the Soviet Union and were inherited by Ukraine after the collapse of the latter. Though they have not been upgraded since then while the technologies have moved far beyond. However, a few of them were modernized for the final part of Euro 2012: the Boryspil airport, the Zhuliany airports (Kiev), Kharkov, Lvov and Donetsk .

According to the State Aviation Service, there are twenty-four (24) airports in Ukraine. This figure is rather nominal and the subject to clarification [8].

The socio-political situation in the East of Ukraine disabled the airports of Donetsk and Lugansk. The airports of Simferopol and Belbek in Crimea operate under a different jurisdiction. At the same time, the airports of Mariupol, Nikolaev and Ternopil do not have a certificate of conformity from the aviation authorities of Ukraine and do not carry out operational activities. Thus, there are only seventeen (17) functioning airports in Ukraine.

Ukraine is striving to create a market economy; therefore, the strategic goal for an airport involves achieving competitive advantage through its successful development. Consequently, in order to determine the required number of airports for the country, it is necessary to determine the factors that ensure the success of the implementation of such infrastructure-related projects.

The cornerstone for airport development is the size and economic condition of its coverage area (the so-called catchment area), which determines the potential for passenger traffic and the number of aircraft takeoff and

landing operations. Typically, the airport coverage area is limited to a radius of 200-250 km, which corresponds to approximately 1.5-2.5 hours by car to the airport. This area can be expanded by combinations with other types of ground transport (bus and rail), the routes of which are designed to bring additional passengers from remote areas according to the aircraft schedule.

The economic condition of the airport's coverage area is influenced by the financial and economic potential of all types of business in the region, as well as the purchasing power of the population in the airport's coverage area. The laws of economics in aviation work very well. The tourist attractiveness of the region should be considered separately as a driving force for the development of passenger traffic at the airport [9].

The next factor for the successful development of the airport is the identification of potential air carriers that can operate flights to / from the airport or become base for it, as well as the constant creative work of the airport management aimed at attracting these carriers. The ideal development of the airport is the joint infrastructure projects with airlines, which form a synergy in the development of the aviation cluster in the region.

The third factor is the analysis of the degree of competition between airports, as well as other modes of transport. The role of an airport in a region depends on its technical condition and location in comparison with direct competitors.

These airports have strategic importance for the state and form the basis of the airport system in Ukraine. They are located in different parts of the country, have their own coverage areas, which practically do not overlap and form the full coverage area of the state territory. There is an obvious overlap of coverage areas at the airports "Boryspil" and "Zhulyany", as well as the airports "Dnepropetrovsk" and "Zaporizhzhya". The solution for the first couple of airports was the correct positioning in the market and their orientation to different niches of passenger traffic: Boryspil successfully implements the hub strategy, focusing on transit passenger traffic and a large base carrier, and Zhulyany focuses on low-cost carriers and business aviation. Such approach creates real competition for the main air gates of the country and has convergent effects. The solution for the second couple of airports was the presence of basic airlines - Dniproavia for Dnipro and Motor Sich for Zaporizhzhya, which generate a small but stable passenger traffic. In addition, their relatively small distance from each other makes it possible to cover the existing demand for air transportation in the region, since they are separate subjects in the intergovernmental agreements of Ukraine.

The main constraints to the development of Ukrainian airports are the state of their infrastructure, which requires significant investments, and competition from land transport. Even the airports that were remodeled for the final part of Euro 2012 have controversial issues with the infrastructure and their solution requires additional investments. As for the airports of Odessa, Dnipro and Zaporozhzhya, the potential of their airfields has long been exhausted and they require major renovations.

In this situation, the solution may be to divide airports into two conditional groups: strategic airports and regional (the rest). The main task of the state should be the modernization of strategic airports, which will make it possible to develop passenger traffic at a rapid pace and attract new airlines operating modern types of aircraft. Further, the more passenger traffic will be generated by strategic airports, the greater the potential for the development of regional airports will be. The second stage in the development of the airport infrastructure should be the modernization of other airports, but only after a detailed analysis of the airport's potential in conjunction with the potential for economic development of the corresponding region, as well as the competitive environment.

37-46
v.10 (2021)
https://smart-scm.org

At the same time, it is necessary to restore the airports of the eastern regions of Ukraine as soon as possible after the cessation of hostilities for their early integration into the country's transport system, which will contribute to the restoration of the region's economy.

An important indicator of the activity of airports is the number of regular routes (ki) and flights (si) served by these airports (in the theory of complex networks, these indicators are called the degree and strength of the node [10]). The characteristics of the runways and RFFCs determine the technical and operational constraints in the development of an airport and, accordingly, the need for additional investments.

Table 3 - Quantitative characteristics of Ukrainian airports

Rating	Airport	k_i	s_i	ICAO aerodrome code	RFFC
1	Kyiv (Borispyl)	86	24787	4E	8
2	Odesa	21	2888	4C	7
3	Donetsk	15	1663	4D	8
4	Lviv	13	1570	4D	8
5	Dnipro	8	1261	4C	6
6	Simferopol	8	551	4D	7
7	Ivano-Frankivsk	5	81	4C	7
8	Kharkiv	4	583	4C/4D	7
9	Chernivtsi	1	542	н/д	6
10	Mikolayiv	1	279	н/д	7
11	Luhansk	1	242	4C	6
12	Zaporizhzhia	1	237	4C	8
13	Sevastopol	1	59	4C	6
14	Krivoy Rog	1	12	4C	6

So, it is possible to make an assumption about the possibility of developing the route network and more intensive operation of the airport in Odessa, provided that the class of the runway and the fire rescue category is increased. When performing this upgrade, it will be possible to receive aircraft such as B757-300, B767-300, DC-8, DC-10, A300, A330-200 and others corresponding to class D, E and 8-10 RFFC categories.

Boryspil International Airport has the prospect of raising the RFFC category to 9, 10, which will make it possible to receive the corresponding aircrafts. However, the need for budgetary financing of the relevant activities should be justified by the presence of potential demand.

Boryspil is the largest airport in Ukraine. Its freight traffic for 6 months in 2015 amounted about 13.5 thousand tons, which is 88% of the total freight traffic of the country.

The second place can refer to the Zaporozhye airport - 556.4 tons of freight traffic. Third place went to another airport in the capital - "Zhulyany" with 422 tons for the same period.

37-46
v.10 (2021)
https://smart-scm.org

The largest amount of international cargo was handled in Boryspil (12.9 thousand tons), Odessa (246.8 tons) and Zhulyany (203.3 tons).

The Zaporizhzhia airport turned out to be the leader in handling domestic cargo (103.8 tons). The second and third places were shared by Boryspil (83.8 tons) and Dnepropetrovsk (46.6 tons).

In terms of growth dynamics, the highest rates were recorded in Kryvyi Rih (288%), Zhulyany (213.8%) and Lviv (205.4%).

It is noteworthy that the leader of the rating, Boryspil, showed a slight decline in volumes (2.6%). The largest drop was noted at the airports of Chernivtsi (94.4%), Poltava (78.8%) and Antonov (45.6%) [11].

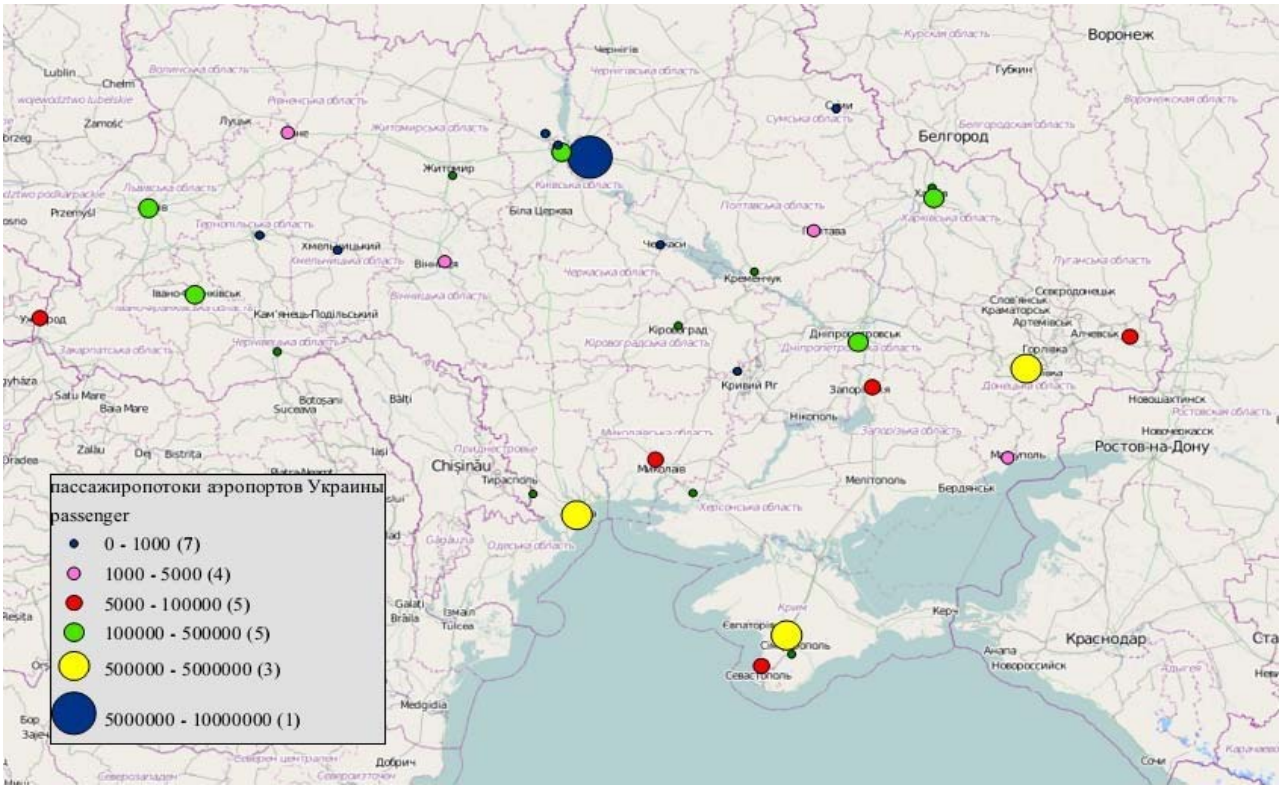

Figure 1 – PassengertrafficofUkrainianairports

Renewal of secondary airports can lead to the development of airport infrastructure. Moreover, regional airports may bring following benefits for the growth of the country's economy as they:

– provide jobs - an average regional airport provides up to 200 jobs for airline employees, security personnel, and passenger services employees;

– provide freight transportation to markets throughout the country and around the world for locally produced goods;

– provide access to the local market for goods imported from around the country and around the world;

– enable local small business owners, contractors, and consultants to travel into and out of the local community for work, and saving valuable time that in turn can be used to conduct business;

– attract large business and major corporations to build local offices, factories, and distribution centers because of the readily accessible to air transportation.

To improve the airport infrastructure, the Government has assigned 8.6 bln UAH, out of which 5 bln UAH are the state budget funds and the rest of the amount is an investment, which is directly guaranteed by the Government. Another ambitious goal of the

37-46
v.10 (2021)
https://smart-scm.org

Government is to restore all 50 airports in Ukraine till 2030.

Conclusions. A great number of abandoned and unutilised airfields as well as small airports have been inherited from the past worldwide and in Ukraine particularly. The classification of airports suggested by the FAA divides them into commercial ones and general aviation airports. The commercial airports, in turn, can be referred to as primary, secondary and minor. The latter includes regional airports which have a great potential to contribute into local and national economies through creating jobs in the local community; providing transportation for locally produced goods to the markets outside of the region and for externally produced goods to satisfy the demand of the local consumers; ensuring passenger flow by small aircrafts for business representatives and tourists; attracting large business and major corporations to build local offices, factories, and distribution centers, etc. The regional airports have become the main ones for low cost airlines because of low airport fees, shorter turn-round times and higher capacity. Renewal of secondary airports can lead to the development of airport infrastructure. Secondary airports give passengers direct and easy connectivity to the 'last mile' of their journey. While implementing effective positioning of strategic and secondary airports in the market, they can cover different niches of passenger traffic and produce convergent effects.

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