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## THE DEVELOPMENT OF THE UKRAINIAN AIRPORTS INFRASTRUCTURE ACCORDING WITH THE INTERNATIONAL EXPERIENCE

*The article discusses the pre-war state of the Ukrainian airports infrastructure and determines the list of problems which interfere the development of aviation branch of Ukraine. The article considers, that airport as a single complex, consists of the list of manufacturing infrastructure objects, which are obliged to regular investments for its development, reconstruction or new construction. For its operation, airport should provide full maintains of flights according with the air companies' standards, demands and rules of security. The problem with the runway destruction is the main trouble of the Ukrainian regional airports and one of the main state airports development initiatives direction. The another important infrastructure element of each airport is a terminal. So, one of the reasons of the Ukrainian airports infrastructure critical level is a permanent underfunding, which makes not only the production threatening, but also the national security. The article proves, that all Ukrainian airports are in need of modernization runways, terminals, buildings, special technics and equipment to meet the international certification requirements. Some airports are in need of renovation, but the most of the Ukrainian airports are in need of full reconstruction. So, because of the airport activity is capital intensive and needs big investments, the main way of the Ukrainian airports infrastructure development in accordance with the international experience is the state-private partnership.*

**Keywords:** airport infrastructure, airport complex, ground handling at airport, production infrastructure, aviation, modernization.

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## РОЗБУДОВА АЕРОПОРТОВОЇ ІНФРАСТРУКТУРИ УКРАЇНИ З УРАХУВАННЯМ СВІТОВОГО ДОСВІДУ

*У статті розглянутий довоєнний стан аеропортової інфраструктури України, виявлені та досліджені недоліки та проблеми які стримують розвиток авіаційної галузі України. Встановлено, що аеропорт як єдиний комплекс є набором об'єктів виробничої інфраструктури, які вимагають постійного фінансування задля їх оновлення та реконструкції або нового будівництва. Для здійснення своєї діяльності, аеропорт повинен забезпечити повноцінне обслуговування авіарейсу відповідно до стандартів перевізника з урахуванням норм та правил безпеки. Питання зношеності злітно-посадкових смуг є головною проблемою українських регіональних аеропортів та основним напрямом державних ініціатив із розвитку аеропортів. Ще однією найважливішою інфраструктурною складовою будь-якого аеропорту є аеровокзальний комплекс. Не менш важливим питанням є необхідність оновлення та модернізації аеродромного обладнання та систем забезпечення зльоту і посадки повітряних суден та аеропортового обладнання. У статті доведено, що майже всі аеропорти України потребують модернізації злітно-посадкових смуг, терміналів, споруд та обладнання, щоб відповідати міжнародним сертифікаційним вимогам з урахування міжнародного досвіду. При цьому, деякі аеропорти потребують ремонту, але переважна їх більшість – повної реконструкції. Досліджено, що провідні країни на державному рівні проводять заходи щодо розвитку аеропортів: реалізуються проекти із збільшення пасажиропотоку, будівництво нових та розширення діючих терміналів, встановлення взаємозв'язків між аеропортами та містами, з'єднання аеропортів із залізничною мережею, реконструкція злітно-посадкових смуг та ін. В той же час в Україні, однією з основних причин низького рівня авіаційної транспортної галузі було недостатнє фінансування та низький рівень технічного обслуговування інфраструктури та транспорту, що становить загрозу не тільки виконанню виробничих функцій, але і національної безпеки країни. Існує гостра необхідність збільшення ефективності авіаційної галузі, подальше вдосконалення та застосування правового механізму державно-приватного партнерства, розвиток взаємодії не тільки між органами державної влади та місцевого самоврядування але й між державним та приватним сектором економіки. Для аеропортів України вкрай необхідні не тільки проекти реконструкції застарілих злітно-посадкових смуг та пасажирських терміналів, але й будівництво нових, покращення доступу до трансферу та збільшення пропускної здатності аеропорту, технічне переоснащення та модернізація, забезпечення безпеки польотів та авіаційної безпеки. Таким чином, враховуючи, що аеропортовий бізнес є капіталомістким та потребує значних вкладень в розвиток інфраструктури, обов'язковою умовою повосного розвитку аеропортової інфраструктури України з урахуванням міжнародного досвіду є державно-приватне партнерство.*

**Ключові слова:** аеропортова інфраструктура, аеропортовий комплекс, наземне обслуговування в аеропортах, виробнича інфраструктура, авіаційна галузь, модернізація.

**Problem formulation.** The main element of the aviation transport system is the airport – the transport enterprise which together with air companies provides arrival and departure of the passengers, baggage, cargo

and mail, organization, carrying out and maintenance the flights of aircrafts and uses the airport infrastructure (the complex of runways, taxiways and apron, buildings and constructions, ground technics and special equipment

for providing takeoff, landing, aircrafts maintains and passengers service).

The problems with runway destruction, needs for terminal repair, modernization and technical renovation are the main trouble of the Ukrainian regional airports and one of the main government initiatives of the airports development.

The issue of the Ukrainian airports infrastructure development will become even more urgent after our Victory and the restoration of the air traffic.

So, there is an urgent need of study the issue of the post-war development of the Ukrainian airports infrastructure according with the international experience which is specify the relevance of research.

#### **Analysis of recent research and publications.**

The questions and problems of airports infrastructure development were studied by lot of Ukrainian and international scientists, in that number such as Arefyeva O. V., Shtangert A. M. [1], Zaporozhets V. V., Shmatko M. P. [2], Lozhacevska O. N., Sydorenko K. V. [3], Liscovych N. Y. [4], Orlovska Y. V. [5], Sydorenko K. V., Ismailzade F. N. [6], Adikariwattage S. [7], Ashford N., Wright P. [8], Button K. J. [9], Neufville R., Odoni A. [10] and others. However, despite of the presence of the deep and thorough scientific works, the problem of the Ukrainian airports infrastructure development according with the international experience is insufficiently disclosed and needs further study.

**Formulation of research objectives.** The aim of article is to research the Ukrainian airports infrastructure situation and to make practical recommendation according with the international experience.

**Presentation of the main research material.** The airport complex is an important infrastructure element of the national transport system, which promotes the development of the national economy and so needs investments in order to provide the necessary level of competitiveness in the national and the international markets. On the other side, the airport is not simply service supplier, which is carried out by government, it is the independent commercial complex with own business aims and strategy to reach an economic efficiency and profit in the variable market conditions.

The main element of the aviation transport system is the airport - the transport enterprise which together with the air companies provide arrival and departure of the passengers, baggage, cargo and mail, organization, carrying out and maintenance the flights of aircrafts and uses the airport infrastructure (the complex of runways, taxiways and apron, buildings and constructions, ground technics and special equipment for providing takeoff, landing, aircrafts maintains and passengers service).

The airports work on the base of licenses and certificates, issued by legal entities, which determined the type of airport – the international or domestic. The domestic airports according with its certificate, don't have the customs and immigration bodies and can't maintains the international flights. This is the main difference between the domestic and international airports [6].

The development strategy of each airport should include the renovation of the ground airport complex and the aviation technical base, technical modernization, improving the logistic and service technologies according with the variable market conditions [7].

The airports, according with its aims, should oriented to increase of the passengers and cargo, which generates by air companies, accordingly with the growth of population air mobility, commodities transfers, increase of country transit potential and consequently the development of national economy and raise of the airports competitiveness in global economy.

The Ukrainian airports activity characteristic is its economic independence and autonomy, unlike the international practice, when there are a lot of airports holdings. The airports holding consist of several airports and the main handling company, which is carrying out by the activity of the airports which the members of the holding. The main handling company provides the single policy of the development, marketing and advertising, as well as cooperation with the air companies, handling companies and national entities. Also there are a lot of airports activities (the maintains of aircrafts, passengers and cargo, the nonaviation services and infrastructure development) are separated in the independent businesses on the base of outsourcing.

All Ukrainian airports can be divided on the three groups:

1. The International airport Borispol, is the largest Ukrainian airport and the transport hub.

2. The regional airports, which has a big passenger's turnover, but don't has a transfer's passengers («Kyiv», «Lviv», «Kharkiv», «Odesa», «Zaporizhzhia», «Dnipro»). Their passengers are the local population.

3. Other regional and local airports.

It's clear, that each group of the Ukrainian airports has its own concept of the infrastructure technical development.

The airport as a single complex, has a number of the production infrastructure objects, which are need a regular investment for its renovation, reconstruction or new building. For its operation, airport should provide full maintains of flights according with the air companies' standards, demands and rules of security such as the possibility to maintain the special type of aircrafts (the specification and category of the runway, taxiway and apron) as well as sizes of terminals and quality of services.

Depends upon the technical characteristics of the runway, the airport can maintain different types of aircrafts, according with its weight and quantity of landings per a day. The problem with runway destruction is the main trouble of Ukrainian regional airports and one of the main government initiatives of the airports development.

Another important infrastructure element of each airport is the terminal. The terminal is the complex of buildings for arrival, departure and staying of passengers, characterizes as its square and bandwidth (the quantity of passengers per an hour). The building and reconstruction of the Ukrainian airports terminals is an integral component of the airport activity not only to reach the demands of the certification requirements and aviation security, but also to maintain the production process of air companies and passengers maintains.

Also very important question is the modernization and renovation of the airfield equipment, the system of aircraft takeoff and landing, the ground airport equipment. The regional Ukrainian airports has an old and obsolete equipment, that don't meet the certification demands.

So, unfortunately, many Ukrainian airports don't meet the requirements of quality and service, economic and energetic efficiency, security and environmental protection.

Also, during the research of the development of the Ukrainian transport infrastructure “Infrastructure index” carried out by the European Business Association among the experts in 2021, the Ukrainian aviation transport despite of the best marks compared with automotive, railway and water river transport, received only 3,15 from 5 possible points, which is the neutral assessment [11].

According with the World Competitiveness Ranking of the “Air transport infrastructure efficiency” by International Institute for Management Development, during 2017 – 2019 Ukraine took the 93, 94 і 101 places accordingly [12].

Also the expert research demonstrates the unsatisfactory conditions and degree of wear and tear for the 14 Ukrainian airports (except «Lviv», «Kyiv», «Borispol», «Odesa», «Kharkiv» and «Zaporizhzhia»). Almost all Ukrainian regional airports need to reconstruction of the runways and terminals, modernization of technics and equipment, etc. Because of the absence of information about real-time situation of the Ukrainian airports infrastructure in open sources, the table demonstrates the state on the end of 2021 (tabl. 1).

The airport activity is a capital intensive and needs big investments into the airports infrastructure development. According with the international practice, the construction and reconstruction of the airport infrastructure are financed by the participants of aviation market (airports and air companies) due to various fees and by the national state authorities as a government investment. The research of the international organizations ICAO and IATA demonstrates that international airports cover their own expenses and necessary investments to infrastructure, also due to paid taxes makes clear input to the national economy [13].

The leader countries on the national level take measures for airports development: to implement projects for the increase of passengers, to build new terminals and to renovate the existing one, to develop transfers between airports and cities, to connect airports with railway, to reconstruct the runways and other.

At the same time, in Ukraine the one of the main reasons of the insufficient level of the aviation are the not enough investment and the low level of the infrastructure and transport maintains, which make a treatment not only for airports operation but to the national security of Ukraine.

There are a strict necessary of the effectiveness of aviation, further improvement and using the state-private partnership, cooperation not only between state and local authorities, but also between government and private business.

For Ukrainian airports it’s really necessary not only the reconstruction of old runways and terminals, but also the building of new one, the increase of the transfer and possibility of airport turnover, the technical improvement and modernization, the maintains of flight safety and aviation security.

Usually, the investment from the state budget and special funds carried out only into the repair and modernization of runways, taxiways and aprons.

From other side, in order to increase the capacity, to raise the level of quality and service, to match the demands of flight security and aviation security for Ukrainian airports it’s better to use the private investment projects in order to solve the problems of the construction of new terminals, technical renovation and infrastructure modernization.

The question of the Ukrainian airports infrastructure development and modernization dedicated series of the national programs, orders and resolutions. The most important are the State target program of the airports development till the 2023 year, approved by resolution of the Cabinet of Ministers of Ukraine from 24.02.2016 № 126 [14] and the National transport strategy of Ukraine till 2030 year, approved by resolution of the Cabinet of Ministers of Ukraine from 07.04.2021 p. № 321-p [15].

But it’s necessary to take into account that the less of investments is a main problem of airport infrastructure

Table 1

The state of the Ukrainian airport infrastructure on the 31.12.2021

City	Runway	Terminal
Borispol	Good condition	Good condition
Vinnitsa	Acceptable condition	Acceptable condition
Dnipro	New construction is underway	New construction is underway
Zhitomir	Needs reconstruction	Acceptable condition
Zaporizhzhia	Good condition	Good condition
Ivano-Frankivsk	Needs capital repair	Needs capital repair
Kyiv	Good condition	Good condition
Kropyvnytskyi	Acceptable condition	Needs reconstruction
Kyvyi Rih	Needs capital repair	Acceptable condition
Lviv	Good condition	Good condition
Mykolaiv	Acceptable condition	Acceptable condition
Odesa	Good condition	Good condition
Poltava	Needs capital repair	Needs reconstruction
Rivne	Needs capital repair	Needs reconstruction
Uzhhorod	Acceptable condition	Needs reconstruction
Kherson	Needs reconstruction	Acceptable condition
Kharkiv	Good condition	Good condition
Khmelnyskyi	Needs capital repair	Needs reconstruction
Chernivtsi	Needs capital repair	Needs reconstruction
Cherkasy	Needs capital repair	Needs capital repair

Data source: own assessment

modernization because it's not enough finance from state and local budget.

In order to find the ways of the Ukrainian airports infrastructure finance in conditions of deficit of state funding, attracting investments is expected on the base of state-private partnership, including by concession.

The first successful example of the state-private partnership into the development of the Ukrainian airports infrastructure was the International airport Kharkiv, when the new terminal was built by the private company DCH. Later, this company made the investment into the construction of the International airport Dnipro. This form of state-private partnership was provided that the private investor made the investments into the terminal, equipment and technics and the state from other side made the investments into construction or reconstruction of the runways, taxiways and apron for aircrafts.

During the research of infrastructure development, it's necessary to pay attention to the ownership of the airports. At this moment, Ukraine has two state airports - the International airport Borispol and International airport Lviv and a lot of other airports are the municipal.

Because of this, in order to invest airports infrastructure, the municipal authorities should to look for the own funds, loans, investments form the State fund of regional development and etc. As example, there are Poltavskay and Vinnitskay regions where the airports were invested from the local budgets; Summy, Kropyvnytskyi, Zhitomir where the possibility of cooperation with private investor on the base of concession and with partly investment from local budget were considered.

As a finished project of the Ukrainian airports infrastructure development in pre-war time was the International airport Zaporizhzhia. During last years were reconstructed the runway, taxiways and apron, also were built and equipped a new terminal with a complex of special technical buildings. This project was invested from the own airport funds, Zaporizhzhia municipal budget and credits, received against the guaranties of Zaporizhzhia municipal council.

Because of the importance of the airports infrastructure development, especially in the post-war time, it's necessary to apply and evaluate the international experience of the airports development, which can be used in Ukraine.

So, as example is a very interesting the experience of airports infrastructure development in Georgia. The Georgian aviation specification is that more than 80% passengers' turnover is generated by the capital International airport Tbilisi. In 2005 it was handled to the Turkish holding TAV. The TAV invested a big fund to reconstruction and modernization of the airfield and terminals, and directed the Georgian air companies to the Turkish hub airports. Also, from other side, the Georgia reformed its touristic sector of economy. Because of this, nowadays the Georgian aviation sector demonstrates the great increase.

So, it's necessary to apply the possibility to attract the Turkish companies to handle and modernize the Ukrainian aviation infrastructure, because there is a big touristic mover potential to the Turkey from Ukraine. And Turkish companies are really interesting in further growth of this touristic mover.

Because of the geographic specification of the Norway, the aviation and airports infrastructure development has

a very important social-economic significance. The State holding «AVINOR» not only owns and manages the 46 Norwegian airports, but also the national provider of aeronautical services. The Norwegian experience is very interesting in the airports fees policy – the nonaviation incomes carries out into the decrease of the calculation of airports fees. Also it's necessary to study the possibility of airports personal optimization due to the maximum combination of positions. Unfortunately, this question in Ukraine is not ordered.

The Baltic counties Lithuania, Latvia and Estonia have a rather different ways of the development of aviation transport. In particular, in Latvia and Estonia the capital airports generate the main part of passengers' turnover. The Lithuania has some equal regional airports which have an equal development. The main stage of the development of airports infrastructure in Baltic countries was in 2004 after entering into EU. The airports received several millions euros to the development. More than 60% of the total sum of investment were the funds of European Union. The programs of airports development were reviewed, which involved not only to reconstruct the infrastructure but also to expand of the route network. The experience of airports infrastructure development after entering into EU is really interesting for Ukraine.

The Poland pays a special attention to airports infrastructure development. From 2004, when Poland became the member of EU, the investments to airports is annually increased. Nowadays, the Polish airports have the modern aviation infrastructure with a lot of aviation and nonaviation services. A developed railway and road networks were built with taking into account the needs of air passengers. The Polish experience is really interesting for studying cooperation between airports and low-cost air companies. In Poland, the national air company "LOT" successfully operates together with other international low-cost air companies.

So, because of the importance of the post-war aviation revival and taking into account the international experience, in order to develop Ukrainian airports infrastructure, it's necessary to make the list of measures:

1. To maintain renovation and modernization of the airports using the state-private partnership throat the concession with participation of the international companies.
2. To make the reform of the system of airports fees calculation in order to attract the international low-cost air companies.
3. To cancel the VAT for domestic flights in order to develop aviation routs between Ukrainian cities.
4. To establish the Airport fund for the development of infrastructure and to foresees its earnings at the same scheme as to the Road fund.
5. To carry out clear privatization of the state airports (International airport Borispol and International airport Lviv) with the international companies' participation.
6. To develop and improve together with international experts the plans of the Ukrainian airports development for 10–20 years.

Because the airports are really important centers not only for regional but also for international economy, the step-by-step implementation of the proposed measures will reviv and develop the Ukrainian airports infrastructure.

**Conclusion.** The research demonstrates the strictly necessary of the post-war revival and development of

the Ukrainian airports infrastructure because of the wear and tear of runways, the need to repair the terminals, modernization and renovation of the Ukrainian regional airports. At the same time, taking into account that these

problems are due to the less of investments, it's necessary to pay a much attention to the finance attraction on the base of state-private cooperation through concession on the basis of the international experience.

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