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**MASTER THESIS
(EXPLANATORY NOTES)**

Theme: “Airport infrastructure development”

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МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНИЙ АВІАЦІЙНИЙ УНІВЕРСИТЕТ

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ДИПЛОМНА РОБОТА
(ПОЯСНЮВАЛЬНА ЗАПИСКА)

ВИПУСКНИКА ОСВІТНЬОГО РІВНЯ
“МАГІСТР”

Тема: “Розвиток інфраструктури аеропорту”

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and the area of the cargo terminal of the Boryspil International Airport, Estimated value of project indicators NPV and IRR.

5. Planning calendar

No	Assignment	Deadline for completion	Mark on completion
1.	Collection and processing of statistical data	10.10.20-19.10.20	done
2.	Writing of the theoretical part	20.10.20-28.10.20	done
2.	Writing of the analytical part	29.10.20-09.11.20	done
3.	Writing of the design part	10.11.20-18.11.20	done
4.	Writing of the introduction and summary	18.11.20-19.11.20	done
5.	Execution of the explanatory note, graphic materials and presentation	20.11.20-25.11.20	done

7. Given date of the task: October 05, 2020

Supervisor of the master thesis:

Task was accepted for completion:

REPORT

Explanatory note to the diploma project “Airport infrastructure development” consists of 97 pages, 17 figures, 16 tables, 100 sources used.

Key words: AIRPORT, INVESTMENT ACTIVITY, PROJECT MANAGEMENT, INTERNATIONAL ENTERPRISE, LOGISTICS INFRASTRUCTURE, PERFORMANCE INDICATORS.

The object of study - is the activities of the international airport "Kiev" in the service of cargo and passenger flows.

The subject of study - is the ways and methods of developing the logistics infrastructure of the airport, improving the quality of air transport services .

The purpose of the thesis is to identify current trends and develop approaches to the development of the logistics infrastructure of Boryspil International Airport.

The relevance of the topic of the thesis is due to the need to develop the logistics infrastructure of the airport. Together with consumers, airports have to orient their activities in the provision and use of air transport services, improve their quality and provide mutual economic incentives. Such an approach can only be when at each stage of the air transport process the quality level of each service parameter will correspond to the level of requirements and expectations.

The graduation work was carried out according to the materials on the activity of air transport of Ukraine, statistical data of the Boryspil airport.

The practical significance of the results lies in the fact that taking into account foreign experience in the formation of a logistics strategy for the development of the airport, the introduction of modern technologies to create comprehensive communications at the Boryspil airport, it is necessary to bet on the development of its logistics infrastructure to meet the needs of all interested parties.

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LIST OF SYMBOLS

BUT - ground handling;
IA – international airport;
LI – logistics infrastructure;
PS – aircraft;
Sita- is a passenger registration program;
SPO - passenger service;
UAH- hryivna;
USD- american dollars.

INTRODUCTION

Air Transportation Management Department				NAU 20.08.69. 001 EN				
Done by:	Pavliukova V.V.			INTRODUCTION	Letter	Sheet	Sheets	
Supervisor	Ivannikova V.Yu.					D	8	3
Standards Inspector	Shevchenko Yu.V.				FML 8.07010102 510			
Head of the Department	Shevchuk D.O.							

In Ukraine, the development of logistics infrastructure is especially relevant, and is not only a necessary condition for the implementation of an innovative model of economic growth, but also a factor in improving the quality of life of the population and the competitiveness of the national economy. Trends in the development of international airports show that it is worth systematically considering the development of airports as one of the objects of the logistics infrastructure, revealing its conceptual patterns. The identification of such patterns and their comparison with the patterns of development of domestic airports can be of great practical importance.

In the context of European integration and transformation of the economic and social life of the Ukrainian state, a global consumer society is being formed in which the interests of the consumer of goods and services occupy a major place in the market. The activities of manufacturers, suppliers and sellers in this market are necessary to meet the needs and requirements of customers in a shorter time at an affordable price. This can only be achieved if transport logistics are well established, it ensures the efficient use of time, financial and material resources throughout the entire process of production and consumption of goods and services.

The development of such relations in Ukraine was facilitated by the formation of a consumer priority, but this did not lead to the creation of an adequate transport and logistics infrastructure that meets international standards. Even despite the fact that individual manufacturers and sellers have achieved success in creating their own logistics chains and complexes, the lack of a centralized all-Ukrainian logistics model that can be embedded in the Ukrainian and world economies demonstrates a noticeable lag in our country in terms of the formation of a competitive market for goods and services. Creating a developed transport and logistics system is a strategic and long-term process that requires a clear and competent preliminary theoretical study and justification.

The importance of Boryspil International Airport lies in the provision of standard airport services. As the “primary business object”, the airport allows companies, industry and tourism to optimize their operations. Therefore, the

economic importance of the airport goes beyond the processes and services necessary for travel. In fact, the airport functions as the primary "engine of tourism and the economy."

A valuable contribution to business and a large number of jobs provided at the airport directly affect the development of the region in which the airport is located.

In this sense, the location of local and international commercial activities and the development of tourism are particularly dependent on the reliability and convenience of air transportation.

Therefore, the purposeful development of the airport and any subsequent selection of suitable investors requires, first of all, a clearly formulated concept of strategic development as a directive for the airport for a short, medium and long-term development perspective.

The relevance of the topic of the thesis is due to the need to develop the logistics infrastructure of the airport. Together with consumers, airports have to orient their activities in the provision and use of air transport services, improve their quality and provide mutual economic incentives. Such an approach can only be when at each stage of the air transport process the quality level of each service parameter will correspond to the level of requirements and expectations.

The purpose of the study is to identify current trends and develop approaches to the development of the logistics infrastructure of Boryspil International Airport.

The main tasks, the solution of which is necessary to achieve the goal of the study:

- explore the development of cargo flows and the logistics infrastructure of the world's airports;
- provide a general description of the Boryspil International Airport;
- analyze the production and financial indicators of the airport;
- assess the state of the existing airport infrastructure and conduct a SWOT analysis of the activity;
- build forecasts of freight traffic at the Boryspil airport;

- consider the prospects for the development of the logistics infrastructure of the Boryspil airport;
- propose a methodology for calculating the main criteria for the effectiveness of the airport logistics infrastructure by type;
- calculate the required area of the airport cargo terminal according to the forecast of cargo traffic;
- determine the deficit of the existing warehouse area of the cargo terminal;
- calculate the indicators of the effectiveness of the project in the LI.

The object of the study - is the activities of the international airport "Kiev" in the service of cargo and passenger flows.

The subject of research - is the ways and methods of developing the logistics infrastructure of the airport, improving the quality of air transport services .

Methodology and methodological foundations of the study - the theoretical and methodological basis of the study are the fundamental provisions and works of famous scientists in the field of economics and logistics, international quality standards and regulations, as well as modern methodological approaches to the formation of the principles of general airport management.

The graduation work was carried out according to the materials on the activity of air transport of Ukraine, statistical data of the Boryspil airport.

The practical significance of the results lies in the fact that taking into account foreign experience in the formation of a logistics strategy for the development of the airport, the introduction of modern technologies to create comprehensive communications at the Boryspil airport, it is necessary to bet on the development of its logistics infrastructure to meet the needs of all interested parties.

1. ***THEORETICAL PART***

Air Transportation Management Department				NAU 20.08.69. 200 EN				
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Supervisor	Ivannikova V.Yu.					D	13	22
Standards Inspector	Shevchenko Yu.V.				FML 8.07010102 510			
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1.1. Airport and its infrastructure

The word "airport" has Greek roots and literally translates as "air harbor". So it is nothing more than the air gates of a country or city. In today's world, the term "airport" refers to a complex of structures designed for the departure, arrival and maintenance of aircraft.

Many passengers associate the airport exclusively with the passenger terminal and runway. But this is not quite true, because the airport includes other important facilities designed to ensure its smooth operation in all conditions. It also includes ground services, which manage the movement of aircraft, and cargo complex, which is engaged in loading and unloading of cargo, including warehouses, cars and other facilities.

Airport is an air transport company providing fast, safe and efficient transportation by air of passengers, luggage, cargo, mail and carrying out the dispatch and reception of aircraft using the means necessary for their take-off or landing, as well as maintenance and repair. The airport includes air terminals and buildings for storing and dispatching cargo and mail, as well as access railroads and highways, ground transport stations and parking lots. Airports are classified according to their purpose, functions, size, types of aircraft they can receive and maintain, and other distinctive features. Airports are distinguished by the following attributes: 1) military or civil; 2) commercial or non-commercial; 3) private or public; 4) types of aircraft served; 5) regularity of air transportation (schedule or its absence); 6) availability of customs, immigration and other types of inspection required to service international air transportation; 7) availability of facilities and facilities for the dispatch and storage of goods.

Buildings and facilities of the main production purpose include: airfield; ATC, radio navigation and landing facilities; buildings and passenger service facilities (air terminal, hotel, onboard catering shop, station square); freight and postal service buildings and constructions (cargo complex, mail transportation

department); aircraft maintenance buildings and facilities; aviation fuel supply facilities.

Production buildings and auxiliary facilities include: the airport management building; preventive clinics; canteen; catering facilities; main and start-up rescue stations; facilities, special transport services; airfield service base; repair and maintenance workshops; logistics warehouse; repair and construction site; boiler room; automatic telephone station; medical and preventive treatment facility; complex dry cleaning and washing of aircraft and other soft equipment; centralized battery charger station; incineration plant; treatment facilities.

The technological scheme of the airport should provide performance of the main technological processes taking into account the following factors: reduction of time of passengers and cargo stay, mail and aircraft at the airport; exceptions or reductions intersections and lengths of aircraft and special vehicles, ways of travel and transportation of passengers, luggage, onboard food, cargo and mail; safety at movement of passengers, cargo clientele and workers of services on territory.

Located on the service and technical territory objects different purposes can be divided into buildings and structures.

A building is the result of construction, representing voluminous construction system having aboveground and (or) underground parts, including premises, networks of engineering and technical support and systems of engineering and technical support and intended for living and (or) activity of people and production facilities;

A structure is the result of construction, representing is a volumetric, planar or linear construction system, having above-ground, aboveground and/or underground parts, consisting of of load-bearing and in some cases enclosing building structures and intended for performance of production processes of various kinds and temporary stay of people.

Buildings and structures are subject to the following legal requirements minimum necessary requirements:

- 1) mechanical safety;

- 2) fire safety;
- 3) safety at dangerous natural processes and phenomena and (or) anthropogenic impacts;
- 4) safety for human health, living conditions and stay in buildings and structures;
- 5) safety for users of buildings and constructions;
- 6) accessibility of buildings and constructions for disabled people and others population groups with limited mobility;
- 7) energy efficiency of buildings and structures;
- 8) safe level of impact of buildings and constructions on environment.

The buildings of STT include: air terminals, hangars, CDP, cargo complex, hotel, fire depot, etc.; the buildings include a fuel and lubricants base, railway platforms, treatment facilities, jet boards, aircraft braking units, etc.

The airport terminal is a building at the airport, where passengers pass between ground transport and means that allow them to get on board and disembark from aircraft.

In the terminal, passengers buy tickets, transfer their luggage and pass through security. The buildings that provide access to the aircraft (through the gate) are usually called consortia. However, the terms "terminal" and "hall" are sometimes used interchangeably, depending on the airport configuration.

Smaller airports have one terminal, while larger airports have several terminals and/or conference rooms. In smaller airports, a building with one terminal usually serves all the functions of the terminal and the site.

So, the terminal is an air terminal building, where passengers check in for the flight, passport and customs control, baggage collection and distribution are carried out. This is where travelers spend most of their time waiting for their flight. The terminal has check-in desks, waiting rooms, gates, arrival halls, stores, cafes, restaurants, luggage rooms, bank branches, airline offices and other necessary services.

The main purpose of the terminal is effective passenger flow management and organization of uninterrupted operation of the airport.

The passenger terminal is not only a business card of the airport and the city, but also an important source of airport profits. Today, the standards of passenger service in the terminal complex has changed radically compared to the Soviet past. Now the main task in the airport terminal is not so much to register and conduct pre-flight and passport control, but to give the passenger the opportunity to feel in the shopping and entertainment center - with its stores, cafes and even cinemas and exhibitions.

The passenger terminal serves as a transfer point between different types of urban, suburban, intercity and international transport. It represents a single architectural volume, where under one roof in several levels of the platform of different modes of transport, passengers who use common facilities, premises and devices.

In the passenger terminal with the help of modern technologies a single information space is created. Being the center of attraction of city-wide interests, the terminal includes objects not related or related indirectly to the service of passengers - banks, hotels, stores.

From the world practice of construction, it follows that under the definition of "passenger terminal" are suitable as complexes that combine stations of international and intercity transport, and complexes that include only stations of urban passenger transport, parking lots and social and business functions. After all, all these buildings have common features - the intersection of platforms in several levels, the connection of all functions in one volume, the presence of additional objects that are not related or related indirectly to the service of passengers. In connection with the variety of objects erected to study the features of functional-planning, volumetric-spatial and urban planning parameters of passenger terminals were typologized.

Typology of passenger terminals. As a result of analysis of foreign and domestic experience in design and construction of passenger terminals, the following criteria for their typologization were identified:

- 1) interaction of different modes of transport;
- 2) town-planning placement;
- 3) location of functional zones.

According to the interaction of different modes of transport, terminals are divided into urban, long-distance and international (the interaction here refers to the transfer of passengers, transfer of cargo, information exchange). City terminals are the interaction of some types of urban passenger transport with others, long-distance - urban and intercity, international - long-distance and international modes of transport.

According to the urban location of passenger terminals are divided into those built in the city and beyond the city limits. Terminals located within the city limits, are created primarily in the main transport hubs of the city - on the basis of existing or projected metro stations, reconstructed railway or combined stations. Outside the city terminals are being built, combining air terminals and high-speed rail stations.

By location of functional zones passenger terminals are divided into terminals with vertical or horizontal location of functional zones. Vertical location is a necessary factor in the construction of terminals within the city, as it allows you to achieve significant savings in territory, as well as reduce the distances that passengers have to travel when transferring from one mode of transport to another. Horizontal location of functional zones is inherent in the terminals, created on the basis of existing airports and located outside the city.

Taking into account the above criteria, three types of terminals were identified among the studied architectural objects.

The first type - passenger terminals that carry out transfers of passengers from one type of urban passenger transport to another. As a rule, they are located in the main transport hubs of the city on the basis of subway stations and have a multi-level construction with vertical placement of functional zones.

The second type - passenger terminals that carry out transfers of passengers from urban to intercity and international directions. They most often arise within the city limits on the basis of reconstructed stations and have a vertical arrangement of functional zones.

The third type - passenger terminals that carry out transfers of passengers of international and intercity directions, located outside the city and have a predominantly horizontal location of functional zones.

Each of the levels of coordination of the interaction of different modes of transport corresponds to its own type of passenger terminal. The first type of terminals performs the interaction of transport at the level of cities, the second - at the level of regions, the third - at the level of the country. Thus, passenger terminals coordinate the system of transport corridors and provide interaction between different modes of transport at all territorial levels - urban, regional and international.

Cargo terminal is a complex of structures, technological and technical devices, which are designed to perform all kinds of logistics operations. Cargo terminals carry out loading and unloading operations, sorting and storage of goods, commercial and information service to all participants in the transportation process.

Cargo terminal accepts for shipment, executes, processes and loads cargo and mail on board. Equipped with a heated indoor warehouse, means of delivery and mechanized loading and unloading, cargo handling means "in bulk" and in containers.

TLC structure.

The main TLC divisions are:

- warehouses specially equipped for loading/unloading/stacking of goods;
- a fleet of electric or forklift trucks for transportation of containers, in some cases a fleet of cranes used for unloading of ships;
- an administrative building with ancillary and auxiliary premises;
- open areas for storage of containers with cargoes;

- a railway station for supplying wagons to unloading and container yards or access roads;
- customs post (in case of import and export operations);
- communication, security, cargo transportation services, etc.

An airport hub is a point of destination where a certain number of passengers go to make an intermediary stop there and, having changed the aircraft (Aircraft) to another one of the same airline or airline alliance, continue their flight to the final destination, as the initial point of their departure is not connected with the direct flight to the destination point. Hub airports offer a better level of service, more choice of destinations and more frequent flights than airports that provide only point-to-point transportation.

For the state, a hub is beneficial, because:

- allows to increase the gross domestic product (GDP), create new jobs, attract foreign direct investments to the region;
- links small municipalities with remote and global markets;
- allows for services related to the needs of the local market (e.g., serving destinations that are attractive to the region's residents).

Passengers benefit from the hub:

- more direct flights;
- more opportunities to return on a return flight on the same day;
- more choice of destinations.

The responsibilities of air hubs include:

- provision of appropriate services to passengers, domestic and foreign airlines
- regulation of aircraft traffic in the area related to the territory of the complex
- compliance with aviation safety requirements
- construction and maintenance of facilities necessary for landing, take-off and other operations

- environmental protection in the entrusted territories - such facilities, first of all, are sources of heavy noise pollution

- implementation of rescue and salvage operations if necessary.

Airports are distinguished mainly by their served destinations, frequency of use, volume and nature of transportation. This division is necessary for proper design, operation of the air complex, its infrastructure and selection of a suitable airfield.

Classification by air traffic volume includes 5 separate types:

- for the first it is 7 to 10 million passengers pass through class I air harbors during the year

- for II it's 4-7 million.

- Class III nodes pass through 2-4 million travelers

- IV - from 500 thousand to 2 million

- in V those whose passenger turnover fits into the range of 100-500 thousand are included

Aerodrome - land or water area with air space, structures and equipment that provide take-off, landing, taxiing, accommodation and maintenance of aircraft, helicopters and gliders.

The aerodrome consists of a flight field and an air traffic control complex, which includes a command and control center; it is equipped with one or more runways (runways).

Aerodrome - land or water area with air space, structures and equipment providing take-off, landing, taxiing, accommodation and maintenance of aircraft, helicopters and gliders.

The aerodrome consists of the PL and the ATC complex.

ATC - a system of organizational and technical measures to ensure the order and safety of aircraft flights in the airspace and information exchange between air

traffic controllers and aircraft crews using radio communications, air navigation and computer.

LP includes:

- 1) Flight Runway - a runway with adjoining side and end safety runways.
- 2) Runningways (RT) connecting the runway with the apron and the ends of the runway with each other.
- 3) Apron - a place for aircraft parking and loading and unloading operations with them.
- 4) Parking places (MS) and aircraft service places. Sometimes apron and parking places are combined, in this case it is also called apron.
- 5) Fuel and lubricants warehouse.
- 6) AC (designed to maintain runway, RD and apron in a condition suitable for operation).
- 7) FTA.
- 8) Auxiliary services (security, etc.).

Table 1.1

Airport's logistics infrastructure

Airport's logistics infrastructure					
Cargo handling	Movement	Transportation	Another auxiliary operations	Communication	Warehousing
picking zones (picking up), packaging, packing equipment, marking means, etc.	elevators, elevators, carts, roller pallets, electric forklifts, other handling equipment	loading (unloading) zones, container yards, trucks, roads, etc.	offices, workplaces, auxiliary zones, zones for performing financial operations, customs clearance zones and others	office equipment, communication tools, software for cargo flow organization and management, coding tools, etc.	warehouses, racks for imported (export cargo), cold stores, special storage areas, customs cargo warehouses and other distribution warehouses

1.2. Recommendations of IATA and ICAO about airport's infrastructure development

International Civil Aviation Organization (ICAO - International Civil Aviation Organization) is a specialized UN agency that establishes international standards for civil aviation and coordinates its development in order to improve safety and efficiency. International Air Transport Association (IATA) is an independent organization and should not be confused with ICAO.

ICAO is funded by the national governments of the 193 signatory states of the Chicago Convention (1944) and operates under their authority, supporting their diplomatic efforts and cooperation between them in the field of air transport.

Its main task is to provide administrative and expert support (ICAO Secretariat) for such diplomatic cooperation, and to develop new guidelines and standards in the field of air transport in accordance with government directives and decisions approved by the ICAO Assembly or elected by the ICAO Council.

The main objectives of ICAO, in accordance with the Chicago Convention, are issues of global importance to international civil aviation:

- development of principles and methods of international air navigation;
- contributing to the planning and development of international air transport in order to ensure safe and orderly development of international civil aviation;
- promoting the art of aircraft design and operation for peaceful purposes;
- promoting the development of air routes, airfields and air navigation facilities for international GA;
- meeting the need of the peoples of the world for safe, regular, efficient and economical air transport;
- prevent economic losses caused by unreasonable competition;
- ensuring full respect for the rights of states and fair opportunities for each of them to use airlines engaged in international air traffic;
- avoidance of discrimination in relations between states;

- ensuring the safety of flights in international air navigation;
- providing assistance to the development of international civil aeronautics in all its aspects.

The financing of modernization of airport infrastructure around the world is done differently. In the U.S., and more recently in Canada and Australia, the use for financing the capital upgrade of long-term debt instruments in the form of bonds.

Short-term debt instruments are often used to cover periods of high interest rates or at some stage of construction when there is a risk of an increase in interest costs is compensated by investing the principal amount of the debt liability. Airports with large construction programs often keep a certain share of their debt portfolio in the short term of debt obligations, thus balancing the risk of interest rate increase. In other parts of the world

To finance their development, airports use bank loans or other mechanisms government-supported funding. With the prospect of an increase in the number of airports going through the Gulf of Mexico ways of acquiring partial or full financial independence, long-term and short-term debt financing is increasingly seen as an attractive alternative. Undoubtedly, the terms debt bond issues must be realizable, and the cost of each bond issue will also be in each case to determine whether the debt is more favourable in comparison with other forms of liability finance.

The most important tasks of IATA in the beginning of its activity were technical and safety issues, which were of fundamental importance for airlines. It was necessary to implement the highest standards in air navigation, airport infrastructure and flight operations.

IATA assumes a leadership role in influencing airport operations, airspace planning and project development around the world to meet the safety, efficiency and functionality requirements of air transport.

IATA seeks to establish and support a global plan to address high-level strategic issues, long-term and short-term strategies, and coherent regional development.

IATA works globally with ICAO, airlines, other organizations, airports and air navigation equipment suppliers to promote an effective, environmentally responsible approach to improving the environment through proper air traffic management.

Working closely with airlines to develop best practices that will benefit the reduction of noise and aviation emissions.

For IATA, it is important that airport infrastructure planning and development covers safe, functional, capacity balanced and user-friendly airports. Working closely with airlines, airport authorities, regulators and design consultants, IATA aims to ensure that airport development strategies result in accessible, flexible facilities that support airline operational and customer service requirements now and in the future.

1.3. Airports with the most developed infrastructure (world practice)

Singapore Changi Airport.

Since its opening, Changi Airport has been named the best in one or another category more than 470 times. For 27 years, it has remained the "Best Airport in the World" according to Business Traveller magazine. Five times Changi was awarded the same title from Skytrax, and the last time it happened in 2014.

The total area of the airport is 1,300 hectares, 870 hectares of which were conquered by the sea. The airport has 2 runways, the length of each of them is 4 km. The airport consists of three terminals with a capacity of 66 million passengers per year. There are about 40,000 people working in Changi.

Terminals 1, 2 and 3 are equipped with 92 contact aircraft parking spaces, 19 of which can accommodate double-deck A380 aircraft. Up to 170,000 pieces of luggage pass through the hands of airport employees daily, regardless of the

weather. If desired, passengers can use a free luggage cart - there are 12,000 of them in Changi. There are over 350 stores and 120 restaurants and bars in the airport.



Fig. 1.1. Singapore Changi Airport.

Inside Changi there are even theme parks - Cactus Park in Terminal 1, Magic Garden, Orchid Park and Sunflower Park in Terminal 2, and Butterfly Gallery in Terminal 3. There are more than 550 free Internet kiosks at the terminals, and the whole area of Changi is covered with free Wi-Fi network. There are 880 electrical outlets in the terminals for passengers who want to charge their gadgets while waiting for the flight. On the unique roof of the main building of Terminal 3 there are 919 glazed openings that let in the sunlight. In this case, in the heat of the room does not become stuffy. In Terminal 3 there is a vertical garden - a green wall 300 meters long and 15 meters high.

In the departure hall of Terminal 1 there is a unique installation "Kinetic Rain", from which it is simply impossible to take your eyes away: 1216 bronze drops, moving, smoothly transformed into 16 different figures and patterns, including an airplane, balloon and even a kite! The installation is designed

specifically for Changi, and you will not see anything like this at any other airport in the world. In addition to "Kinetic Rain", on the territory of the Singapore airport, you can see many works of art. Carefully selected installations will help you relax and distract from the fatigue associated with a long flight. In addition, they decorate the rooms and play an important role in interior design, bringing a sense of peace and coziness to it.

The volume of cargo received and shipped by the airport in 2014 reached 1.84 million tons. Every week Changi receives and sends more than 6600 flights, or one plane every 90 seconds. Changi Airport is directly or indirectly linked to 300 cities around the world. Changi serves over 100 airlines, including 5 Singapore Airlines, SilkAir, Scoot, Tigerair and Jetstar Asia.

2. Adolfo Suárez Madrid–Barajas Airport.

Madrid-Barajas Airport (Aeropuerto de Madrid-Barajas) is the main



international airport of the Spanish capital, built back in 1928. At present, Madrid Barajas is the largest airport in the country. It is located 12 km northeast of the center of Madrid and includes four terminals.

Fig. 1.2. Adolfo Suárez Madrid–Barajas Airport.

Madrid Airport consists of five passenger terminals: T1, T2, T3, T4 and T4S, and a private aviation terminal. 1 Serves international flights to any destination. 2 Mainly used for flights to Schengen countries. 3 Operates only for flights acceptance, check-in at the terminal is closed. 4 The largest airport terminal, one of the largest terminals in the world. It serves as a base for Iberia and its Oneworld alliance partners. 4S Is a satellite of the T4 terminal, located just 2.5 km from it. It serves international flights. Executive is designed for private aviation. The free bus running between the terminals is painted in green, the light panel shows the directions: T1, T2, T3 and T4. The route connects the airport terminals with each other, as well as with a long parking lot. Communication between the terminals T4 and T4S is carried out by an underground automatic electric train.

3. Princess Juliana International airport.

The Caribbean island of St. Maarten (or St. Maarten) is divided into two approximately equal parts between France and the Netherlands. The airport of Princess Juliana and the adjacent beach of Maho are on the Dutch side.



Fig. 1.3. Princess Juliana International airport

Princess Juliana International Airport is located on the Dutch part of St. Maarten Island (Caribbean). Its runway adjoins the famous beach of Maho. Planes, entering the landing, fly almost over the heads of tourists. This particular feature is the "chip" of the airport, and the beach has become a favorite place for spotters from around the world - lovers of photography and watching the planes. Recently, among spotters and tourists have become popular "selfies" against the background of a flying plane. It should be noted that by agreement between France and the Netherlands, the airport also serves the French part of the island.

The airport has a single runway numbered 10/28, measuring 2,300 m x 45 m.

The passenger terminal consists from:

- area - 10400 m².
- 36 check-in windows.
- 8 immigration terminals.

Throughput capacity of 1.5 million passengers per year. Designed to handle some 2.5 million passengers annually, the new four-story terminal building offered 30,500 square meters of floor space and was fully air-conditioned. Available facilities included 46 check-in desks, 10 transit desks and 13 boarding gates. There were 20 immigration booths for arriving passengers and five exit-control booths for departing passengers. The building also featured 40 shops and food & beverage units.

The cargo terminal consists from:

- area - 10287 m².

Capacity 5 tons/m² per year.

Main apron measures 72,500 square meters with another 5,000 square meters on Eastern apron. For freight handling a dedicated apron of 7,000 square meters is available.

1.4. Method of forecast development and transportation in region

Prediction is a prediction of the trajectory of future development of the internal and external environment of enterprises for a relatively long period, based on scientific methods and intuition of specialists.

It differs significantly from planning, which is a purposeful decision-making on the expected development of production for a relatively short period of time (usually up to 1 year). Prediction and planning are sometimes distinguished as prediction and forecasting respectively. Prediction is an important part of market research.

In the last decade, the problem of forecasting demand for cargo transportation due to rapid and difficult to predict changes in the external environment has become particularly difficult. As a result, even the current transportation plans have become known as plans-predictions, i.e. practically planning has been carried out through forecasting. Due to increasing competition and instability in the development of the country's economy, long-term forecasting in the industry is very limited. Meanwhile, the need in forecasts of demand for transportation for railroad transport, as a very funding intensive industry with long payback period, is very high.

The demand for passenger and freight transport and logistics services is affected by many factors, which are taken into account in the appropriate forecasting models. An economy that reflects the gross domestic product (GDP) or total value added of a country, as well as the gross product or value added of a region, affects the total derivative demand.

The economic crisis has obviously had a major impact on the volume of international cargo transportation services, as well as the demand for transport goods and services, especially in the maritime and aviation sectors. Economic structure, in terms of resources, goods, and services, such as product specialization, as well as culture, trade and tourism. services, affect the level of demand for transport services and the share of vehicles. Supply or upgrade of higher quality

transport infrastructure and services. (higher frequencies, greater seating capacity, higher speed, greater safety and comfort) as well as supporting infrastructure (e.g. intelligent transport systems or ITS) may lead to forced demand. Extending the use of existing transport infrastructure (for example, by taking measures to reduce congestion) can improve service levels in terms of speed, reliability and safety, reduce operating costs and increase demand for transport.

Transport demand forecasting models can usually be categorized according to the stages of traditional four-stage transport planning.

The steps include:

- (a) trip generation,
 - (b) trip distribution,
 - (c) division into modal parts (or mode selection)
- traffic distribution

2. *ANALYTICAL PART*

Air Transportation Management Department				NAU 20.08.69. 200 EN				
Done by:	Pavliukova V.V.			ANALYTICAL PART	Letter	Sheet	Sheets	
Supervisor	Ivannikova V.Yu.					D	36	34
Standards Inspector	Shevchenko Yu.V.				FML 8.07010102 510			
Head of the Department	Shevchuk D.O.							

2.1. General information about Boryspil international airport

Boryspil International Airport is the biggest and the most powerful in Ukraine. It provides more than 68% of air passenger traffic in Ukraine, annually serves for more than 10 million passengers. Logo of “Boryspil” International Airport in fig. 2.1.

Boryspil is located at the intersection of many air routes that connect Asia with Europe and USA. More than 40 national and foreign airlines carry passengers and cargo from Boryspil along 80 regular routes around the world.



Fig. 2.1. Logo of “Boryspil” International Airport

The history of Boryspil airport development dates back to May 1959, when the Council of Ministers of the USSR adopted a resolution on the establishment of a civilian air fleet at Kyiv (Central) on the basis of the Boryspil military airfield and obliged to provide it with modern aircraft, ground equipment and radio equipment. . On July 7, 1959, the crew of the Moscow Civil Aviation Administration made the first flight on the Tu-104 on the route Moscow-Kiev-Moscow. There were 100 passengers and 1.6 tons of cargo on board. As this flight was considered successful, from July 10 Tu-104 flights become regular. Rapid development of Boryspil Airport is underway, financing is being conducted and coordination of the airport is being improved by leading organizational aviation structures, in particular the General Directorate of the Civil Air Fleet.

Boryspil International Airport occupies a territory of 943 hectares. On the territory of the territorial airport there are two goldfinches and more than 200 microfinch, additive and extrasporal bullfinches and disputes. At the moment, Boryspil Airport has its own warehouse with other terminals.

Terminal "A" - transport terminal of the Boryspil International Airport is focused on serving passengers traveling within Ukraine. Most of the flights are operated by "Aerosvit" and "Dniproavia" airlines, also in terminal "A" serve domestic flights of passengers of the International Airlines of Ukraine, "Motor-Sich".

Terminal "B" is the main terminal of the airport, built to serve the majority of air passengers traveling to far and near abroad. Now it is being reconstructed to increase capacity.

Terminal "C" - transport terminal is designed to serve VIP-passengers. It is designed primarily to serve personal aircraft of small aircraft.

Terminal "F" - the new terminal of the Boryspil International Airport is focused on servicing passengers traveling abroad. The official opening of the terminal was held on October 31, 2010. Terminal F serves the passengers of 25 airlines: Ukraine International Airlines (international flights), UM Air, Utair Ukraine, Air Valtic, Armavia, Adria Airways, Belavia, Caspian Airlines, Austrian Airlines (Austria), Georgian Airways, Germanwings, Libyan Arab airlines (Libya), Lufthansa (Germany), Finnair (Finland).

Cargo terminal is a transport terminal of the airport of destination for servicing air cargo transportation. It has a parking lot for 17 airplanes.

The airport has two runways and two passenger terminals. The technical capabilities of airfield of Boryspil Airport remain unique for Ukraine, the CIS countries and Eastern Europe. The runway, 4000 m long and 60 m wide, allows to receive aircraft of all types around the clock, including in conditions of limited visibility. Boryspil is the only airport in Ukraine from which transcontinental flights operate. The airport is a member of the International Air Transport Association

(IATA), the International Civil Aviation Organization (ICAO) and the Airports Council International (ICI Europe).

Opened in 2012, the most powerful in Ukraine passenger terminal "D" is a logical development of the airport infrastructure, which takes it to a fundamentally new level of quality and quantity of air travel.

The list of airlines operate at airport Boryspil includes Ukraine International Airlines (Ukraine), Windrose Airlines (Ukraine), Azurair (Ukraine), Aigle Azur (France), Turkish Airlines (Turkey), Flydubai (UAE), British Airways (United Kingdom), KLM (The Netherlands), Air France (France), Lufthansa (Germany), Alitalia (Italy), Austrian Airlines AG (Austria), Czech Airlines (Czech Republic), LOT Polish Airlines (Poland), YanAir (Ukraine), Swiss International Airlines AG (Switzerland), Brussels Airlines (Belgium), Ryanair (Ireland), Laudamotion (Austria), EL AL Israel Airlines (Israel), Qatar Airways (Qatar), Belavia (Belarus), Air Baltic (Latvia), Air Arabia (UAE), Iraqi Airways (Iraq), Georgian Airways (Georgia), Azerbaijan Airlines (Azerbaijan), SkyUp (Ukraine), Atlas Global (Ukraine), Aircompany Jonica LLC (Ukraine), Dream Wind Airlines (Ukraine), Ellinair S.A. (Greece), Aegean Airlines (Greece), Air Malta (Malta).

Airport "Boryspil" until 1990 had the best performance among the airports of Ukraine. The crisis that was caused by the collapse of the Soviet Union, could not affect the activities of the airport. However, the company does not close, and begins to look for investors. The Cabinet of Ministers of Ukraine issued a decree, which had historical significance, on the reconstruction of the Boryspil airport. The decree stipulated that 60% of the funds would be raised from investing firms. This gave a new impetus to the development of the enterprise: on March 11, 1993, the Boryspil airport received the status of the State International Airport.

In 1995, Terminal C was opened to serve VIP passengers. In 1998, Dr. Assad Kotaite, President of the Council of ICAO (International Civil Aviation Organization), officially confirmed the status of the airport's training center as the ICAO Aviation Security Training Center (today, this Airport is one of 21 such centers in the world).

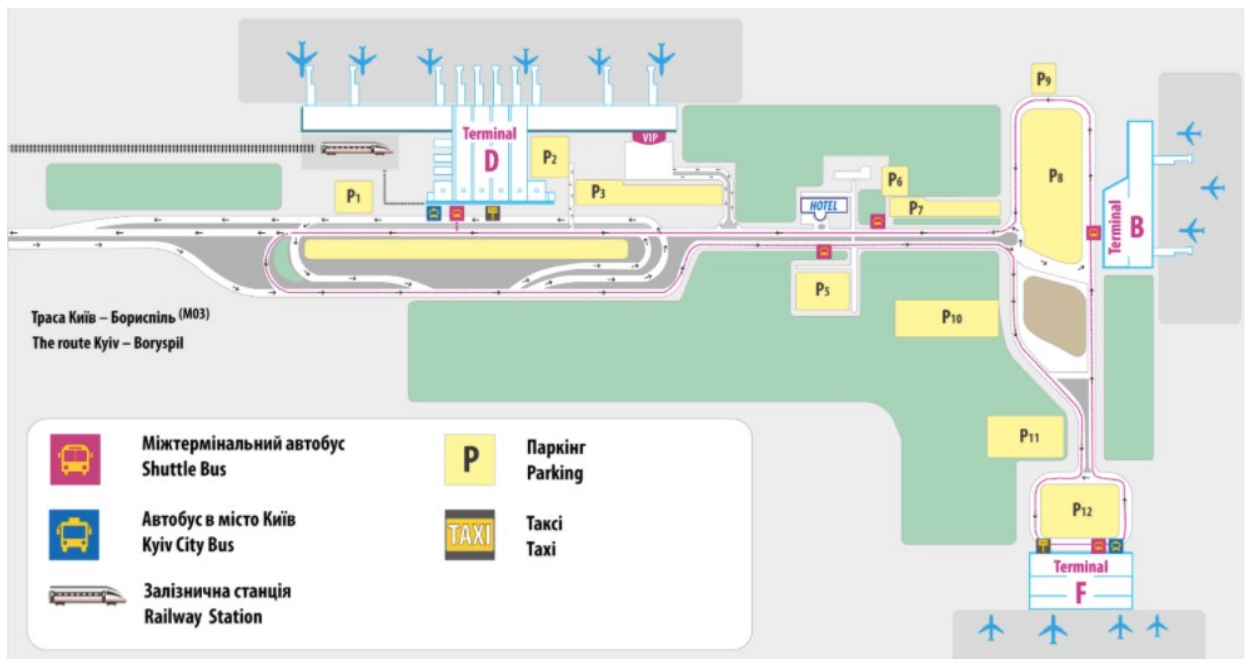


Fig. 2.2. Map of location the main area of Boryspil airport

September 21, 2010, the new terminal “F” was opened, the capacity of which is 900 pass per hour. on departure and 900 on arrival. The development of the enterprise does not stop there. On May 28, 2012, Ukraine’s largest passenger terminal “D” opens, with a carrying capacity of 3,000 passengers per departure and 3,000 per arrival.

Implementation of the "hub" strategy for the development of the airport, from 2015, the attraction of new air carriers, improving the level of service provides a steady increase in passenger transportation. In 2017, the airport served a record number of passengers in the history of its existence.

2.2. Infrastructure of Boryspil international airport

The cargo terminal of the Boryspil International airport is the largest and most equipped aviation cargo terminal in Ukraine. Production facilities are located on the territory of the Boryspil International Airport, which allows us to offer a wide

geography of traffic. The annual turnover is more than 25 thousand tons of cargo and 4.5 thousand tons of mail. In the beginning of 2019 the director of Boryspil (fig. 2.3).

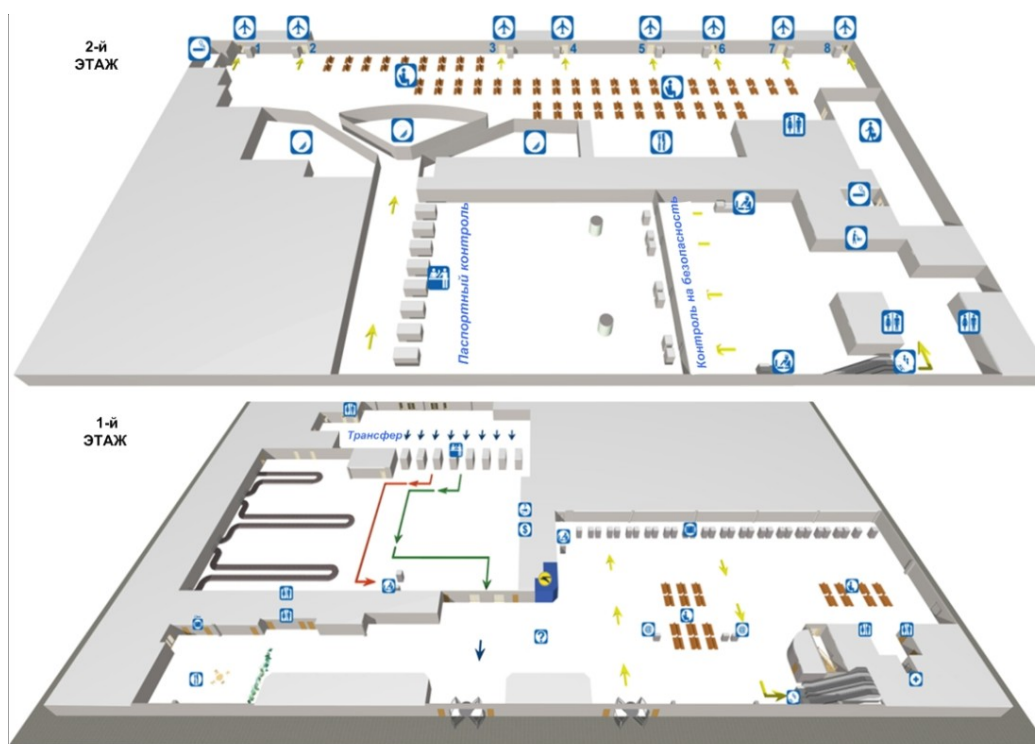


Fig. 2.3. The scheme of the terminal F of Boryspil International Airport.

International airport made a statement that the cargo traffic has increased in several times and handles approximately 70-100 tons of cargo per day (taking into account that fact, that the capacity of cargo terminal is 40 tons). This is why the director proclaimed about enhancement of the cargo terminal and now he is working on the project for new warehouse with the square of 7 thousand m², instead of 5 of warehouses.

Other facilities located on the Cargo terminal territory:

- Kyiv Customs authorities (Boryspil Airport Customs Station);
- Sanitary and Quarantine station of Sanitary and Epidemiological Service;
- Plants quarantine station;

- Veterinary station of State Veterinary Control Department;
- Representative offices (GAs) of the carriers and shipping agencies.

2.3. Airport financial analysis

Dynamics of incomes of Boryspil International Airport for 2015-2019, thousand UAH is presented in fig. 2.4.

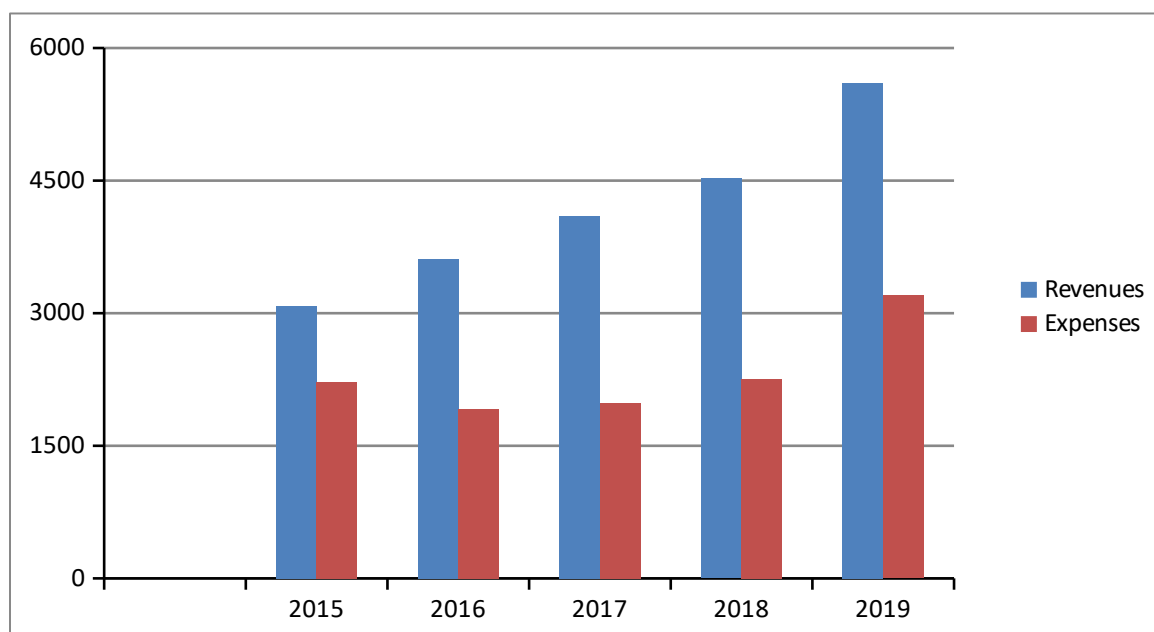


Fig. 2.4. Dynamics of incomes of Boryspil International Airport for 2015-2019, thousand UAH

The Order of the Ministry of Infrastructure of Ukraine from July 28, 2015 No 289 approved the Strategic Development Plan of the state enterprise "International Airport "Boryspil" for 2015-2019".

It should be noted that the production and financial performance indicators of the State Enterprise Boryspil International Airport significantly higher than planned, which are provided by the Strategic Development Plan of the State Enterprise Boryspil International Airport for the years 2015-2019, namely:

- passenger traffic in 2015 was 7 277.1 thousand people, which is 733.1 thousand more than expected (111.2% growth), in 2016 - 8 645 thousand people, which is 1 545 thousand people more (121.8% growth);

- net profit in 2015 amounted to 2 515.9 million UAH, which is by 218.9 million UAH more than it was planned (growth by 109.5%), in 2016 - 3 352.8 million UAH, which is by 825.8 million UAH more (growth by 132.7%), while the increase of UAH against USD in 2015 amounted to 152. 2% (from 15.7686 UAH per 1 US dollar as of 01.01.2015 to 24 UAH per 1 US dollar as of 31.12.2015, in 2016).

- 113.3% (from 24 UAH per 1 USD as of December 31, 2015 to 27,1909 UAH per 1 USD as of December 31, 2014);

- net profit in 2015 amounted to UAH 696.5 million, which is UAH 529.5 million more than planned (increase by 317%) in 2016. - 1 385,9 mln. hrn.

According to the results of 2018, profit before tax of the Boryspil International Airport amounted to 2.3 billion USD, which means that the airport's profit increased by 8.7% compared to 2017.

A small difference between the planned and actual indicators shows stable and predictable growth dynamics, which allows planning infrastructure development, income and expenses.

In addition, it is reported that the gradual annual growth of all categories of passengers, including transit passengers, indicates the success of the hub model of the airport, as the number of transit passengers in 2018 increased by 16.8%.

According to the financial plan for 2018, the airport has planned a passenger flow of 12.5 million people. At the end of the year, passenger traffic amounted to 12 603 000 passengers.

According to the above, in 2014 State Enterprise Boryspil International Airport did not receive any profit from its activities (net loss amounted to 126 818 thousand UAH), while in other periods there was a tendency to significantly increase net profit.

It should be noted that according to results of activity of State Enterprise Boryspil International Airport in 2014, in particular, increase of other expenses in the amount of UAH 488 954 thousand in comparison with 2013, decrease of other operating expenses by UAH 72 094 thousand, decrease of other financial income in the amount of UAH 25,713 thousand and other income - UAH 44 354 thousand.

2.4. SWOT-analysis of Boryspil international airport

The most important stage in the development of an effective strategy of the enterprise is a strategic analysis, which should provide a real assessment of its own resources and capabilities in relation to the state (and needs) of the external environment in which the enterprise operates. Based on this analysis, there should be a rational choice of strategies with a possible variety of options.

SWOT is a comprehensive analysis of internal strengths and weaknesses as well as external threats and opportunities. The result of this comprehensive analysis is the development of a general strategy for the behavior of the enterprise.

At the first stage of the research it is necessary to enumerate internal and external factors. Internal factors (IF - internal factors) in this case are those factors of State Enterprise Boryspil International Airport activity, which can be directly influenced by quiet or other instruments of influence (regulation, changes in regulatory legislation, etc.).

In this case, the strengths (S - strengths) are those that contribute to the integrated development of Boryspil International Airport, improve the competitive position of the airport in relation to external threats.

Let us define the strengths of the Boryspil International Airport.

1. Favorable geographical location.
2. High culture of service.
3. Coordinated work of departments.

4. Positive image of the airport among clients and partners.
5. Equipped with modern equipment.
6. Continuously expanding range of high quality services.
7. High level of security.
8. Leading position in the air transport market.
9. The airport's compliance with international standards.
10. Introduction of advanced airport technologies.
11. State support.
12. Availability of educational institutions for training aviation industry specialists.
13. The growth of the country's GDP (for the first quarter of 2008. As compared to the corresponding period of the previous year, the real GDP grew by 6.0%, and the greatest growth of gross value added was observed, including in transport activity - by 8.7%).
14. Start of the processes of modernization and expansion of the airport infrastructure capacity (including the construction of terminals, hangars, runways).

The weak sides (W - weaknesses) - those that lead to the suspension of the pace of development and deterioration of the general condition of the Boryspil International Airport.

Let's define the internal weaknesses (weaknesses) of the Boryspil International Airport.

1. High costs of implementing advanced airport technologies.
2. Low salary level.
3. High prices for services.
4. Lack of financing for the construction of airport facilities.
5. Lack of proper state support.
6. High airport, air navigation fees.
7. High prices for materials (for example, fuel).
8. Inadequate condition of the airport's material and technical base. The State Target Program for Development of Airports for the period up to 2020 states that as

a result of lack of investment, the state of the material and technical base of airports, including airfield buildings and structures, runways, passenger terminal complexes, available equipment, etc., does not allow to provide the growing in the future volumes of passenger and cargo transportation, ground handling of aircraft in compliance with flight safety and aviation security requirements. Further delay with attraction of investments into construction and reconstruction of the airport infrastructure will lead to deterioration of the situation and threaten national security of Ukraine and its establishment as a transit country.

9. Lack of appropriate number of simulators for crew training.

10. Lack of clear leasing mechanisms.

External factors (EF - external) are those that Ukraine has no right to influence directly.

Positive environmental factors, opportunities (O - opportunities) - are those that contribute to the strengthening and stable development of Boryspil International Airport.

Let's define the external opportunities (opportunities) of Boryspil International Airport.

1. Transformation of Boryspil International Airport into an international transit hub airport with transcontinental value.

2. Possibility to attract investors to the airport facilities construction.

3. Expansion of economic and partnership relations.

4. Growth of air transportation market and directions.

5. Growing demand for quality air services.

6. Increase in SE profits for replenishment of own working capital.

7. Expansion of range and quality of services for passengers.

8. Interest of the European side in modernization and expansion of capacity of Ukrainian airports.

9. Improvement of conditions for integration into European structures and implementation of European safety and environmental protection standards.

Negative environmental factors, threats (T - threats) are those that can create a threat to the instability of Boryspil Airport, to the economic security of the country and its national interests.

Define external threats at Boryspil Airport.

1. Terrorist acts.
2. Decrease in profits of state enterprises to replenish their working capital.
3. Threat of reduced demand for air transportation.
4. Sharp increase in prices for materials (e.g., fuel).
5. Growing demands on safety and passenger service from the state.
6. Intensification of competition.
7. Entry of European low-cost carriers into Ukrainian market.
8. Costs of harmonizing the legal field with EU standards.

Identified strengths and weaknesses, opportunities and threats of the Boryspil International Airport are reduced to the primary SWOT-matrix (table 2.1).

At this stage, the results of the first stage - internal and external factors (IF-SW and EF-OT) - are evaluated. For this purpose, two matrices are compiled:

- IFE-matrix ("Internal Factor Evaluation Matrix" - Matrix of internal factors analysis);
- EFE-matrix ("External Factor Evaluation Matrix" - Matrix of analysis of external factors).

Algorithm of internal factor analysis matrix development.

1. Factor - lists all S (strengths) and W (weaknesses) factors.
2. Weight (importance) - evaluates the importance of each factor in relation to the others in terms of achieving the desired effect and results. The estimation is made from 0 for the least important factor to 1.00 for the most important one. The sum of assessments of S and W factors should be 1.

SWOT-matrix of Boryspil international airport

Internal environment of Boryspil International Airport	
S (strengths)	W (weaknesses)
<ul style="list-style-type: none"> - advantageous geographical location. - high service culture. - coordinated work of departments. - positive image of the airport among clients and partners. - modern equipment. - continuously expanding range of high quality services. - high security level. - leading position in the air transport market. - airport's compliance with international standards. - introduction of advanced airport technologies. - state support. - availability of educational institutions for training aviation industry specialists. - country's GDP growth. - beginning of the processes of modernization and expansion of the airport infrastructure capacity. 	<ul style="list-style-type: none"> - high expenses for implementation of advanced airport technologies. - low salary level. - high prices for services. - lack of financing for the construction of airport facilities. - lack of proper state support. - high airport, air navigation fees. - high prices for materials (for example, fuel). - inappropriate condition of the airport material and technical base. - lack of proper number of simulators for crew training. - lack of clear leasing arrangements
External environment of Boryspil International Airport.	
O (opportunities)	T (threats)
<ul style="list-style-type: none"> - transformation of Boryspil International Airport into an international transit hub airport of transcontinental significance. - possibility to attract investors to the airport facilities construction. - expansion of economic and partnership relations. - growth of the market and air transportation directions. - growing demand for quality air services. - Increase in profit of state enterprises to replenish their own working capital. - expanding the range and improving the quality of services for passengers. - interest of European side in modernization and expansion of capacity of Ukrainian airports. - better conditions for integration into European structures and - implementation of European safety and environmental protection standards. 	<ul style="list-style-type: none"> - terrorist acts. - decrease in profit of state enterprises to replenish their own working capital. - threat of reduced demand for air transportation. - sharp increase in prices for materials (for example, fuel). - growing demands on safety and passenger service from the state. - intensification of competition. - entering the Ukrainian market of European low-cost carriers. - costs for harmonization of the legal field with EU standards.

3. Rating - the importance of each factor for a given situation is assessed. The evaluation is carried out according to the following system: 1 - "significant weakness", 2 - "minor weakness" - for W factors, 3 - "minor strength", 4 - "significant strength" - for S factors.

4. Weighted Score - the values of the previous two columns are multiplied. The sum of weighted estimates of all S and W factors will be a weighted average factor

for the assessment of the internal environment of Boryspil International Airport ("Total Weighted IF Score" or TW IFS).

Table 2.2

Criteria for making SWOT analysis of airport

Factors	S (strengths)	W (weight)	Rating	Weighted score
S1	Favorable geographical location	0,1	4	0,4
S2	High service culture	0,03	3	0,09
S3.	Coordinated work of divisions	0,06	4	0,24
S4.	Positive image of the airport among customers and partners	0,05	4	0,2
S5.	Equipped with modern equipment	0,05	3	0,15
S6.	The range of high-quality services that is constantly expanding	0,01	3	0,03
S7.	High level of security	0,05	3	0,15
S8.	Leading position in the air transportation market	0,02	3	0,06
S9.	Compliance of the airport with international standards	0,01	3	0,03
S10.	Introduction of advanced airport technologies	0,01	4	0,04
S11.	State support	0,03	4	0,12
S12.	Availability of educational institutions for the training of aviation specialists	0,02	4	0,08
S13.	Stable growth of the country's GDP	0,1	3	0,3
S14.	Initiation of processes of modernization and expansion of airport infrastructure capacity	0,05	4	0,2
Factor	W (Weaknesses)	Weight	Rating	Weighted Score
W1.	High costs for the introduction of advanced airport technologies	0,04	1	0,04
W2.	Low wages	0,08	1	0,08
W3.	High prices of services provided	0,07	1	0,07
W4.	Insufficient funding for the construction of airport facilities	0,07	2	0,14
W5.	Lack of proper state support	0,05	2	0,1
W6.	High airport, air navigation fees	0,01	2	0,02
W7.	High prices for materials (eg fuel)	0,05	1	0,05

Algorithm of compiling the matrix of external factors analysis.

Factor - lists all O (opportunities) and T (threats) factors.

Weight (importance) - evaluates the importance of each factor in relation to others in terms of achieving the desired effect and results. The assessment ranges from 0.00 for the least important factor to 1.00 for the most important factor. The sum of assessments of B and T factors should be 1.

Rating - the degree of adequacy of the reaction or "response" of Boryspil International Airport to each factor in a given situation is assessed. The evaluation is carried out according to the following system: 1 - "no reaction or it is very weak / inadequate", 2 - "reaction rather weak / inadequate", 3 - "reaction rather strong / effective", 4 - "reaction extremely strong / very effective".

Weighted Score - the previous two columns are multiplied. The sum of weighted estimations of all O and T factors will be a weighted average factor of the external environment assessment of Boryspil International Airport ("Total Weighted EF Score" or TW EFS).

The difference in filling the Rating columns of these matrices of analysis of external and internal factors is that in the latter it is necessary to determine exactly the reaction of the system to this or that external factor, rather than how positive or negative it is in itself.

Normal average values of the final TW IFS and TW EFS are considered to be from 2.00 to 2.99. Values above 3.00 indicate a high overall score, below 2.00 - an underestimated overall score.

In the calculated embodiment, the values of the final TW IFS and TW EFS are equal to 2.65 and 2.08, respectively, which determines the normal result.

The third stage.

At this stage, the position of the calculated variant of the final TW IFS and TW EFS values according to the cell of the combined matrix "IE Matrix" (Matrix of combined analysis of internal and external factors), which is the basis for determining the strategy.

Matrix of analysis of external factors

Factor	O (opportunities)	Weight	Rating	Weighted score
O1	Transformation of Boryspil International Airport into an international transit hub airport with transcontinental significance	0,09	2	0,18
O2	Opportunity to attract investors to the construction of airport facilities	0,1	3	0,3
O3	Expansion of economic and partnership ties	0,07	3	0,21
O4	Growth of the market and directions of air transportations;	0,04	3	0,12
O5	Growing demand for quality air transportation	0,08	4	0,32
O6	Increasing the profits of state-owned enterprises to replenish their working capital	0,03	2	0,06
O7	Expanding the range and quality of services for passengers	0,02	3	0,06
O8	The interest of the European side in the modernization and expansion of the capacity of Ukrainian airports	0,02	3	6
O9	Improving the conditions for integration into European structures and the implementation of European safety and environmental standards	0,03	2	0,06
Factor	T (threats)	Weight	Rating	Weighted score
T1	Terrorist acts	0,01	2	0,2
T2	Reduction of profits of state-owned enterprises to replenish working capital	0,08	1	0,08
T3	The threat of declining demand for air transportation	0,09	2	0,18
T4	Sharp rise in prices for materials (eg fuel)	0,05	1	0,05
T5	Increasing requirements for safety and passenger service by the state;	0,02	1	0,02
T6	Exacerbation of competition	0,07	1	0,07
T7	Entering the Ukrainian market of European low-cost carriers	0,03	1	0,03
T8	Costs for harmonization of the legal field with EU norms	0,08	1	0,08
Total		1	-	2,08

Table 2.4

Matrix of combined analysis of internal and external factors.

IE Matrix	TW IFS (4.0 - 3.0) Strong	TW IFS (2.99 - 2.0) Middle	TW IFS (1.99 - 1.0) Weak
TW EFS (3.0 - 3.99) High	Stability strategy	Stability strategy	Growth strategy
TW EFS (2.0 - 2.99) Middle	Stability strategy	Growth strategy	Restructive strategy
TW EFS (1.0 - 1.99) Low	Growth strategy	Restructive strategy	Restructive strategy

After that, the strategy is determined in accordance with the three main directions.

Table 2.5

Types and kinds of corporate strategy

Types of strategies	Characteristics	Options for corporate strategies of different types
Stability strategy	Organizations that are satisfied with their previous course of action and want to leave the status quo.	Adherence to the previous course of action
Growth strategy	It can be done in several ways, ie there are different strategic growth options.	Strategies for growth. Expansion strategy: market capture; market development; production development. Diversification strategy (the process of penetration into new areas of activity, not previously characteristic of the enterprise, designed to change, supplement or replace products (services) already issued (provided).
Restructive strategy	Used in cases where the organization leaves certain markets or reorganizes production. There are several options within the restructuring strategy.	Liquidation strategy The strategy of cutting off the excess Reorientation strategy Strategy for creating "strategic coalitions"

Based on the results of the SWOT-analysis, a combined matrix of the "TOWS-matrix" of strategic measures is developed.

When filling in the TOWS-matrix of strategic measures, the most important IF (Internal Factors) factors are consistently compared with the most significant EF (External Factors) factors.

Table 2.6

TOWS-matrix

<p>SO - measures that need to be taken to use the strengths to increase the company's capabilities</p>	<p>ST - measures that use the strengths of the organization to prevent threats</p>
<p>S1-14 O1 - All the strengths of the airport are equally conducive to the transformation of Boryspil International Airport into an international transit hub airport of transcontinental significance. S1, 4 O2 - Favorable geographical location and a positive image of the airport among customers and partners help attract investors to finance the construction of airport facilities. S4 O3, 4 - The positive image of the airport among customers and partners contributes to the further expansion of economic and partnership ties, growth of the market and air transportation. S1-14 O5 - All the strengths of Boryspil International Airport contribute to the increase in demand for quality air transportation. S11 O6 - State support promotes tax loyalty.</p>	<p>S7 T1-High level of security of Boryspil International Airport minimizes the possibility of terrorist acts at the airport or on board the aircraft. S11 T2 - The government does not provide for a reduction in the profits of state-owned enterprises to replenish working capital. S4 T3 - A positive image of the airport among customers and partners reduces the risk of falling demand for air transportation. S6 T4 - The range of high-quality services of the airport, which is constantly expanding, is always in demand, despite the sharp rise in prices for materials (such as fuel). S7 T5 - A high level of safety precludes an increase in state security and passenger service requirements. S8 T3, 6 - Boryspil International Airport holds a leading position in the air transportation market, which reduces the threat of intensification of competition and reduces the demand for quality air transportation.</p>
<p>WO - measures to be taken, overcoming weaknesses and using the opportunities presented</p>	<p>WT - measures that minimize weaknesses to prevent threats</p>

<p>W1 O5 - The growing demand for quality air travel justifies the high cost of implementing advanced airport technologies.</p> <p>W3 O5 - The growing demand for quality air travel justifies the high prices for services provided by the airport.</p> <p>W4 O1, 2 - The possibility of transforming Boryspil International Airport into an international transit hub airport of transcontinental significance and the possibility of attracting investors to invest in the construction of airport facilities improve the situation with construction financing.</p>	<p>W1 T6 - aggravation of competition is impossible due to the fact that Boryspil International Airport has leading technologies.</p> <p>W3 T3,6 - The state of Boryspil International Airport in the air transportation market is constantly analyzed, marketing research of competitors' services similar to the services provided by Boryspil International Airport is conducted. This reduces the risk of declining demand for air travel, and avoids the intensification of competition.</p> <p>W2.4 T5 - Despite the existing threat of growing safety and passenger requirements, the good potential of production facilities allows to build the airport and improve working conditions.</p>
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Taking into account the results obtained with the help of SWOT-analysis and the TOWS matrix (see Table 2.6), it can be noted that for effective operation of Boryspil International Airport needs strategic growth solutions.

Boryspil International Airport State Enterprise has been counting down since 1959, when the decision was made to establish the Boryspil Airport of the Kyiv Civil Air Fleet (Central) on the basis of a military airfield.

The activities of all airports are not only related to passenger service, but also to freight and mail. Boryspil International Airport increases traffic volumes by various flights, regular, non-scheduled and booked. The annual increase in the number of flights has led to an increase in passenger traffic and freight traffic.

As part of Ukraine's strategy to ensure the quality of goods and services to European standards, Boryspil International Airport has been constantly working over the last decade to improve the quality of services and expand production capacity, taking into account the strategic needs of the airport.

Total revenues from airport services consist of aviation and non-aviation activities. At Boryspil Airport, the most powerful revenues are aviation revenues. However, the share of non-aviation revenues in the Ukrainian "air gates" is much smaller than in the leading foreign airports.

Let's consider current cargo terminal of Boryspil international airport.

The total warehouse area is 600 square meters. meters: 300 square meters. meters occupied by warehouse docks for temporary storage of goods that do not require a special storage mode, another 300 square meters. meters designed to handle cargo in the "customs warehouse" [19].

In fig. 2.5 present the general characteristics of the Boryspil cargo terminal.

At the warehouse you can get services for transportation, warehousing and customs clearance of goods, as well as professional advice on all related issues.

The main activities:

- FEA outsourcing

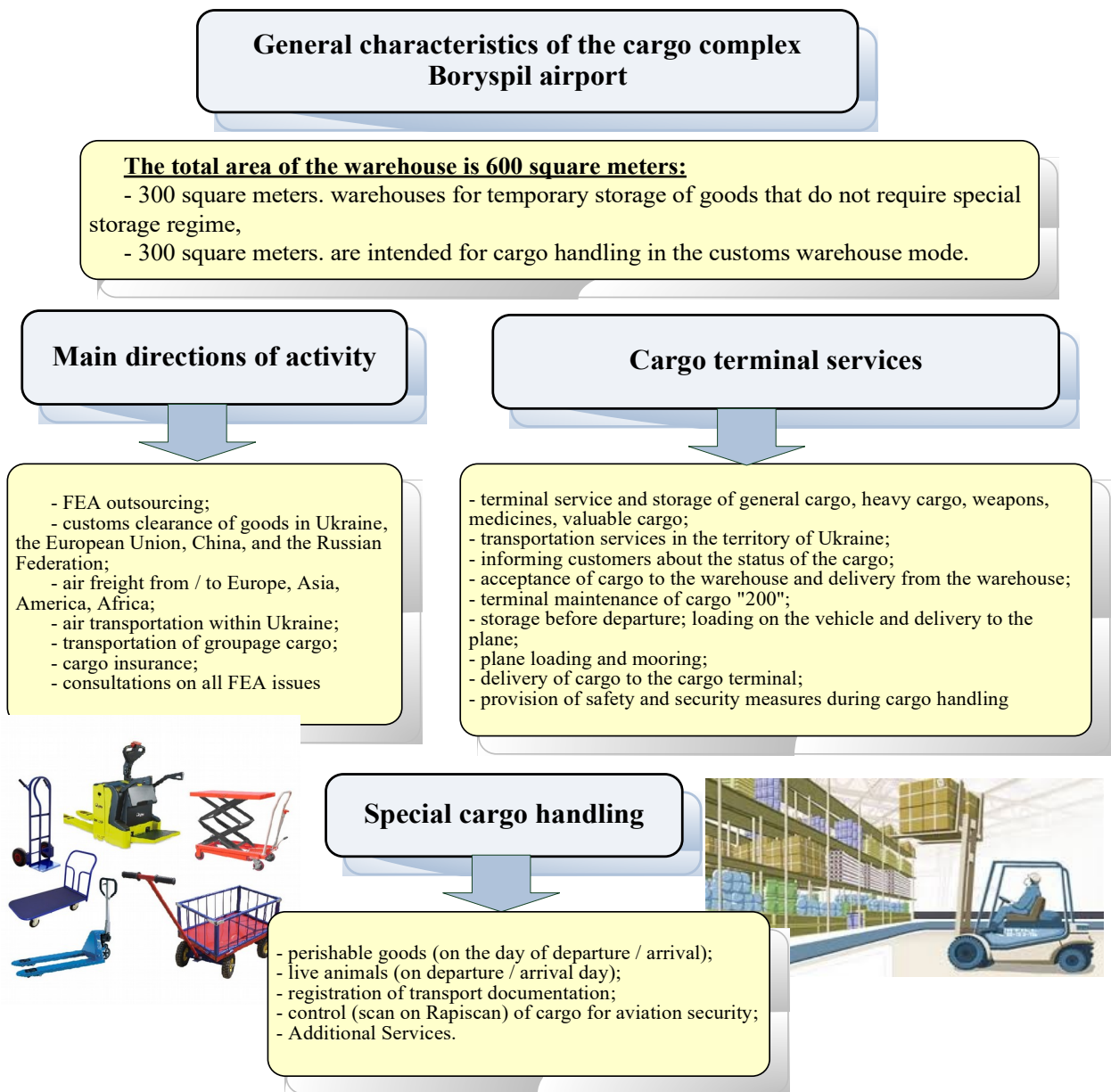


Fig. 2.5. General characteristics of the airport cargo complex

- Customs clearance of goods in Ukraine, the European Union, China and the Russian Federation;
 - Airliner / to countries of Europe, Asia, America, Africa;
 - air transportation within Ukraine;
 - transportation of groupage cargo;
 - cargo insurance;
 - consultations on all issues of foreign trade activities
- Cargo terminal services:

- terminal maintenance and storage of general cargo, heavy cargo, weapons, medicines, valuable goods;
- transport services in Ukraine;
- informing customers about the status of the goods;
- acceptance of goods to the warehouse and delivery from the warehouse;
- terminal cargo service “200”;
- storage before departure; loading onto a vehicle and delivery to an airplane;
- loading into the plane and mooring;
- cargo delivery to the cargo terminal;
- ensuring safety and security measures during cargo handling.

Special Cargo Handling

- perishable goods (on the day of departure / arrival)
- live animals (on the day of departure / arrival)
- execution of shipping documentation;
- control (scanning on Rapiscan) of cargo for aviation security;
- Additional services.

As a result of the study of the situation, we can conclude that the Boryspil should develop a “Niche Strategy” with a focus on the key advantages of the main airport of Ukraine. In addition to this, a new transportation sector may arise, which will develop exclusively within the framework of this new niche in the market.

So, in general, the airport offers a comprehensive service to the enterprise in the implementation of international trade operations for the delivery, customs clearance, storage, legal and financial clearance of goods. However, the weaknesses in the airport’s activities are: limited limits due to the location of the airport in the city (expansion options, environmental aspects, road system), due to the growth of cargo flows - limited cargo terminal capabilities, compared with the main competitors - small market share, small the number of carriers involved, handlers.

3. DESIGN PART

Air Transportation Management Department				NAU 20.08.69. 300 EN			
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3.1. Formation of logistics infrastructure strategy for Boryspil international airport

The conducted studies of the activities of the Boryspil international airport showed in favor of the choice of making a decision “Niche Strategy” with a focus on the key advantages of the main airport of Ukraine. In terms of this strategy, the strategic success factors are determined by the company's current market position, the overall future direction of the airline business and the general principles of strategic management. To determine the strategic location of the airport, the strategic success factors are compared and correlated with the strengths and weaknesses of the airport (management company).

The management company should operate on a revenue and expense center approach. Individual business units will offer and sell their services to external clients, thus generating revenues and profits. For example, terminal and airfield activities, ground handling, refueling, cargo handling, car parking, hotel, retail (drinks and food, restaurant, duty-free, etc.).

Each business unit should be organized as an independent unit and should be managed separately as a profit center based on the electronic processing of cost accounting data and a planning system:

- operation of the airport;
- ground handling;
- refueling;
- parking;
- Non-aviation business;
- Non-aviation.

Airport operations make the largest contribution to the airport’s total revenue as it relates to aircraft landing fees, aircraft maintenance fees, security fees and aircraft parking fees.

Airports usually receive these types of payment for providing their technical capabilities, such as a runway equipped with a lighting system, taxiways, parking lots and certain types of technical services for aircraft maintenance. One of the main success factors for this business unit is the ability to offer a set of several services for all types of aircraft in accordance with international standards. To provide such a service, modern equipment is required. The results of the SWOT analysis are presented in table 3.1.

Table 3.1

SWOT analysis for Boryspil international airport

<i>Strengths</i>	<i>Weak sides</i>
Possibility of 24-hour service, no restrictions on flights; low costs; sufficient capacity / area; availability of slots; good access roads to the airport; good weather conditions; no need for additional investment for ATC equipment (separate company)	difficulties with the throughput of the cargo terminal; the need to modernize equipment at the cargo warehouse; underdeveloped non-aviation / commercial activities in the transport of goods
<i>Opportunities</i>	<i>Threats</i>
optimization of the use of space and land; increasing the terminal capacity; special terminal for the transportation of perishable goods, pharmaceuticals	high level of competition Cancel of flights and increased safety during the global Covid-19 pandemic

The main drivers for generating income from airport operations are:

- increase in traffic volumes;
- tariff policy management;
- regulatory framework;
- development of aircraft technologies;
- airline marketing;
- the composition of the operated aircraft.

vision:

1. Offer an individual set of airport services focused on client needs;

2. Maintain all operational processes and costs in accordance with the airport development strategy.

Strategic goals:

- safe, reliable, efficient and profitable airfield services activities;
- optimization of the use of land and buildings;
- adequate infrastructure (facilities and equipment);
- to a large extent client-oriented services, products and infrastructure;
- sufficient capacity, especially during peak hours, no restrictions on flights;
- minimum time for performing airfield service operations and passing customs, immigration service;
- fast turnaround times for airlines on the ground
- technical capabilities to serve modern aircraft;
- focus on high labor productivity;
- competitive air fares;
- continuous improvement of the relationship between the airport and the airline customers.

Strategic Initiatives:

1. Functionality of aerodrome services and services offered;
2. A simple and understandable information system that allows the passenger to quickly and efficiently navigate;
3. Reducing the waiting time when leaving the aircraft;
4. Development and implementation of incentive schemes for new air carriers, new directions;
5. Competitive pricing policy.
6. Comprehensive airline marketing strategy based on differentiated market segmentation.
7. Separate implementation of work with such key clients:
 - international carriers;
 - airlines operating regular flights;
 - airlines operating charter flights.

The level of service in the provision of aerodrome services and ground handling should be continuously improved in line with international benchmarking performance.

Next, we present a strategy for the development of ground handling, the SWOT analysis of which is reduced to the form of table 3.2. Note that in ground handling we consider ramp service and baggage handling, as well as the monopoly of the management company.

Table 3.2

SWOT analysis of the development of ground handling at the Boryspil airport

<i>Strengths</i>	<i>Weak sides</i>
Providing satisfactory standard / standard ground handling services	Insufficient existing systems and technologies for cargo transportation can negatively affect the professional / efficient provision of ground handling services - delays, dissatisfied customers
<i>Opportunities</i>	<i>Threats</i>
The potential for growth in the number of passengers, cargo Training in the effective provision of ground services to improve quality Interaction with customs and immigration services Competitive prices for airlines	Absence or low growth rates of passenger traffic (due to the global pandemic) The development of freight traffic requires significant investment in upgrading all systems

The main factors in the development of ground handling services at Boryspil are: price; quality; types of airlines / aircraft; the number of passengers in the structure of future rush hours; area optimization; quality and quantity of equipment; quality and quantity of staff.

Offers:

- offer competitive ground handling services consistent with airport development strategies.

Strategic goals:

- ground handling services for all commercial aircraft;

- modern technologies and systems for all aircraft, contribute to the provision of professional / efficient ground handling services - without delays and with satisfied customers;

- safe, reliable, efficient and profitable ground handling activities;
- minimum time for ground handling operations - especially during peak hours;
- quick turnaround time for airlines;
- optimization of land and land use;
- adequate infrastructure (facilities and equipment);
- competitive tariffs for ground handling;
- development of quality standards based on customer-oriented performance indicators (customer research);
- implementation of activities in accordance with the operation manual;
- focus on high labor productivity;
- an increase in the average growth rate of revenues and profits from ground handling services;
- Continuous improvement of relations between the airport and customer airlines.

Strategic Initiatives:

- separate ground handling activities into a separate unit (new business unit) in accordance with the principles of profit centers;
- develop and implement training programs in the field of ground handling;
- conduct strategic market research to analyze and assess the needs and requirements of the main customers - airlines;
- lack of telescopic ladders for passengers or tractors for aircraft;
- appropriate equipment should be used, the costs of providing ground services and their prices should be maintained at a competitive level.

Fueling is a very interesting business for a management company, since almost any aircraft lands at the airport and needs it, except for short-haul routes. The fueling system consists of equipment used to obtain fuel, its storage and supply. In

the table 3.3 presented a SWOT analysis of the fueling infrastructure at Boryspil Airport.

Table 3.3

SWOT analysis of the fueling infrastructure at Boryspil Airport

<i>strengths</i>	<i>weaknesses</i>
there is storage capacity	Outdated Refueling Park
<i>opportunities</i>	<i>threats</i>
Growth potential due to increased number of aircraft flights Attractive and competitive prices for air carriers Fuel refueling concession - fee for the quantity skipped as a marketing fee	Global contracts of some airlines with certain fuel suppliers

Key factors:

- development of the number of take-off and landing of aircraft;
- increase in fueling per aircraft (= fuel capacity per 1 aircraft)
- competitive / low fuel prices set for airlines;
- high efficiency and modernization of equipment and facilities used for refueling;
- The introduction of international standards of reliability and safety for ground handling and fueling operations.

Offers:

- turn airport into a competitive airport for the provision of fueling services.

Strategic objectives:

- availability of fuel competitive in quantity and quality (supply and storage);
- Attractive and competitive fuel prices for air carriers;
- An equally high level of service for all airlines arriving and departing from the airport;
- high efficiency and modernization of equipment and facilities used for refueling;

- implementation of international standards of reliability and safety for ground handling and fueling operations;

- minimizing the time required to complete the refueling of aircraft.

Strategic Initiatives:

- create a regulatory framework with future suppliers (supplier) full of price, quality, reliability of the equipment used and overall safety;

- conduct a comparative analysis with airports located in the region, based on the performance of airports;

- introduce a system to control the amount of fuel entering the airport;

- maximize the fee for the fuel supply capacity, paid by the concessionaire of the management company;

- Provide maximum marketing assistance and support to the fuel concessionaire in attracting new customers.

The main objective of the development of infrastructure for parking is to ensure a sufficient number of parking for cars (table 3.4).

Table 3.4

SWOT analysis of airport parking infrastructure

<i>strengths</i>	<i>weaknesses</i>
Parking in front of the passenger terminal Enough land to expand car parking Security level on the right side of the airport	Underdeveloped activities to ensure the work of the parking lot near the cargo warehouse - no assortment, limited area
<i>opportunities</i>	<i>threats</i>
Passenger growth Personalized assortment development Indoor parking Opportunities for short and long parking, specially allocated places for airport staff cars Attractive price for each target group / product	Low security Absence or slow growth in the number of passengers Optimization of the use of public or low-cost regular scheduled transport as a vitro-dispersing mechanism for the development of expensive parking

Key factors:

- increase in the number of passengers, the number that they see off and meet, visitors;

- development and application of the principles of the “right size” and profitability;

- implementation of effective, safe and reliable activities;

- Attractive and competitive prices for the target group and related products.

Vision:

1. Provide personalized parking services at a short distance from passenger terminals.

Strategic goals:

- provision of a sufficient number of parking spaces;

- A small distance to the terminals, which is easy to overcome on foot;

- Attractive and competitive prices for the target group and related products;

- introduction of a modern access / security system;

- constant and guaranteed flow of cars;

- optimization of parking layout;

- 24-hour parking and storage;

- optimization of land use (area)

- adequate infrastructure (equipment facilities).

Strategic Initiatives:

- functionality against high-cost construction;

- the use of automatic cashiers;

- Introduction of a flexible parking access system thanks to modern working methods and databases;

- Organization of 24-hour parking and car storage;

- conducting a comparative analysis of costs, quality and safety;

- development of quality standards based on customer-oriented performance indicators.

The purpose of developing infrastructure for concessions for non-aviation activities is to develop a non-aviation business, for example, food and drinks, retail, duty-free shops, advertising, hotels, etc. (table 3.5).

The main factors are:

- understanding of customer market segments and their profiles;
- the degree of conquest of target client groups;
- speed, efficiency, short delay time - factors that have a great influence on the development of non-aviation activities / facilities.

Vision:

- concentrating on the development of the main business, the airport aims at a clear and clear dynamic optimization strategy for non-aviation businesses in accordance with the requirements and needs of the main client groups.

Table 3.5

SWOT analysis of infrastructure under concessions for non-aviation activities

<i>strengths</i>	<i>weaknesses</i>
Low cost available space	The concept of low-cost airport limits the development of expensive commercial and retail trade, as well as airline lounges inside the passenger terminal
<i>opportunities</i>	<i>threats</i>
Passenger growth Development of commercial potential, currently underutilized Creation of a concept for the development of low-cost individualized retail business at the airport Advertising at the airport Passengers bought goods upon departure	Creation and development of other shopping centers, hotels, etc. In the immediate vicinity of the airport

Strategic goals:

- develop an individualized concept for the airport for retail development;
- non-aviation activities in the terminal should fully comply with the concept of the airport;
- introduce as many concession contracts as possible and optimize all activities through quality control and activities, as well as the development of functional contracts;
- develop mutually beneficial scenarios of cooperation between the airport and commercial concessionaires for the management of concession activities;

- optimize the needs of national and international air carriers (for example, fast service, short distances, short delay times), achieve an acceptable level of customer satisfaction and maximize existing non-aviation capabilities available inside and outside the terminal;

- introduction of competitive and best prices for retail trade compared to prices in the city - an attractive alternative for low-cost passengers and customers from Kiev;

- develop and implement quality standards based on indicators of customer-oriented activities (customer research).

Strategic Initiatives:

- implementation of a program of quantitative and qualitative market research to achieve a better understanding of customer profiles, their spending and future potential;

- Development of airport branding necessary for an advertising company and a promotion company;

- development and application of close business relations with retail companies and concessionaires to ensure a mutually beneficial situation;

- Improving the trading environment at the airport;

- optimization of space design and distribution of space for retail outlets in the new terminal, taking into account passenger flows;

- joint implementation of marketing and promotion programs with tenants;

- combining international retail brands with typical local retail features;

- terminal - application of the “price” principle: maximum stimulation of impulse purchases with the help of an appropriate emotional presentation of goods and services; cafe cafes; self-service kiosks; restaurants overlooking aircraft parking and the airfield; additional cost of the trip.

The following are the main types of real estate located at the airport:

- office space for airlines, forwarding companies, etc.

- office and conference centers;

- shopping areas and recreation / entertainment areas;

- production area;
- life support systems located on the territory;
- hangars and workshops;
- the land on which the airfield is located;
- warehouses at the airport;
- restaurants;
- shops and kiosks.

Revenues from concession activities are directly related to professional property management. The optimal commercial use of land and surrounding territories is currently, as well as the strategic development of this land, will ensure that the management of aeropark can increase the level of income from real estate management.

Real estate management should be carried out by professional employees allocated to a separate profit center.

Aeropark is a special territory where auxiliary and service campaigns with all necessary infrastructure and areas are located. Due to the fact that some companies are located nearby, due to this cooperation additional benefits may arise. Therefore, Aeropark is usually positioned with a separate market orientation. SWOT analysis of the airport will be presented in table 3.6.

Table 3.6

SWOT- analysis of the aeropark of the Boryspil airport

<i>strengths</i>	<i>weaknesses</i>
Large available space (approximately 740,000 m ²) Central location at the airport Relatively low prices	The need to redistribute existing office layouts
<i>opportunities</i>	<i>threats</i>
Expansion options Hotel and business center that best meet the needs of the local market Corporate use in accordance with defined standards	Competition with hotels / hotels of the city, office premises, etc., that in Kiev

Key factors:

- good location;

- development based on local needs;
- an attractive level of costs and prices;
- increase in price depending on market conditions;
- professional tender;
- New contracts and related rental income;
- Professional management of real estate and buildings / structures.

Note that the development strategy of the airport as a city airport reduces the possibility of using the airport for its intended purpose, for example, transportation of goods and various products by cargo airlines, cargo planes and forwarding companies, etc.

However, the use of the space available at the airport should be optimized by redistributing the premises necessary for the aviation business to be carried out for the work of the target group. The remaining space should be used for the development of non-aviation business lines to increase the city's income and (partially) cover the capital investments necessary for the further development of the airport. It should be noted that the use of space and premises in accordance with the requirements of the local market has the greatest potential for ensuring a high level of income, for example, a business park, office park, shopping center and recreation / entertainment area, hotels, etc.

To develop the concept of aeropark of Boryspil airport should allocate a special space / territory free of any buildings and functions used in the airport's activities, but with the existing engineering and infrastructure (access system, power supply system, water, communications, etc.).

Strategic goals:

- offer effective solutions affordable to customers at a price in accordance with the requirements of the local market;
- develop a business center for enterprises operating in the field of aviation business;
- develop a concession base;

- the space that will need to be used again to conduct the main business must, if necessary, be left free;

- to direct income from Aeropark activities to cover expenses related to investments in the airport.

Strategic Initiatives:

- based on a master development plan, optimizes the use of existing space (zoning) and, in this way, ensures the availability of free land necessary for further development;

- the use of high standards of service to ensure appropriate quality, thus strengthening the competitive advantages of the branding strategy of Boryspil Airport;

- It is recommended that an open competition be held.

The concept of strategic development defines not only technical requirements, but also commercial and economic goals, as well as goals ensuring the feasibility of airport investment projects. Only a smart development program, which is based on sound economic principles, has a chance to attract private investors and international financial partners.

3.2. Construction of a model for the development of the Boryspil international airport logistics infrastructure

To build a model for the development of logistics infrastructure, it is necessary to fulfill the conditions of 4 components:

- formed strategic initiatives (development strategy goals);
- defined criteria for their functioning;
- formed a mechanism (tool kit) of an effective LIA control system;
- The necessary resources for ensuring the implementation of the development of logistics infrastructure have been identified.

A special condition for the formation of strategic initiatives is the identification of goals and goals for the development of the logistics infrastructure of the airport, which we depict schematically in fig. 3.1.

The statement of goals is one of the ways in which the airport fights uncertainty. Adequate statement of goals opens up the possibility of outlining the boundaries beyond which airport operations are appropriate or inappropriate at this time and in this place. Properly formulated goals make it possible to identify the unique features of the airport - something that formally distinguishes it from everyone else, including competitors in this area.

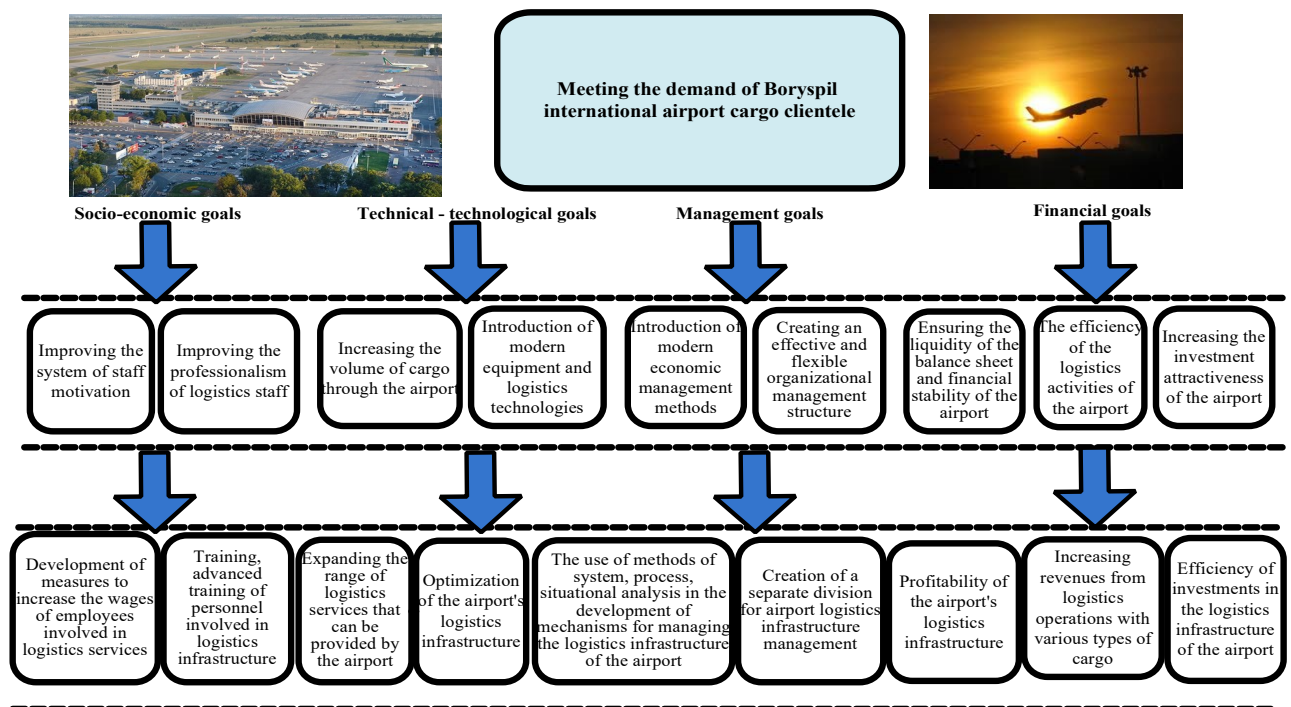


Fig. 3.1. Strategic goals of the development of the Boryspil international airport logistics infrastructure

Thus, the goal is a guideline, the planned result of the airport, which is a complex system consisting of a large number of system units. The above allows us to build a scheme for achieving goals with the definition of the main elements and services for the development of the airport logistics infrastructure (fig. 3.2).

The process of achieving goals can occur behind the prince "bottom up" and vice versa. It should be noted that for each individual element of the logistics infrastructure its own method is shaved to determine and identify criteria for the effectiveness of its functioning.

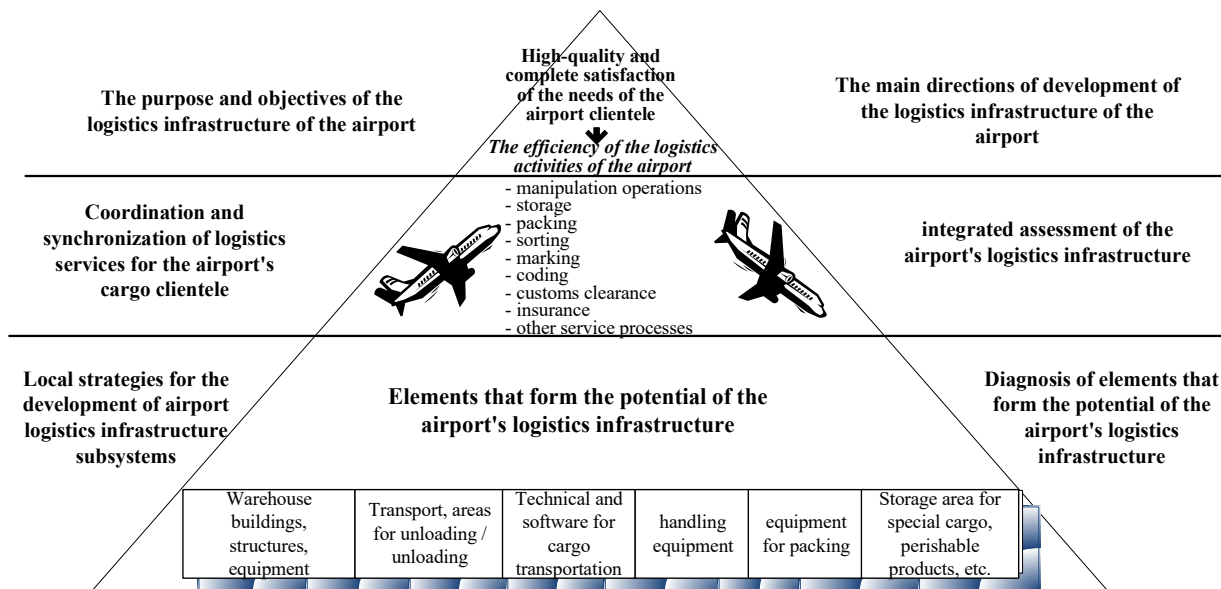


Fig. 3.2. The process of logistics infrastructure strategy forming

In fig. 3.3 - 3.6 presented the main criteria and the selected methodology for calculating the effectiveness of the logistics infrastructure of the airport.

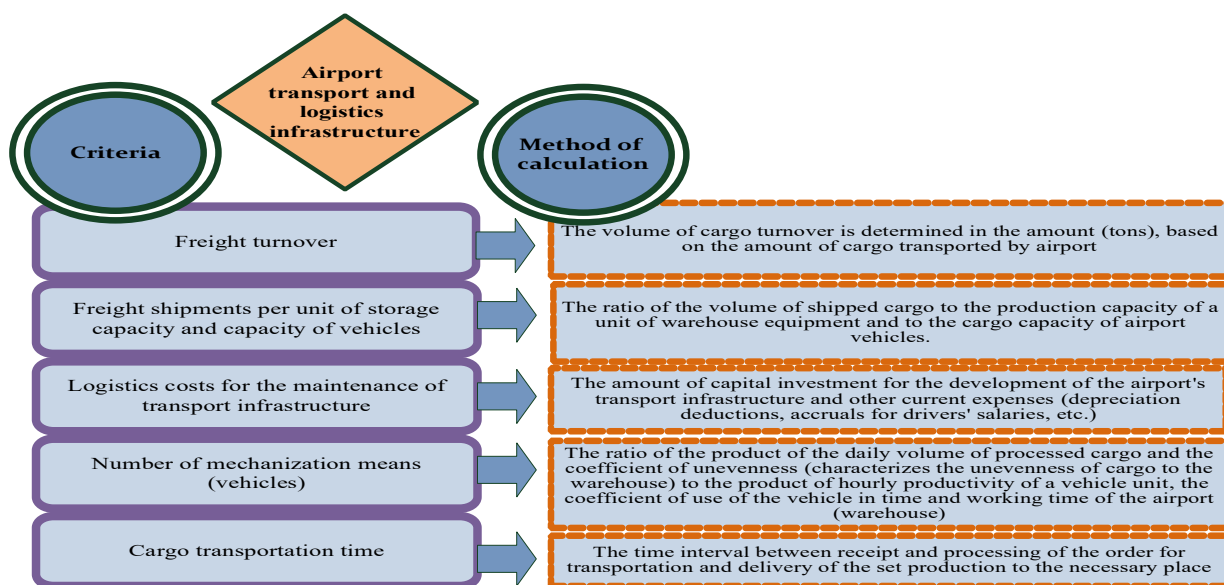


Fig. 3.3. Criteria and methodology for calculating the efficiency of the transport logistics infrastructure of the Boryspil airport

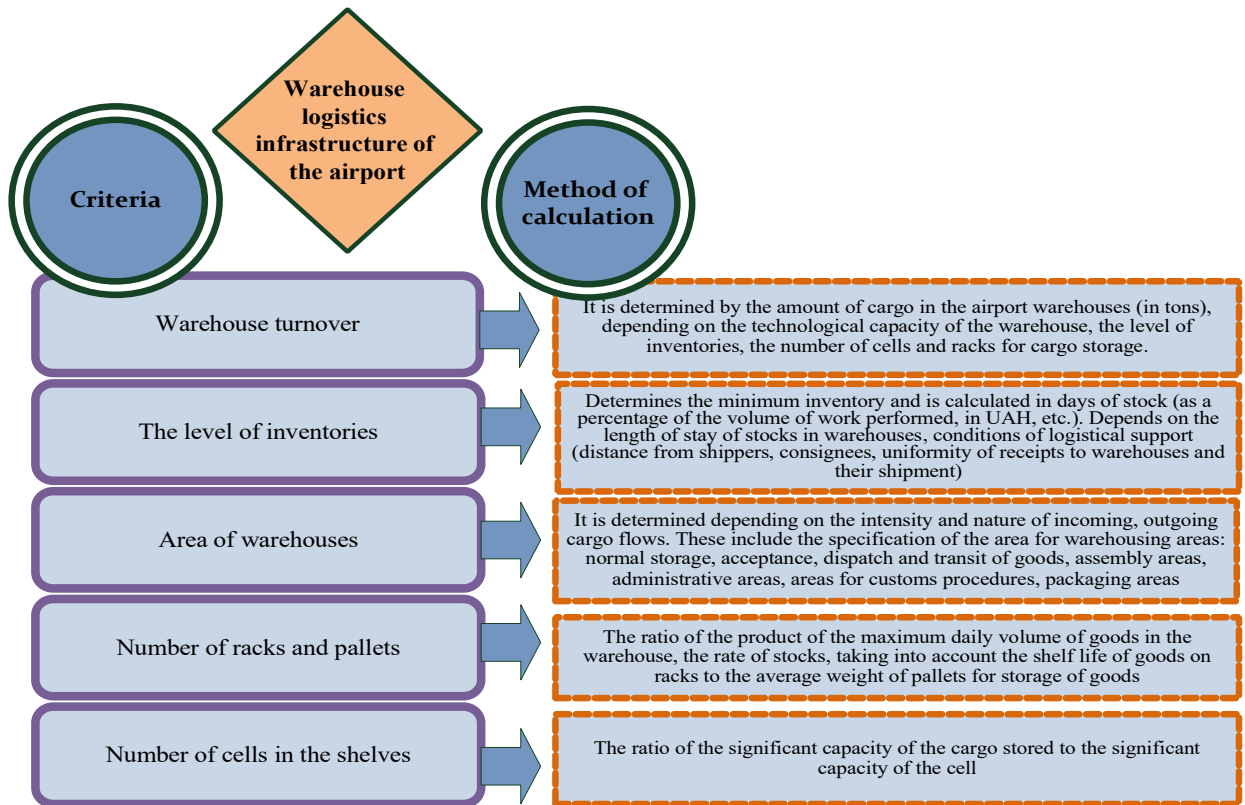


Fig. 3.4. Criteria and a methodology for calculating the effectiveness of the warehouse logistics infrastructure of the Boryspil airport

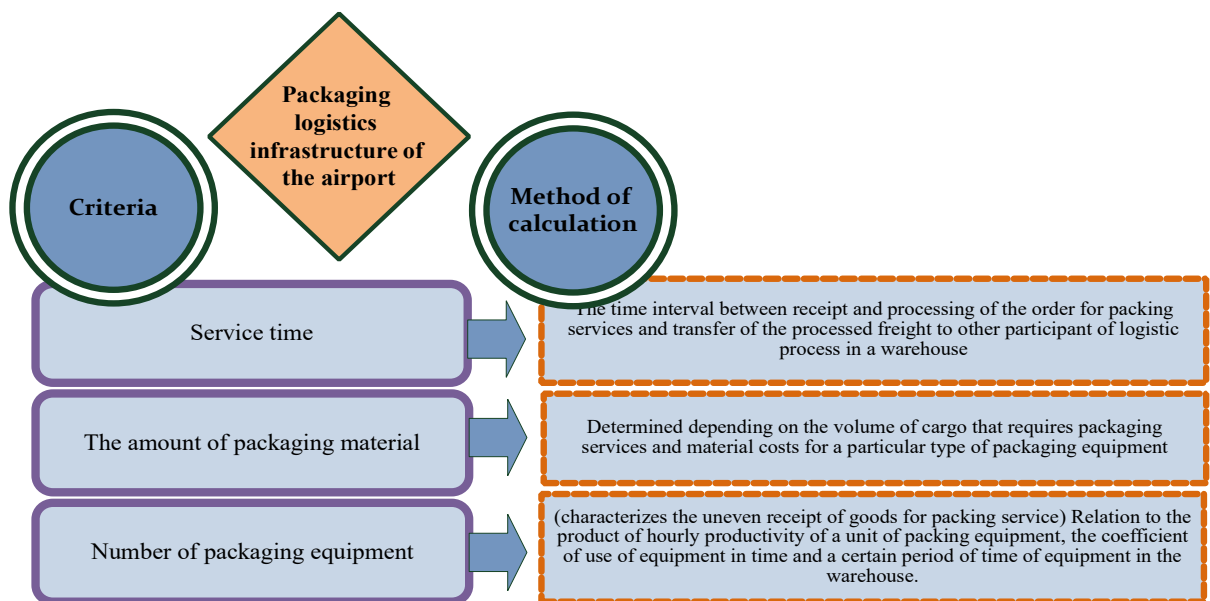


Fig. 3.5. Criteria and a methodology for calculating the effectiveness of packaging

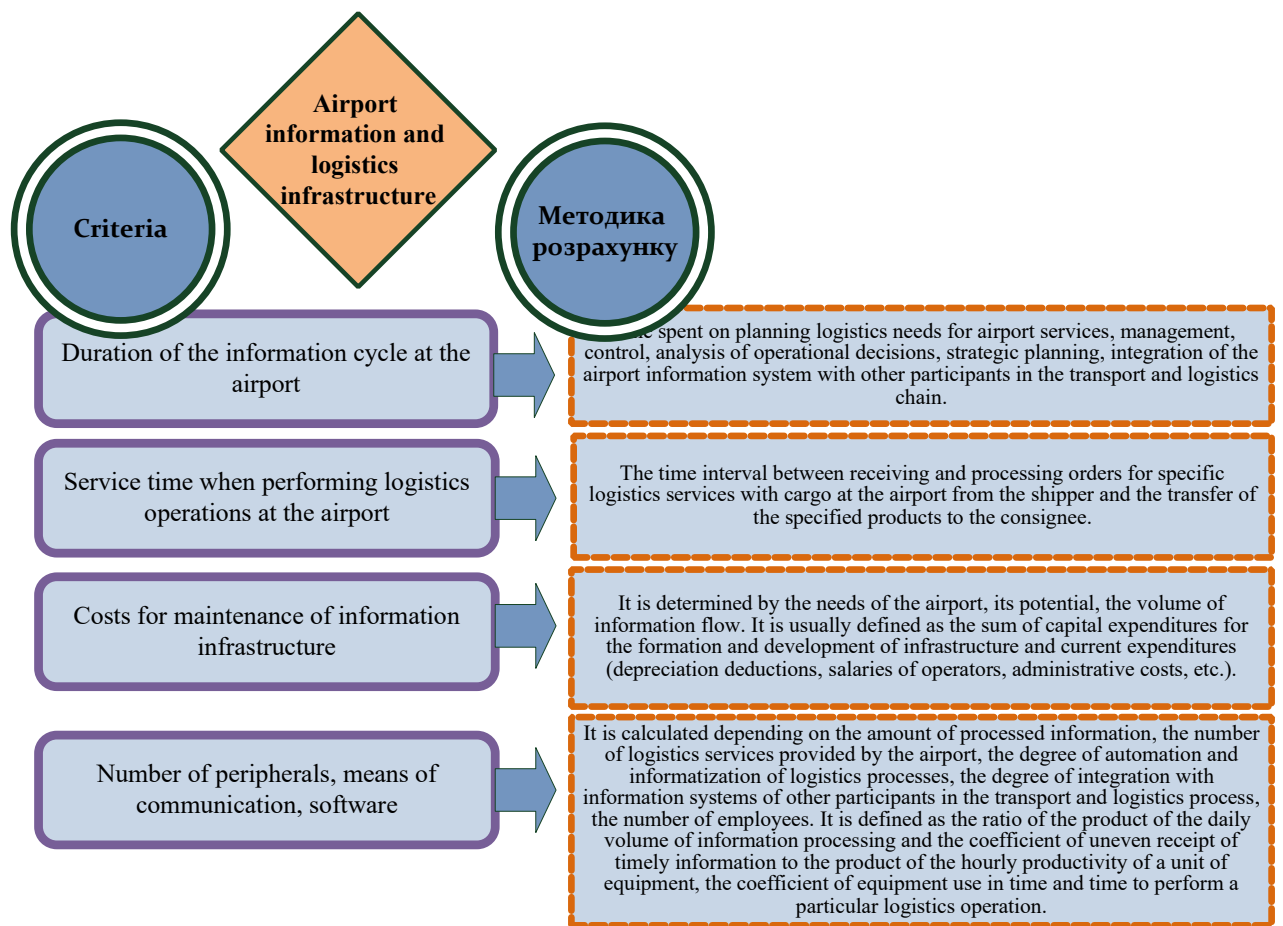


Fig. 3.6. Criteria and a methodology for calculating the effectiveness of the information logistics infrastructure of the Boryspil airport

Thus, the development of the logistics infrastructure of the Boryspil airport is determined by the development efficiency of each individual component of the logistics infrastructure as a common airport system. The calculation methods presented by us and the selected criteria for the individual components of the logistics infrastructure are the basis for the formation of a system for managing cargo flows and the cargo terminal as a whole at Boryspil Airport and the development of further development measures.

3.3. Forecasting cargo flows and determining the potential of the airport cargo terminal

The optimal use of available storage space for any airport is even more important than for logistics companies that are not tied to the place of production and, if necessary, can rent additional space in various warehouse complexes. Airports are limited by that storage area, they have available at the location of the airport itself, and do not always have the opportunity to increase the area due to additional leases.

Demand for cargo transportation by air directly affects the analysis of existing airport capacities and planning for an increase in the size of the cargo terminal. In fig. 3.7 shows the cargo terminal and apron of the Boryspil airport. As noted earlier, its area is 600 m².



Грузовой перрон

Fig. 3.7. Cargo terminal and apron of Boryspil airport

In order to calculate the existing capacity of the cargo terminal, it is worth taking into account the cargo turnover and making its forecast. The calculations will make it possible to find out the value of the cargo flow that can be serviced in the existing cargo terminal, and, accordingly, to determine the necessary area of the terminal in the future for 5 years.

The cargo complex of the airport is a collection of buildings and structures designed to receive cargo, vehicles, mechanization and other equipment.

Cargo complex planning should meet the following requirements:

1. Have a small distance to the aircraft parking lots (aircraft), since about half of the cargo is transported as additional load in the luggage compartments of passenger aircraft.

2. Have convenient access roads to and from the city of the cargo complex.

3. Have minimal cargo flows inside the airport itself, avoid crossing cargo / baggage flows / aircraft traffic.

The cargo complex includes:

1. Administrative, office and utility rooms, includes:

- work rooms of staff (warehouse manager, dispatcher, cashier, source, etc.);

- Bureau of cargo search;

- operational areas for customer service;

- lounges, dining rooms, locker rooms, dryers, etc ..;

- A room for representative offices of airlines and the fuel and energy complex.

2. Commercial composition - one of the main elements of the cargo complex, as a rule, cargo is received here (weighing, packaging, labeling), as well as its delivery to the recipient.

3. Cargo yard - the territory adjacent to the freight train with a fence and a checkpoint, intended for the movement, parking and maneuver of vehicles, the placement of mechanization equipment and overpasses for storing some types of cargo in the open.

4. The cargo apron adjacent to the warehouse is intended for the parking of cargo aircraft and loading and unloading of cargo on (c) the aircraft.

5. The container platform is designed to accommodate containers, aircraft pallets, mechanization equipment and other equipment, provides handling and transportation of goods in containers.

6. Open areas and awnings designed to accommodate special cargo.

7. Warehouses with a heating system are designed to accommodate animals, etc.

8. Warehouses equipped with refrigeration units for storing perishable goods.

9. Composition for storing dangerous goods, set remotely from other buildings and structures of the cargo complex and the airport, are built from fire-resistant materials, which provides a fire system.

10. Customs warehouse - a specially allocated and equipped room or other place where the customs regime of the customs warehouse operates, is based on the customs authority of Ukraine.

When forecasting cargo flows in Boryspil international airport, if it is necessary to increase the cargo terminal, we note that there are opportunities for its expansion at the airport.

When assessing the potential of the existing airport cargo terminal, we use the following formula to find out the necessary cargo area, respectively, from the given cargo turnover for the year [21]:

$$S_{\text{cargo.airport}} = \frac{3 \cdot T}{D \cdot \eta} \quad , \quad (3.1)$$

where 3 - is the size of the stock in days of turnover;

T - cargo turnover, t

D- the number of working days in a year;

η - load per 1 m² of area, t / m² (assume the existing value at the airport is 0.6 t / m²).

Also, after calculating the cargo area of the terminal, we calculate the total area using the following formula [21]:

$$S_{\text{Total.Cargo.airport}} = \frac{S_{\text{Cargo.airport}}}{k_{\text{utility}}} \quad , \quad (3.2)$$

$k_{utility}$ - where is the utility coefficient (is 0.5).

It should be noted that the existing freight train area at Boryspil Airport is 600 m².

In order to determine the cargo turnover that can be serviced in the existing airport cargo terminal, we substitute $S_{total.cargo.airport}$ from formula 3.1 to formula 3.2 and obtain the following form of the calculation of cargo turnover [21]:

$$T = \frac{S_{Total.Cargo.airport} \cdot \Delta \cdot \eta \cdot k_{utility}}{3}, \quad (3.3)$$

In this formula, we take the average shelf life of 14 days. So, the calculation of the cargo turnover in the Boryspil is equal to:

$$T = \frac{600 \cdot 365 \cdot 0,6 \cdot 0,5}{14} = 4692,85 \text{ t.}$$

Thus, it can be seen that the existing cargo terminal can handle an average of 4692 tons of cargo per year.

Given the statistics of the amount of cargo handled at the airport by years, we will carry out forecast calculations of warehouse space (table 3.7).

We will describe the methodology for forecasting airport traffic flows. First, we calculated the annual growth in percent, showed a share of the increase compared to last year. When calculating the pessimistic development scenario for determining freight traffic, the last reporting period was increased by the minimum annual growth rate of 6.32%, in the realistic scenario it was increased by the average value of 9.69%, and in the optimistic scenario, the highest annual growth rate was taken which is 16.87%. Thus, the results showed that under a realistic scenario for forecasting cargo flows, the cargo area deficit will come in 2022. In general, until 2025 it will be 260 m². Schematically, the value of the deficit / surplus of the terminal cargo area, depending on the value of the cargo flow, is presented in Fig. 3.8.

Table 3.7

Forecasted calculations of cargo turnover at Boryspil Airport and deficit / profit of cargo area of the warehouse

of the year	Initial data						forecast data				
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cargo flow, t	2676,00	2935,00	3430,00	3670,00	3985,00	4237,00	-	-	-	-	
The required area, m2	342,14	375,25	438,54	469,22	509,50	541,72	-	-	-	-	
Deficit / surplus of storage space, m2	257,86	224,75	161,46	130,78	90,50	58,28	-	-	-	-	
Annual increase in freight traffic, %		9,68	16,87	7,00	8,58	6,32					
Pessimistic scenario for the development of cargo flows at the Boryspil airport											
Cargo flow, t	-	-	-	-	-	-	4504,9358	4789,815	5092,7092	5414,7576	5757,1713
The required area, m2	-	-	-	-	-	-	575,974	612,396	651,123	692,298	736,077
Deficit / surplus of storage space, m2	-	-	-	-	-	-	24,026	-12,396	-51,123	-92,298	-136,077
Realistic scenario for the development of cargo flows at the Boryspil airport											
Cargo flow, t	-	-	-	-	-	-	4647,5479	5097,8762	5591,8395	6133,6658	6727,9928
The required area, m2	-	-	-	-	-	-	594,207	651,783	714,938	784,213	860,200
Deficit / surplus of storage space, m2	-	-	-	-	-	-	5,793	-51,783	-114,938	-184,213	-260,200
Optimistic scenario for the development of cargo flows at the Boryspil airport											
Cargo flow, t	-	-	-	-	-	-	4951,5877	5786,6937	6762,6437	7903,1918	9236,0981
The required area, m2	-	-	-	-	-	-	633,080	739,851	864,630	1010,454	1180,871
Deficit / surplus of storage space, m2	-	-	-	-	-	-	-33,080	-139,851	-264,630	-410,454	-580,871

So, the calculations show that starting from 2022 there will be a shortage of warehouse space at the airport, which may lead to a shortfall in profit from this activity. Such data indicate the need to increase the cargo terminal to at least 1000 m².

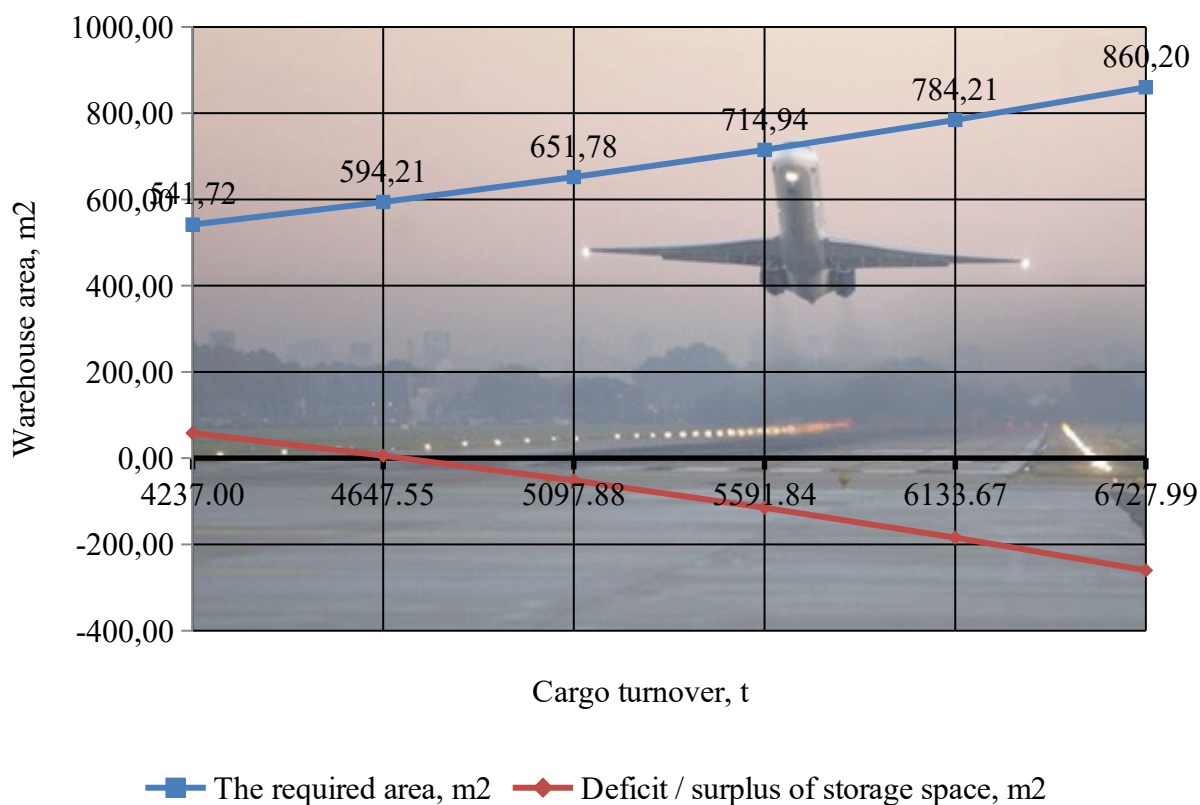


Fig. 3.8. Forecast of cargo flow and the area of the cargo terminal of the Boryspil International Airport until 2025

The goal of the development of the Boryspil airport logistics infrastructure is to create a modern logistics center that will allow:

- create new jobs for the population;
- increase tax revenues to budgets of all levels;
- on the terms of mutually beneficial cooperation to combine the existing structure for the processing of cargo flows;
- carry out the construction of a new and modernization of the existing transport infrastructure of the airport;
- provide customers with a modern level of service;

- implement state policy on the development of aviation transport;
- create a single information space for all participants in the transportation process through the introduction of modern transport, logistics and information technologies;
- reduce the harmful effects of transport on the environment through the introduction of modern technology, technology of the transportation process and production management system.
- attraction of additional volumes of cargo, including international;
- creating conditions for the development of small and medium-sized businesses to provide services at the facilities of the logistics infrastructure.

3.4. Calculation of investment performance indicators in the development of logistics infrastructure

We consider the calculation of the investment project from an economic point of view, the main one in which is the calculation of the performance indicators of the investment project. As a rule, investment projects are evaluated according to standard methods and include the calculation of the following investment performance indicators [21]:

1. Net present value of the project (NPV).
2. Internal Rate of Return (IRR).
3. Investment Return Index (PI).
4. Benefit / Cost Ratio - Benefit / Cost Ratio (BCR).
5. Discounted payback period (RR).

Next, we present formulas and calculate each of them.

1. Net present value (NPV).

This indicator is defined as the difference between the current value of cash receipts from a project or investment and the current value of cash payments to

receive investments, or to finance a project, calculated at a fixed discount rate. The NPV value can be represented as the result obtained immediately after a decision on the implementation of this project is made, since the calculation of NPV excludes the influence of the time factor, that is, if the value of the indicator:

NPV > 0 - the project will bring profit to investors;

NPV = 0 - an increase in production volumes will not affect investor profit;

NPV < 0 - the project will bring losses to investors.

The first feature of the net present value of the project (net present value) is that, being an absolute indicator of the effectiveness of an investment project, it directly depends on its size. The larger the investment cost of the project and, accordingly, the amount of planned net cash flow for it, the higher (*ceteris paribus*) will be the absolute amount of NPV.

The second feature of the net present value of the project is that its amount is strongly influenced by the structure of the distribution of the total amount of investment costs for individual periods of the project cycle time. The larger the share of such expenses is carried out in future periods of the project cycle (in relation to its beginning), the greater, all other things being equal, will be the amount of the planned net present income for them. The lowest value of this indicator is formed under the condition of full implementation of investment costs with the presence of the project cycle.

The third feature of the net present value of the project is that its numerical value is significantly affected by the start time of the operational stage (relative to the start time of the project cycle), which allows you to start generating net cash flow for the investment project. The longer the time interval between the beginning of the project cycle and the beginning of the operational phase, the smaller, other things being equal, will be the size of NPV.

And finally, the peculiarity of net present value is that its numerical value varies greatly depending on the level of the discount rate for bringing to the present value the main indicators of the investment project - the amount of investment costs and the amount of net cash flow.

The NPV value is influenced by two types of factors: the production process (more products - more revenue, less costs - more profit, etc.) and the discount rate. And also affects the scale of activity, expressed in "physical" volumes of investment, production or sales. The formula for calculating NPV is as follows [21]:

$$NPV = \sum_{t=1}^n \frac{D_t - B_t}{(1+i)^t}, \quad (3.4)$$

or

$$NPV = \sum_{t=1}^n \frac{D_t}{(1+i)^t} - \sum_{t=1}^n \frac{B_t}{(1+i)^t}, \quad (3.5)$$

where D_t , - project benefits in year t ;

B_t , - project costs in year t ;

i is the discount rate;

p - duration (life span) of the project.

Next, we calculate the net present value of the project, the benefits and costs of which are distributed by year, if the discount rate is 10% and 15%.

The initial data for the calculation are the values of the following costs

- 1) the construction of a new cargo terminal of 1000 m² (769 123 usd);
- 2) technical equipment (150,000 usd);
- 3) information support (\$ 150,000 - SAP R / 3).

The total cost of the project will be: 1069123 usd

We calculate the income from the project as follows: taking into account the total warehouse area of 1000 m², on which it is possible to store 7821 tons / year of cargo (according to the calculation according to formula 3.3), with an average shelf life of 14 days and the cost of cargo handling 100.92 usd/t, we get the value of income 789 300 usd)

In the table. 3.8 presented the calculations of the NPV value of the project at a discount rate in dollars of 10% and 15%. So the difference between the current value of the stream of future benefits and the current value of future costs for the implementation of the project is 495,396.963 usd at a discount rate of 10%. Since the sum of the discounted net values is positive - the net present value is positive, the project will positively affect the airline and may be recommended for financing.

Tabl 3.8

Project Performance Calculations

Year s	Benefits , usd	Costs, usd	Net benefits	The discount rate at i=10%	Discounted net benefits	The discount rate at i=15%	Discounted net benefits
t	Δt	B_t	$\Delta_t - B_t$	$1/(1+i)^t$		$1/(1+i)^t$	
1	789300	1069123	-279823	0,909	-254359,107	0,87	-243446,01
2	907695	0	907695	0,826	749756,07	0,76	689848,2
				NPV	495396,963	NPV	446402,19

Where i is the discount rate at which the depreciation of money is estimated in future periods relative to the beginning of the first year of the project, or is the increase in the value of money in earlier periods relative to the end of the year the project ends.

2. Internal rate of return (IRR).

The internal rate of return indicator or the internal rate of return is calculated on the basis of the NPV indicator, this ratio shows the maximum cost of investments, indicates the maximum allowable relative level of expenses that can be associated with this project.

For example, if the project is fully funded by a commercial bank loan, then the IRR value indicates the upper limit of the acceptable level of the bank interest rate, the excess of which makes the project unprofitable.

The economic meaning of this indicator is as follows: the airport can make any investment decisions, the level of profitability (LP) of which is not lower than the current value of the LP indicator (price of the source of funds for this project). It is

with him that the IRR calculated for a specific project is compared, while the relationship between them is as follows:

- if $IRR > LP$, then the project should be accepted;
- if $IRR < LP$, then the project should be rejected;
- if $IRR = LP$, then the project is neither profitable nor unprofitable.

Another interpretation option is to interpret the internal rate of return as a possible discount rate at which the project is still profitable by the NPV criterion. The decision is made on the basis of comparing IRR with normative profitability; Moreover, the higher the value of the internal rate of return and the greater the difference between its value and the selected discount rate, the greater the margin of safety of the project. The calculations are carried out according to the formula [21]:

$$\sum_{t=1}^n \frac{D_t - B_t}{(1+i)^t} = 0, \quad (3.6)$$

In practice, the definition of IRR is carried out according to the following formula:

$$IRR = A + \frac{a(B-A)}{(a-b)}, \quad (3.7)$$

where A is the value of the discount rate at which NPV is positive;
 B is the value of the discount rate at which NPV is negative;
 a is the value of positive NPV, with the value of the discount rate A;
 b - the value of negative NPV, with the value of the discount rate B.

Calculate IRR using formula 3.7:

$$IRR = 10\% + \left(\frac{495396,963(15-10)}{495396,963 - 446402,19} \right) \% = 60,55\%$$

Schematically, the values of the project indicators NPV and IRR are shown in fig. 3.9. In fig. 3.9 N is the net present value at a discount rate of 10%, and n is the net present value at a discount rate of 15%.

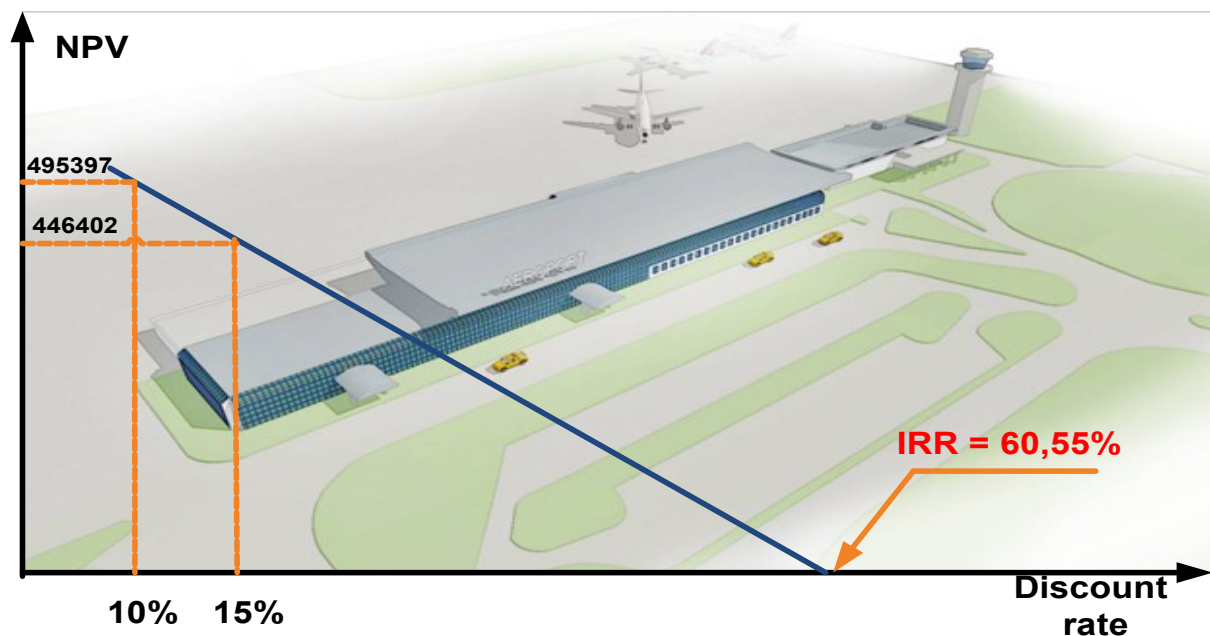


Fig. 3.9. Estimated value of project indicators NPV and IRR

3. The coefficient of benefits / costs - Benefit / Cost Ratio (BCR).

BCR is the ratio of discounted benefits to discounted costs. The basic calculation formula has the following form [21]:

$$BCR = \frac{\sum_{t=1}^n \frac{D_t}{(1+i)^t}}{\sum_{t=1}^n \frac{B_t}{(1+i)^t}}, \quad (3.8)$$

BCR is positive for the choice of investment project with a value greater than one. The calculation results are presented in table. 2.9.

Table 2.9

Calculation of the BCR coefficient

Years	Benefits, usd	Costs, usd	The discount rate at 10%	The discount rate at 15%	BCR at 10%	BCR at 15%
t	D_t	B_t	$1/(1+i)^t$	$1/(1+i)^t$	B/C,10%	B/C,15%
1	789300	1069123	0,909	0,87	1,50975534	1,47603
2	907695	0	0,826	0,756		

The resulting calculations show that the BCR is greater than unity, which indicates the effectiveness of the design decision.

4. The payback period of capital investments.

The payback period is one of the main indicators, since it shows when exactly this project will pay off and investors will begin to make a profit. The NPV calculation table shows that the payback period is more than a year.

Summing up, we note that the international practice of assessing the effectiveness of investments is essentially based on the concept of the time value of money and is based on the following principles:

1) Assessment of the effectiveness of the use of invested capital is carried out by comparing the cash flow (cash flow), which is formed in the process of implementing the investment project and the initial investment. A project is considered effective if it provides a return on the initial amount of investment and the required return for investors who have provided capital.

2) Capital invested in the same way as cash flow is brought to date or to a specific settlement year (which usually precedes the start of the project).

3) The process of discounting capital investments and cash flows is carried out at various discount rates, which are determined depending on the characteristics of investment projects. When determining the discount rate, the structure of investments and the cost of individual components of capital are taken into account.

CONCLUSIONS

Air Transportation Management Department				NAU 20.08.69. 300 EN				
Done by:	Pavliukova V.V.			CONCLUSIONS	Letter	Sheet	Sheets	
Supervisor	Ivannikova V.Yu.					D	46	31
Normative Supervisor	Shevchenko Yu.V				FML 8.07010102 510			
Head of the Department	Shevchuk D.O.							

Transport ensures the unity of the country's economic space, improving interregional and international transport and economic relations, streamlining the distribution of productive forces, increasing the efficiency of the use of natural resources and the socio-economic potential of the country's regions, developing entrepreneurship and expanding international cooperation, entering our country into the world economy as an equal partner.

Airports is an essential infrastructure element of the international air transportation system. Airports, as part of the transport system, are also an essential component of the national, regional and local infrastructure of countries. The geography and intensity of flights, the volumes of passenger, cargo, baggage and mail transportation, as well as the availability and connectedness of certain regions of the countries and connections with other types of trunk transport, depend on their condition and location. The world experience in the development of civil aviation testifies to the effective role of airports in promoting the development of the airline business, expanding the volume and geography of flights, transporting passengers, baggage, cargo and mail, as well as in creating high standards of quality of service for consumers of air transport services.

Terminals being built at Ukrainian airports meet the needs of the modern market. At present, most Ukrainian airports are international: the larger the airport, the more flights are carried out and, as a result, cargo transportation, and therefore there should be enough space for storing goods. After updating the existing and building new terminals that make up the core of the airport, there are prospects and opportunities for investing in the further development of the airport infrastructure and the surrounding areas. The airport through which cargo transportation is carried out is an important place of attraction for warehouse and logistics complexes.

In the thesis, a study was conducted on the development of cargo flows and the logistics infrastructure of the world's airports. According to statistics over the past few years, a drop in cargo turnover is a rather rare phenomenon that can only be found in countries that are conducting hostilities. In general, there is a noticeable tendency in the annual increase in the turnover of goods, which is explained by the

annual growth of production in the world and an increase in the level of globalization.

Analysis of the development of air cargo in Ukraine showed that cargo turnover is growing, the demand for air transportation is increasing.

Boryspil International Airport State Enterprise has been counting down since 1959, when the decision was made to establish the Boryspil Airport of the Kyiv Civil Air Fleet (Central) on the basis of a military airfield.

The activities of all airports are not only related to passenger service, but also to freight and mail. Boryspil International Airport increases traffic volumes by various flights, regular, non-scheduled and booked. The annual increase in the number of flights has led to an increase in passenger traffic and freight traffic.

As part of Ukraine's strategy to ensure the quality of goods and services to European standards, Boryspil International Airport has been constantly working over the last decade to improve the quality of services and expand production capacity, taking into account the strategic needs of the airport.

Total revenues from airport services consist of aviation and non-aviation activities. At Boryspil Airport, the most powerful revenues are aviation revenues. However, the share of non-aviation revenues in the Ukrainian "air gates" is much smaller than in the leading foreign airports.

The design part of the thesis is devoted to the development of the logistics infrastructure of the Boryspil International Airport. The main goal is to create a modern cargo complex, because increasing the demand for transport services and the quality of logistics services will require the coordinated work of all types of transport, and in turn requires their developed infrastructure. Therefore, today one of the urgent issues is the formation and development of the aviation transport system of Ukraine and the logistics air transport infrastructure.

In the thesis it was found that the development of LI is determined by a comprehensive assessment of the effectiveness of the functioning of all its constituent subsystems and elements. It is the logistics infrastructure that has a direct impact on the efficiency of the logistics system of the airport as a whole.

Considering the growing volume of cargo flows passing through the airport, it was necessary to calculate the area of the cargo terminal, determined at which the existing area of the terminal can handle the cargo flow. The results showed that with a realistic scenario for forecasting cargo flows, the shortage of cargo area will come in 2022. In general, until 2025 it will be 260 m². Refusal from cargo services due to insufficient space may lead to a shortfall in profit from this activity. Such data indicate the need to increase the cargo terminal to at least 1000 m². To decide on the feasibility of the project, indicators were used based on the idea of discounting. The following were calculated: net present value, internal rate of return, profit / cost ratio and payback period. The results of the indicators indicate the effectiveness of this project.

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