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THE CONCEPT OF NATIONAL INTEGRATED RISK MANAGEMENT OF AIR TRANSPORT OF UKRAINE

Dmytro Bugayko, Yuliya Ierkovska, Fariz Aliyev, Mariia Bahrii. *"The concept of national integrated risk management of aviation transport of Ukraine". In the context of modern conditions of air transport development, the concept of the national air transport integrated risk management system is substantiated. The concept is based on the definition of risk as the probability of occurrence of events in a complex of hazards of different nature, manifestations of safety vulnerabilities, consequences of past negative phenomena and explains the danger of the threat due to determination "maximum potential energy". Its remaining part is subsequently converted into kinetic energy, which affects the safety management system of air transport and has a negative impact on the sustainable development of the national economy as a whole. At the same time, priority attention is paid to the list of hazards by the criterion of deviation from the point of sustainable development, the importance of the impact of threats on the coefficient of elasticity, which allows more adequate assessment of hazards and respond to them. The classification of the main risks in the functioning of Ukrainian air transport has been developed, which includes the negative consequences of the*

COVID-19 pandemic, reduction of export-import operations in the economic downturn, number of flights and air passenger traffic, low congestion of airports and air infrastructure. Risks are identified in the following areas of operation and development of air transport in Ukraine: export-import operations, aviation infrastructure, air cargo, airports, air navigation service providers and general aviation, which allows early detection of risks and response to them. The concept was implemented by the State Aviation Regulation Department of the Ministry of Defense of Ukraine, the State Civil Aviation Agency of Azerbaijan, Almaty International Airport (Kazakhstan), Ukraine-Air Alliance, ICAO NAU Institute, Georgian Aviation Training Center (Georgia).

Keywords: air transport, concept, national management of integrated risks, state regulation, aviation safety, hazards.

Дмитро Бугайко, Юлія Єрковська, Фаріз Алієв, Марія Багрій. "Концепція національного управління інтегрованими ризиками авіаційного транспорту України". У контексті сучасних умов розвитку авіаційного транспорту обґрунтовано концепцію національної системи управління інтегральними ризиками авіаційного транспорту. Концепція базується на визначенні ризику, як імовірності виникнення подій у результаті взаємодії в комплексі загроз різної природи, проявів вразливості системи безпеки, наслідків минулих негативних явищ, а також пояснює небезпечність впливу загрози поняттям «максимальна потенційна енергія», яка проникає скрізь різні ієрархічні системи захисту, а її залишкова частина в подальшому перетворюється на кінетичну енергію, що вражає систему безпеки авіаційного транспорту та має негативний вплив на сталий розвиток національної економіки загалом. При цьому першочергову увагу приділено переліку загроз за критерієм відхилення від точки сталого розвитку, вагомості впливу загроз за коефіцієнтом еластичності, що дозволяє більш адекватно оцінювати загрози та реагувати на них. Розроблено класифікацію основних ризиків у функціонуванні авіаційного транспорту України, яка включає негативні наслідки пандемії COVID-19, зменшення обсягу експортно-імпортних операцій в умовах спаду економіки, кількості рейсів та обсягів авіап перевезень пасажирів, низьку завантаженість аеропортів та авіаційної інфраструктури. Ризики визначено за такими напрямками функціонування та розвитку авіаційного транспорту України: експортно-імпортні операції, авіаційна інфраструктура, вантажні авіаційні перевезення, аеропорти, провайдери аеронавігаційного обслуговування та авіації загального призначення, що уможливорює випереджаюче виявлення ризиків і реагування на них. Концепцію впроваджено Управлінням регулювання діяльності державної авіації Міністерства оборони України, Державним агентством цивільної авіації Азербайджану, Міжнародним аеропортом Алмати (Казахстан), авіакомпанією «Україна-Аероальянс», Інститутом ІКАО НАУ, Грузинським авіаційним навчальним центром (Грузія).

Ключові слова: авіаційний транспорт, концепція, національне управління інтегрованими ризиками, державне регулювання, безпека авіації, загрози.

Дмитрий Бугайко, Юлия Ерковская, Фариз Алиев, Мария Багрий. "Концепция национального управления интегрированными рисками авиационного транспорта Украины". В контексте современных условий развития авиационного транспорта обоснована концепция национальной системы управления интегральными рисками авиационного транспорта. Концепция базируется на определении риска, как вероятности возникновения событий в результате взаимодействия в комплексе угроз различной природы, проявлений уязвимости системы безопасности, последствий прошлых негативных явлений, а также объясняет опасность влияния угрозы понятием «максимальная потенциальная энергия», проникающая везде в различные иерархические системы защиты, а ее остаточная часть в дальнейшем превращается в кинетическую энергию, что поражает систему безопасности авиационного транспорта и оказывает негативное влияние на устойчивое развитие национальной экономики в целом. При этом первоочередное внимание уделено перечню угроз по критерию отклонения от точки устойчивого развития, весу влияния угроз по коэффициенту эластичности, что позволяет более адекватно оценивать угрозы и реагировать на них. Разработана классификация основных рисков в функционировании авиационного транспорта Украины, которая включает негативные последствия пандемии COVID-19, уменьшение объема экспортно-импортных операций в условиях спада экономики, количества рейсов и объемов авиап перевозок пассажиров, низкую загрузженность

аэропортов и авиационной инфраструктуры. Риски определены по направлениям функционирования и развития авиационного транспорта Украины: экспортно-импортные операции, авиационная инфраструктура, грузовые авиационные перевозки, аэропорты, провайдеры аэронавигационного обслуживания и авиации общего назначения, что позволяет опережающее выявление рисков и реагирования на них. Концепция внедрена Управлением регулирования деятельности государственной авиации Министерства обороны Украины, Государственным агентством гражданской авиации Азербайджана, Международным аэропортом Алматы (Казахстан), авиакомпанией «Украина-Аэроальянс», Институтом ИКАО НАУ, Грузинским авиационным учебным центром (Грузия).

Ключевые слова: авиационный транспорт, концепция, национальное управление интегрированными рисками, государственное регулирование, безопасность авиации, угрозы.

Introduction. In the system of advanced risk management, the hazard has the maximum potential energy, which can directly damage the air transport system in particular and indirectly cause negative consequences for the sustainable development of the national economy as a whole.

With this view of the problem, an effective mechanism for anticipating risk management of hierarchical systems is to manage the degree of vulnerability of the system using the model of "Swiss cheese" J. Reason (Reason J. (1997)) [1] and structural analysis of deficiencies (GAP Analysis) at the level of active and passive systems of protection of the air transport system, namely: equipment and technologies, norms, rules and regulations and personnel training / retraining systems. Identifying vulnerable or under protected sites (GAPs) at the level of each protection system, as well as analyzing their interconnectedness or singularity with respect to the passage of a hazards through protection systems, makes it possible to identify hierarchical and complex vulnerabilities to identified threats.

In fact, the answer is what part of the potential energy will be lost due to the opposition of each of the systems of protection of air transport and due to the synergistic effect of their integrated use. All residual energy is converted into kinetic energy and affects air transport due to spontaneous fractalization of negative impact factors, which is assessed as negative consequences of the impact of the threat after its passage through different hierarchical

systems of active and passive protection. In this way, the risk can be assessed as a combination of hazard, vulnerability and consequences (Fig. 1).

The article is a logical continuation of a number of publications devoted to the introduction of a systematic approach to determining the level of sustainable development and development of advanced risk management system for air transport safety management of Ukrainian scientists D. Bugayko [2-4, 6], Y. Kharazishvili [2-5], A. Antonova [4], M. Hryhorak [3], Y. Ierkovska [6], Poland scientists (Z. Zamiar [3-4]) and scientists of other countries. Statistical data for aviation transport risk assessment are taken from the following statistical sources of the State Statistics Service [7], Ministry of Infrastructure [8], the Civil Aviation Authorities [9] and National Bureau for the Investigation of Aviation Accidents and Incidents with Civil Aircraft of Ukraine [10-16].

The purpose of the article is to develop the concept of national integrated risk management of aviation transport of Ukraine at the level of state regulation, which is actually a set of proactive risk reduction measures to support further sustainable development of the national economy.

Presentation of the main results. The concept of national aviation risk management includes:

– classification of the main hazards to air transport in the context of globalization, liberalization and sustainable economic development, taking into account changes in multilateral and bilateral regulation;

- mechanisms for the appointment of airlines, ensuring their national ownership and control, development of new forms of commercial activity and interaction of air transport market participants, commercialization of airports and air navigation service providers, significant growth in air freight and logistics development;
- formation of the list of hazards on the criterion of deviation from the point of sustainable development;
- determining the severity of the impact of hazards on the coefficient of elasticity;

assessment of the vulnerability of the air transport system of Ukraine;

- identifying the most serious negative consequences and using the tools of advanced risk management to counter them, which provides an opportunity to more adequately assess and respond to hazards.

The introduction of the concept of national risk management of air transport allows to increase the effectiveness of early detection and response to emerging risks in changing conditions (Change Management) and uncertainty.

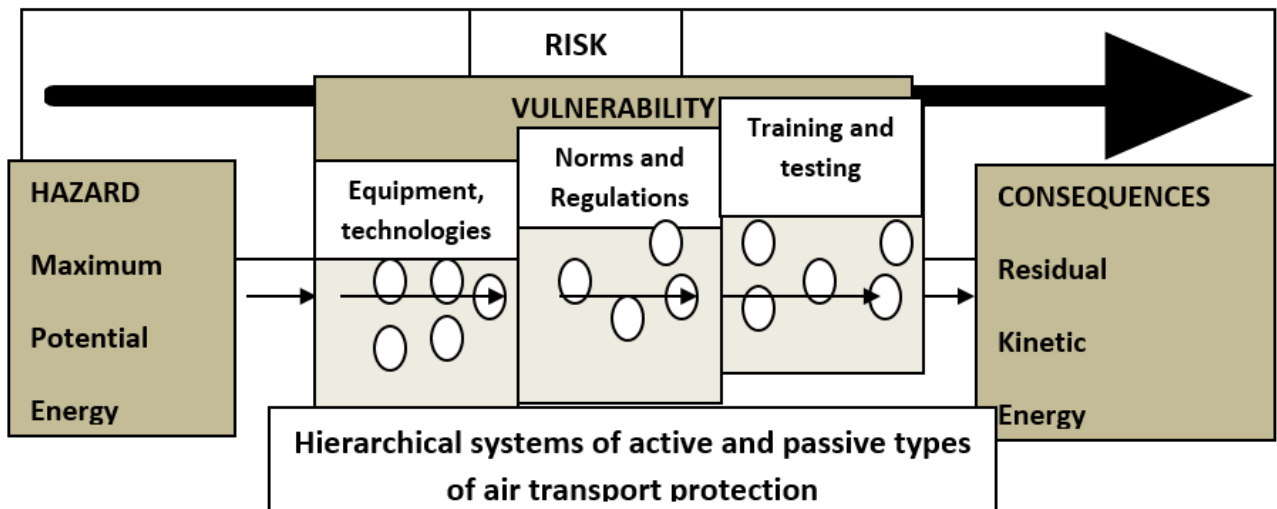


Figure 1. Using the model of "Swiss cheese" by J. Reason in the concept of national aviation risk management

Source: finalized by the authors[1].

Risk integration is carried out in the following areas: economic, environmental, social, technological, flight safety, aviation security and protection against terrorism, foreign policy, logistics and related sectors (Fig. 2). Advance management of integrated risks allows to obtain a positive synergetic effect at the level of sustainable national economy

Risks of the national air transport of Ukraine in the conditions of globalization of the world market of air transportation. For more than half a century, the international air

transport industry has been developing on the basis of clearly defined legal, economic, regulatory and organizational principles set out in the 1944 Chicago Convention (International Civil Aviation Convention). Convention covers issues of implementation of international air transport, propose standard intergovernmental agreements on "transit" and the Chicago type, which are chosen as the basis for all interstate agreements in the field of international air transport.

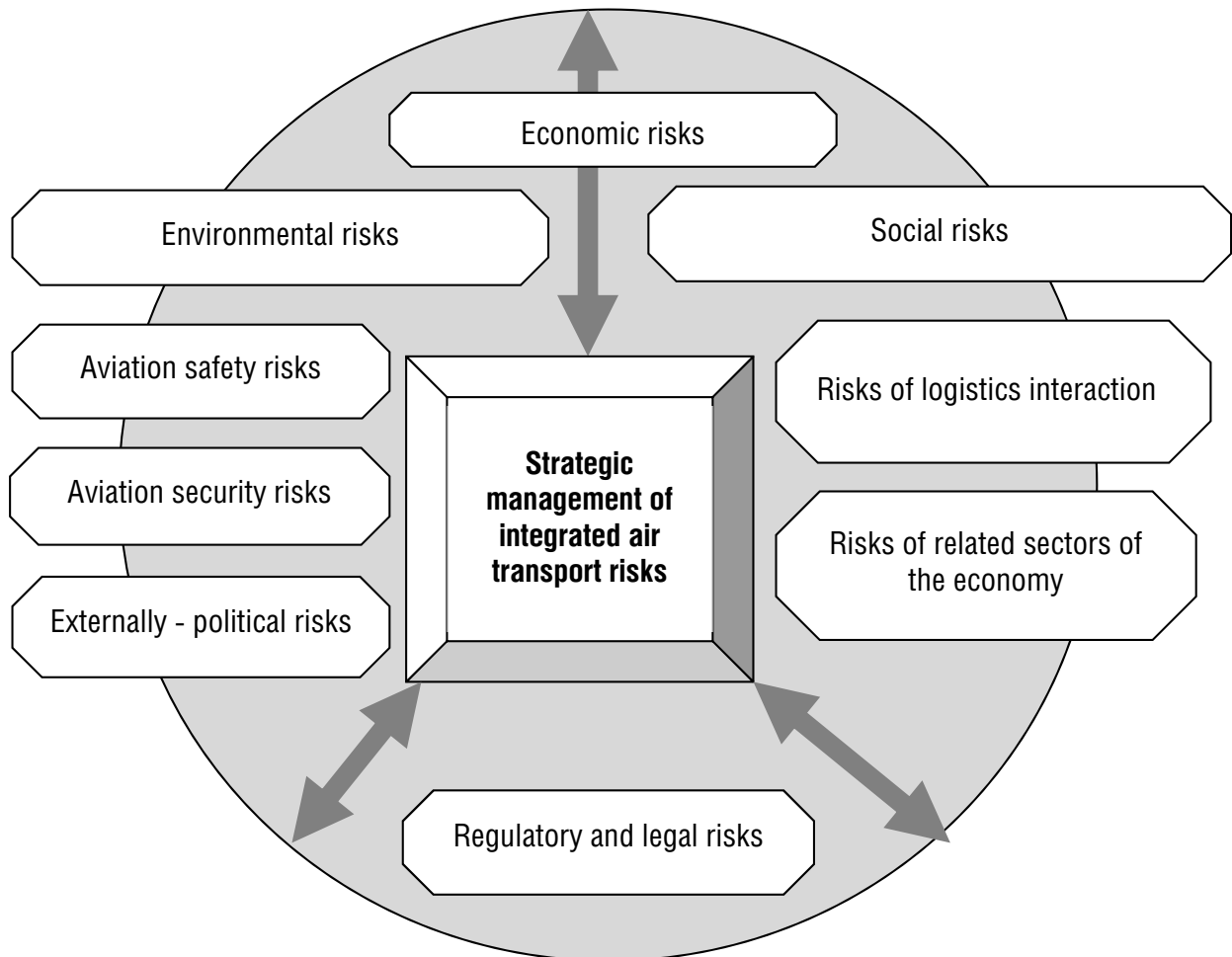


Figure 2. Integrated risks of air transport
Source: developed by the authors

The years of international air transport are characterized by the development and application of well-established mechanisms to protect their own air transport markets and national carriers through interstate agreements such as Bermuda 1 and Bermuda 2, which strictly stipulate commercial issues such as air freedoms, tariffs, capacities, points of sale, conditions of destination of air carriers, predominant ownership and actual control of countries over them, etc.

However, since the 1990s, the globalization of the world economy, on the one hand, and the steady increase in operating costs of air carriers - on the other led to qualitative changes not only commercial policy in civil aviation, but also

the development of its international regulatory framework. Among the most negative factors for air carriers are the destructive impact of the COVID-19 pandemic, the rampant rise in aviation fuel prices, dependence on the negative effects of global and regional financial crises, tragic events related to terrorist organizations (such as September 11, 2001 in the US), natural disasters (volcanic eruptions, tsunamis, earthquakes, etc.).

At the same time, while traditionally states have taken care of the development of their own national airlines, providing them in various ways overt or covert assistance, since the 1980s there has been a clear trend of states to withdraw from this practice. The

introduction of this ideology was initiated in the United States, where for the first time state aid was refused in order to intensify competition between airlines.

Unfortunately, there is a very dangerous risk of excessive cost savings, which could potentially lead to a decrease in the level of security of the air carrier. The development of this ideology has led to the de facto refusal of many countries to finance their own airlines. A clear example of this is the de facto ban on financial support for air carriers from EU countries and the application of this principle to airlines operating in the EU air transport market. These trends could not but cause qualitative changes in the global air transport market. This period is marked by a series of high-profile bankruptcies not only of small airlines, but also leaders in the global air transport market. Powerful global airlines are actively using the latest forms of commercial cooperation - multilateral interline agreements, agreements on special rates, code-sharing agreements, which lay the legal basis for the creation of marketing, strategic and global alliances of airlines.

Recent years have been years of global financial transactions, with powerful airlines from around the world buying up stakes in foreign airlines and de facto controlling foreign markets, leaving them to foreign airlines, despite existing intergovernmental agreements. On the other hand, the opening of markets and the development of regional cooperation opens up opportunities for open dumping in the field of tariff policy, which is successfully used by low-cost airlines, which are rapidly capturing dynamic market segments, such as the air transport market in the EU.

These globalization trends have outlined new requirements for the liberalization of air transport markets and the regulatory framework of interstate agreements. Liberalization at the present stage covers not only the two most powerful air transportation markets - the United States and the EU, but is also spreading rapidly in different regions of the world (Table 1).

Table 1. Types of intergovernmental agreements governing air transport

Trend	Period	Type of intergovernmental agreement	Contents of intergovernmental agreement
↓ ↓ ↓	1944	Chicago	Does not contain provisions on transportation capacity and tariffs
	1946	Bermuda I	Tariffs are set by airlines on the recommendation of IATA with the subsequent approval of both parties. The establishment of capacity is also the responsibility of airlines within the framework of certain principles with the possibility of joint review by the parties after a certain period of operation
	1977	Bermuda II	Strict restrictions on tariffs and capacity have been set
↓ ↓ ↓	from 1980	Liberal	The issues of commercial regulation are presented in an abbreviated version and provide for autonomous regulation by airlines.
	from 2005 (for Ukraine)	"Horizontal"	Eliminates flight restrictions - a prerequisite for "open skies"
	from 2011 (for Ukraine) 2021 with EC	"Open sky"	The principles of free competition are defined - all restrictions on the main elements related to the provision of air transportation are abolished (from 1 to 6 freedom of air)
Liberalization			

Source: developed by the authors

It was during this period that regional, multilateral and bilateral agreements were developed with significant expansion of content, departure from traditional regulatory tools and the transition to the model of "open skies" and liberalization of access to national markets for international transport. This reduces or completely eliminates control over commercial issues of international aviation, such as air freedom, tariffs, capacity, frequency of traffic, points of traffic. The procedure for assigning an air carrier to an international airline is undergoing significant changes. Historically, states have generally not granted the right of destination to airlines to airlines that are not in the predominant possession and de facto control of the state or its citizens.

On October 12, 2021, Ukraine and the European Union signed the long-awaited Common Aviation Area Agreement, known as the Open Skies Agreement. bilateral agreements, facilitate the opening of new

routes between Ukrainian and European cities, and as a result - should reduce ticket prices. The EU emphasizes that one of the consequences of signing the agreement should be the entry of new low-cost airlines to Ukraine and increase the tourist attractiveness of Ukraine. The agreement was initialed in 2013, but has not yet been signed due to the British-Spanish dispute over Gibraltar's ownership. As a result of globalization and liberalization, the application of the criterion of national ownership and control has become increasingly impractical. Many carriers are no longer owned by the state, and some have transferred a controlling stake to citizens of their own countries. Some bilateral air service agreements have introduced certain expanded criteria for airline ownership and control. The classification of threats, vulnerabilities, consequences and risks of air transport of Ukraine at the level of its regulation is given in Table 2.

Table 2. Classification of threats, vulnerabilities, consequences and risks of Ukrainian air transport at the level of its regulation¹

Classification of hazards	Vulnerability of protection systems (GAP Analysis)	Consequences	Risks
1. Problems of air transport regulation: 1.1 Changes in aviation safety regulation at the global and regional levels. 1.2 Changes in multilateral and bilateral regulation of the air transportation market. 1.3 Changing the mechanisms of destination of air carriers	1. Imperfection of national aviation legislation: 1.1 Lack of program development and implementation of Safety State Program (SSP). 1.2 Imperfection of mechanisms of protectionism of national airlines by the state. 1.3 Lack of preferences for state and mixed airlines	1. Insufficiently effective national regulation of air transport safety: 1.1 Discretion of management actions and insufficient level of resource provision of air transport safety. 1.2 Financial imbalance of national airlines, complicated by conditions of fierce competition. 1.3 Redistribution of segmentation of the national air transportation market	1. Reducing the level of efficiency and safety of national air transport: 1.1 Problems with maintaining a nationally acceptable level of aviation safety. 1.2 Bankruptcy of national airlines. 1.3 Obtaining the national market by the airlines with 100% foreign capital and control

Source: Dmytro Bugayko, Yuliya Ierkovska. *Institutional Measures of Air Transport Safety Strategic Management at the Level of State Regulation. Intellectualization of Logistics and Supply Chain Management. The electronic scientifically and practical journal v.9 (2021). P.6 – 19. ISSN 2708 -3195. <https://smart-scm.org>. [6].*

¹ The list of hazards, vulnerabilities, consequences and risks is not constant. The concept requires the introduction of a system of continuous monitoring of threats and the use of tools for change management (Change Management).

Thus, the globalization of international air transport is a global trend, which, on the one hand, gives airlines more opportunities to develop business, enter new international air transport markets, and on the other - there are many threats - from losing commercial control over their own air transport market to bankruptcy and destruction of national airlines due to fierce competition from financially powerful airlines, members of global airline alliances and low-cost airlines. In the conditions of the COVID-19 pandemic, the well-established mechanisms of economic security of air transport are losing their effectiveness and require integrated application of advanced risk management.

Risks of the national aviation transport of Ukraine in the conditions of the COVID-19 pandemic. One of the most threatening problems in the history of aviation is the spread of the new coronavirus infection COVID-19, which in fact leads to a quarantine blockade of entire regions and a sharp reduction in the number of air traffic or even their ban. Demand for air travel has declined sharply due to the spread of the coronavirus and flight restrictions in many countries. This creates big problems not only for air carriers, but also for airlines and their suppliers. As a result of the COVID-19 pandemic, air traffic

"fell" in a way that was not observed after the aftermath of the September 11, 2001 terrorist attacks in the United States. A significant reduction in the number of passengers has led to the flight of aircraft empty between airports and the cancellation of flights. Global demand for air travel has fallen by 70% compared to last year, and millions of jobs are at risk. Global airlines are even preparing for the possible voluntary termination of almost all international and domestic flights due to declining demand. In total, according to preliminary estimates of the International Air Transport Association (IATA), airlines could lose more than \$ 250 billion. because of the pandemic. Sydney-based consulting firm CAPA gives an even more pessimistic forecast. She predicts that a coronavirus pandemic could lead to the bankruptcy of most airlines around the world if the authorities refuse to agree on steps to avoid such a situation.

The COVID-19 pandemic has had a significant impact on the aviation industry due to the effects of travel restrictions as well as falling demand among travelers. In assessing the economic impact on civil aviation, ICAO is working with many different scenarios to reflect the very uncertain nature of the current situation and the rapidly changing environment (Fig. 3).

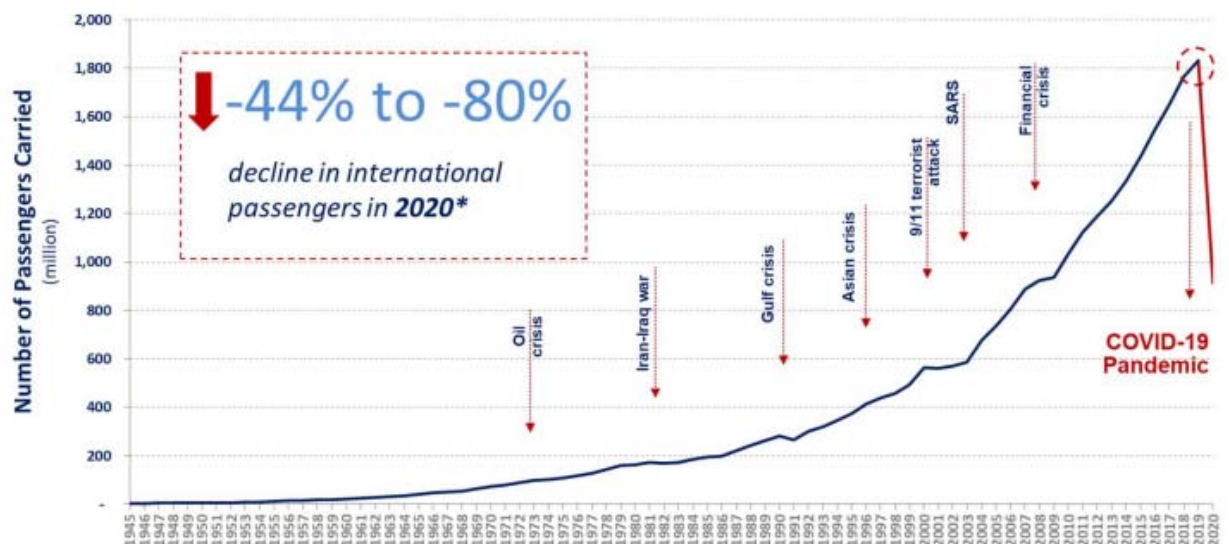


Figure 3 - The evolution of global air transport in the period up to 2020

Source: ICAO / Economic Development - Air Transport Bureau (2021) [17].

Therefore, according to the ICAO forecast, the global impact of COVID-19 on aviation, tourism, trade and the economy is expected, namely:

international air passenger traffic - total reduction of the number of international passengers in the range from 44 to 80% (ICAO);

airports - estimated losses of more than 50% of passenger traffic and 57%, or more than 97 billion dollars. USA, in revenue of airports (ACI);

airlines - reduction of passenger km revenue by 48% (RPK - both international and domestic) (IATA);

tourism - reduction of revenues from international tourism will be from 910 to 1170 billion dollars. US compared to 1.5 trillion in 2019, with 96% of the world's destinations have travel restrictions (UFTAA);

trade - a decrease in world trade in goods by 13-32% compared to 2019 (WTO);

the world economy - the projected reduction in world GDP by 3% in 2020 is much worse than during the financial crisis of 2008-2009 (IMF) (ICAO / Economic Development - Air Transport Bureau (2021)).

Global trends fully affect the economy of air transport in Ukraine. Operational statistics of the aviation industry of Ukraine in 2020 and 2021 allow us to assess the devastating impact of the pandemic on the functioning of the industry. The global pandemic situation associated with the COVID-19 outbreak and the restrictions imposed by states to counter its spread have directly affected the world's aviation industry, including Ukraine. In 2020, there is a significant reduction in the production performance of aviation enterprises compared to the previous year (Table 3) (CAA Ukraine (2021)) [18].

Table 3. Dynamics of production indicators of Ukrainian air transport enterprises in the conditions of the COVID-19 pandemic

Indicator	Total			Including international		
	2019	2020	% 2020/2019	2019	2020	% 2020/2019
Activities of airlines						
Passengers were transported, thousands of people	13705	4797,5	35,0	12547	4287,7	34,2
including on regular lines, thousand people	8267,8	1788,1	21,6	7122,6	1284,6	18,0
Passenger-kilometers, billion pass-kilometers are executed	30,2	10,1	33,5	29,7	9,8	33,0
including on regular lines, billion pass-km	17,5	3,1	17,7	17,0	2,9	17,1
Freight and mail transported, thousand tons	92,6	88,3	95,4	92,0	88,0	95,7
including on regular lines, thousand tons	19,6	5,7	29,1	19,4	5,6	28,9
Completed tonne-kilometers (cargo + mail), million tkm	295,6	316,2	107,0	295,2	316,1	107,1
including on regular flights, million tkm	93,0	18,4	19,8	92,9	18,4	19,8
Made commercial flights, thousand	103,3	45,3	43,9	86,7	35,3	40,7
including regular, thousand	66,6	20,4	30,6	51,7	11,8	22,8
Airport activities						
Sent and arrived aircraft, thousand units	201,2	94,0	46,7	162,7	69,0	42,4
including on regular flights, thousand units	153,6	58,6	38,2	124,9	41,7	33,4
Passenger traffic, thousand people	24334	8664,5	35,6	21994	7628,9	34,7
including on regular flights, thousand people	18833	5643,5	30,0	16530	4627,2	28,0
Mail and cargo flows, thousand tons	60,2	52,2	86,7	58,4	51,5	88,2
including on regular flights, thousand tons	54,1	40,8	75,4	53,0	40,4	76,2

Source: CAA Ukraine (2021) [18].

Activities of airlines. During 2020, passenger and cargo transportation was provided by 26 domestic airlines (in 2019 - 29), which performed a total of 45.3 thousand commercial flights (against 103.3 thousand flights in 2019). The aggravation of the epidemic situation in Ukraine and the world led to a decline in demand for air transportation and a decrease in commercial traffic at the end of the first quarter of 2020. As a result, airlines were forced to reduce frequency or cancel most flights. At the same time, due to the introduction of restrictive measures by the Government of Ukraine in the framework of combating the spread of COVID-19, both international (from March 17 to June 15) and domestic (from March 24 to June 5) passenger flights were almost suspended. In addition, temporary restrictions on crossing the Ukrainian border for foreign nationals were reintroduced (from August 28 to September 28), which, together with the extension of restrictions on entry of Ukrainian citizens to certain countries, significantly restrained demand in the air transport market (CAA Ukraine) 2021) [18].

These factors had a negative impact on the dynamics of passenger traffic of domestic airlines. Thus, for the first quarter of 2020, the reduction compared to the same period in 2019 was 17.7%, for the second quarter, which was the peak of restrictive measures - 98.3%. However, after the resumption of passenger flights in June, the rate of decline in traffic slowed down significantly and in the third and fourth quarters amounted to 61.4 and 66.2%, respectively. In general, during the reporting year the number of passengers who used the services of domestic airlines decreased compared to 2019 by 65% and amounted to 4797.5 thousand people. At the same time, the volume of passenger traffic by air transport of Ukraine returned to approximately the level of 2006-2007, when this figure was 4208.3 and 4928.6 thousand people, respectively. The largest decrease in the number of passengers carried by

domestic airlines (82%) was observed in such a segment of the air transport market as international scheduled flights. At the same time, 31 foreign airlines from 34 countries operated regular flights to Ukraine. During the reporting year, 3,323.5 thousand passengers used their services, which is 64.7% less than a year earlier and accounts for 72% of the total volume of regular passenger traffic between Ukraine and the world. The average employment rate of passenger seats on domestic scheduled flights decreased by 13.3 percentage points to 62.6% (CAA Ukraine (2021)) [18].

The system of airports of Ukraine has had significant negative consequences. The number of departing and arriving aircraft during 2020 amounted to 94 thousand (against 201.2 thousand in the previous year). At the same time, passenger traffic through the airports of Ukraine decreased by 64.4%, mail and freight traffic - by 13.3% and amounted to 8664.5 thousand people and 52.2 thousand tons, respectively. According to the results of the year, the number of passengers served by the country's main airport "Boryspil International Airport" decreased compared to the previous 2019 by 66.2%. Passenger traffic through Kyiv Airport (Zhulyany) decreased by 73.1%, Lviv - by 60.4%, Odessa - by 58.8, Kharkiv - by 50.8, Zaporizhia - by 24.9%. The number of flights in the airspace of Ukraine has sharply decreased. During the reporting year, the State Air Traffic Services Enterprise UkSATSE provided 142,000 flights for air navigation services, compared to 335.4 thousand a year earlier. The number of flights operated by aircraft and helicopters of Ukrainian airlines decreased by 54.7%, foreign airlines - by 59.1% CAA Ukraine (2021) [18]. The negative trend spread to 2021. In January-April 2021, the volume of passenger traffic of domestic airlines decreased compared to the same period last year by 16.2% and amounted to 1632.9 thousand people, including international - by 15.2 % and amounted to

1484.9 thousand people. Passenger traffic through the airports of Ukraine decreased by 33.2% and amounted to 2695.5 thousand people, including international traffic - by 34.2% and amounted to 2394.6 thousand people. During January-April 2021, Ukrainian

airlines performed 14.9 thousand commercial flights (a decrease compared to the same period last year was 11.8%), including international - 11.7 thousand (a decrease of 16.4%) CAA Ukraine (2021)) [18].

Table 4. Classification of threats, vulnerabilities, threats and risks of air transport of Ukraine that arose as a result of the COVID-19 pandemic¹

Classification of hazards	Vulnerability of protection systems (GAP Analysis)	Consequences	Risks
2. Challenges of the COVID-19 pandemic: 2.1 Reducing the volume of export-import operations in a recession. 2.2 Reducing the number of flights. 2.3 Reduction of air passenger traffic. 2.4 Under crowding of commercial activity level of airports and infrastructure	2. Vulnerabilities of the national aviation safety management system in a pandemic: 2.1 Imperfection of compensatory state mechanisms of air transport protection and national economy in the conditions of pandemic COVID-19. 2.2 Unprepared system of strategic financial management and economic security of air transport enterprises in conditions of the unpredictable impact of crisis phenomena	2. Total financial crisis at the general system level of air transport of Ukraine, as well as at the level of its hierarchical components: aviation infrastructure, airlines, airports, air navigation service provider and general aviation	2. Bankruptcy and destruction of the national air transport system at the general system level, as well as at the level of its hierarchical components: aviation infrastructure, airlines, airports, air navigation service provider and general aviation

Source: Dmytro Bugayko, Yuliya Ierkovska. *Institutional Measures of Air Transport Safety Strategic Management at the Level of State Regulation. Intellectualization of Logistics and Supply Chain Management. The electronic scientifically and practical journal v.9 (2021). P.6 – 19. ISSN 2708 -3195. <https://smart-scm.org>. [6].*

¹ The list of hazards, vulnerabilities, consequences and risks is not constant. The concept requires the introduction of a system of continuous monitoring of threats and the use of tools for change management (Change Management).

The classification of hazards, vulnerabilities, consequences and risks of air transport of Ukraine, identified as a result of the concept of national risk management of air transport within the integrated multifactor hierarchical model of describing the level of sustainable development in the safety dimension, resulting from the COVID-19 pandemic represented in Table 4.

Conclusions. In the context of modern conditions of air transport development, the concept of the national system of integrated risk management of air transport, based on

the classification of the main hazards of air transport in modern conditions, is substantiated. At the same time, priority attention is paid to the list of threats by the criterion of deviation from the point of sustainable development, the importance of the impact of hazards on the coefficient of elasticity, which allows more adequate assessment of threats and respond to them.

The classification of the main risks in the functioning of Ukrainian air transport has been developed, which includes the negative consequences of the COVID-19 pandemic,

reduction of export-import operations in the economic downturn, number of flights and air passenger traffic, low congestion of airports and air infrastructure. Risks are identified in the following areas of operation and development of air transport in Ukraine: export-import operations, aviation infrastructure, air cargo, airports, air navigation service providers and general

aviation, which allows early detection of risks and response to them.

The concept was implemented by the State Aviation Regulation Department of the Ministry of Defense of Ukraine, the State Civil Aviation Agency of Azerbaijan, Almaty International Airport (Kazakhstan), Ukraine-Aeroalliance, ICAO NAU Institute, Georgian Aviation Training Center (Georgia).

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