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SECURITY MANAGEMENT OF INTERMODAL TRANSPORTATION IN CONDITIONS OF SUSTAINABLE DEVELOPMENT OF GLOBAL SUPPLY CHAINS

Kulik Volodimir, Marchuk Volodimir, Harmash Oleh, Karpun Olga, Perederii Nadiia. «Security management of intermodal transportation in conditions of sustainable development of global supply chains». *The article considers the complex problem of ensuring the security of supply chains of various kinds,*

including dangerous, when they are transported by different modes of transport with the necessary transshipment in a single logistics flow. At the same time, the authors tried to take into account both the general concept of sustainable development of the system of global supply chains (consumer goods) and the dynamics of change of supply objects depending on specific needs and situations in the world. Therefore, given the current tense military situation in the world, the main focus was on intermodal transport of dangerous goods and systemic security risks and threats of man-made nature and their consequences for the generalized characteristics of economic and social security.

The research was based on the United Nations World Development Program to 2030, scientific and theoretical foundations of supply chain management and security, SCM, the concept of advanced risk management, as well as standards and practical recommendations of leading international organizations (ISO, BTO, ICAO and others) issues of economic security and protection of components of the world transport system from threats and exacerbation of risks.

The practical result of scientific research is the development of recommendations for ensuring man-made safety of intermodal transport in the supply chain of dangerous goods under the programs of preventive, compensatory and remedial measures.

***Keywords**:* security of supply chains, transport and logistics risks, dangerous goods, technical means, international terrorism, man-made threats, intermodal transportation, sustainable development.

Кулик Володимир, Марчук Володимир, Гармаш Олег, Карпунь Ольга, Передерій Надія. «Управління безпекою інтермодальних перевезень в умовах сталого розвитку глобальних ланцюгів постачань». *В статті розглянута комплексна проблема забезпечення безпеки ланцюгів постачань вантажів різного роду, в тому числі і небезпечних, при їх перевезенні різними видами транспорту з необхідними перевалками в єдиному логістичному потоці. При цьому автори намагались враховувати як загальну концепцію сталого розвитку системи глобальних ланцюгів постачань вантажів (продукції) широкого вжитку, так і динаміку зміни об'єктів поставок в залежності від конкретних потреб і ситуацій в світі. Тому, зважаючи на існуючу напружену військову ситуацію в світі основну увагу було приділено інтермодальним перевезенням небезпечних вантажів та системним безпековим ризикам і загрозам техногенного характеру і їх наслідкам для узагальнених характеристик економічної та соціальної безпеки.*

Базою виконаних досліджень була Програма ООН щодо світового розвитку до 2030 року, науково-теоретичні основи управління ланцюгами постачань та їх безпекою, SCM, концепція випереджаючого управління ризиками, а також стандарти і практичні рекомендації провідних міжнародних організацій (ISO, BTO, ICAO та інші) з питань економічної безпеки і захисту складових світової транспортної системи від загроз і загострення ризиків.

Практичним результатом наукових досліджень є розробка рекомендацій забезпечення техногенної безпеки інтермодальних перевезень в ланцюгах постачань небезпечних вантажів за програмами превентивних, компенсаційних та відновлювальних заходів.

Ключові слова: безпека ланцюгів постачань, транспортно-логістичні ризики, небезпечні вантажі, технічні засоби, міжнародний тероризм, техногенні загрози, інтермодальні перевезення, сталий розвиток.

Кулик Владимир, Марчук Владимир, Гармаш Олег, Карпунь Ольга, Передерий Надежда. "Управление безопасностью интермодальных перевозок в условиях устойчивого развития глобальных цепей поставок". *В статье рассмотрена комплексная проблема обеспечения безопасности цепей поставок грузов разного рода, в том числе и опасных, при их перевозке разными видами транспорта с необходимыми перевалками в едином логистическом потоке. При этом авторы пытались учитывать, как общую концепцию устойчивого развития системы глобальных*

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цепей поставок грузов (продукции) широкого потребления, так и динамику изменения объектов поставок в зависимости от конкретных потребностей и ситуаций в мире. Поэтому, учитывая существующую напряженную военную ситуацию в мире, основное внимание было уделено интермодальным перевозкам опасных грузов и системным рискам безопасности и угрозам техногенного характера и их последствиям для обобщенных характеристик экономической и социальной безопасности.

Базой выполненных исследований была Программа ООН по мировому развитию до 2030 года, научно-теоретические основы управления цепями поставок и их безопасностью, SCM, концепция опережающего управления рисками, а также стандарты и практические рекомендации ведущих международных организаций (ISO, BTO, ICAO и другие) с вопросов экономической безопасности и защиты составляющих мировой транспортной системы от угроз и обострения рисков.

Практическим результатом научных исследований разработка рекомендаций обеспечения техногенной безопасности интермодальных перевозок в цепях поставок опасных грузов по программам превентивных, компенсационных и восстановительных мероприятий.

Ключевые слова: безопасность цепей поставок, транспортно-логистические риски, опасные грузы, технические средства, международный терроризм, техногенные угрозы, интермодальные перевозки, устойчивое развитие.

General statement of the problem and its connection with scientific and practical tasks. In today's global transformations of international business, its cross-border and logistisation, especially in the extreme circumstances of Russia's military aggression on the territory of sovereign Ukraine and the threat to the whole of Europe, the problem of strategic security management of intermodal transport in global supply chains is becoming increasingly important. It requires unprecedented in scale and effectiveness measures to reorient the structure of specific transportation facilities, atypical use of modes of transport and their routes, increase the risks of safe implementation of systemic transport processes, procedures and actions. Ensuring the reconstruction of sustainable development of the global, regional and national economy not only in Ukraine but also in the EU as a whole directly depends on the comprehensive solution of this task in the future. The Sustainable Development Agenda 2030 remains a strategic document of the UN global level. It is an action plan aimed at ensuring global sustainable development in economic, social and environmental areas, which ensures that no UN member state is left behind. The 17 Sustainable Development Goals on the agenda for 2030 can be used as benchmarks for the coherent and balanced development of UN member states. Achieving such levels of safety and efficiency of intermodal transport in the system of world transport communications directly or indirectly depends on the achievement of such Global Goals for Sustainable Development (SDG) as: 4. Quality education; 8. Decent work and economic growth; 9. Industry, innovation and infrastructure; 11. Sustainable cities and societies; 13. Climate change. This list of Sustainable Development Goals, in which intermodal transport is involved, is not exhaustive. The number of states expanding the range of UN Sustainable Development Goals, including Objectives 4, 8, 9, 11, 13, 14, 16 and 17, is growing every year. In the future, this list will only grow [2]. Threats to supply chain security will arise at both global, regional and national levels. Accordingly, the requirements of strategic and operational coordination, harmonization and partnership between the United Nations as a whole and economic specific economic entities, as well as such international real and virtual entities as global networks of supply channels and chains, international transport corridors (ITC) passenger and freight traffic [4. 5]. In conditions of increased danger, such formations act as integral objects of end-to-

end security management of synchronized flow processes of integrated logistics systems.

The practical problem #1 of ensuring security for all mankind is protection from various threats caused by:

- high rates of change in all areas of life;
- the constant emergence of new dangers in a dynamic environment of transport activities;
- growing instability of the economic and socio-political environment;
- huge complexity and volumes of production and technological capacities;
- weak structure of security threats critical factors.

The growth of threat factors in supply chains is realized through:

- vulnerability of interdependence relations of chain subjects;
- insufficient structure of the resources of the information platform chain as a single integrated economic entity;
- growing unpredictability of development and forecasting of the global chain as a highly complex dynamic system;
- lack of time for decision-making on counteraction to danger in the conditions of high-speed electronic communications and vehicles of LP [3];
- the threatening nature of some technological advances due to their expected consequences;
- illegal activities of criminal organizations.

Security of supply chains provides their integral and systemic protection against internal and external threats of deviation and destruction of stable functioning and development of all interacting elements of the chain.

Review of publications and results of the analysis. Transportation can be defined as a key logistics activity related to the movement of products by a particular vehicle on a particular technology in the logistics chain, and which consists of complex and basic logistics operations and functions, including forwarding, cargo handling, packaging, transfer of ownership, insurance risks, customs procedures, etc. Intermodal in this case is the system of delivery of goods by several modes of transport on a single transport document with their reloading at transshipment points from one mode of transport to another without the participation of the goods owner.

An important issue is the classification of types and directions of ensuring the supply chains security. Focusing on economic security is necessary but not enough. Today, the environmental and technogenic safety of both logistics processes and technologies, as well as the goods themselves, which are transported in global supply chains, are equally important. Particularly dangerous threats of international terrorism exist in intermodal transportation systems [1, 9]. After all, the supply chain and its movement are connected with the rich infrastructure of vehicles and the paths of extensive warehousing, loading and unloading equipment, communication systems, computer technology and information technology. Figure 1 shows the relationship of structural elements of sustainable development with the security of intermodal transport of global supply chains [6].

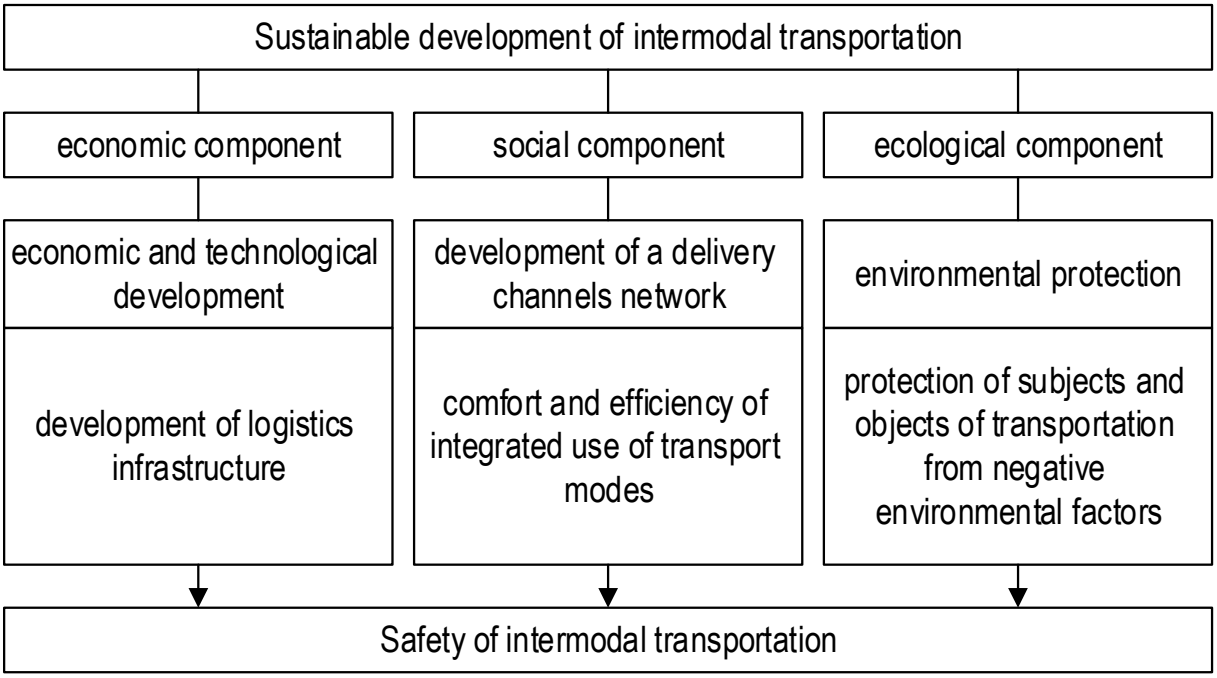

Figure 1 – The system of sustainable development of intermodal transportation in supply chains

Decreased security in supply chains increases the risks of cargo theft, corruption, fraud, and organizational and management errors. In some countries, especially ITC routes, this is facilitated by open access to cargo traffic information via the Internet, the lack of a unified cargo incident information system, the ability to obtain confidential information about companies and organizations and other fraudulent activities, and the low level of legal regulation of illegal actions in the transportation of commercial goods, and especially dangerous goods. At the same time, security problems in Ukraine are exacerbated by the lack of a unified system of transport safety standards in the national transport network, deterioration of the criminogenic situation, a marked reduction in law enforcement response and especially the complexity of transport in the war zone and escalating threats in the uncontrolled Donbass and Crimea.

The system of ensuring the supply chains security in general is designed to solve a range of interrelated problems: resolving conflicts between the interests of participants; control of responsibility transfer; security strategy and tactics based on modern scientific concepts, rights, standards and best practices, new models, methods, technologies and techniques; taking into account modern international approaches to the organization and management of supply in accordance with the requirements of ISO 28.000 to the security of the global supply chain [7].

World experience in building a supply chain security system draws attention to the most important elements in the activities of chain links, namely: services quality of supply chain participants; services quality of organizations that ensure the supply chain safety, territories and routes of movement; cargo categories; features of packaging and labeling; tracking and tracing technologies; cargo storage technologies; list of transport reserves by types of transport; chain information support; a list of characteristic obstacles in the way of logistics flows; a list of required internal flow processes covering all parts of the supply chain; characteristics of external conditions that affect the operation of the chain links; list of security threats in supply chains (updated); a list of significant problems that arise during the implementation of security threats [2, 9].

All trends in supply chain security management, discussed in the scientific literature [6], focus on economic security issues. In our opinion, this does not take into account the technogenic safety of supply chains, as the most complex technical entities with a very rich infrastructure of vehicles and roads, warehousing, handling equipment, telecommunications and computer technology [6].

One of the painful problems in the implementation of transport security policy in Ukraine in recent years has been the security of the ITC and their involvement in the unified international transport network. Russia's military aggression has effectively destroyed the transit capabilities of ITCs operating in Ukraine. World trends of globalization, new scientific and technological revolution, logistics and integration have enabled ITC, as a set of different modes of transport, to provide significant transportation of goods and passengers in the areas of their greatest concentration [1].

Presentation of the main material. In general, supply chain security covers three main areas:

- security of key infrastructure facilities - logistics enterprises of terminal and warehousing facilities, roads and highways;

- security of the moving part of the chain - all types of transport, packages, containers and, above all - the objects of supply - cargo;

- cybersecurity - information environment of IT technologies, databases of customers, suppliers, finance and programs.

Supply chain security management is identified as activities to maintain them at the level of stable operation (viability) and sustainable development, which includes the process of combating unauthorized actions, planning, monitoring and improving the system of comprehensive measures, including organizational and managerial, legal, physical, technical, technological, insurance, financial, economic and cultural aspects in order to reduce losses, identify and prevent offenses and other security threats, bring the perpetrators to justice, achieve goals and results [7].

Security management regulates security risks using a complex integrated mechanism of effective management depending on their risk category (Fig. 2).

Advanced management of integrated risks allows obtaining a positive synergetic effect at the level of supply chains sustainable operation.

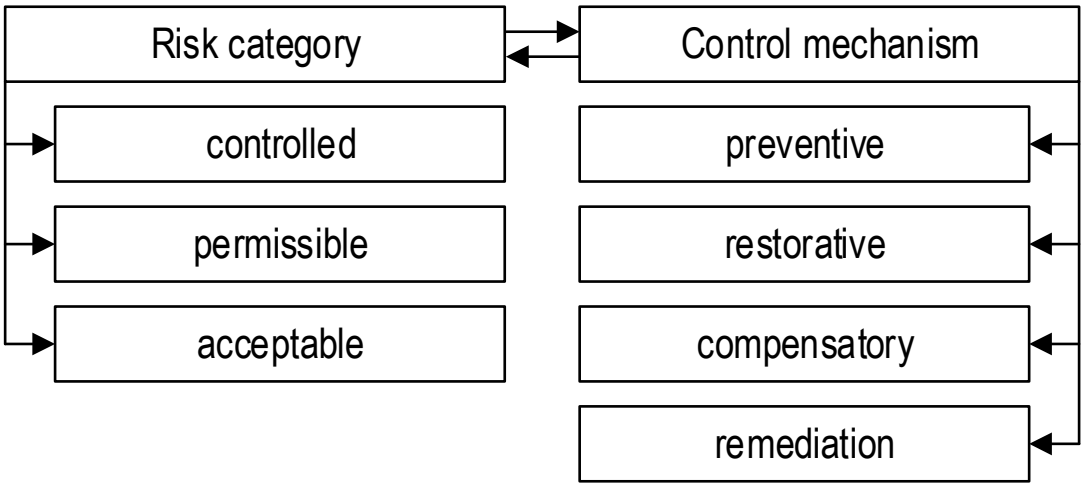

Figure 2 – Classification of risk management mechanisms

The concept of advanced risk management of intermodal transport in global supply chains. The leading link in the supply chain is transportation, and the most vulnerable stage of transportation is air transportation of cargo, as there are serious

threats of hijacking, terrorist explosions, unauthorized transportation of plastic explosives, weapons and nuclear materials. In the system of advanced risk management, the threat has the maximum potential energy, which can directly damage the system of intermodal air transport in particular and indirectly cause negative consequences for the sustainable development of the national economy as a whole. With this vision, 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" by J. Rieson and structural analysis of deficiencies (GAP Analysis) at the level of active and passive systems to protect vulnerable component of intermodal transport (that is an aviation transport), namely: techniques and technologies, norms, rules and regulations and personnel training / retraining systems. Identifying vulnerable or underprotected places (GAPs) at the level of each protection system, as well as analyzing their interconnectedness or singularity with respect to the passage of a threat 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 air transport protection systems and the synergistic effect of their integrated use. All residual energy is converted into kinetic energy and affects intermodal transportations due to spontaneous fractalization of negative impact factors, which is assessed as negative consequences of the threat impact after its passage through different hierarchical systems of active and passive protection. With such a question, risk can be assessed as a combination of threat, vulnerability and consequences (Fig. 3).

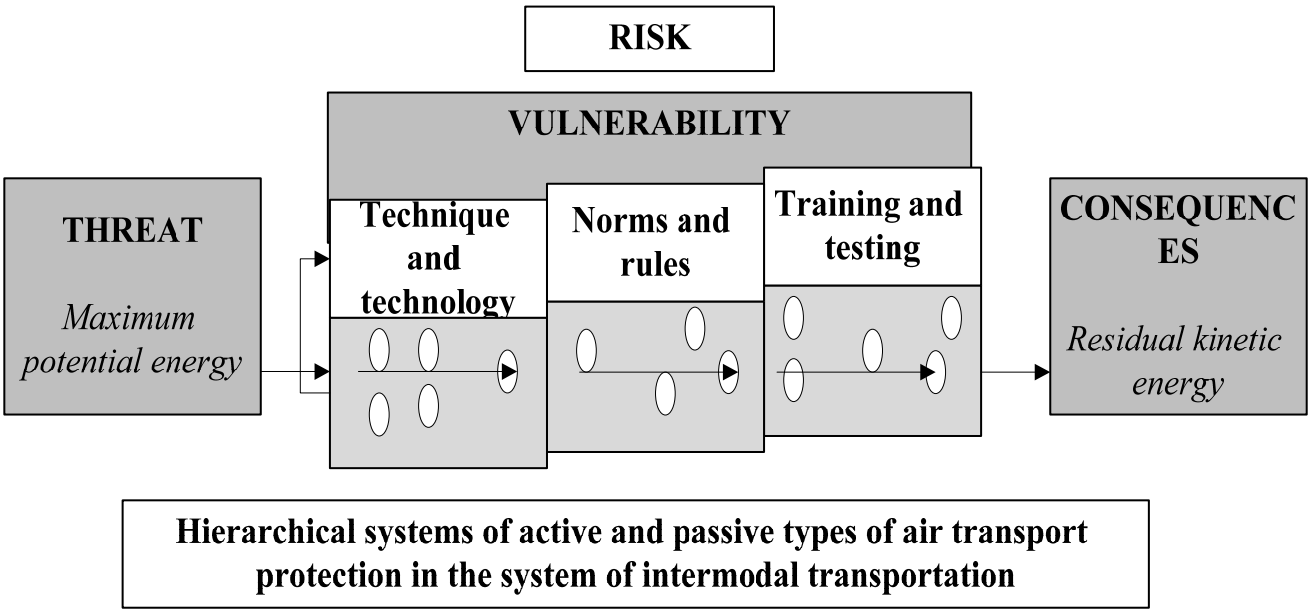

Figure 3 – The use of the "Swiss cheese" model by J. Rizon in the strategic management of air transport

Integrated air transportation risks are formed in the following areas: economic, environmental, social, technological, flight safety, aviation security and protection against terrorism, foreign policy, logistics and related sectors of the economy (Fig. 4).

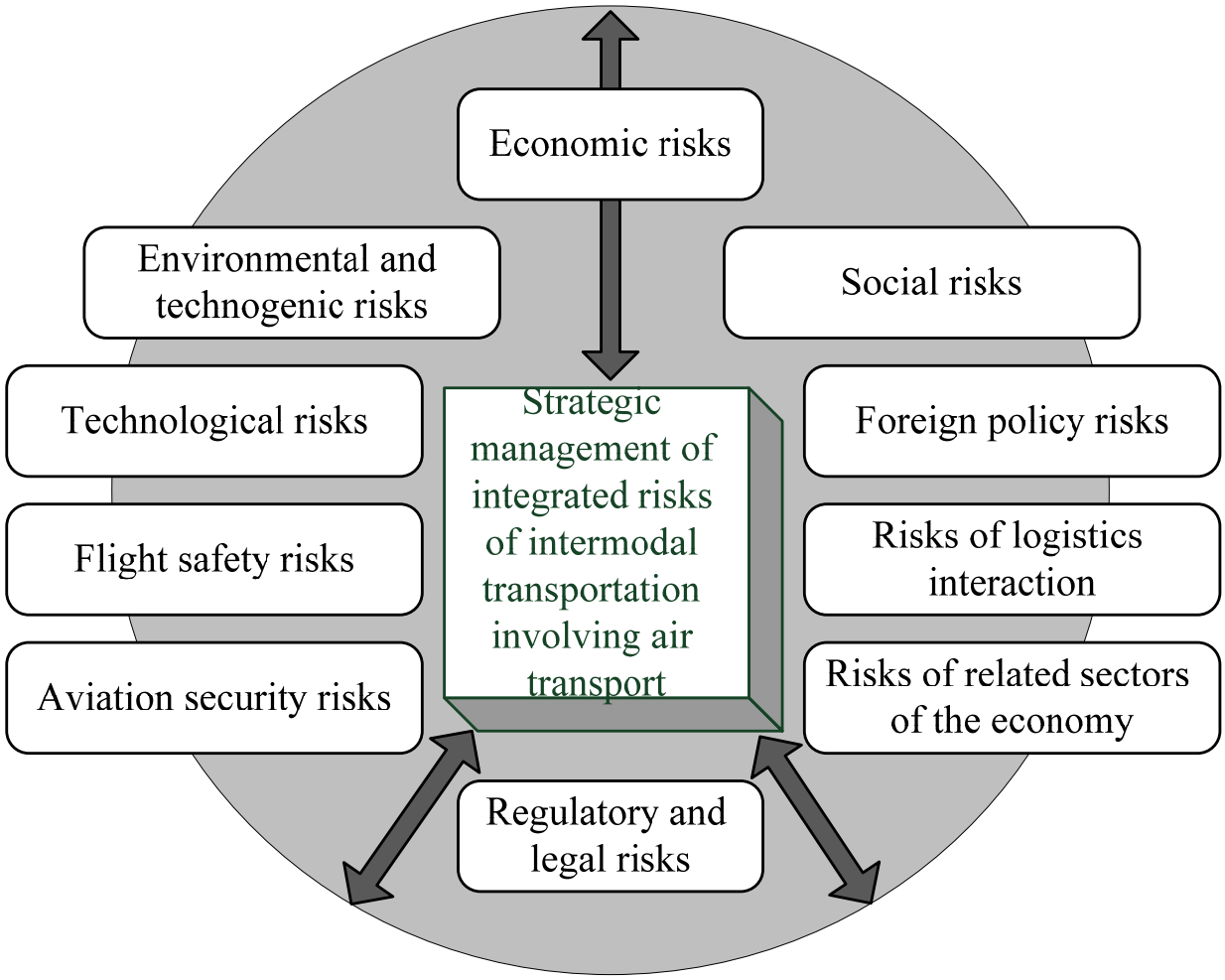

Figure 4 – Integrated risks of intermodal transportation involving air transport

Exacerbation of risks is facilitated by various economic factors - production, market, financial and investment - that reflect the specific situation and constantly changing state of supply chains (Fig. 5).

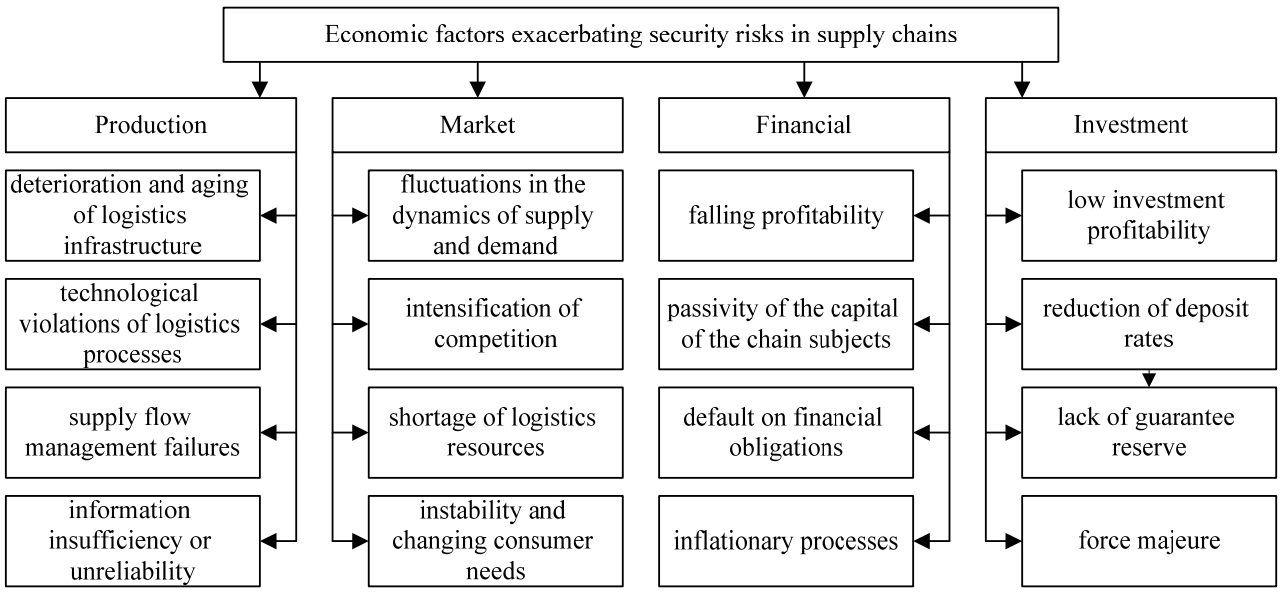

Figure 5 – System of risk exacerbation factors in supply chains

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For intermodal transportation, the most problematic in terms of supply flows security is the delivery of dangerous goods.

Dangerous goods are raw materials, products, wastes of production or other activities, which due to their inherent qualities in the presence of certain factors may pose a risk of explosion, fire, damage to equipment, facilities and other objects, causing material damage to the environment and lead to death, injury, poisoning of people and animals. Deliveries of such goods today account for about 20% of the total volume of goods supplied, and the trend of their growth continues. It is impossible to completely rule out the possibility of threats, and the use of standard and proven measures is not enough. Obligatory accompaniment of especially dangerous cargoes, end-to-end patrol of all trajectories of the logistics flow, territories of commodity and sorting enterprises, use of mobile inspection complexes are still relevant.

Ecological and technogenic aspect of intermodal transportation in global supply chains. The ecological aspect is especially important in the transportation of dangerous goods. As hazardous substances during transport and emergencies can have a negative impact on the environment (irreversible changes in the ecological background, the death of some species of plants and animals) and cause significant damage to human life and health, in many countries there are special safety rules operate in the carriage of dangerous goods. That is why the transportation of such goods, as well as all intermediate operations with them (loading and unloading, temporary storage, etc.) are strictly regulated in accordance with the European Agreement International Carriage of Dangerous Goods by Road (ADR). It was drafted within the framework of a requirements single system for the transportation of dangerous goods, designed to simultaneously secure their transportation between countries and simplify customs formalities as much as possible. European Agreement International Carriage of Dangerous Goods by Road (ADR) was established at the initiative of the United Nations and concluded in Geneva on September 9, 1957.

The United Nations (UN) has created a special list of hazardous substances (more than 3,000 items). Each hazardous substance included in this list has a four-digit number, which is called the UN number. This number can be used to find out the exact name of the dangerous substance being transported. The list is divided into classes. It is allowed to transport a dangerous substance of one class only according to the rules assigned to it (Table 1).

Table 1 – Classification of Dangerous Goods

UN Class	Dangerous Goods	Sub-Divisions
I class	Explosives	1.1. Substances and articles which have a mass explosion hazard 1.2. Substances and articles which have a projection hazard but not a mass explosion hazard 1.3. Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both 1.4. Substances and articles which present no significant hazard; only a small hazard in the event of ignition or initiation during transport with any effects largely confined to the package 1.5. Very insensitive substances which have a mass explosion hazard 1.6. Extremely insensitive articles which do not have a mass explosion hazard

End of table 1

UN Class	Dangerous Goods	Sub-Divisions
II class	Gases	2.1. Flammable gases 2.2. Non-flammable, non-toxic gases 2.3. Toxic gases
III class	Flammable liquid	There are no subdivisions within Class 3
IV class	Flammable solids	4.1. Flammable solids 4.2. Substances liable to spontaneous combustion 4.3. Substances which, in contact with water, emit flammable gases
V class	Oxidizing substances, Organic Peroxides	5.1. Oxidizing substances 5.2. Organic peroxides
VI class	Toxic and Infectious substances	6.1. Toxic substances 6.2. Infectious substances
VII class	Radioactive materials	There are no subdivisions within Class 7
VIII class	Corrosive substances	There are no subdivisions within Class 8
IX class	Miscellaneous dangerous goods	There are no subdivisions within Class 9

It is in cases of transportation of dangerous goods that threats to technogenic safety acquire catastrophic consequences. All these technical and technological components of the supply chain actors become a potential and real danger both for the direct participants - the performers of logistics operations, and for the environment. In Fig. 6 systematized directions and mechanisms of technogenic supply chains safety management.

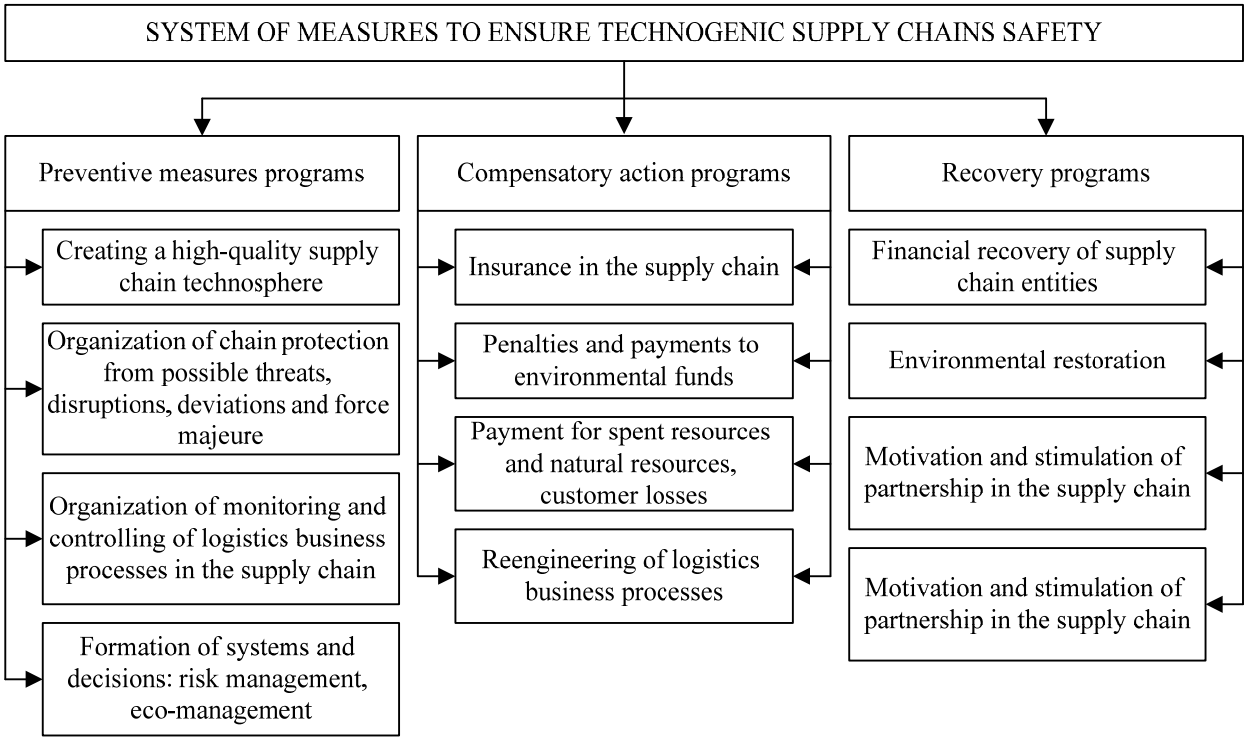

Figure 6 – The program of ensuring technogenic safety

First of all, it is necessary to develop a set of preventive measures that minimize the possibilities and conditions of technogenic disasters. It is not only about reducing or completely eliminating the problem of accidents due to violations of the operation rules of technical means and rules of transportation, but also about the system of monitoring the condition of dangerous goods at all stages of the supply chain. The US program of 100% container cargo scanning can be declared relevant and justified [7]. An obligatory component of the security program is a set of compensatory actions in the form of a logistics processes and operations reengineering system in response to new hazards and harmful effects, as well as fines and charges for deviations from standard requirements and regulations similar to the existing ICAO provisions on penalties for violations of the permissible noise level during aircraft landing and take-off. The program of technogenic safety measures should provide at the same time restoration projects of the territories, buildings, constructions and ecological environment affected as a result of technogenic situations.

The international requirements for the safety management system are based on a risk-oriented approach. The system must:

- to identify individual logistics processes of the supply chain;
- to determine the sequence of their interaction in the process of intermodal transportation;
- to define criteria and methods for effective operational control of data on security risks;
- to ensure the availability of resources, including information, for the sustainable operation of supply chains;
- to monitor, measure and analyze the risks of intermodal transport processes in supply chains to ensure their safety.

The nearest prospect of such systems development in the field of intermodal transportation will be a new quality of interaction of transport participants and logistics business on the basis of the developed models of integrated risks management in supply chains.

Risk management is, in essence, the economic mechanism of the regulation process and decision-making to reduce costs, improve productivity and quality of products and services in the integrated logistics chain. It provides an acceptable level of stability ("survival") of the system and its development, which is the safety of all economic processes.

The goals and principles of "absolute safety" or "zero risk", which have been used for many years in economic and technical systems, today give way to the principles of "acceptable risk" (ALARA - As Low As Reasonably Achievable). Following the world community, this approach is acceptable for Ukraine [4].

Today, Ukraine's transport system is not fully prepared to ensure the security of adequate volumes of international intermodal transportations. The main directions of solving this problem are:

- modernization of the unified transport system sections that limit their capacity;
- ensuring compliance of technical means and transport network with international standards;
- ensuring European standards of transportation quality - speed, safety, service, cargo storage and information services;
- signing and adherence to international documents that guide other European countries in regulating transport;
- development of infrastructure for all modes of transport.

Conclusions and proposals. In its activities to ensure the safety of intermodal transportation on all transport links of the supply chain it is necessary:

1. Harmonize and synchronize the standards requirements for all types of safety for intermodal transportation at all links in the supply chain.

2. To create, by analogy with the United States, the Transportation Security Administration (ITA).

3. Introduce transport worker ID cards.

4. Introduce a cargo traffic control system with prior electronic notification of any imported or exported cargo.

5. Scan the contents of the container before loading on the vehicle and follow the tracing technology throughout the transport period.

6. Carry out mandatory certification under the C-TRAT system (Customs - Trade Partnerships Against Terrorism).

7. Organize a system of mandatory information from the importer of the carrier (10 + 2) for 12 items of safety standards [8].

References

1. Bakayev O.O. Mizhnarodni transportni korydory – priorytet ukrayins'koyi ekonomichnoyi perspektyvy / O.O. Bakayev, S.I. Pyrozhkov, V.L. Revenko // Sotsial'no-ekonomichni doslidzhennya v perekhidnyy period. Ukrayina v KHKHI stolitti: kontseptsiyi. 112 Visnyk Natsional'noyi akademiyi derzhavnoho upravlinnya ta modeli ekonomichnoho rozvytku: Vyp. KHKHIII: materialy dop. V Mizhnar. konhresu ukr. ekonomistiv, m. L'viv, 22-26 trav. 2000 r. / NAN Ukrayiny. In-t rehion. doslidzh.; L'viv, 2001. – S.495-514.

2. Buhayko D.O., Kharazishvili YU.M. Teoretychni zasady stratehichnoho upravlinnya bezpekoyu aviatsiynoyi haluzi u konteksti zabezpechennya staloho rozvytku natsional'noyi ekonomiky. Visnyk ekonomichnoyi nauky Ukrayiny. 2020. № 1 (38). S. 166-175.

3. Boychenko M.V. Upravlinnya lantsyuhamy postavok: shlyakhy vdoskonalennya. – Rezhym dostupu: URL: http://www.evd-journal.org/download/2020/3(61)/16-Boichenko.pdf

4. Merezha mizhnarodnykh transportnykh korydoriv na terytoriyi Ukrayiny. – Rezhym dostupu: URL: http://www.mintrans.gov.ua/uk/transports/print/42.html.

5. Miroshko V.M. Mizhnarodni transportni korydory i Ukrayina / V.M. Miroshko. – Rezhym dostupu: URL: http://www.rusnauka.com/ 12.APSN_2007/Economics.

6. Bugayko D., Kharazishvili Yu, Liashenko V., Kwilinski A. Systemic approach to determining the safety of sustainable development of air transport: indicators, level, threats. Journal of European Economy. [Ternopil]. 2021. Vol. 20. № 1 (76). January – March. P. 146-182.

7. Byrd E. Rules for Importing Cargo Security / E. Byrd // Customs and Border Protection Today. – 2004, March. – P. 5-10.

8. Edmonson R.G. 10+2 now / R.G. Edmonson // Journal of Commerce. – 2009. – June. – P.13.

9. www.mipt.org. – Terrorism Knowledge Base

10. Marchuk V.Ye., Harmash O.M., Ovdiienko O.V (2020) "World Trends in Warehouse Logistics". Intellectualization of logistics and Supply Chain Management. [Online], vol.2, pp.32-50, available at: https://smart-scm.org/en/journal-2-2020/marchuk-volodymyr-harmash-oleh-ovdiienko-oksana-world-trends-in-warehouse-logistics/ (Accessed 28 July 2020). DOI: https://doi.org/10.46783/smart-scm/2020-2-3