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FACTORS INFLUENCING THE EFFICIENCY OF THE ORGANIZATION OF MULTIMODAL TRANSPORTATION UNDER THE CONDITIONS OF THE STATE OF MARTIAL

Dmytro Bugayko, Volodymyr Reznik, Shevchenko Olga *"Factors influencing the efficiency of the organization of multimodal transportation under the conditions of the state of martial".* Intermodal transportation plays an important role in the global economy. Many manufacturing sectors require various components in remote locations. Intermodal transportation is used to ensure that production processes are not interrupted. The war particularly affected Ukraine's entire intermodal transportation system. Ports, shelters and piers stopped their activities. The main role shifted to road transportation. Many airports were completely destroyed and most of the major ports were occupied, making further operations impossible until Ukraine was completely victorious. Road transportation became the saving link for supply chains and further economic activity. One of the main problems in this situation is to choose the best mode of transportation and the most suitable carrier. Trucking companies continue to cooperate with air agencies, but the shift of their main hubs to neighboring countries may raise new questions about optimizing deliveries. Factors such as price, quality of service, distance and time will always play an important role in the supply chain. The main goal of transport companies and their staff in intermodal transportation is to deliver the goods ordered by manufacturers safely, completely and on time. In this article, all the risks, bottlenecks of the organization of multimodal transportation under martial law are researched.

Keywords: transport system, cargo transportation, multimodal transportation, optimization processes, routes planning.

Дмитро Бугайко, Володимир Резнік, Шевченко Ольга. «Фактори, що впливають на ефективність організації мультимодальних перевезень в умовах воєнного стану». Інтермодальні перевезення відіграють важливу роль у світовій економіці. Багато виробничих секторів потребують різноманітних компонентів у віддалених місцях. Інтермодальні перевезення використовуються для забезпечення того, щоб виробничі процеси не переривалися. Війна особливо вплинула на всю систему інтермодальних перевезень України. Порти, причали та причали припинили свою діяльність. Основна роль перейшла до автомобільного транспорту. Багато аеропортів було повністю знищено, а більшість великих портів окуповано, що унеможливило подальші операції до повної перемоги України. Рятівною ланкою для ланцюгів поставок і подальшої господарської діяльності став автомобільний транспорт. Однією з головних проблем у цій ситуації є вибір найкращого виду транспорту та найбільш підходящого перевізника. Автотранспортні компанії продовжують співпрацювати з авіаагенціями, але перенесення їх основних хабів у сусідні країни може викликати нові питання щодо оптимізації поставок. Такі фактори, як ціна, якість обслуговування, відстань і час завжди будуть відігравати важливу роль у ланцюжку поставок. Основною метою транспортних компаній та їх персоналу в інтермодальних перевезеннях є безпечна, повна та вчасна доставка вантажів, замовлених виробниками. У статті досліджено всі ризики, вузькі місця організації мультимодальних перевезень в умовах воєнного стану.

Ключові слова: транспортна система, вантажні перевезення, мультимодальні перевезення, процеси оптимізації, планування маршрутів

Introduction. The modern globalized economy requires new conditions for the adaptation of intermodal transport. The role of intermodal transportation is becoming increasingly important. This is because this type of transportation allows production processes in different geographical locations to continue without interruption. When considering intermodal transportation, it is first necessary to consider the nature of this concept. Intermodal transport is the transportation of goods by two or more means of transport organized by a single logistics company. Moreover, the main transport company has the possibility to contract with subcontractors who provide other means of transport, but the main transport company is responsible for delivery. The different types of transport include rail, sea, car and air.

Thus, the main objective of the carrier's activity in the field of intermodal transportation is to ensure the timely delivery and integrity of the goods without violating

the conditions of a smooth production process.

A number of Ukrainian researchers such as Kharazishvili Y. [2, 7], Bugayko D. [1-2, 4-7], Reznik V. [1], Hryhorak M.Yu [4, 19], Ovdienko O., Marchuk V. [4], Logutova T. G., Poltoratskyi M. M [3] Hariesh Manaadiar [8-9] , David Simchi-Levi and Pierre Haren [11-13], Perkhun L.P.[16], F. Pérez-Galarce [17], are devoted to the study of the problems of further development of intermodal transportation. The work of many researchers is devoted to the development of aviation logistics, including: Johnson R., Hegre H., Karlsen J., Nygård H. M., Strand H., Urdal H., Shallcross N. J., Ahner D. K., Bogachov S., Feldman N., Eiran E., Rubin A., Brown G., Langer A., Schirch L., Kaspersen A., Barth E., Shetler-Jones Ph., Shallcross N. J., Ahner D. K., et al.

Also, among domestic researchers of the mentioned issue, the works of such scientists as: Arefieva O[20]., Simkova T., Zhurakivskyi V., Kharizashvili Yu., Bugayko D., Lyashenko V.,

Solovyova O., Gerasimenko I., Pron S. should be noted., Kravchenko T., Vysotska I., Valko A., Volkovska G [21]. Vysotska I [22] , Voychenko T., Radchenko O.[23] , Gura S [24]. and others.

Also, among the foreign researchers of the issue mentioned works are : Poliak M., Poliaková A., Mrníková M., Šimurková P., Jaśkiewicz M., Jurecki R., who researched the Competition and Regulation in the Provision of Local Transportation Services. Also, Glover, L. should be mentioned.

Dissertation studies sufficiently cover the issues of institutional support for the development of air transport in Ukraine, methodological aspects of increasing the efficiency of enterprises in the specified industry (Hura S. [24].), scientific justification for increasing the efficiency of managing logistics costs in the multimodal transportation (Kharchenko M.), the development of innovative activity of logistic companies (Tsymbalistova O.), management of the efficiency of logistics activities of e companies (V. Voytsekhovskiy) and others.

While highly appreciating the available scientific achievements of domestic researchers, we will nevertheless single out insufficiently covered scientific problems related to the development of logistics in the conditions of martial law and in the post-war period in Ukraine. The article was written to note the most important factors influencing the organizing of the multimodal transportation under martial law.

The purpose of the article is to provide research is to provide the theoretical foundations and problems of managing multimodal transportation and to develop project recommendations for transformation of the organization of multimodal transportation under martial law. It was also reviewed the main bottlenecks at the process of the organization of multimodal transportation during the state of martial law". It was also reviewed on the example of the Transport Organization, including the data provided by LLC "Freight Transport Partner".

Presentation of the main results. The effectiveness of intermodal transportation depends on a number of strategic constraints of internal and external nature.

In today's unstable conditions of institutional functioning, it is important to create a logical chain that forms effective organizational and economic mechanisms for innovative development of the transport sector in the intermodal transport system.

The efficiency of intermodal transportation depends on several factors, including

- Availability. The efficiency of intermodal transport depends to a large extent on how well the different means of transport are connected and accessible to each other. Adequate connections between means of transport reduce transit times and costs and increase overall efficiency;

- Coordination and synchronization. For intermodal transport to be effective, the various means of transport must be well coordinated and synchronized. This requires proper communication, planning and management to ensure that all means of transport are ready when needed and that there are no unnecessary delays;

- Infrastructure and technology The quality of infrastructure and technology used in intermodal transportation affects the efficiency of transportation. Good infrastructure such as well-developed roads, efficient ports and modern airports can reduce delays and increase efficiency. Advanced technologies such as tracking systems and real-time information can also help optimize the use of different modes of transport;

- Economic efficiency. To encourage the use of intermodal transport and make it a viable option, the cost of intermodal transport must be reasonable and competitive with other modes of transport. [25]

The effectiveness of intermodal transportation depends on the extent to which the above elements can synergize. Done properly, intermodal transport can provide a variety of benefits, such as

shortening transport times, reducing costs and improving environmental sustainability.

Air plays a key role in improving the efficiency of intermodal transport and its benefits include speed and time savings (air transport is one of the fastest modes of transport and helps reduce the time needed to move goods and people over long distances); flexibility (ensuring the flexibility of intermodal transport, which consists of responding quickly to changes in transport routes and schedules), accessibility (improving accessibility to remote and hard-to-reach areas) and efficiency (the speed and efficiency of transporting large quantities of goods and people, which is also a key component of the intermodal transport system). (the use of air transport as a component of the intermodal transport system contributes to increasing the throughput and, ultimately, the efficiency of the overall system).

Thus, the main criteria for selecting the optimal transport company within the framework of intermodal transportation are the criteria of economic efficiency and convenience, which contribute to reducing the costs of transporting raw materials and supplies necessary to ensure an uninterrupted production process. In cases of martial law, intermodal transport is the best transport option for domestic production enterprises. These include regulations that have been taken in the form of solutions in the form of decrees, orders, requests, applications, manuals, etc. Regulations and orders of local authorities shall within the competence and operate within the respective cities, districts, villages, towns, neighbourhoods, etc. Typically, these acts regulate relations in the sphere of public order, health, and trade within the respective administrative- territorial unit.

The last challenge on the global transportation market was during the first staged of COV-19 pandemic. Because of closed borders the terms of delivery were corrected. But shortcomes and failures, which discontinue the whole scheme of

transportation. The main reason for this were COV-19 restrictions, due to which the most harm was for container transportation. The whole process was stopped and timely paused, a lot of containers were in harbours waiting for repacking and reloading in auto, there was the lack of auto which are constructed for container transportation. But unfortunately, after one problem, there is an another, due to the war in Ukraine, all the airports are closed and harbours also temporary inefficient. All the capacity fallen into road transport, which consequent the lack of car transport and higher prices in different cases prices for transportation increased more than twice. Ukrainian carriers, which capital and sources survived under russian aggression, fastly restructurised their kind of services under new market terms. The first priority is humanitarian cargo. According to the official statistics of volunteer organizations, only at the first month of war, 120 humanitarian transportations had been performed.

This number includes both domestic and international deliveries. Food medicines, clothing, hygiene products, ammunition and goods for the militaries were carried. Mainly from the west of Ukraine to Kyiv, and from Poland and the Netherlands to Lviv. From Lviv this were carried to other points which were dangerous.

In most cases first time, humanitarian routes were free, the freight included only costs for fuel, but when the situation became getting better, the prices and demand became to grow. All the trucks, moving from one point of loading to another, to avoid the empty fuel wasting, were loaded by humanitarian cargo.

A lot of big logistics companies temporarily stopped their operational activity in Ukraine during the first month of war. There was lack of drivers, so the Ukrainian authority in order to reduce lack, allow to drive trucks with different categories of driver license. The commercial transportation of cargoes was also almost stop, in average only 15%-20% from all the orders and customers remained.

Table 1. Classification of restrictions affecting the efficiency of transport infrastructure.

A group of restrictions	A types of restrictions	Brief description
1	2	3
1. External	1.1. Innovative resources	Restrictions at the state level, restraining the level of development of the technological base, equipment, the use of resource-saving technologies, which determine the presence of a scientific and technical development department for the development of transport infrastructure
	1.2. Financial resources	The availability of financial resources in the state for investing in transport infrastructure, including the possibility foreign investments.
	1.3. Workforce	The availability of engineering, production, and logistics personnel of the necessary qualifications and appropriate level in the studied region, the possibility of involving personnel in the development of transport infrastructure
	1.4. Environmental resources	The possible negative impact of the use of transport infrastructure on the ecological situation, i.e. to what extent transport, development and expansion of the productivity of its infrastructure correspond to the ecological capabilities of the region in terms of air pollution, ecological load on the biosphere, etc.
	1.5. Political resources	They are determined by the economic policy of the state, the political situation at the time of the management decision, etc.
2. Internal	2.1. Financial resources	The availability of financial resources at enterprises for the formation and development of transport infrastructure, for the implementation of measures for the modernization of the transport fleet, etc.
	2.2. Material resources	Availability of enterprise assets that are a necessary component of the transport system
	2.3. Workforce	The availability of personnel of the appropriate level of qualification who are able to develop management decisions and participate directly in the formation and further use of transport infrastructure
	2.4. Innovative resources	Restrictions restraining the level of development of the technological base of the transport infrastructure, which determine the level of scientific and technical developments regarding the development of a new spectrum of transport and logistics services that consumers need more
	2.5. Information resources	Availability of information communication between all participants of the transportation chain; the possibility of functioning of information systems of different levels on a real-time scale with appropriate accuracy, speed and productivity

Developed by: Developed by Bugayko Dmytro, Reznik Volodymyr, Shevchenko Olga

Only after few months of war, export starts to alive. As for domestic transportation, situation began stable in save and remote regions. The war also created a shortage of warehouses, with many buildings either completely destroyed or partially bombed. Warehouses in the Western Region did not have sufficient capacity to store so much

cargo, including humanitarian cargo, which more than doubled compared to before the war. Moreover, despite the restructuring of the normal logistics network, prices rose rapidly. For example, a 20-ton truck from Kiev to Lviv, which cost UAH 10,000 before the war, now starts at UAH 50,000. Many factors influence prices: - urgency of transportation,

delivery time- Existing transport conditions. The active use of scientific and technological achievements and innovative technologies can increase the competitiveness of transport companies in national and international markets. Therefore, "technological developments in the transport sector include:

- Intelligent transportation systems (intelligent road transportation systems);
- Robotic process automation (Robotic Process Automation);
- Artificial Intelligence (Artificial Intelligence);
- Blockchain (Blockchain and all distributed ledger technologies);

Table 2. Sea ports in Ukraine [3]

№	Port name	Port location
1	2	3
1	Belgorod - Dniester seaport	The port is located on the shores of the Dniester estuary northwest of the Dniester-Constantinople estuary (southern bucket of the Dniester estuary)
2	Berdyansk seaport*	Sea of Azov, Berdyansk Bay, Tonka Strait
3	Izmail seaport	Port in the Odessa region, located at the mouth of the Kili River Danube.
4	Chernomorsk seaport	Black Sea
5	Mariupol seaport *	North-western part of the Taganrog Bay of the Sea of Azov
6	Mykolaiv seaport	The Mykolaiv seaport is located in the city of Mykolaiv near the left bank of a bend of the river the Southern Bug for 19 miles to the north from its mouth. The port also includes the port of Ochakiv and a raid near the city of Ochakiv near the banks of Trutayev
7	Odessa seaport	Black Sea, Odessa Bay
8	Specialized seaport Olbia	The left bank of the Bug-Dnieper estuary
9	Reni seaport	Coastline on the left bank of the Danube
10	Skadovsk seaport*	Black Sea. Dzharihgatskaya Bay
11	Ust-Dunaisk seaport	Odessa region, Kiliya district, Vilkovye city
12	Kherson seaport*	right and left banks of the Dnieper River in the city of Kherson
13	Southern seaport	Black sea, Adzhalik estuary

Developed by: Volodymyr Reznik, Bugayko Dmytro

According to the operational data of SE "AMPU", by the end of 12 months of 2021, port operators in all ports of Ukraine handled 153.076 million tons of cargo, down by 6.04 million tons or 3.8% compared to the same period last year.

In 2021, port operators handled 118.1 million tons of export cargo at sea (-4% compared to the same period in 2020), 24 million tons of import cargo (+1.5% compared to the same period in 2020), 8.6 million tons of transit (-14.3% compared to the same period in 2020), 2.3 million tons of cabotage cargo (-2.4% compared to the same period in 2020). handled.

Grain and ore were the largest cargoes handled at the ports in the 12-month period, with 49.9 million tons (+3.9% y/y) and 37.75 million tons (-14.8% y/y), respectively. Transshipment of petroleum products increased by 82% in the 12-month period, reaching 1.93 million tons.

On the Figure, represented by author, you can see the map if the Ukrainian railroads. Railway transportation plays a key role at the transport infrastructure of Ukraine. Also it is one of the component of the whole systems of multimodal supply chain. [26]



Figure 1 – Railway road map of Ukraine

Source: Screenshot Electronic resource- [Link] - <http://www.ua-maps.com/map-10/>

As to the railway transportation, for accurate understanding the dynamics, the Table 3 is provided bellow.

Table 4 – Calculation of assessments according to quantitative criteria

№	Freight type	Years					
		2016	2017	2018	2019	2020	2021
1	Total freight	343	339	322	313	306	314
2	oil and oil products	15 (4)	14 (4)	12 (4)	12 (4)	11 (4)	12 (4)
3	coal	73 (21)	67 (20)	65 (20)	59 (19)	49 (16)	50 (16)
4	coke	8 (3)	6 (2)	6 (2)	5 (1)	5 (2)	5 (2)
5	ore	77 (23)	70 (21)	71 (22)	75 (24)	80 (26)	78 (25)
6	cement	6 (2)	6 (2)	6 (2)	6 (2)	6 (2)	6 (2)
7	chemical and mineral fertilizers	11 (3)	12 (4)	9 (3)	9 (3)	9 (3)	11 (4)
8	timber	4 (1)	4 (1)	3 (1)	1 (0)	1 (0)	1 (0)
9	ferrous metals (including scrap)	29 (8)	26 (7)	25 (8)	24 (8)	22 (7)	24 (8)
10	grains, cereals and flour	32 (9)	37 (11)	34 (10)	40 (13)	35 (11)	34 (11)
11	other freight	88 (26)	97 (28)	91 (28)	82 (26)	88 (29)	93 (30)

Source: State statistics service-[Electronic source]-Link- <https://www.ukrstat.gov.ua>.

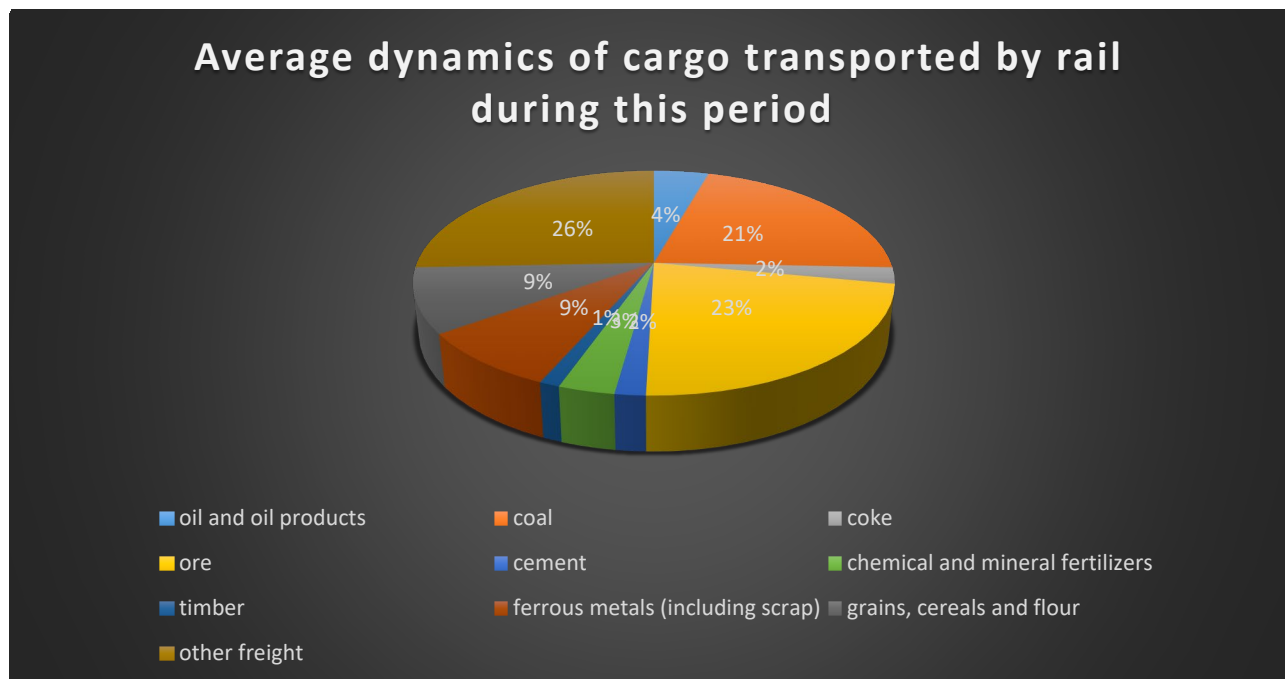


Figure 2 – Average dynamics of cargo transported by rail during this period (2016-2021)
 Source: State statistics service-[Electronic source]-Link- <https://www.ukrstat.gov.ua>.

Table 4. – Dynamics of volumes of cargo transportation by types of transport in Ukraine, million tons

№	Type of transport	Years									2022 in % by 2021
		2013	2014	2015	2016	2017	2018	2019	2020	2021	
1	Total of all transport including:	1837	1623	1474	1543	1582	1643	1579	1641
2	Rail	444	386	350	343	339	322	322	306	314	102,9
3	Road	1261	1131	1021	1086	1122	1206	1206	1232
4	including car companies	126	131	109	123	126	134	190	152	224	147,4
5	Sea	3	3	3	3	2	2	2	2	2	95,2
6	River	3	3	3	4	4	4	4	4	4	96,7
7	Air	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	92,7
8	Pipeline	126	100	97	107	115	109	113	97	78	79,6

Source: State statistics service-[Electronic source]-Link- <https://www.ukrstat.gov.ua>.
 Developed by: Reznik Volodymyr

The data in Table 4 shows that freight traffic by rail has been decreasing for six years: A slight increase of 2.6% in 2021 compared to 2020, but a decrease of 8.5% compared to 2016. At the same time, coal transport volumes fell significantly, by 31.5% in 2021 compared to 2016, and oil and petroleum

products by 20% compared to 2016. However, volumes of ore and grain, cereals and flour increased: 1.3% and 6.3% respectively in 2021 compared to 2016. The analysis of the structure of freight transportation by rail shows that the largest share in the structure of freight transportation

by rail belongs to other cargoes with 26%-30%. Ore and coal account for 21%-26% and 16%-21%, respectively.

According to the results of October 2022, 'Ukrzaliznitsia' transported 12.06 million tons of cargo. This is an increase of 380,000 tons or 3.3% compared to September this year. The volume of export cargoes in October was 5.186 million tons, of which 3.059 million tons were grain cargoes. UZ as a whole transported 3.598 million tons of grain in October (5.8% more than in September), the highest monthly volume since the start of the full-scale war. The transport volume was the highest on record.

Cement was transported at 288.6 million tons, coal at 2,213 million tons and construction materials for mines at 1,951 million tons. The volume of iron and manganese ore transported fell to 1.4259 million tons (-4.3% compared to September)

and steel to 6.285 million tons (-9.2% compared to September) [27]

It can be made such conclusions from the Table 4, as

Rail transportation: freight traffic fell by 65.3%. About 6.3 thousand km of tracks were destroyed. 'Ukrzaliznytsia' increased freight transportation tariffs by 70%.

Road transportation: the total length of destroyed roads is 24,000 km. Overloading due to huge queues at border crossings.

Water transport: closure of sea ports (exception: ships of the "Grain Agreement"). There are four ports in the occupied territory (Berdiansk, Mariupol, Skadovsk and Cologne).

Air transportation: all forms of civilian transportation are completely suspended. Twelve airports have been partially or completely destroyed.

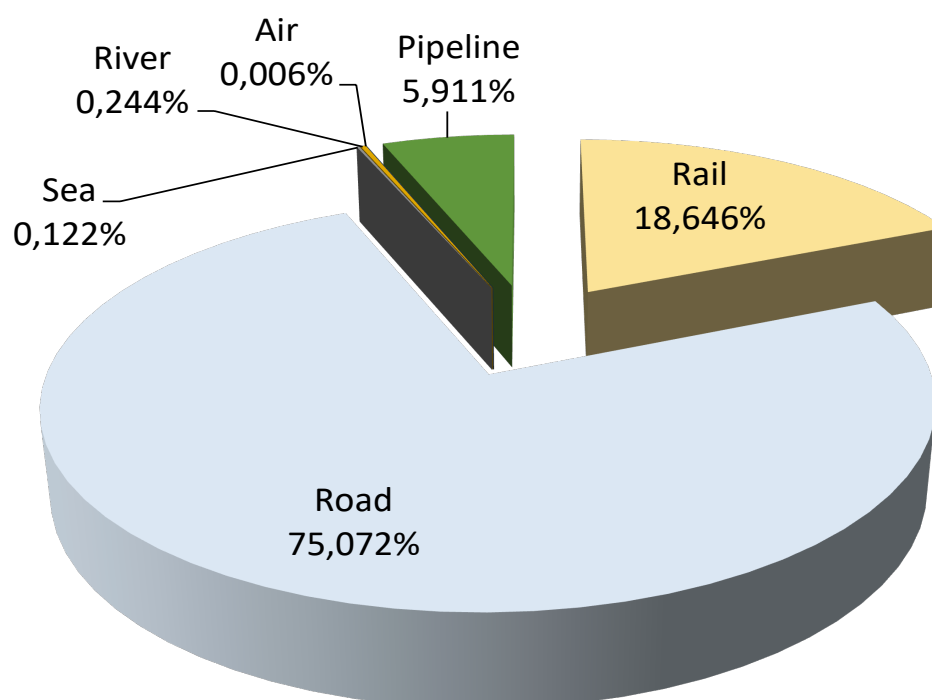


Figure 4 – The share of types of transport in volumes of cargo transportation by 2021 year.

Source: : State statistics service-[Electronic source]-Link- <https://www.ukrstat.gov.ua/>

Developed by: Bugayko Dmytro, Reznik Volodymyr, Shevchenko Olga.

Taking into account the experience of intermodal transport in Europe, the creation and development of this type of transport in

Ukraine is very important and requires solving a number of issues related to the organization of transport on existing and new routes, in

particular, compliance with EU norms. Due to the complex geopolitical situation, road and rail transport leads the westward transport flows. It is clear that the work of the transport complex reflects the state of the regional economy, which is currently not in the best condition. In order to make the most of Ukraine's transport capacity, especially as a transit country, it is necessary to create a customer-oriented transport service system, ensure effective organization of the country's transport and road complexes, and effectively combine all types of transport capacities and capabilities on the basis of partnership and competition in transport. Below are some of the key elements of the system. Measures should be taken to achieve synergies from the combination of two. [28]

Conclusions. In today's unstable situation of institutional functioning, it is important to create a logical chain that forms an effective organizational and economic mechanism for innovative development of the transport sector in the intermodal transport system.

The objectives of innovative activities of transport enterprises are:

- Ensuring the quality of transportation services;
- Responsiveness to orders and timeliness of transportation;
- Ensuring the safety of freight transportation;
- Implementation of up-to-date information systems;
- Use of energy-saving technologies;
- Increasing the environmental compatibility of transport services.

The priority direction of state regulation of the economy is the stimulation of innovative activities, which requires the establishment of an effective innovation and innovative processes management system to ensure the exit of the transport sector from the crisis situation and the development of an intermodal transport system. The main reasons hindering the innovative development of the transport sector in the intermodal transport system are:

- Incomplete legal basis for the implementation of intermodal transportation of goods;
- Incompatibility of regulations on the transportation of dangerous goods with EU norms;
- Lack of conditions for the establishment and operation of national intermodal transport operators;
- Incomplete customs policy in transport;
- High risks for intermodal operators when organizing long-distance transport involving multiple means of transport;
- Technological backwardness of transport and infrastructure; low level of implementation of modern technologies and innovative policies in the transport sector;
- Disproportion between the level of development of railway infrastructure capacities and cargo handling capacities of ports;
- Existence of 'bottlenecks' in the infrastructure for transit transport by rail;
- low level of development of railway infrastructure capacity and port cargo handling capacity;
- Slow adoption of new information technologies;
- Lack of compensation mechanisms for investments in strategic transport facilities;
- Lack of a transparent accounting system for transport costs and effective control mechanisms for the provision and use of funds for the repair, reconstruction and construction of transport infrastructure;
- Lack of specialized and experienced professionals in the field of intermodal transport; etc.

Taking into account the experience of intermodal transport in Europe, the creation and development of this type of transport in Ukraine is of great importance and requires solving a number of issues related to the organization of transport on existing and new routes, in particular, through adaptation to the norms of the European Union. Due to the complex geopolitical situation, road and rail transport directs transport flows westward. It is clear that the work of the transport complex

reflects the state of the domestic economy, which is currently not in the best condition.

In order to make the most of Ukraine's transport potential, especially as a transit country, it is necessary to create a customer-oriented transport service system, to ensure effective organization of the country's transport and road complexes, to ensure effective organization of all types of transport potential and capacities on the basis of partnership and competition in transport. Measures should be taken to achieve synergies from the combination of the two

The prerequisites for the formation of intermodal transport routes on the market under modern conditions were analyzed. The pre-war conditions of the transportation market were analyzed: Until February 2022, the market had a heterogeneous development structure, as the global downturn following the coronavirus pandemic had a significant impact on the market. At the same time, it should be noted that total transportation volumes in 2020 increased compared to 2019. This increase was mainly due to road transport. Other types of transport remained at the same level (water transport, air) or decreased (rail). The beginning of the large-scale occupation had a significant impact on Ukraine's transport infrastructure, many railway and road routes were destroyed, air routes were completely closed, and sea ports were almost completely blockaded. The increase in passenger and freight traffic to the West has highlighted problems with border infrastructure Logistics companies, like many commercial enterprises, had to rebuild their operations

with the start of the war and develop new operational plans under martial law conditions. Therefore, companies, having experienced the destruction of many transportation schemes, had to find ways to build new routes. Mixed air transport will be taken to airports in Poland and Germany, from where it will be transported by road to Ukraine. Transportation is a key complex activity related to the movement of material resources, work-in-progress or finished products by a certain means of transport in the logistics chain. The development of the multimodal cargo transportation system contributes to the solution of the region's economic issues; ensures coordination and organizational-technological interaction of all links of the cargo delivery chain; ensures the development of the transport services market infrastructure. The development of the country's transport complex under martial law is a very important task for supporting the country's economy. On the one hand, the need to restore many kilometers of destroyed roads will require huge investments, and on the other hand, it gives an opportunity to immediately build a modern transport infrastructure that meets all global quality requirements. At the enterprise level, it is necessary to solve the tasks of restructuring one's own business processes or modernizing existing ones to adapt to external circumstances. Thus, due to the cancellation of air transportation and the blockade of sea ports, the company should focus to rebuild its multimodal routes. Delivery by air transport will be carried out to the airports of European countries

References

- 1) Bugayko D.O., Reznik V.V., Borysiuk A.V., Bugayko D.D. (2023) "Transformation of the organization of multimodal transportation under martial law" – Intellectualization of logistics and Supply Chain Management. [Online], vol.17, pp.6-22, available at: <https://smart-scm.org/en/journal-17-2023/transformation-of-the-organization-of-multimodal-transportation-under-martial-law/>. DOI: <https://doi.org/10.46783/smart-scm/2023-17-1>

- 2) Kharazishvili, Y., Bugayko, D., Liashenko, V., & Kwilinski, A. (2021). Systemic approach to determining the safety of sustainable development of air transport: indicators, level, threats. *Journal of European Economy*, 20(1), 146-182.
- 3) Logutova T. G., Poltoratskyi M. M. The current state of the transport infrastructure of Ukraine. Theoretical and practical aspects of economics and intellectual property. 2015. Issue 2(12). T. 2. P. 8-14
- 4) Ovdiienko, O., Hryhorak, M., Marchuk, V., & Bugayko, D. (2021). An assessment of the aviation industry's impact on air pollution from its emissions: worldwide and the Ukraine. *Environmental & Socio-economic Studies*, 9(2), 1-10.
- 5) Bugayko, D., Leshchynskyi, O., Sokolova, N., Isaienko, V., & Zamiar, Z. (2019). Analysis of the Aviation Safety Management System by Fractal and Statistical Tools. *Logistics and Transport*, 44, 41-60.
- 6) 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>.*
- 7) Bugayko D., Kharazishvili Yu., Antonova A., Zamiar Z. Identification of Air Transport Ecological Component Level in The Context of Ensuring Sustainable Development of the National Economy. *Intellectualization of Logistics and Supply Chain Management: the electronic scientifically and practical journal. 2020. № 3. October. P. 38-53. URL: https://smart-scm.org/wp-content/uploads/3_20_titul_j_full.pdf*
- 8) Hariesh Manaadiar. (2013). Understanding the difference between Intermodal and Multimodal transport. *Shipping and Freight Resource. URL: <https://www.shippingandfreightresource.com/difference-between-intermodal-and-multimodal-transport/>*
- 9) Hariesh Manaadiar. (2013). Understanding the difference between Intermodal and Multimodal transport. *Shipping and Freight Resource. URL: <https://www.shippingandfreightresource.com/difference-between-intermodal-and-multimodal-transport/>*
- 10) The Recalculation of the Weights of Criteria in MCDM Methods Using the Bayes Approach-[Electronic source]-Link-https://www.researchgate.net/publication/325648841_The_Recalculation_of_the_Weights_of_Criteria_in_MCDM_Methods_Using_the_Bayes_Approach
- 11) David Simchi-Levi and Pierre Haren [Electronic source] – Access Link - <https://hbr.org/2022/03/how-the-war-in-ukraine-is-further-disrupting-global-supply-chains>
- 12) Criteria for decision making [Electronic source] – Link-<https://studfile.net/preview/6267450/> P:17
- 13) Mokhova Yu.L. Significance of the transport gallery in the system of the national economy of Ukraine. *Manager. 2015. No. 1 (69). P. 88-96.* 8 Mokhova Yu.L. Significance of the transport gallery in the system of the national economy of Ukraine. *Manager. 2015. No. 1 (69). P. 88-96.*
- 14) Hariesh Manaadiar. (2013). Understanding the difference between Intermodal and Multimodal transport. *Shipping and Freight Resource. URL: <https://www.shippingandfreightresource.com/difference-between-intermodal-and-multimodal-transport/>*

- 15) Ovchar P.A., Golubka S.M. Strategy for the development of the motor transport system: change and special molding. Economic Bulletin. 2018. No. 1. S. 102-108.
- 16) Perkhun L.P., Bratushka S.M., Sinyavska O.O. K13 Stability of dynamic systems with an invariable hour: heading guide / V.A. Kadievsky, L.P. Perkhun, S.M. Brother, O.O. Sinyavska. – Sumi: Vidavnistvo: PP Vinnichenko M.D., FOP Litovchenko Y.B., 2014. – 120. p. 18 - <https://core.ac.uk/download/pdf/141455028.pdf>
- 17) F. P´erez-Galarce, E. Alvarez-Miranda, A. Candia, and P.Toth"On exact solutions for the Minmax Regret spanning tree problem. Computer Operation Research, 2014, P.2. - <https://www.ijsr.net/archive/v9i2/ART20204447.pdf>
- 18) The Recalculation of the Weights of Criteria in MCDM Methods Using the Bayes Approach-[Electronic source]-Link- https://www.researchgate.net/publication/325648841_The_Recalculation_of_the_Weights_of_Criteria_in_MCDM_Methods_Using_the_Bayes_Approach
- 19) Logistics of supply, production and distribution. Hryhorak M.Yu., Katerna O.K., Karpun O.V. Tutorial. - K.: NAU, 2017. – P.- 75-84
- 20) Arefieva, O., Simkova, T., & Zhurakivskyi, V. (2022). STRATEGIC DEVELOPMENT OF AIR TRANSPORT ENTERPRISES IN COMPETITIVE CONDITIONS. Economy and society, (44). <https://doi.org/10.32782/2524-0072/2022-44-101>
- 21) A. Valko, O. Soloviova, G. Volkovska, I. Herasymenko Konstrukting a system of aviation safety as a key element of airport service quality // Eastern-European Journal of Enterprise Technologies. - Kharkiv,– 2021. – P. 38-50
- 22) Soloviova O., Herasymenko I., Pron S., Kravchenko T., Vysotska I. Directions of communication relations development in the agricultural aviation works market // Financial and credit activity: problems of theory and practice. -. Kharkiv, 2022. - P. 238–247.
- 23) Voichenko T., Radchenko O. Peculiarities of managing the marketing of transport services. URL: <http://projects.dune-hd.com/bitstream/handle/2010/36667/21-5695.pdf?sequence=1&isAllowed=y#page=277>
- 24) Hura S.M. (2021). Institutional and economic mechanisms for regulating the development of aviation transport. URL:https://nau.edu.ua/site/variables/news/2021/12/%D0%93%D1%83%D1%80%D0%B0_%D0%A1_%D0%9C_%D0%B0%D0%B2%D1%82%D0%BE%D1%80%D0%B5%D1%84%D0%B5%D1%80%D0%B0%D1%82.pdf
- 25) Yurii Vovk, Oleh Karyy INNOVATION PROCESS MANAGEMENT IN UKRAINE: PROBLEMS IN COMMERCIALIZATION OF SCIENTIFIC AND TECHNICAL DEVELOPMENTS/ Monography/p.8-10 URL: file:///C:/Users/User/Downloads/Innovation%20Process%20_%20Monograph%20_%202018.pdf
- 26) Electronic source [Link] - <https://dia.dp.gov.ua/en/the-cargo-turnover-of-ukrainian-seaports-will-decrease-by-three-times-in-2022/>
- 27) Electronic source [Link] - <https://gmk.center/en/news/ukrainian-railways-has-transported-1-million-tons-of-iron-ore-since-the-beginning-of-june/>
- 28) National Transport Strategy of Ukraine 2030 Electronic source p. 9-14 [Link] https://mtu.gov.ua/files/for_investors/230118/National%20Transport%20Strategy%20of%20Ukraine.pdf