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## РОЗВИТОК ЕКСПОРТНОГО ПОТЕНЦІАЛУ ПОРТОВОЇ ІНФРАСТРУКТУРИ В УМОВАХ НЕВИЗНАЧЕНОСТІ ПОЗИЦІОНУВАННЯ

**Актуальність.** Доцільність розробки наукових положень пов'язана з необхідністю урахування параметричних особливостей позиціонування морських портів України в умовах глобального сегменту морської торгівлі. Важливим є урахування нових умов функціонування то розвитку експортного потенціалу портової інфраструктури України. Насамперед необхідно проаналізувати зовнішні умови конкурентного позиціонування транспортних підприємств України та урахувати тенденції та перспективи функціонування транспортної інфраструктури України, параметри та фактори регіонального ринку транспортних послуг.

**Мета та завдання.** Систематизація та обґрунтування факторів розвитку експортного потенціалу портової інфраструктури України, уточнення нових тенденцій та перспектив позиціонування морських торгових портів в структурі глобального сегмента морської торгівлі.

**Матеріали та методи.** Науковою базою статті є аналітичні дані адміністрації морських портів України; Міністерства розвитку громад, територій та інфраструктури України; Міністерства інфраструктури України; матеріали статистики України; дані конференції Організації Об'єднаних Націй з торгівлі та розвитку; методи групування; методи аналізу та синтезу; методи теорії прийняття рішень, методи дослідження операцій.

**Результати.** Розглянуто тенденції та перспективи розвитку портів Великої Одеси та портів Дунайського кластеру. Представлена динаміка вантажообігу портів Великої Одеси за 2016-2023 рік та динаміка вантажообігу портів Дунайського регіону за 2016-2023 рік. Дана оцінка стану експортного потенціалу портової інфраструктури України. Проаналізовано умови функціонування Українського морського коридору та Зернової угоди. Представлена динаміка експорту вантажів Українським морським коридором та динаміка заходу суден до портів Великої Одеси. Проаналізована контейнерна програма доставки агропродукції та впровадження регулярних контейнерних сервісів в портах Дунайського регіону. Обґрунтовано тенденції та конкурентний розвиток сухопутної логістики в Україні. Наведена динаміка обсягу перевезення вантажів Укрзалізницею по місяцям за 2022 – та початок 2024 року. Підкреслено важливість функціонування експортного потенціалу портової інфраструктури України в забезпеченні продовольчої безпеки в світі.

**Висновки.** Систематизовані фактори розвитку портової інфраструктури України в умовах воєнного часу (впровадження гнучких моделей управління портовою інфраструктурою, сучасні цифрові технології в структурі управління портовою інфраструктурою, оптимізація бізнес процесів). Зазначені шляхи покращення внутрішньої логістики для забезпечення стійкого зростання експорту (підвищення технічного – економічного рівня суміжних видів транспорту, розробка нових маршрутів доставки експортної продукції). Розглянуті принципи ухвалення інвестиційних рішень в портової галузі (принцип конкурентного розвитку стивідорного бізнесу з урахуванням обмеженості інвестиційних ресурсів, принцип адекватності портової інфраструктури вимогам негативного впливу зовнішнього середовища).

**Ключові слова:** морський торговий порт, портова інфраструктура, експортний потенціал, логістика, морська торгівля.

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## **DEVELOPING THE EXPORT POTENTIAL OF PORT INFRASTRUCTURE IN THE FACE OF UNCERTAIN POSITIONING**

**Topicality.** *The expediency of developing scientific provisions is related to the need to take into account the parametric features of positioning of Ukrainian seaports in the international segment of maritime trade. It is important to take into account the new conditions of functioning and development of the export potential of the port infrastructure of Ukraine. First of all, it is necessary to analyse the external conditions for the competitive positioning of Ukrainian transport enterprises and take into account the trends and prospects of the functioning of the transport infrastructure of Ukraine, parameters and factors of the regional transport services market.*

**Purpose and tasks.** *To systematize and substantiate the factors of development of the export potential of the port infrastructure of Ukraine, to clarify new trends and prospects for the positioning of commercial seaports in the structure of the global segment of maritime trade.*

**Materials and methods.** *The scientific basis of the article is the analytical data of the Ukrainian Sea Ports Authority; the Ministry of Community, Territorial and Infrastructure Development of Ukraine; the Ministry of Infrastructure of Ukraine; Ukrainian statistics; data from the United Nations Conference on Trade and Development; grouping methods; methods of analysis and synthesis; methods of decision-making theory; methods of operations research.*

**The results.** *The trends and prospects for the development of the ports of Greater Odesa and the ports of the Danube cluster are considered. The dynamics of cargo turnover of the ports of Greater Odesa in 2016-2023 and the dynamics of cargo turnover of the ports of the Danube region in 2016-2023 are presented. An assessment of the export potential of Ukraine's port infrastructure is given. The conditions of functioning of the Ukrainian sea corridor and the Grain Agreement are analysed. The dynamics of cargo exports via the Ukrainian sea corridor and the dynamics of vessel calls to the ports of Greater Odesa are presented. The container programmer for the delivery of agricultural products and the introduction of regular container services in the ports of the Danube region are analysed. The trends and competitive development of land logistics in Ukraine are substantiated. The dynamics of the volume of cargo transportation by Ukrzaliznytsia by month for 2022 and early 2024 is presented. The importance of the export potential of Ukraine's port infrastructure in ensuring food security in the world is emphasised.*

**Conclusions.** *The article systematizes the factors of development of Ukraine's port infrastructure in wartime (introduction of flexible models of port infrastructure management, modern digital technologies in the structure of port infrastructure management, optimization of business processes). The ways to improve domestic logistics to ensure sustainable export growth (improving the technical and economic level of related modes of transport, developing new routes for the delivery of export products) are indicated. The principles of investment decision-making in the port industry are considered (the principle of competitive development of the stevedoring business, taking into account the limited investment resources, the principle of adequacy of the port infrastructure to the requirements of the negative impact of the external environment).*

**Keywords.** *Sea port, port infrastructure, export potential, logistics, sea trade.*

### **Problem statement and its connection with important scientific and practical tasks.**

The functioning and development of Ukraine's sea port infrastructure is of strategic importance for global food security. When exporting the products of Ukrainian farmers, the sea and river routes of cargo delivery, as well as the condition and functioning of port infrastructure, are at the forefront of the cost-effectiveness criterion. For example, in August 2023 and February 2024, 93% of Ukraine's total agricultural exports were exported via the Ukrainian sea corridor and the Danube River. It should also be noted that, for example, to replace one ship with 50 thousand tons of grain, 2 thousand trucks are needed. This causes difficulties, as the roads in Ukraine are overloaded, and there can be huge queues on the railway tracks. Given the recent events on the border with Poland, the development of alternative ways of delivering goods is very relevant.

The functioning and importance of sea ports for Ukraine's international trade is measured by the percentage increase or decrease in Ukraine's gross domestic product.

The dynamics of cargo handling in the port industry is characterized, firstly, by the parameters of national economic development, and secondly, the dynamics of cargo turnover reflects the positioning of the seaport in the international division of labor. The efficient and sustainable development of port infrastructure is an integral part of ensuring the sustainability of the maritime industry. In 2022 and 2023, the functioning of the global maritime industry is stable and according to UNCTAD forecasts, in 2024 the total volume of maritime traffic will increase by 2.1%, and in 2025 and 2026 the maritime industry is expected to grow by 2.2%.

However, it should be noted that the global maritime industry and the dry cargo transportation market in particular are experiencing negative trends caused by the consequences of the war in Ukraine. Russia's aggression has led to changes in the organization of global transportation and an increase in the distance of grain transportation routes.

Ensuring uninterrupted operation of port infrastructure is the basis for the economic sustainability of commercial seaports. It should be emphasized that one of the main indicators of the economic efficiency of port infrastructure is the time required to process cargo flows. The time spent by vessels for loading and unloading in global seaports had been decreasing for many years before the pandemic. During the COVID-19 pandemic, this indicator increased, and although in 2022 there was a tendency to decrease the overall indicator of the time spent by ships for loading and unloading, in many world seaports in 2022 the average time spent by ships in world seaports was 1.04 days for all ships, which exceeds the pre-pandemic level.

As a result of the war, six seaports operate in Ukraine in 2023: the ports of Greater Odesa: Odesa Sea Port, Pivdenny Sea Port, and Chornomorsk Sea Port; and the seaports of the Danube cluster: Reni Sea Commercial Port, Izmail Sea Commercial Port, and Ust-Danube Sea Port.

The seaports of Reni, Izmail and Ust-Dunaisk are logistics hubs for the transportation of grain cargo by sea. In 2021, the cargo turnover of the Danube ports amounted to 5.5 million tons, in 2022 - 16.4 million tons, and in 2023 - 31.9 million tons.

In addition, in 2023, the ports of the Danube Cluster opened 23 new terminals and 20 cargo handling points, introduced nighttime vessel handling, and implemented the leading method.

In 2023, the cargo handling of the Izmail Commercial Sea Port was dominated by grain cargo, meal, sunflower and oil. It should be emphasized that in 2023, the Commercial Sea Port of Izmail fulfilled the annual cargo handling plan for four months and as of the beginning of May 2023, 6.2 million tons were handled.

The aggressor country is deliberately destroying the infrastructure of Ukraine's ports. Since July 2023, the aggressor country has damaged or destroyed 69.7 thousand square meters of grain storage facilities.

Due to the decrease in the volume of grain cargo transportation as a result of the blockade of sea routes in the Black Sea basin by the aggressor state, there are possible consequences for global maritime trade: deterioration of the freight situation, due to uncertainty and fears of shipowners to deliver vessels to the seaports of Odesa, Pivdenny, Chornomorsk, emergence of excess supply in the maritime trade market, and higher food prices.

**Analysis of recent publications on the problem.** Much attention in scientific research is paid to the issues and problems of the functioning and competitive development of the maritime industry. The conditions for the effective development of maritime transport enterprises are substantiated (Wagner, N., & Wiśnicki, B), and the principles of competitive positioning of port infrastructure are systematized (Krikigianni, E. S., Latsa, E., Gayialis, S. P., Panayiotou, N. A., Kostovasili, M., Kanellopoulos, I., & Amditis, A.).

**Allocation of previously unsolved parts of the general problem.** To ensure the efficient functioning and competitive development of port infrastructure in the segment of maritime trade, it is necessary to substantiate scientific provisions that take into account the peculiarities of positioning stevedoring enterprises in the specific conditions of the transport services market. In this case, the following tasks are distinguished: competitive positioning of port infrastructure under conditions of uncertainty and risk, ensuring the economic stability of commercial seaports under martial law, selection of arterial approaches that ensure economies of scale and efficiency of investment policy aimed at improving the technical and economic level of port infrastructure. A lot of attention is paid to the development of these tasks in scientific research: competitive development of transport enterprises in the conditions of the transport services market (Panayiotou, N. A.); ensuring the economic sustainability of maritime transport enterprises (Wagner, N., Wiśnicki, B.).

However, it should be noted that the mechanism of functioning and development of port infrastructure, taking into account the adaptive conditions of positioning of the maritime and river industry, has not been fully investigated.

**Formulation of research objectives (problem statement).** The purpose of the article is to clarify the new conditions for positioning seaports in the structure of the maritime trade market and to substantiate and systematize the factors of functioning and development of the export potential of Ukraine's port infrastructure with due regard for martial law.

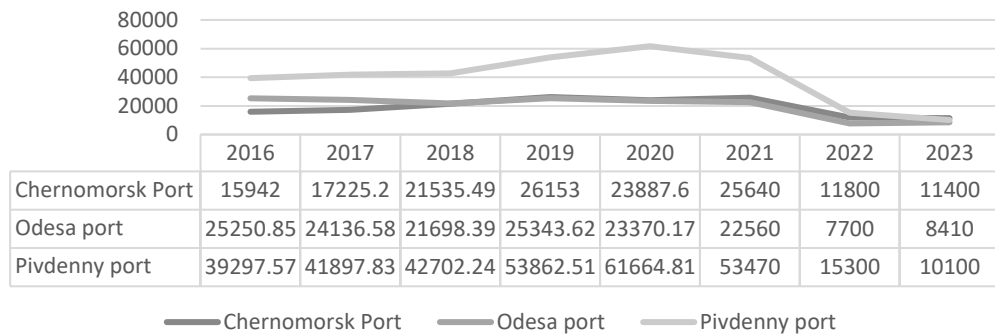
**Materials and Methods.** The research was based on analytical data from the Ukrainian Sea Ports Authority; the Ministry of Community, Territorial and Infrastructure Development of Ukraine; the Ministry of

Infrastructure of Ukraine; analytical materials of the Ukrainian statistics; data from the United Nations Conference on Trade and Development; grouping methods; methods of analysis and synthesis; methods of decision-making theory; and methods of operations research.

**An outline of the main results and their justification.** Sea trade ports are of strategic importance for the export of Ukrainian products. Before the war, 75% of Ukraine's foreign trade turnover passed through national sea ports. It should be emphasized that during the war, the sea route and the functioning of the port infrastructure also ensure food security in the world. In the transportation sector, Ukraine's leading cargo export sector is maritime transport, which during the war provided 54% of Ukrainian exports (data for 2022).

Despite the blockade of sea routes in Ukraine, the state continues to support global food security and the supply of grain cargo to foreign markets: a new Ukrainian sea corridor is functioning without the participation of Turkey, the UN, or Russia.

In 2023, the cargo turnover of Ukrainian ports amounted to 62 million tons, of which 56.3 million tons were exports. The main cargo in 2023 was grain cargo (45.5 million tons), of which 12.7 million tons were agricultural products. The cargo turnover of the ports of Greater Odesa in 2023 amounted to 30 million tons (Fig. 1), and the cargo turnover of the ports of the Danube region amounted to 32 million tons (Fig. 2).

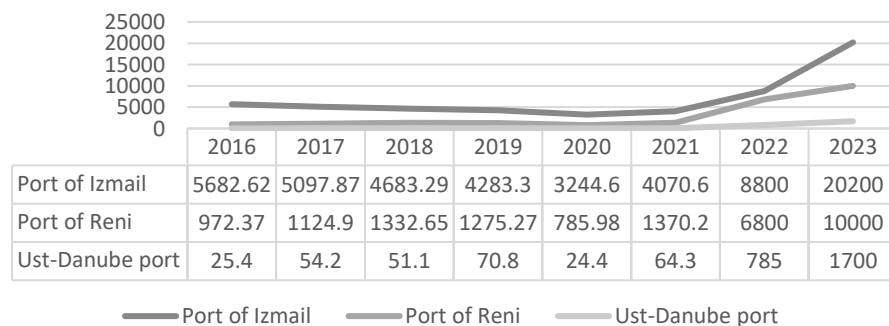


**Fig. 1. Cargo turnover dynamics of the Greater Odesa ports in 2016-2023, thousand tons**

Source: according to the data magazine *Ports of Ukraine*, Ministry of Development of Communities, Territories and Infrastructure of Ukraine (2023)

In 2023, the ports of Greater Odesa transshipped 15% more cargo than in 2022 (50+ million tons), exporting agricultural products to Egypt, China, the United States, Spain and others.

From August 2023 to February 2024, 26 million tons of cargo were exported from the ports of Greater Odesa to 42 countries via the Ukrainian corridor, of which more than 18 million tons were agricultural products.



**Fig. 2. Dynamics of cargo turnover of the Danube Region ports in 2016-2023, thousand tons**

Source: according to the data magazine *Ports of Ukraine*, Ministry of Development of Communities, Territories and Infrastructure of Ukraine (2023)

In 2023, the cargo traffic of the Danube Cluster seaports reached record levels, an increase of 6 times compared to the pre-war period (over 29 million tons of cargo in 2023). Ship calls amounted to 13045 units in 11 months of 2023, which is 46% more than in 2022 for the same period.

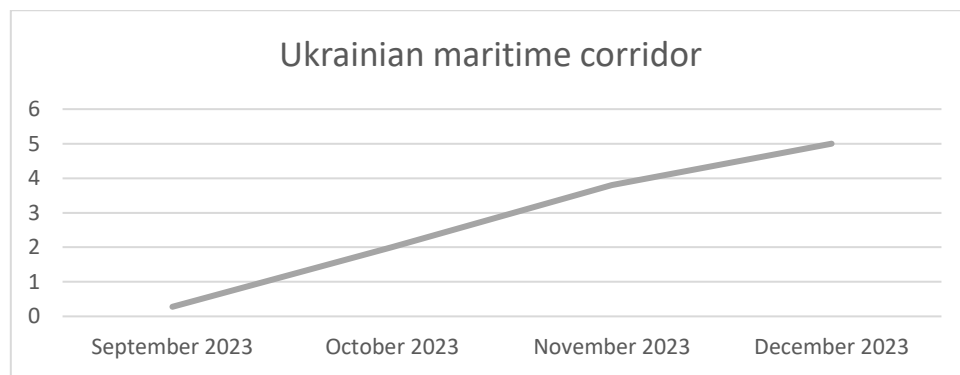
Since the beginning of the Grain Deal and up to May 7, 23, 900 vessels have sailed through the sea corridor, transporting 29.6 million tons of Ukrainian agricultural products, including 14.9 million tons of corn, 8.2 million tons of wheat and 1.5 million tons of sunflower oil.

The harvest and exports of Ukrainian grain in 2023/24 MY are projected to decline by about 50% . It should be noted that before the war, Ukraine's corn harvest in 2021 amounted to 42 million tons.

Between August 8, 2023, and December 2023, 200 vessels sailed through the temporary Ukrainian sea corridor to and from ports and 226 vessels sailed to and from ports, and more than 7 million tons of cargo were exported, including 5 million tons of agricultural products.

During the five months of the export sea corridor's operation (from August 8, 2023 to January 8, 2024), almost 15 million tons of cargo were exported, including 10 million tons of agricultural products: 33% of the cargo went to China, 11% went to Egypt, 4% to Indonesia, and 2% to Turkey. Also, ships that were blocked due to the war and were not covered by the Grain Agreement left the ports of Greater Odesa through this corridor.

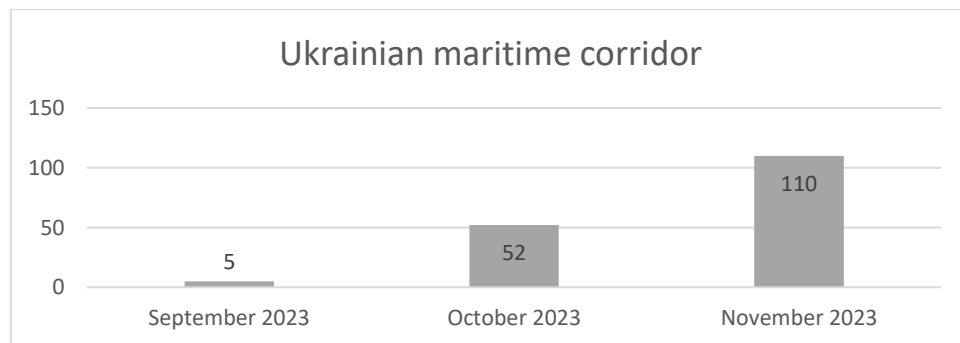
It should be emphasized that the growth rate of exports through the Ukrainian Sea Corridor exceeded the growth rate of exports under the Grain Agreement (Fig. 3).



**Fig. 3. Dynamics of cargo exports by the Ukrainian sea corridor, mln tons**

*Source: Ministry of Development of Communities, Territories and Infrastructure of Ukraine (2023)*

Most of the cargo exported through the Ukrainian sea corridor is grain. It should also be noted that as of the end of December 2023, 463 vessels called at national ports for loading (Fig. 4).



**Fig. 4. Dynamics of vessel calls to the ports of Ukraine (Odesa, Chornomorsk, Pivdennyi) via the Ukrainian Sea Corridor, vessels**

*Source: Ministry of Development of Communities, Territories and Infrastructure of Ukraine (2023)*

The war in Ukraine is changing the geography of maritime transportation. For example, corn shipments to China from Ukraine in March 2023 decreased by 33% compared to the same period. China is looking for new suppliers of agricultural products, for example, in May 2023, the first shipment of corn from South Africa arrived in China.

In response to the high demand for the transportation of strategic grain cargo in containers, the container port infrastructure was introduced in the seaports of Reni and Izmail during martial law and three regular container services were put into operation.

Risoil Ukraine is developing the shipment of agricultural products in containers to end consumers (Southeast Asia, Africa, and the Middle East). It should be emphasized that there is a fairly high demand in the market for the supply of grain cargo to end consumers in containers, but on the other hand, this market segment is characterized by complex and expensive logistics.

It should be noted that the supply of agricultural products in containers is not new for Risoil; the company has been developing a container program for the delivery of agricultural products to India, China, the Philippines, Thailand, Bangladesh, Nepal, and others since the beginning of its trading activities.

Bunge Agroindustrial Corporation and Viterra AgroTrader, which own production and port assets in Ukraine, including Viterra AgroTrader, which owns the grain and oilseeds terminal in the Black Sea port, signed a merger agreement in June 2023. The global commodity trader Glencore owns a 49.9% stake in the agro-trader Viterra. The merger is expected to be completed in mid-2024, and after the deal is finalized, Viterra shareholders will own 30% of the combined business. The merger will create a global agricultural company with assets of approximately USD 34 billion. The combined business will operate as Bunge.

Since the beginning of the war, the attractiveness of the Danube region has increased dramatically and the logistics have changed significantly. It should be noted that logistics in the Danube region has certain technical limitations.

From a technical point of view, the functioning of the port infrastructure of the Danube ports requires maintaining the depths and hydraulic structures necessary for the passage of ships in the waters of the ports.

It should be emphasized that at the beginning of the war, the maximum draft for ships to pass the Bystryi Estuary was 3.9 meters, and in February 2023, the maximum draft was already 6.5 meters. As for the development of logistics in the Danube region, the following is being considered: construction and modernization of access railways, provision of direct rail service and creation of conditions for unimpeded road communication.

Ukrzaliznytsia's transportation volumes to the Danube ports are expected to grow by 33% in 2023.

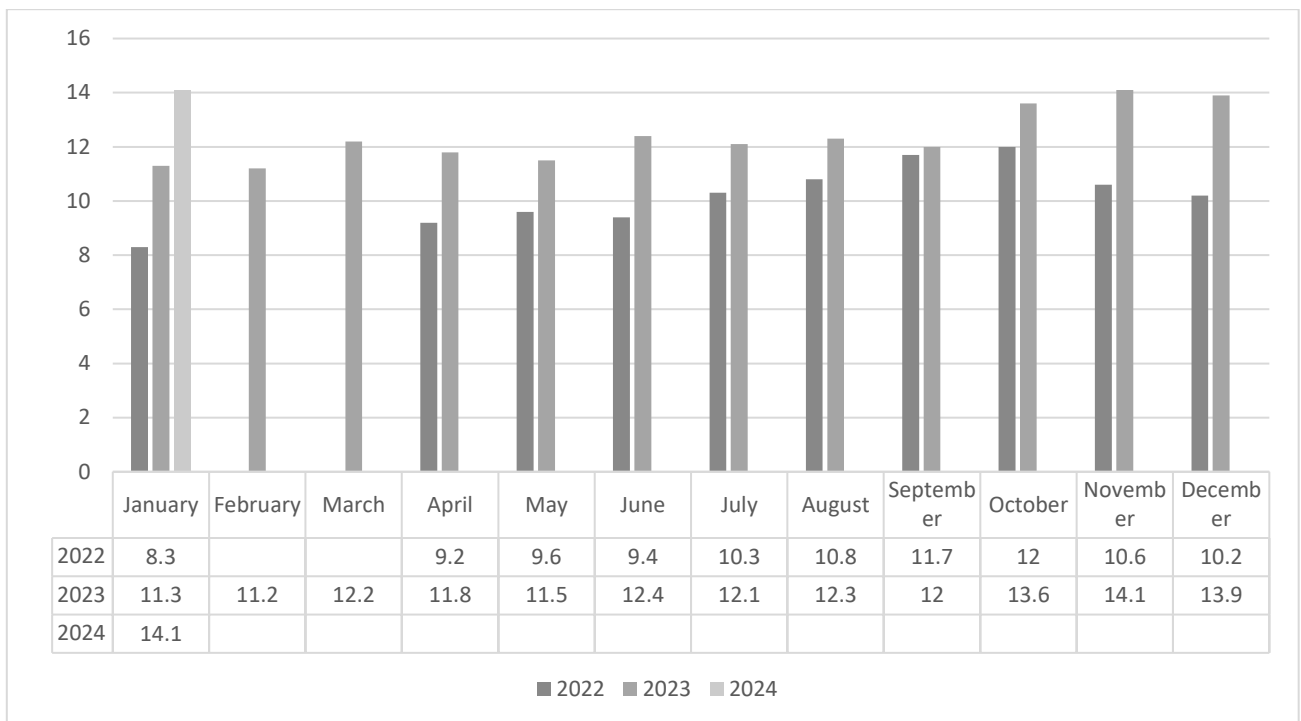
The state is developing land logistics - for example, in 2023, Ukrzaliznytsia produced a grain carrier that is maximally adapted for grain transportation across the territory of Ukraine and the European Union's gauge and takes into account the requirements and features of the technical component of the infrastructure. Next, Ukrzaliznytsia plans to start mass production of grain carriers.

It should be noted that in January 2024, Ukrzaliznytsia increased the volume of cargo transportation at a record high (Fig. 5), exports in January 2024 amounted to 7.5 million tons of cargo, including 3.4 million tons of grain cargo. One of the reasons for the increase is the operation of the Ukrainian sea corridor.

It should also be noted that in 2023, Ukrzaliznytsia transported 148.4 million tons of cargo, of which 84.8 million tons were domestic transportation, 56 million tons were exports, 6.8 million tons were imports, and 0.6 million tons were transit. In 2023, Ukrzaliznytsia built 528 freight cars at its own facilities.

Ukraine is actively looking for new solutions to support its exports: it has established economic cooperation with Romania, expanded and developed logistics. It is worth noting that up to 60% of Ukraine's total grain exports are already transported through Romania. Ukrainian grain cargoes arrive at the port of Constanta by rail, road, and barge on the Danube River. The port of Constanta is one of the largest alternative sea routes for agricultural exports.

In 2022, the handling of Ukrainian grain cargo in the port of Constanta amounted to almost 36% of the total grain volume. In total, grain handling in the port of Constanta in 2022 amounted to 24 million tons. In October 2023, it was agreed to increase the transit capacity of agricultural products from Ukraine through Romanian ports to 4 million tons.



**Fig.5. Dynamics of cargo transportation by Ukrzaliznytsia, mln tons**

*Source: Ministry of Development of Communities, Territories and Infrastructure of Ukraine (2024)*

It should be noted that as part of the Solidarity Roads program, the European Commission is allocating investments of EUR 126 million to develop Romanian ports that have increased the volume of Ukrainian exports. For example, in 2023, 14 million tons of grain were exported through Constanta (in 2022 - 8.6 million tons), which is 40% of the total volume of grain supplies to the port for the year.

For the stable functioning of the port infrastructure, it is necessary to use the mechanism of fast cargo delivery, modern digital technologies, innovative business models, and optimize business processes (Figure 6).

To ensure the development of the national transportation industry, it is necessary to improve the state of domestic logistics. For example, due to the blockade of the border with Poland in early 2024, the Ukrainian Danube Shipping Company proposes to redirect cargo transported to the European Union to river transport: it is introducing a new additional route across the Danube River.

This route will run from one of the Ukrainian ports to Constance and the Danube ports of Germany: barge caravans will deliver 2.1 thousand TEU to Regensburg or 5.9 thousand TEU to Constance every month. It should be noted that the delivery of goods to the port of Romania makes it possible to export to any part of the world.

It should be emphasized that the development of land logistics cannot fully compensate for the blocking of seaports. Before the war, for example, Ukraine exported up to 70% of its agricultural products by sea. One of the main economic factors was the high cost of land logistics.

After the end of martial law in Ukraine, given the extent of the destruction of the port infrastructure of commercial seaports and inland waterway transport, the most pressing issue will be the need to attract significant investment in the industry to restore operations and develop enterprises. An important stage is the planning of an investment project, which involves achieving the ultimate goals within the system of economic constraints and in accordance with the criterion of cash flow optimization. The port infrastructure is expected to recover 85% of cargo.



**Conclusions and perspectives of further research.** To ensure the functioning and development of the seaport infrastructure under martial law in Ukraine, it is important to introduce flexible management models that take into account the current operating conditions, military and economic risks.

The main principle of making investment decisions on the introduction of innovative technologies is to achieve a normalized value of stevedoring business efficiency when realizing production potential, taking into account the conditions of uniform terminal loading. It should be noted that making rational decisions in the investment activities of stevedoring enterprises requires taking into account the balance of supply and demand in the global maritime trade market.

In order to ensure the economic security of the state, the model of port business functioning requires a balance between private and state-owned enterprises, as well as ensuring the criteria for efficiency and profitability of the port industry.

When formulating an economic strategy for competitive positioning of the port business, it is necessary to take into account the conditions for achieving financial stability and the required level of competitive positioning of stevedoring enterprises in the structure of maritime trade. Competitive development of the stevedoring business is limited by the complexity of securing financing to improve the technical component to meet the requirements of the external environment and the tasks of maximizing the cash flows of the port business. In this aspect, it is necessary to consider the principles of stevedoring business development: gradual increase of fixed assets of stevedoring enterprises, compliance of the technical and economic level of stevedoring enterprises with the requirements of the world maritime trade market.

In the course of the study, it was possible to identify the factors and conditions for the development of the export potential of port infrastructure under martial law: an effective investment policy aimed at restoring port infrastructure and improving the technical and economic level of maritime transport enterprises; effective personnel policy; expanding the range of cargo handling and introducing innovative technologies; use of modern and flexible management models in the port industry; use of technologies and digitalization tools at enterprises.

Prospects for further research are the development of an effective mechanism for managing the export potential of commercial seaports, taking into account the martial law in Ukraine.

## REFERENCES

93% of Ukrainian farmers' products are exported through the ports of Greater Odesa and the Danube (2024). *Report by Ministry of Communities, Territories and Infrastructure Development of Ukraine*. <https://mtu.gov.ua/news/35339.html>

160 tons of Ukrainian grain are damaged at a Polish railroad station (2024). *Report by Ministry of Communities, Territories and Infrastructure Development of Ukraine*. <https://mtu.gov.ua/news/35344.html>

UNCTAD (2023). *Review of Maritime Transport 2023*. <https://unctad.org/publication/world-investment-report-2023>

UNCTAD (2022). *Review of Maritime Transport 2022*. <https://unctad.org/publication/world-investment-report-2022>

Ukrainian ports and the grain initiative (2023). *Report by Ukrainian Sea Ports Authority*. <https://uspa.gov.ua/>

Wagner, N., & Wiśnicki, B. (2022). The importance of emerging technologies to the increasing of corporate sustainability in shipping companies. *Sustainability*, 14(19), 12475. <https://doi.org/10.3390/su141912475>

Krikigianni, E. S., Latsa, E., Gayialis, S. P., Panayiotou, N. A., Kostovasilis, M., Kanellopoulos, I., &

Amditis, A. (2022). *Matchmaking the emerging demand and supply need in the maritime supply chain domain: A system design framework*. *Sustainability*, 14(21), 14622. <https://doi.org/10.3390/su142114622>

More than 20 million tons were exported from the ports of Greater Odesa via the Ukrainian corridor (2024). *Report by Ministry of Communities, Territories and Infrastructure Development of Ukraine*. <https://mtu.gov.ua/news/35247.html>

Trade and Development Report (2023). *Report by the UNCTAD secretariat*. <https://unctad.org/publication/trade-and-development-report-2023>

Ukrainian ports in 2022: growth only on the Danube (2023). *Ports of Ukraine* (№1-2 pp. 54-59)

A miracle on the Danube (2023). *Ports of Ukraine* (№1-2 pp. 44-48)

Ukrzaliznytsia increases freight traffic at a record high (2024). *Report by Ministry of Communities, Territories and Infrastructure Development of Ukraine*. <https://mtu.gov.ua/news/35210.html>