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ПОТЕНЦІАЛ ВНУТРІШНЬОГО ВОДНОГО ТРАНСПОРТУ УКРАЇНИ ЯК ФАКТОР СТАЛОГО РОЗВИТКУ

Актуальність. Сьогодні внутрішній водний транспорт відіграє важливу роль у перевезенні вантажів у всьому світі. Потенціал збільшення частки внутрішнього водного транспорту у різних видах транспорту дуже значний. У порівнянні з іншими видами транспорту, які часто стикаються з проблемами перевантаженості та пропускної спроможності, внутрішній водний транспорт відрізняється надійністю, енергоефективністю та високою пропускною спроможністю. Розвинені країни світу прагнуть просувати та зміцнювати конкурентоспроможність внутрішніх водних шляхів у транспортній системі та сприяти їх інтеграції до інтермодальних логістичних ланцюгів. Виходячи з цього потенціал внутрішнього водного транспорту України потребує всебічного дослідження та вивчення можливостей його підвищення.

Мета та завдання. Здійснити дослідження теоретичних та методологічних засад розвитку перевезень вантажів річками та розробити рекомендації щодо підвищення потенціалу внутрішнього водного транспорту України.

Матеріали та методи. Концептуально-методологічну основу дослідження становлять фундаментальні положення провідних зарубіжних і вітчизняних вчених та фахівців з теорії й практики закономірностей розвитку ринку та умов функціонування внутрішнього водного транспорту. Інформативною базою дослідження є нормативно-правові акти України, Європейського союзу, офіційні публікації Міністерства інфраструктури України, Державної служби статистики України, Державної служби морського та річкового транспорту України, а також результати власних досліджень. У процесі проведення дослідження застосовано такі загальнонаукові та спеціальні методи та підходи: системо-структурний підхід, компаративний аналіз, методи статистичного аналізу, функціональний синтез та економико-математичні методи а також проведено аналіз сфери внутрішнього водного транспорту України із графічним представленням інформації шляхом застосування методів економіко-статистичного аналізу, деталізації та порівняння.

Результати. Досліджено науково-прикладні засади визначення потенціалу та конкурентних переваг сфери внутрішнього водного транспорту які враховують вантажопотоки, структурні ринки та властивості його агентів, фактори що стримують розвиток ВВТ як зі сторони попиту так і пропозиції, особливості правового регулювання, інфраструктурні характеристики та технічні можливості суб'єктів господарювання досліджуваної сфери, а також значення у забезпеченні соціально-економічного розвитку Особливості правового регулювання та інфраструктурні характеристики, а також значення у забезпеченні соціально-економічного розвитку України, що дозволяє використовувати систематизовані сили та слабкі сторони а також потенційні можливості та загрози для посилення потенціалу внутрішнього водного транспорту України. А також сформовано алгоритм підвищення потенціалу та конкурентних переваг внутрішнього водного транспорту України, який засновано
на застосуванні правових, регулятивних, інвестиційних, кооперативних та інформаційно-комунікаційних інструментів.

Висновки. Внутрішній водний транспорт серед усіх видів транспорту є більш екологічно чистим, безпечнішим та економічнішим. Внутрішні водні шляхи України відіграють сьогодні другорядну роль у транспортній системі країни. Для посилення потенціалу внутрішнього водного транспорту України необхідно: розробити галузеві транспортні програми зі збалансуваним розподілом вантажопотоків між видами транспорту; створити сприятливий інвестиційний клімат; активне впровадження інноваційних технологій; створити конкурентний ринок для іноземних і національних агентів сфери перевезень ВВТ а також сприяти умови для розвитку мультимодальних перевезень. Згадані заходи сприятимуть посиленню потенціалу ВВТ України, особливо в післявоєнний період.

Перевезення внутрішніми водними шляхами необхідно розвивати для підтримки української економіки через збільшення кількості транспортних та логістичних альтернатив з метою створення більш ефективної та стійкої логістичної системи. Розвиток річкового транспорту, що забезпечує зелені перевезення, може мати значний вплив також на соціальний розвиток та навколишнє середовище України.

Для підтримки української економіки і забезпечення більш різноманітних можливостей транспортування та логістики, слід сприяти розвитку внутрішніх водних шляхів. Це дозволить створити більш ефективну та стійку логістичну систему з забезпеченням «зелених» перевезень, що в свою чергу матиме значний вплив на соціально-економічний розвиток та навколишнє середовище України.

Ключові слова: потенціал внутрішнього водного транспорту, річковий транспорт, теоретичне обґрунтування, інфраструктура, пропускна спроможність, вантажопотоки, діджиталізація, інвестиційні потоки, план відновлення України.

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POTENTIAL OF UKRAINE’S INLAND WATER TRANSPORT AS A FACTOR OF SUSTAINABLE DEVELOPMENT

Topicality. In the contemporary landscape, inland waterway transport holds a significant position in the global movement of commodities. The potential for increasing the share of inland waterway transport in various modes of transportation is very significant. Compared to other modes of transport, which often face problems of congestion and capacity, inland waterway transport is reliable, energy-efficient, and has high throughput. Developed countries are striving to promote and strengthen the competitiveness of inland waterways in the transport system and facilitate their integration into intermodal logistics chains. Based on this, the potential of inland waterway transport in Ukraine requires a comprehensive study and exploration of opportunities to improve it.
**Aim and tasks.** To study the theoretical and methodological foundations for the development of river cargo transportation and develop recommendations for increasing the potential of inland waterway transport in Ukraine.

**Materials and Methods.** The conceptual and methodological basis of the study is the fundamental provisions of leading foreign and domestic scientists and experts in the theory and practice of market development patterns and conditions of inland waterway transport. The information base of the study is the regulatory legal acts of Ukraine, the European Union, official publications of the Ministry of Infrastructure of Ukraine, the State Statistics Service of Ukraine, the Ukrainian Sea Ports Authority, the State Service of Sea and River Transport of Ukraine, as well as the results of the author's own research. In the process of conducting the study, the following general scientific and special methods and approaches were applied: systemic and structural approach, comparative analysis, methods of statistical analysis, functional synthesis and economic and mathematical methods, as well as an analysis of the inland waterway transport sector of Ukraine with a graphical presentation of information using methods of economic and statistical analysis, detailing and comparison.

**Research results.** The scientific and applied principles of determining the potential and competitive advantages of the inland waterway transport sector are studied, taking into account cargo flows, market structure and characteristics of its agents, factors that constrain the development of IWT on both the supply and demand sides, peculiarities of legal regulation, infrastructure characteristics and technical capabilities of economic entities in the studied sector; as well as the importance in ensuring the socio-economic recovery of Ukraine, which allows to identify and systematize the strengths and weaknesses of the sector. The article also forms an algorithm for strengthening the potential and competitive advantages of the inland waterway transport of Ukraine, which is based on the use of legal, regulatory, investment, cooperation, and information and communication tools.

**Conclusion.** Inland waterway transport is more environmentally friendly, safer and more economical than any other mode of transportation. Today, Ukraine's inland waterways play a secondary role in the country's transportation system. To enhance the potential of Ukraine's inland waterway transport, it is necessary to: develop sectoral transport programs with a balanced distribution of cargo flows between modes of transport; create a favorable investment climate; actively introduce innovative technologies; create a competitive market for foreign and national agents in the field of inland waterway transportation, as well as favorable conditions for the development of multimodal transportation. These measures will contribute to strengthening the potential of Ukraine's inland waterway transport, especially in the postwar period.

In order to support the Ukrainian economy and provide more diverse transportation and logistics opportunities, the development of inland waterways should be promoted. This will create a more efficient and sustainable logistics system with green transportation, which in turn will have a significant impact on the socio-economic development and environment of Ukraine.

**Keywords:** the potential of inland waterway transport, river transport, theoretical justification, infrastructure, capacity, cargo flows, digitalization, investment flows, Ukraine's recovery plan.

**Problem statement and its connection with important scientific and practical tasks.** Effective use of all available resources and opportunities is an essential condition for the progress of the country, its business sector, investment attraction, and the development of new technologies. Understanding the impact and development of inland waterway transport is necessary not only for the development of long-term state policy but also serves as a guide for regions and business entities in shaping their future development strategies, especially in the post-war recovery of Ukraine.

**Analysis of recent publications on the problem.** Inland waterway transport plays an important role in ensuring the sustainable economic development of the country. The analysis of scientific articles and documents of international organizations allows us to identify both significant problems in the development of inland waterway transport and emphasizes its opportunities and prospects for development.

Among the foreign scientists conducting case studies of inland waterway transport development, it is worth noting the works of such scientists as Voldzekivits, Kaupb, Kolarz, Ionescu R.-V., Krchum, M., Plazibat V., Bortsa, B.; Putz, L.-M., Plotnikova E., Venagindienė M., Slavinskas S., and others.

The study of regulatory and legal regulation, socio-economic issues, and challenges related to the technical and technological aspects of advancing Ukraine's transportation system, and logistics chains, including the development of inland waterway transport, was devoted to the works of Burkinskyi B. V., Ilchenko S. V., Karpenko O. O., Kasich A. O., Masliy N. D., Bursa O.V., Demianchuk M., and others. Thus, these scientists emphasize the obvious importance of strengthening and developing the potential of inland waterway transport in Ukraine.

**Allocation of previously unsolved parts of the general problem.** Today, there are many scientific papers on the theoretical substantiation of various issues related to the functioning of water transport, but the issue of determining the potential and competitive advantages of inland waterway transport and its enhancement by transport market
players in the current conditions and the need to rebuild Ukraine after a full-scale invasion is extremely relevant and requires further study.

**Formulation of research objectives (problem statement).** The objective is to explore the theoretical and methodological principles underlying the advancement of cargo transportation by inland waterway transport in Ukraine. We also aim to propose measures to improve it in the postwar period to rebuild Ukraine's economy.

**Materials and Methods.** This study uses comparative, system-structural, comparative analysis, and empirical observations to investigate the pros and cons of inland waterway transportation in Ukraine, and, taking into account the context of the post-war economic recovery of Ukraine, to propose measures to increase the potential of the studied mode of transport.

**An outline of the main results and their justification.** Mako, P.; Dávid, A.; Böhm, P.; Savu, S. (Mako et al., 2021) significantly contributed to the advancement of inland waterway transportation and illustrated its advantages. The authors presented a mathematical model for estimating CO2 emissions from transport based on the results of the Danube Waterway, which proved that transporting a quantity of cargo by inland waterway can lead to a significant reduction in CO2 emissions per kilometer compared to road transport. According to the authors' study, inland waterway transport offers a cheap and effective way to reduce CO2 emissions and provides evidence that inland waterway transport is a viable and ecologically responsible method of transit.

For their part, Ilchenko et al. (Ilchenko et al., 2021) emphasized that the development of water transport can ensure the transfer of rational consumption and production models, the preservation of ecosystems, and the reduction of energy consumption.

Researchers Vega-Muñoz, A.; Osama, E. and others (Vega-Muñoz et al. 2021; Osama, 2017; European Commission, 2019) often refer to the economic efficiency of inland waterway transport as a key factor in moving cargo from road transport to inland waterways.

Also, for example, barges have the lowest carbon emissions (17 grams/ton-km) compared to other modes of transportation (road 71 grams/ton-km, rail 19 grams/ton-km) (Slipenko, 2019). A developed market for the transportation of goods by RVT can complement rail and road transportation and relieve congestion on the roads. And water transport is best suited for the transportation of oversized cargo. The use of large vessels makes it possible to be more economical in terms of crew costs.

River transport is also generally characterized by lower maintenance costs. The cost of maintenance of inland waterways is only 20% of the cost of maintaining an equivalent roadway. Experts estimate that transportation of about 1 million tons of cargo by IWT can save more than 32 million USD on road maintenance and repair over four years (Molchanov, 2022). Another advantage is that inland waterway transport can be easily integrated with maritime transport. This will reduce the additional costs required to transfer goods to sea transport vessels.

The need to develop the IWT is also due to the fact that Ukraine is actively moving towards integration into the European Union. The European Union is actively working towards decreasing the proportion of goods transported via road, aiming to alleviate road congestion, mitigate emissions of pollutants into the air, and diminish the transport sector's reliance on energy resources. To achieve these goals, the European Commission has prepared a roadmap that plans to shift more than 30% of cargo transportation from road to river and rail transport by 2030. By 2050, it is planned to move 50% of cargo and most of it to the RRT.

To investigate the impact of the volume of transportation by the RVT on the overall economic development of Ukraine, we will conduct a regression analysis using a VAR model that estimates systematic dynamic correlations between the relevant variables. The general form of vector autoregression models is presented in equations 1 and 2

\[ X_t = a_1 + \beta_{11}X_{t-1} + \beta_{21}Y_{t-1} + \epsilon_{1t} \]  
\[ Y_t = a_2 + \beta_{21}X_{t-1} + \beta_{22}Y_{t-1} + \epsilon_{2t} \]

Where \( X_t \) and \( Y_t \) are jointly dependent variables, \( t \) is time, \( \epsilon_{1t}, \epsilon_{2t} \) are white noise (error), and \( \beta \) are coefficients.

The advantage of using VAR models is that it is possible to assess directly the impact of inland waterway cargo transportation on Ukraine's economic development, represented by the country's GDP. Models 3 and 4 use monthly statistical data from the State Statistics Service and the World Bank.

The models have the following general form:
\[
\log GDP_t = a_1 + \sum_{i=1}^{p} \beta_{1i} \log GDP_{t-i} + \sum_{i=1}^{p} \gamma_{1i} \log CT_{t-i} \epsilon_{1t}
\]

(3)

\[
\log CT_t = a_1 + \sum_{i=1}^{p} \beta_{1i} \log CT_{t-i} + \sum_{i=1}^{p} \gamma_{1i} \log GDP_{t-i} \epsilon_{1t}
\]

(4)

where.

\(\log CT_t\) is the logarithm of freight transportation volumes of the Gross Domestic Product; \(\log GDP\) is the logarithm of Ukraine's GDP

The model results are presented in Table 1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>AIC and SIC</th>
<th>Lag</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOG(CT)</td>
<td>1</td>
<td>LOG(CT)</td>
</tr>
<tr>
<td>LOG(GDP)</td>
<td>1</td>
<td>0,16(0,08)*</td>
</tr>
</tbody>
</table>

Note: The numbers in the parentheses beside the Wald statistics are the P-values: **/*/**/.* represent the 1%, 5%, and 10% significance levels, respectively.


Based on the results of the model, it should be noted that GDP and transportation volumes are interdependent. Economic development will contribute to the development of freight transportation, and the growth of transportation volumes will lead to the growth of Ukraine's GDP. This also confirms the need for development of the sphere under study.

It should also be noted that inland waterway transport contributes to employment. And its development will help to increase jobs. The inland waterway transport sector employs 0.03% of the total number of employees, and despite this, every additional job in this sector creates additional jobs in related areas. Unfortunately, the number of people employed in inland waterway transport is rapidly decreasing every year (State Statistics Service of Ukraine 2023).

The economic activity of water transport affects not only the level of employment and welfare of individuals but also the development of the region where water transport enterprises are located. They participate in the formation of the region's budget and develop its infrastructure, increasing its investment attractiveness. Being important components in trade relations, water transport enterprises support the collaboration between local communities, regional and international entities in the field of trade, thereby ensuring foreign economic relations and integration processes.

The potential of the IWT is also demonstrated by the fact that only one tug and two NSP barges can replace 250 fully loaded trucks or two locomotives carrying 100 railroad cars (Molchanov, 2022). According to calculations conducted within the framework of the draft State Program for the Development of Inland Water Transport, river transport is five times more economical than rail freight transport and much more profitable than road transport (On the Dnipro, on the Bug, 2016). It is also worth noting that one liter of fuel per kilometer allows to transport 127 tons of cargo by river transport, while 97 tons by rail, and only 50 tons by road (Slipenko & Manayenko, 2019). In general, the cost of inland waterway freight transportation per ton of cargo is the lowest, indicating a significant cost-effective aspect of using river transport where technically feasible.

Therefore, the study of the inland waterway transport potential is very relevant for the post-war recovery of Ukraine.

The potential of inland (river) water transport in Ukraine consists of:

- inland waterways (navigable rivers, reservoirs, hydraulic structures and other technical facilities)
- navigation system;
- various categories of river fleet: passenger, cargo, technical and specialized;
- river ports and ship repair plants and other river infrastructure.

Ukraine's inland waterways comprise more than 4,000 km of navigable rivers, of which the Dnipro is the largest, flowing along almost 1,000 km of the country's territory. The Ukrainian part of the Danube (more than 160 km), Bug (about 110 km), and Dniester (about 900 km) rivers also play an important role in the country's inland waterways (Molchanov, 2022).

The inland waterway infrastructure on the
Dnipro River includes 6 locks and 16 river ports and port points that provide inland and transit navigation on the river.

In accordance with the European Agreement on Main Waterways of International Importance, the Danube is one of the highest category E river shipping routes (waterway category E 80-09). There are three ports of international importance on the Danube River: Reni, Izmail and Ust-Dunaik.

The length of the navigable part of the Southern Bug River from Voznesensk to Mykolaiv is 110 km. The main player in the transportation market on this river is «Nibulon».

With such a significant mileage of potential inland waters, Ukraine uses only a small part of its cargo transportation capacity, with inland waterways accounting for less than 1% compared to the EU average of 7% (EU4Business. 2017).

Due to its geopolitical location, Ukraine is a party to most of the existing international treaties governing inland waterway transport. These include the European Agreement on Main Inland Waterways of International Importance (AGN or Geneva Agreement) and the Budapest Convention on the Contract for the Carriage of Goods by Inland Waterways (CMNI).

The volume of cargo transportation by inland waterway transport in Ukraine fell from 60 million tons in 1990 to 12 million tons in 2006, and then to 5 million tons in 2011, and in 2021 amounted to only 2 million tons. In recent years, inland waterway transportation has accounted for about 0.8% of all transportation.

![Graph](image1.png)

**Fig. 1.** Volume of freight transportation by types of transportation, million tons

Source: State Statistics Service of Ukraine 2023

An analysis of the dynamics of cargo transportation volumes of Ukraine's military-industrial complex by type of transportation shows that cabotage transportation accounts for the largest share, although during the study period, there was a decrease in it. The situation is similar with foreign transportation.

![Graph](image2.png)

**Fig. 2.** Commodity structure of freight transportation, %.

Source: State Statistics Service of Ukraine 2023
As we can see (Fig. 2), only a small amount of goods is currently transported by rivers in Ukraine. There is a possibility of transporting inland waterway transport and other goods, such as containers and rolling stock (cars, trucks, agricultural machinery), as similar goods are transported by rivers in many EU countries. There are also factors that hinder the growth of transportation by waterborne transport (Figure 3).

In general, these factors are related to:
- tariff regulation for rail transportation;
- implementation of control systems to prevent overloading of vehicles;
- regulation of duties and taxes on the import of ships and ship equipment, as well as on the construction of ships in Ukraine;
- regulation of fees charged during transportation by inland waterways;
- development of optimal mechanisms for financing inland waterway infrastructure that take into account the economics of carriers.

**DEMAND**

**UNCOMPETITIVE PRICE OF TRANSPORTATION OF IWT**

- Lack of effective control over the excessive load of cars on the roads
- Low tariffs of Ukrzaliznytsia for freight transportation
- High cost of transportation to the river and transshipment
- Insufficient number of terminals
- Insufficient number of access roads to terminals
- Risks of cargo loss or damage due to low terminal automation

**SUPPLY**

- Relatively high mandatory payments to the state for the use of the highway, including:
- Excise tax on fuel (for vessels flying the Ukrainian flag)
- Pilotage of the river navigation
- Port fees in seaports
- Small potential number of flights
- Infrastructure constraints
- Seasonality of navigation
- The existing fleet does not meet modern needs
- Significant capital expenditures for the acquisition or construction of a new fleet

Fig. 3. Factors restraining the growth of freight transportation

Source: Office of Effective Regulation 2017.

It should also be noted that today only 60% of inland waterways have guaranteed depths (National Institute for Strategic Studies, 2018). This leads to a decrease in the speed of transportation and even makes it impossible in some areas. To increase the potential of commercial navigation, it is necessary to dredge the Dnipro River and the Southern Bug River, where the river depth reaches only 1.6 m, while the required minimum is 2.9 m (Kasych, 2018). Unfortunately, no work is currently being done on these sites and they require very significant investment. During the war, the development of the Danube region attracted considerable attention.
The main document that drives this region is the Convention on the Regime of Navigation on the Danube. According to this convention, the Danube states must maintain their sections in a navigable condition for river vessels and in appropriate sections for sea vessels, and the Danube region is working on dredging the river. After the opening of the canal, 840 vessels passed through the Bystryi estuary, which allowed for a 10 million-ton increase in cargo turnover. And after the passport depths on the Ukrainian section of the Danube River were restored and the declared draft was 6.5 meters. Danube ports reached a record high of 12 ship calls and 90 thousand tons per day. These measures have also resulted in more efficient and safer navigation between the Black Sea and the Danube River, as well as increased cargo flow through the Danube ports. Eliminating natural siltation and maintaining the required depths of the river mouths is essential for the further development of navigation in Ukraine (Ministry of Reconstruction, 2023).

Costs for a typical short sea shipping operation on the Dnipro include diesel fuel (40%), depreciation and lease payments (30%), personnel costs (11%), and excise tax on petroleum products (7-10%). In addition, the pilotage fee for river pilots is about 6% (BRDO, 2017).

Some actions at the legislative level with the adoption of the Law on Inland Water Transport were taken to reduce these costs. But this does not change them significantly. As a result of the inadequate infrastructure on Ukraine's rivers, the cargo transportation market is not being used efficiently. For example, the maximum service life of many locks is 70 years. And due to chronic underfunding of lock maintenance, which in recent years has not exceeded 50% of the required amount, there is a situation where there is a real threat of a man-made disaster and increased risks of accidents in water transport (Kasich, 2018).

In recent years, the level of funding for the operation of the gateways has reached an average of 21% of the required costs, of which 11% is from the state budget and 10% is from gateway fees. Thus, in 2019, only UAH 22.7 million out of the required and planned UAH 124.3 million was allocated, as the funds are allocated at the end of the year on a residual basis. This makes it clear that the necessary capital repairs cannot be carried out. All this leads to the impossibility of normal navigation on the Dnipro, and, accordingly, to the impossibility of cargo transportation on the river. Poorly maintained locks can impede navigation and create environmental hazards. These locks are also strategic infrastructure facilities. And according to the results of the experts' study, the identified priority areas require investments ranging from 80 thousand to 16.2 million USD to update the technical conditions of the gateways. One of the solutions is the example of the People's Republic of China, which has transferred the locks to partial financing by energy companies, where locks and hydropower plants are one complex and are financed from deductions from the sale of electricity (Special release, 2014).

There is also a significant level of wear and tear on all types of river vessels, both self-propelled and towed. Technically and ethically obsolete vessels account for 81% of the fleet in inland waterway transport with an average age of 21 to 25 years. Cargo ships constitute the majority of outdated vessels (97%), liquid bulk carriers (90%) and dry bulk carriers (85%). On average, the fleet is less energy efficient than modern ships, which calls into question the profitability of inland shipping and its competitiveness compared to rail transport.

<table>
<thead>
<tr>
<th>Ukrainian-flagged fleet (as of 12/31/2020)</th>
<th>River vessels</th>
<th>Vessels of mixed type</th>
<th>Sea vessels</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger ships</td>
<td>82</td>
<td>3</td>
<td>21</td>
<td>106</td>
</tr>
<tr>
<td>Cargo ships</td>
<td>366</td>
<td>103</td>
<td>123</td>
<td>592</td>
</tr>
<tr>
<td>Tugs</td>
<td>151</td>
<td>27</td>
<td>107</td>
<td>285</td>
</tr>
<tr>
<td>Technical fleet</td>
<td>148</td>
<td>7</td>
<td>70</td>
<td>225</td>
</tr>
<tr>
<td>Mooring fleet</td>
<td>75</td>
<td>1</td>
<td>10</td>
<td>86</td>
</tr>
<tr>
<td>Other</td>
<td>52</td>
<td>3</td>
<td>91</td>
<td>146</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>874</strong></td>
<td><strong>144</strong></td>
<td><strong>422</strong></td>
<td><strong>1 440</strong></td>
</tr>
</tbody>
</table>

Source: Shipping Register of Ukraine

1 140 vessels were registered under the Ukrainian flag at the end of 2020, including 874 riverine vessels, 144 mixed-type vessels and 422 offshore vessels. Considering the present political situation...
circumstances in Ukraine and the significant destruction, a significant increase in the fleet is unlikely to happen.

And as we all know, Ukraine is a world breadbasket and has significant water resources and water transport capabilities, but inland waterway transportation accounts for only up to 5% of the total export transportation of the agricultural sector. And it is the unsatisfactory state of the inland waterway transport infrastructure and fleet that World Bank experts say is one of the main problems, as the cost of logistics of agron products in Ukraine is 40% higher than in other European countries.

In general, the Ukrainian River merchant fleet could transport 10 to 15 million tons of cargo per year. Bulk cargo - more than 9 million tons, such as construction materials, grain, coal, ore, piece goods - 1 million tons, mainly metal, timber, and fertilizers, TEU containers up to 100 thousand. In general, the river industrial fleet has excess capacity and opportunities to increase cargo transportation of military goods. However, the existing old fleet does not allow for full utilization of the available capacities. At the same time, the purchase of vessels on the secondary market from other river basins and other countries may not be justified. There are certain criteria that vessels must meet for each river, such as current speed, guaranteed depth, maximum vessel length, lock size, environmental requirements, etc. As for the terminals, it should be noted that specialized technical capabilities of such terminals are required for the transshipment and transportation of different types of products.

Today, agricultural products are mostly handled at special terminals designed and built by private producers and traders. These are primarily loading stations using conveyor belts and pipes to load river barges and ships. However, such specialized terminals generally cannot be used by third parties, which limits the overall capacity of the river. Small traders cannot be fully or partially serviced at certain terminals or will be forced to do so at high tariffs, making their business less profitable.

The main trader, whose terminals and fleet serve other traders and not only are used for their own needs, is «Ukrrichflot», which partially serves agro-traders on a commercial basis, but the equipment of its grain handling terminals is outdated and does not ensure the speed and reliability of grain and oilseeds transshipment at the current level.

In order to strengthen inland waterway transport, it is necessary to focus on addressing the shortcomings in this area.

To enhance the potential of inland waterway transport in Ukraine, it is necessary to:
- development of sectoral transport programs with a balanced distribution of cargo flows between modes of transport
- attracting investments for infrastructure rehabilitation
- active participation of the private sector in expanding the capabilities of the IWT
- digitalization of processes, modernization of software systems and access control systems in sea and river ports of Ukraine
- creation of a competitive market for foreign and national agents in the field of transportation of military goods and services.
- creating conditions for the development of multimodal transportation.

The development and adoption of strategic sectoral programs for the development of the transport industry with a balanced distribution of cargo flows between road, rail and river transport will allow the IWT to become more competitive. Reorientation to river transportation may be encouraged by bringing rail freight tariffs in line with market conditions, reorienting state subsidies from rail transport to inland waterway transport due to its higher economic efficiency. Also, stabilization of the road transportation market, especially addressing the problem of overloading vehicles, which negatively affects the condition of roads and requires significant costs for their repair and requirements for the technical condition of vehicles. All of this will encourage the transfer of cargo to water transportation due to its lower cost and higher environmental friendliness, and thus the state will be able to support the development of the sector's potential.

Create conditions for investment in Ukraine's transportation infrastructure. According to the Kyiv School of Economics, as of September 2022, the losses of Ukraine's infrastructure as a whole from the hostilities amounted to $35.1 billion and transportation to $2.7 billion (Kyiv School of Economics, 2022). Even before the war, the development of transport infrastructure required large investments. According to a study by the European Business Association in 2021, the composite infrastructure index of Ukraine's transport sector was 2.76 out of 5. «The highest value of the Infrastructure Index was recorded in air transport - 3.15 points, road transport - 2.96 points, inland waterway transport - 2.75, sea transport - 2.47, and rail transport - 2.45 points» (National Institute for Strategic Studies, 2022). And as we can see, inland waterway transport, like other sectors, requires significant investment
flows.

As can be seen from the study, the financing of the shipbuilding industry in Ukraine is insufficient. Thus, the construction of new ships, which is very rare, is mainly carried out by market participants who want to control the supply chain themselves rather than chartering ships on the market. In terms of ownership, there are almost no independent ship operators on the market, with the exception of the Ukririchflot fleet, which has a large customer base and does not limit its activities to one product or company. And the available financing for the industry comes from its own funding and sometimes from international financial institutions such as the EBRD. To maximize the potential of the WT sector, Ukraine needs independent operators capable of serving the market. For this purpose, the process of investment and financing of the shipping industry should be simplified and accessible to investors who have a business case for inland waterway transport.

The draft Recovery Plan for Ukraine stipulates that a total of about UAH 212.7 billion is needed to restore the transport infrastructure. Funding will be used «to restore critical transport infrastructure, build rail, road, and inland waterways to improve logistics, increase exports, and ensure food security in the world. The estimated funding needs for projects to implement the transport infrastructure restoration plan for the period 2022-2026 in the field of maritime and inland waterway transport are UAH 14.6 billion» (National Institute for Strategic Studies, 2022).

Based on the Recovery Plan for Ukraine, the European Union agrees to directly participate in projects to rebuild Ukraine's transportation infrastructure. Even before the war, the European Investment Bank was one of the largest investors in Ukraine's transport infrastructure: in 2021, the total investment from this institution reached €554 million, and in 2020, it exceeded €1 billion.

Amid the military events unfolding in Ukraine, the European Commission revised the maps of the Trans-European Transport Network (TEN-T) to encompass Ukraine's logistical pathways. This strategic move signifies a significant step towards Ukraine's integration into the European Union and is set to enhance the realization of the Solidarity Roads initiative, which aims to facilitate the export of agricultural products and humanitarian aid to Ukraine.

Specifically, adjustments were made to the North-Baltic Corridor, extending it through Lviv and Kyiv to Mariupol. The Baltic-Black Sea-Aegean Corridor now stretches through Lviv and Chernivtsi (including Romania and Moldova) to Odesa. In the realm of inland waterway transport, the Baltic Sea-Adriatic Sea and Rhine-Danube corridors will now have an extended reach to Lviv via Chop (Ukrinform, 2022).

In 2017, Ukraine became a member of the TEN-T network. According to the investment plan outlined by the European Commission for the advancement of TEN-T corridors, Ukraine was slated to execute projects amounting to €4.45 billion by 2030. Notably, this figure stands as the most substantial allocation among all the countries within the EU Eastern Partnership program. Within the framework of the TEN-T development blueprint for Ukraine, a comprehensive array of 49 potential transport infrastructure projects has been identified. Among these, seven projects, encompassing both road and rail initiatives, have already been successfully executed and are undergoing further development.

In addition, to create a mechanism for investing in Ukraine's inland waterway infrastructure by both international financial institutions and private investors, it is necessary to reform Ukrvodshlyakh into a structure that can receive funds in the form of investments under state guarantees. A striking example of this is the State Road Agency of Ukraine, which, in particular, has received significant investments from the European Bank for Reconstruction and Development for the construction of new roads (Special release, 2014).

The development of public-private partnerships (PPPs) will also help to attract investment in the reconstruction of the transportation sector. To develop the PPP component in the process of rebuilding war-damaged facilities, it is necessary to adopt the Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine on Improving the Mechanism for Attracting Private Investment Using the Mechanism of Public-Private Partnership to Accelerate the Restoration of War-Damaged Facilities and the Construction of New Facilities Related to the Post-War Reconstruction of the Ukrainian Economy" (draft law No. 7508 of 01.07.2022), which, in particular, simplifies the procedure and reduces the time for preparing tenders and the terms Also, taking into account the experience of transferring seaports to concession (concession agreements for the Kherson port were transferred to Risoil-Kherson and Olvia in Mykolaiv was concessioned to a subsidiary of the Qatar-based QTerminals Group), the draft law should also consider mechanisms to prevent unfair distribution of risks and revenues between participants in PPP projects, as well as a mechanism for providing guarantees to private companies for investments in the reconstruction of
Ukraine (National Institute for Strategic Studies, 2022).

In order for investors to come to Ukraine and help it, it is necessary for the Ukrainian insurance market to function effectively as an integral part of the country's financial market. Private investors can receive guarantees from the state, but this has a major impact on its debt position, which is already in a very difficult situation, as well as from private insurance companies, both Ukrainian and foreign, through the reinsurance market. Ukrainian insurance companies are currently unable to cover the entire volume of military risks and are therefore forced to turn to reinsurance, transferring part of the risks abroad. Currently, the NBU has changed the regulation of reinsurance abroad and allowed only 2 companies to carry out such reinsurance. Liberalization of this sector will allow Ukraine to attract more private investors. Infrastructure is one of the areas where cooperation between the state and the private sector is most effective.

In addition to the liberalization of the insurance market, the price of insurance for risks in Ukraine, especially those related to the war, will remain a major problem. Prices have increased almost 10 times since 2014, and especially since 2022, and for most market participants, these are unaffordable amounts. In these circumstances, it is possible, for example, to organize a system of subsidies for insurance of investment project risks for large and small businesses, when the state compensates for a part of the market tariff, the growth of which is due to military operations. Another option is to create an insurance pool of insurance companies that will be dedicated to military risks. For example, the nuclear insurance pool operates in Ukraine.

The government, in cooperation with international organizations, such as the EBRD, can also create an insurance company that will increase risk coverage using the assets of the specialized fund for the restoration of Ukraine.

And speaking generally, the state should not cover all the risks associated with military operations, as this is a significant burden for the state apparatus. It is important for Ukraine to pay attention to the strategies of the EBRD and other development banks, which attract even more private capital through their investments. Thus, every hryvnia invested by the state in the war risk guarantee system should attract 2-3 hryvnias of private capital to this system. This way, Ukraine's recovery will be more effective and investors will feel more secure.

In the inland waterway transport sector, a large number of small and medium-sized enterprises located within 100 km of the river can be potential stakeholders in the development of IWT. In addition to the large companies present in the IWT market, such as Nibulon and Ukrichflot, other companies are also interested in developing IWT. These small businesses can form industrial parks around river ports, which in turn will become a factor in the development of small and medium-sized businesses in this area. Today, such a positive experience already exists in Germany and is being actively adopted by China. The immediate impact on SMEs' IWT development will be moderate, unlike the existing large enterprises in this area, but in the medium term, after the implementation of initiatives to improve river infrastructure, a class of small entrepreneurs may emerge that owns and directly operates a small cargo fleet, similar to what is happening in Europe today (Regulation Delivery Office, 2017).

Digitalization. Establish an IWT platform where representatives of the public and private sectors can hold regular and structured discussions to improve the conditions of inland waterway transport and create a market surveillance system to monitor the development of river transport.

Analogous platforms are already effectively operational in multiple European Union member states. The mid-century period witnessed significant shifts in the advancement of inland waterway transportation within Europe. Barriers hindering unrestricted market entry were eliminated, and an equitable tariff structure was instituted to ensure competitiveness. The regulatory framework governing vessels and crew operations in multiple European Union member states. The mid-century period witnessed significant shifts in the advancement of inland waterway transportation within Europe. Barriers hindering unrestricted market entry were eliminated, and an equitable tariff structure was instituted to ensure competitiveness. The regulatory framework governing vessels and crew operations within EU member states.

A pivotal stride in the evolution of European inland navigation was the establishment of the distinctive European CESNI platform. This milestone heralded a transformative phase, wherein all nations utilizing this mode of transportation actively engage. CESNI orchestrates sustainable expansion, fosters accessibility to novel technologies, and bolsters the growth of inland navigation as a pivotal and competitive facet of the broader European transportation network.

Also very well known is the Notification to Captains (NtS) system, which is one of the key services for safety and efficient navigation on inland waterways. And the Danube Commission Working Group has already decided and aims to promote the practice of NtS between the countries of the Danube Region. Since June 23, 2022 (Notification to Captains Standard 4.0), the NtS
implementation in the Danube Region has been organized in a digital format. The digitalization of the NTs was discussed with representatives of all countries in the Danube Region. Further events and bilateral discussions on NTs transfer will be continued in the future.

A necessary element to increase the potential of the STS is equal competitive conditions for Ukrainian and foreign flag vessels. Before the war, Ukraine's VSS operated an average of 300-350 flights per year by foreign-flagged vessels. This is due to the fact that the International Convention on the Simplification and Harmonization of Customs Procedures, which allows for the exemption of ship supplies (Section VI Annex J), including excise and VAT on fuel, gives foreign ships a competitive advantage over national carriers.

«In accordance with the Association Agreement between Ukraine, on the one hand, and the European Union, the European Atomic Energy Community and their Member States, on the other hand (Directive 87/540/EEC, Directive 96/75/EC, Directive 96/50/EC, EU Directive 2016/1629, Directive 2005/44/EC, Directive 2009/16/EC, Directive 2009/21/EC, Directive 2009/15/EC, Regulation (EC) No 391/2009, Regulation (EC) No 336/2006)» (Gorbachev M. 2020). It is also worth noting the implementation of EU Directive 2003/96 to restore the competitiveness of Ukrainian shipping on inland waterways. This directive provides for the introduction of compensation to shipping companies for the excise tax paid on fuel for water transport in inland waterways (except for cases when vessels are used for personal purposes). Such a step will have a positive multiplier effect on the country's economy, contributing to cheaper water transportation, the restoration of Ukrainian shipping and the development of the shipbuilding industry in Ukraine.

It is also very important to include inland waterway transport in the multimodal transportation system. This is an important condition because in winter, the locks are closed for a certain period of time, and during this time, cargo can be transported by other modes of transport. And traders who choose river transportation should be informed about this in advance so that they can plan the last possible river transportation and organize alternative cargo transportation. Given the concept of multimodal transportation, the inland waterway operator can organize alternative transportation methods for shippers on its own behalf. This concept has been used very successfully in the field of container transportation on the Rhine during times of low water or severe winter. Improvements to the locks will also help reduce the time it takes for a vessel to pass through, which will increase the number of voyages and the volume of transportation. Also, the schedule of vessels may provide for a reserved time for more or less guaranteed transportation time. And the inclusion of the IWT in the multimodal transportation structure will allow shippers and freight forwarders to quickly use another mode of transport in case of an expected significant delay.

The development of water-railway services is particularly relevant. Unfortunately, this area is not developed in Ukraine today. There are vertically integrated supply chains of major producers and traders along the Dnipro and Dumai rivers, mostly grain terminals or traditional bulk cargo terminals that require significant modernization. Thus, for the transport hubs mentioned in the National Transport Strategy of Ukraine for the period up to 2030 as a development priority, the water-rail-road connection is essential.

**Conclusions and perspectives of further research**

Based on the research conducted by scientists, it can be argued that inland waterway transport is a more environmentally friendly, safer and more economical mode of transport among all modes of transport.

Today, Ukraine's inland waterways play a secondary role in the country's transportation system. The rivers of Ukraine are underutilized as waterways and have the potential for development, as this will not only allow the use of rivers for cargo transportation but will play a substantial role in fostering the sustainable evolution of the transportation sector.

The Ukrainian government views inland waterway transportation as a vital component in bolstering and nurturing the national economy. Through the augmentation of the transportation and logistics infrastructure, the government endeavors to enhance the logistical framework, striving for a more streamlined and eco-friendly logistics system. The advancement of river transport, geared towards environmentally conscious conveyance, holds the potential to exert a substantial influence on Ukraine's societal advancement and ecological well-being.

To enhance the potential of Ukraine's inland waterway transport, it is necessary to: develop sectoral transport programs with a balanced distribution of cargo flows between modes of transport; create a favorable investment climate; actively introduce innovative technologies; create a
competitive market for foreign and national agents in the field of inland waterway transport; and create favorable conditions for the development of multimodal transportation. These measures will contribute to strengthening the potential of Ukraine's inland waterway transport, especially in the postwar period.

The strengthening and development of river transport will enable Ukraine to unlock the potential of inland waterway freight transportation and offer a cost-effective alternative to road and rail transport. This, in turn, will stimulate a reduction in overall transportation costs. Since transportation costs are included in the selling price of goods, it is obvious that transportation should be organized as efficiently as possible and minimize these costs.

Advancements in the expansion of river transport within Ukraine, coupled with its seamless integration into the multimodal transportation network, have the potential to markedly diminish energy expenditures and mitigate environmental harm by curbing emissions. Moreover, this synergy can facilitate the movement of commodities between the nation's key industrial hubs and the Black Sea ports, utilizing river-sea vessels, thus circumventing the need for supplementary transshipment operations.

The efficient use of inland waterway transport stimulates economic growth of territorial communities, entrepreneurial activity and competition in the market, as well as the inflow of investments that contribute to the development of innovative technologies, curbing migration processes and retaining qualified personnel. In the long term, strengthening the potential of inland waterway transport will help reduce social tensions and improve living conditions, harmonious development and consolidation of society, GDP growth and improvement of Ukraine's position on the world stage and promote sustainable development of the country.

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