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# PRINCIPLES OF ECONOMIC JUSTIFICATION FOR THE DEVELOPMENT OF LOGISTICS THROUGH THE DANUBE PORTS

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# ЗАСАДИ ЕКОНОМІЧНОГО ОБҐРУНТУВАННЯ РОЗВИТКУ ЛОГІСТИКИ ЧЕРЕЗ ДУНАЙСЬКІ ПОРТИ

*The Russian military aggression against Ukraine, which escalated to a full-scale war in 2022, has significantly affected all sectors of the national economy,*

*particularly the logistics infrastructure. The blockade of Black Sea ports, the destruction of transport hubs, and the threat to the security of cargo transportation have posed a critical challenge for Ukrainian carriers to find alternative routes for the export and import of goods. The purpose of the article is to provide an economic justification for the prospects of developing logistics through the Danube ports, taking into account their increasing role in ensuring export-import operations and the stable functioning of the national foreign economic activity. The study highlights that the development of logistics through the Danube ports should be measured by a comprehensive socio-economic effect in the following key areas: regional economic growth; enhancing the competitiveness of the national economy; deepening Ukraine's integration into the European transport and logistics space; strengthening food and energy security; ensuring social stability. It has been proven that regarding the economic growth of the Danube region of Ukraine, the focus is on stimulating the development of local businesses, increasing the volume of exports and transit shipments, and creating new jobs in related sectors. It has also been proven that with respect to enhancing the competitiveness of the national economy, this involves reducing logistics costs, shortening cargo delivery times, and expanding access to Ukrainian goods to international markets. It has been proven that, regarding integration into the European transport and logistics space, the focus is on expanding Ukraine's participation in the Pan-European transport corridors and deepening cooperation with EU countries in the fields of port infrastructure and multimodal transportation. It has been proven that with respect to strengthening food and energy security, this involves ensuring the uninterrupted export of agricultural products as well as the import of critical resources even under conditions of military threats. It has been proven that, regarding social stability, this concerns the growth of local budget revenues, the development of social infrastructure, and the improvement of living standards in port communities.*

*Військова агресія рф проти України суттєво вплинула на всі сфери національної економіки, зокрема на логістичну інфраструктуру. Блокування морських портів Чорного моря, руйнування транспортних вузлів та загроза безпеці вантажоперевезень поставили перед перевізниками України критичне завдання з пошуку альтернативних шляхів експорту та імпорту товарів. Відповідно до наведених положень метою статті є економічне обґрунтування розвитку логістики через Дунайські порти з урахуванням їх висхідної ролі у забезпеченні експортно-імпортних операцій та стабільного функціонування національної зовнішньоекономічної діяльності. У межах дослідження звернуто увагу на те, що розвиток логістики через Дунайські порти має вимірюватися через комплексний соціально-економічний ефект у таких ключових напрямах, як: економічне зростання регіону; підвищення конкурентоспроможності національної економіки; поглиблення інтеграції України в європейський транспортно-логістичний простір; зміцнення продовольчої та енергетичної безпеки; забезпечення соціальної стабільності. Доведено, що щодо економічного зростання Придунайського регіону України, мова йде про стимулювання розвитку місцевого бізнесу, збільшення обсягів експорту та транзитних перевезень, створення нових робочих місць у суміжних секторах. Що щодо підвищення конкурентоспроможності національної економіки, мова йде про зниження логістичних витрат, скорочення часу доставляння вантажів, розширення доступу українських товарів на міжнародні ринки. Доведено, що щодо інтеграції в європейський транспортно-логістичний простір, мова йде про поглиблення співпраці з країнами ЄС у сфері портової інфраструктури та мультимодальних перевезень. Доведено, що щодо зміцнення продовольчої та енергетичної безпеки, мова йде про забезпечення безперервного експорту аграрної продукції, а також імпорту критичних ресурсів навіть в умовах воєнних загроз. Щодо*

*соціальної стабільності мова йде про зростання доходів місцевих бюджетів, розвиток соціальної інфраструктури, підвищення якості життя у припортових громадах.*

***Keywords:*** *regional economic growth; competitiveness of the national economy; European transport and logistics space; logistics security; Danube ports.*

***Ключові слова:*** *економічне зростання регіону; конкурентоспроможність національної економіки; європейський транспортно-логістичний простір; логістична безпека; Дунайські порти.*

***Problem statement.*** The Russian military aggression against Ukraine, which escalated to a full-scale conflict in 2022, has significantly impacted all sectors of the national economy, particularly the logistics infrastructure.

The blockade of Black Sea ports, the destruction of transport hubs, and threats to the security of cargo transportation have posed a critical challenge for Ukrainian carriers to find alternative routes for the export and import of goods.

In this context, the role of the ports located along the Danube River has significantly increased. In particular, they now serve as strategic assets for ensuring the stable operation of the country's foreign economic activities and its logistics chains. Specifically, ports such as Reni, Izmail, and Ust-Danube have demonstrated dynamic growth in cargo turnover, adapting to new challenges and market demands.

For example, based on the results from January to November 2022, the cargo turnover of the ports of Izmail, Reni, and Ust-Danube increased by 2.9 times. The growth continued in 2023 [5]. According to analysis by the Ukrainian Sea Ports Authority, the port of Izmail alone handled over 8 million tons of cargo in 2023, becoming the largest port in Ukraine by cargo turnover under wartime conditions [1; 7].

Furthermore, according to the Ukrainian Agribusiness Club (UCAB), the share of Danube ports in Ukraine's total agricultural exports increased from less than 5% in 2021 to over 30% in 2023. Additionally, following the termination of the "grain corridor" (after the Russian side ceased the grain agreement), the Danube ports became the key route for exporting Ukrainian grain. Under these circumstances, logistics through the Danube ports requires a fundamentally new economic justification, which will enable the development of effective strategies amid current challenges and prospects for post-war recovery.

***Analysis of research and publications.*** Various challenges and development prospects of logistics through open sea and river ports have been examined in the works of Verbytskyi V. [3], Hryhorenko Y. [1], Koblianska I.I., Mishchenko O.V. [4], Husenko O.S., and Bomchak Y.V. [2]. In particular, the main focus was on optimizing transport routes, enhancing the infrastructural capacity of ports, integrating into international logistics chains, and ensuring transportation security amid wartime risks.

Koblianska I.I. and Mishchenko O.V. [4] also emphasized the necessity of implementing innovative technologies to improve cargo turnover efficiency and develop multimodal transportation, which are key factors for the advancement of logistics through the Danube ports in the context of Ukraine's European integration.

At the same time, most authors emphasize the importance of an economic justification for the development of logistics through the Danube ports as an alternative route with high capacity; however, a systematic and comprehensive study of this issue is still lacking.

***Formulation of the article's objectives.*** By the above provisions, the purpose of this article is to provide an economic justification for the development of logistics through the Danube ports, taking into account their increasing role in facilitating export-import operations and ensuring the stable functioning of the national foreign economic activity.

***The paper main body.*** The authors emphasize that in the context of war and the ongoing risks of shelling of port infrastructure, the development of alternative high-capacity logistics routes—particularly through the Danube ports (Izmail, Reni, and Ust-Danube) — is extremely relevant. The economic justification for this process should be based on a set of principles and mechanisms that ensure an objective assessment and enhance the efficiency of logistics infrastructure development in Ukraine's Danube region.

In this context, the key principles and mechanisms for economically justifying the development of logistics through the Danube ports include fundamental provisions and specific tools aimed at achieving the following objectives (see Table 1):

- Strategic feasibility.
- Efficient use of existing infrastructure.
- Investment attractiveness.
- Cargo turnover predictability.
- Logistics security.

Thus, the foundations of the economic justification for the logistics development through the Danube ports should encompass a system of principles and mechanisms that create a comprehensive basis for forming an effective logistics development policy through the Danube ports. This policy must meaningfully address both the current conditions of war and the prospects for post-war recovery and Ukraine's integration into the European transport and economic space. The main components of this foundation are presented in Figure 1.

**Table 1. Principles and mechanisms ensuring the economic justification for the development of logistics through the Danube ports**

| Principles | Description of mechanisms for the economic justification of logistics development through the Danube Ports |
|---|---|
| strategic feasibility [1] | Analysis of the geopolitical situation and the significance of the ports in ensuring critically important cargo flows. |
| efficient use of existing infrastructure [2] | Modernization of the deep-water channel and maintenance of navigational depths, development of transport access to the ports, and ensuring resilience to seasonal and military risks. |
| investment attractiveness [3] | Creation of favorable conditions for attracting private and international capital; assessment of the economic feasibility of projects based on cargo flow forecasts; preparation of feasibility studies considering payback periods and multiplier effects. |
| cargo turnover predictability [4] | Analysis of current and prospective cargo movement trends; scenario modeling taking into account seasonal, military, and market fluctuations; use of statistical and analytical forecasting methods for infrastructure investment planning. |
| logistics security 5 | Monitoring of threats related to combat operations and infrastructure risks, as well as development of scenarios to ensure continuity of logistics processes. |

Note

1. Focusing logistics development on leveraging the advantageous geopolitical and transport position of the Danube ports, and their role in ensuring critically important cargo flows during wartime challenges and integration into European transport and logistics systems.
2. Optimizing the utilization of existing port, transport, and hydraulic engineering capacities; modernizing the deep-water channel; reconstructing access routes (rail and road); and enhancing resilience to seasonal and wartime restrictions.
3. Developing ports and related logistics infrastructure based on economic feasibility and potential project payback, considering their impact on the national economy and the readiness of private and international capital to invest in the region.
4. Planning the development of port infrastructure based on the analysis of current and prospective cargo flow trends, taking into account possible scenarios of changing external conditions, including the impact of military and natural factors.
5. Systematically considering risks associated with combat operations, infrastructure limitations, and emergencies, as well as developing plans and scenarios to ensure continuity of logistics processes in crisis.

*Source: compiled based on [1;3-5]*

The consideration of the outlined principles and mechanisms for the development of logistics through the Danube ports determines the scope of the comprehensive socio-economic effect, which manifests itself in various dimensions, including [1; 3-4]:

- Economic growth of the Danube region of Ukraine.

- Increased competitiveness of the national economy.

- Deepening of Ukraine's integration processes into the European transport and logistics space.

- Strengthening of food and energy security.

- Social stability.

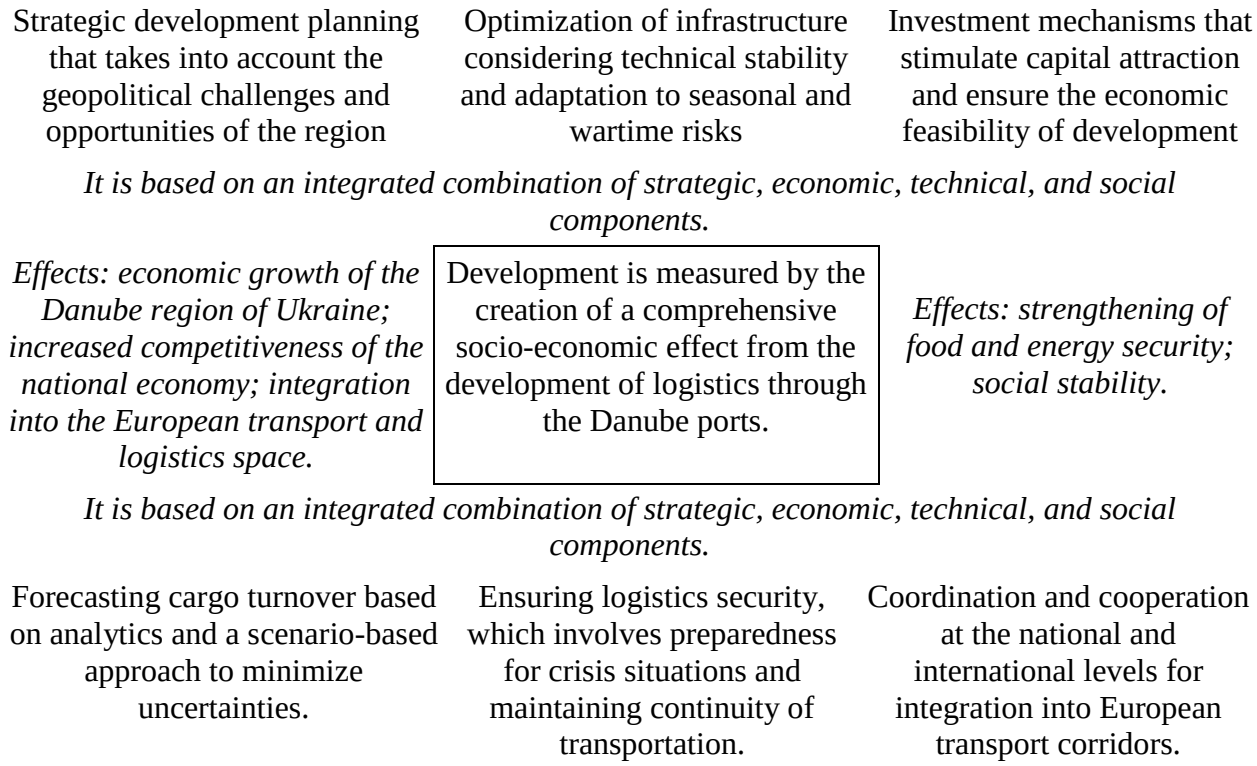


**Figure 1. A comprehensive foundation for shaping an effective logistics development policy through the Danube ports**

*Source: compiled based on [1; 5-7]*

This is due to the creation of a comprehensive foundation for effective logistics policy, which is based on the integration of strategic, economic, technical, and social components. Such an approach facilitates the adaptation of logistics infrastructure to wartime challenges and lays the groundwork for sustainable growth in the post-war period.

The consideration of geopolitical location is important for the economic justification of logistics development through the Danube ports. In particular, it is significant that these ports are situated at the intersection of major international

transport corridors, especially in the context of the implementation of the initiative to expand the Trans-European Transport Network (TEN-T) to the territories of Ukraine and Moldova. This has traditionally given the Danube ports strategic importance. TEN-T aims to integrate both countries into a unified system of European rail, road, inland waterway, and air routes, creating conditions for the active involvement of the Danube region in international logistics.

At the same time, in the pre-war period, the significance of the Danube ports remained relatively limited: in the three years preceding the full-scale war, the average cargo turnover through the ports of Izmail, Reni, and Ust-Danube amounted to 3–5 million tons per year, which accounted for only 2.5–4.2% of Ukraine's total export volume. Specifically, in 2021, the cargo turnover through these ports reached 5.5 million tons [7].

However, with the onset of Russia's full-scale invasion in February 2022, the geostrategic role of the Danube ports increased significantly. Thanks to their advantageous geographical location—proximity to the ports of EU countries (Bulgaria and Romania), as well as the possibility of safe navigation along the Danube—these ports for a time became the only water corridor for exports amid the effective maritime blockade imposed by Russia (both before the implementation and after the cessation of the "grain initiative").

By the end of 2022, the cargo turnover through the ports of Izmail, Reni, and Ust-Danube reached 16.5 million tons. In 2023, this figure rose to 32 million tons. Although in 2024 the volume decreased to 17.3 million tons (due to the resumption of operations at the ports of Greater Odesa from August 16, 2023, within the framework of the national maritime corridor), the Danube ports have retained their key role in ensuring the continuous export, primarily of agro-industrial products, as confirmed by the data in Table 2.

The presented statistics indicate a continuous transformation of the status of these ports. Specifically, from 2022 to 2024, they have evolved from secondary facilities into strategic logistics hubs that are critically important for the country's

economic resilience in wartime conditions. Since 2024, these ports serve short-distance routes toward Black Sea and Mediterranean ports [1; 7].

**Table 2. Key indicators of logistics development through the Danube ports, 2021–2024**

| Key indicators | Evaluation period, years | | | | Rate of change (+/-), % | | |
|---|---|---|---|---|---|---|---|
| | 2021 | 2022 | 2023 | 2024 | 2022/2021 | 2023/2022 | 2023/2024 |
| Cargo turnover, million tons | 5,5 | 16,5 | 32 | 17,3 | 200 | 93.94 | -46 |
| Number of vessels handled, units | 3614 | 10067 | 14031 | 7744 | 178 | 39,38 | -44,81 |

*Source: compiled based on [1]*

Thus, the combination of a favorable geopolitical position and crisis challenges is the key factor driving the development of the Danube ports. We concur with the conclusions of Hryhorenko Yu. [1], who notes that these ports are currently crucial elements of the national foreign trade system, as they are capable of providing alternative logistics routes amid limited access to other Ukrainian seaports. This underscores the need for better integration of Danube ports into European logistics and economic networks, particularly concerning the development of Pan-European transport corridors.

Regarding the effective use of existing infrastructure, it should be noted that during the period from 2022 to 2024, market operators actively utilized the logistics connection between the Ukrainian Danube ports and the Romanian port of Constanța, where cargo was transshipped onto sea vessels for further transportation, particularly to countries in Southeast Asia. The total volume of investments in the Danube port infrastructure over this period exceeded 100 million USD [1]. As of 2025, export activities are predominantly concentrated in the port of Izmail, utilizing small coaster vessels with a cargo capacity of up to 10,000 tons. Despite significant infrastructure improvements made after the start of the full-scale aggression — including the opening of the navigable passage through the Bystre estuary, the launch of 23 new terminals (mainly for grain and liquid

bulk cargoes), and the creation of 20 new transshipment points — opportunities for organizing large-tonnage river exports remain significantly limited [1].

Considering the importance of the efficient use of existing infrastructure for the economic justification of logistics development through the Danube ports, the key determining factors include:

- Frequent shallowing of the Danube during the summer-autumn period, which reduces the navigability of the shipping route; limitations of port infrastructure, particularly depths that do not allow the acceptance of vessels with a draft exceeding 6–7 meters and deadweight over 6,000 tons [1];
- The limited capacity and wear of access routes — both rail and road — complicate the delivery of cargo to the ports. For example, the railway to the Izmail port is currently single-track and non-electrified, while the line to Reni passes through Moldovan territory (with limited transport capacity and higher transportation costs).

Thus, despite intensive infrastructure investments and the overall growing role of the Danube ports, targeted measures are necessary to realize their full potential [3]. These include maintaining and modernizing the deep-water channel, expanding transport access, and ensuring resilience to seasonal and military risks.

The state of investment attractiveness is crucial for the economic justification of developing logistics through the Danube ports. In particular, it is determined by the significance of these ports for the country’s economy, especially considering that products from the mining and metallurgical complex (MMC) have traditionally been characteristic cargo for this route.

For example, before the full-scale war, Ferrexpo shipped about 10% of its products via the Danube, enjoying a competitive advantage through its own shipping company, First-DDSG, which operates various types of river vessels (including tugboats and barges), ensuring flexibility in handling different types of cargo [1].

Other mining and metallurgical enterprises also utilize the Danube route. In 2024, the export of ferroalloys through Romania reached 17 thousand tons to Italy

and 15.3 thousand tons to Turkey, while the import of manganese ore amounted to 84.3 thousand tons [1].

However, market participants realistically assess the current state of Danube logistics: under wartime conditions, it remains specialized and unstable, which reduces its attractiveness to private capital and international financial institutions. To ensure the investment appeal of the Danube ports, it is necessary to create predictable business conditions through long-term guarantees for the operation of ports and transport corridors, as well as to introduce financial incentives (tax benefits, compensation mechanisms [4-5]) for investors in port and access infrastructure.

The predictability of cargo turnover is an important component of the economic justification for developing logistics through the Danube ports. As of 2025, cargo turnover remains limited — there are no stable forecasts or long-term development scenarios. In 2023, record cargo volumes were achieved, but by 2024, turnover had nearly halved. In the first quarter of 2025, only 2.3 million tons of cargo passed through the Danube ports (for comparison, the major seaports of Greater Odessa handled 23 million tons) [1].

Among the main reasons for such unpredictability is the combination of seasonal, infrastructural, technological, and security factors, as well as the variability of transport routes, which significantly complicates accurate forecasts of future volumes.

To improve the predictability of cargo turnover at the Danube ports, a comprehensive set of measures must be implemented at the state level simultaneously across three interconnected areas: data and analytics, infrastructure and technical stability, and policy, coordination, and investments (see Table 3).

**Table 3. Measures to ensure predictability of cargo turnover at the Danube Ports**

| Data and Analytics (Timeliness and Detail) | Infrastructure and technical stability | Policy, coordination, and investments |
|---|---|---|
| Establishment of a unified cargo flow monitoring system in near real-time for each port, with breakdowns by cargo types and directions.<br>Integration of hydrological forecasts and weather data into the planning system.<br>Monitoring the condition of access infrastructure (railways, roads) and conducting regular capacity assessments.<br>Implementation of scenario-based forecasting considering key risks. | Dredging and maintenance of the fairway to minimize the impact of shallowing during the summer-autumn period.<br>Modernization of berths and transshipment capacities to reduce downtime and increase flexibility in handling different types of vessels.<br>Development of multimodal logistics — integration of rail, road, and river transport to enable rapid reorientation of cargo flows.<br>Backup solutions for emergencies or attacks (mobile transshipment complexes, additional storage facilities). | Develop a long-term development strategy for the Danube ports with forecast scenarios linked to international corridors.<br>Provide investment guarantees and risk insurance for private operators to encourage investment in port and fleet development.<br>Coordinate internationally with the EU to harmonize schedules, tariffs, and procedures.<br>Conduct regular forecast updates (quarterly) to enable market participants to plan their operations effectively. |

*Source: compiled based on [1-2; 4; 6]*

Only the systematic implementation of such measures will create a predictable environment for market operators and ensure the sustainable development of the Danube region.

The current state of logistics security is crucial for the economic justification of developing logistics through the Danube ports. This condition is determined not only by the seasonal shallowing of the river but also by significant threats arising from military actions. In particular, since the beginning of the full-scale invasion by the Russian Federation, port infrastructure has repeatedly been targeted by attacks.

So, on July 24, 2023, Russian forces launched a missile strike on port facilities on the Danube, destroying a grain warehouse, damaging storage tanks for other cargo, and starting a fire in a production building, which was promptly extinguished [7]. These incidents highlight the high risk to the logistical stability of the region.

Therefore, to improve the logistics security of the Danube ports, it is advisable to implement a comprehensive approach that takes into account both military threats and natural seasonal risks.

***Conclusions*.** The authors emphasize that in wartime conditions, with ongoing risks of attacks on port infrastructure, the development of alternative logistics routes with high throughput capacity—particularly through the Danube ports—is extremely important. The study highlights that the development of logistics via the Danube ports should be measured by a comprehensive socio-economic impact in the following key areas: regional economic growth; enhancement of the national economy's competitiveness; deeper integration of Ukraine into the European transport and logistics space; strengthening of food and energy security; and ensuring social stability.

It has been demonstrated that regarding the economic growth of the Ukrainian Danube region, this involves stimulating the development of local businesses, increasing export volumes and transit shipments, and creating new jobs in related sectors.

It has also been proven that in terms of enhancing the competitiveness of the national economy, the focus is on reducing logistics costs, shortening cargo delivery times, and expanding access to Ukrainian goods in international markets.

It has been demonstrated that regarding integration into the European transport and logistics space, this involves expanding Ukraine's participation in the Pan-European transport corridors and deepening cooperation with EU countries in the areas of port infrastructure and multimodal transportation.

It has also been proven that, concerning strengthening food and energy security, the focus is on ensuring the uninterrupted export of agricultural products as well as the import of critical resources even under conditions of military threats.

It has been demonstrated that regarding social stability, this entails increasing local budget revenues, developing social infrastructure, and improving the quality of life in port communities.

According to the above provisions, prospects for further research lie in developing concrete strategies for implementing the comprehensive

development of logistics infrastructure in the Danube ports, taking into account military risks, as well as in modeling long-term scenarios of the impact of this development on the socio-economic condition of the region and Ukraine's integration into the European transport and logistics space.

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