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ПРІОРИТЕТНІ НАПРЯМИ ТА МОЖЛИВОСТІ ВІДНОВЛЕННЯ ІНФРАСТРУКТУРИ ГОСПОДАРЮВАННЯ УКРАЇНИ

Актуальність. Інфраструктурні об'єкти стали однією з основних сфер, які зазнали найпотужніших атак з боку агресора після початку повномасштабної війни проти України. Зокрема, в перші тижні конфлікту російські війська активно обстрілювали авіаційну інфраструктуру, включаючи аеродроми як військового, так і цивільного та подвійного призначення. Пізніше атаки були зосереджені на залізничній інфраструктурі, зокрема на електричних підстанціях. На сьогоднішній день потреба у відновленні господарської інфраструктури України оцінюється у 411 мільярдів доларів. Основний акцент робиться на відбудові критично важливих об'єктів, таких як житло, соціальна та транспортна інфраструктура. Для реалізації цих завдань Україна потребує підтримки міжнародних партнерів у формі фінансування та матеріально-технічної допомоги. Для консолідації зусиль відновлення інфраструктури господарювання України було створено Державне агентство відновлення та розвитку інфраструктури України. Ця структура є відповідальною за ефективність, прозорість та підзвітність інфраструктурної відбудови, а також у впровадженні масштабних проєктів із залученням як бюджетного, так і зовнішнього фінансування. Отже, відновлення зруйнованого та розвиток інфраструктури господарювання є складним і багатогранним процесом, що передбачає реалізацію десятків тисяч проєктів у різних секторах та в усіх регіонах України.

Мета та завдання. Проаналізувати та обґрунтувати ключові напрями відновлення та розвитку інфраструктури господарювання України внаслідок пошкоджень, які сталися через пряму агресію з боку РФ.

Матеріали та методи. Матеріальну базу дослідження складають результати теоретичного узагальнення розробок, наукових підходів до виявлення першочергових шляхів та можливостей відновлення пошкодженої інфраструктури господарювання України, які висвітлені в публікаціях фундаментального, аналітичного та практичного характеру, а також офіційні статистичні дані, аналітичні матеріали Світового банку, USAID, Міністерство розвитку громад та територій України, Державне агентство відновлення та розвитку інфраструктури України.

Результати. У статті подано детальну характеристику пріоритетів та можливостей відновлення інфраструктури господарювання, які спираються на макрорегіональний підхід, ресурсний потенціал країни, перспективи інтеграції з ЄС та потребу у формуванні нової економічної структури. Розглянуто та охарактеризовано стан інфраструктури господарювання України та визначено збитки в результаті обстрілів та масованих атак з боку агресора. З огляду на постійну загрозу з боку росії та Білорусі, доцільно запровадити поділ України на три макрорегіони для ефективного планування відновлення та стратегічного розвитку: Східний регіон (фронтір), Центральний регіон (опора) та Західний регіон (тил). Такий макрорегіональний підхід сприяє визначенню спеціалізації кожного регіону, оптимізації структури регіональної економіки, плануванню розміщення виробничих об'єктів і системи розселення, а також дозволяє переглянути транспортні коридори та логістичні зв'язки між макрорегіонами України. Відновлення та розвиток інфраструктури господарювання в Україні потребує всебічного підходу, спрямованого на подолання наслідків війни та забезпечення стабільного економічного зростання. З цією метою у статті представлена детальна характеристика пріоритетних напрямків та можливостей відновлення цієї інфраструктури, що базуються на макрорегіональному підході, ресурсному потенціалі країни, перспективах інтеграції з ЄС та необхідності створення нової економічної структури. Серед основних напрямків та перспектив розвитку економіки України виділено: 1) адаптацію аграрного сектору до нових ринкових умов, що передбачає розвиток біотехнологій, застосування інноваційних методів вирощування та переробки продукції, що в підсумку сприятиме збільшенню експортного потенціалу країни; 2) розвиток інноваційної економіки та технологічного прогресу, який має стати основою для стійкого довгострокового відновлення. Зростання ІТ-сектора, формування стартап-екосистем та технологічних інкубаторів у західних і центральних регіонах забезпечить стабільне економічне зростання; 3) регіональну диверсифікацію економіки, яка дозволить знизити залежність від окремих галузей. Промисловість, енергетика, аграрний сектор та технологічні інновації мають стати ключовими елементами цієї стратегії. В межах окреслених пріоритетів відновлення у статті детально розглянуто етапи відновлення інфраструктури господарювання.

Висновки. На основі окреслених напрямків розвитку економічних галузей України запропоновано рекомендації для планування відновлення інфраструктури господарювання, які включають три ключові напрями: 1) створення стійкої інституційної основи для координації процесу відбудови та розвитку, що передбачає заснування державних і регіональних інститутів, відповідальних за залучення інвестицій, координацію міжнародної допомоги та реалізацію відновлювальних проєктів; 2) розробку нової політики управління ризиками для захисту критичної інфраструктури. Умови війни та загрози з боку РФ і Білорусі потребують вдосконалення механізмів моніторингу, реагування та захисту; 3) підвищення кваліфікації робочої сили відповідно до нових умов праці та розвитку технологічних галузей. Програми професійної підготовки, що відповідають сучасним вимогам ринку праці, мають сприяти розвитку людського капіталу як фундаменту економічного зростання.

Таким чином, зважаючи на численні виклики, що постають перед Україною, процес відновлення інфраструктури господарювання повинен супроводжуватися впровадженням новітніх технологій, диверсифікацією економіки та оптимізацією розміщення виробничих потужностей, що забезпечить стабільний і стійкий розвиток країни в умовах тривалої загрози війни.

Ключові слова: пріоритетні напрями, інфраструктура господарювання України, розвиток, відновлення.

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PRIORITY DIRECTIONS AND OPPORTUNITIES FOR RESTORATION OF UKRAINE'S ECONOMY INFRASTRUCTURE

Topicality. Infrastructure facilities have become one of the primary targets of the aggressor's most intense attacks since the start of the full-scale war against Ukraine. In particular, during the first weeks of the conflict, Russian forces actively shelled aviation infrastructure, including airfields for military, civilian, and dual-purpose use. Later, the attacks shifted focus to railway infrastructure, especially targeting electrical substations. As of today, the need for restoring Ukraine's economic infrastructure is estimated at \$411 billion. The primary emphasis is on rebuilding critically important facilities such as housing, social, and transportation infrastructure. To achieve these goals, Ukraine requires support from international partners in the form of funding and material-technical assistance. To consolidate efforts for restoring Ukraine's economic infrastructure, the State Agency for Restoration and Development of Infrastructure of Ukraine was established. This entity is responsible for ensuring the efficiency, transparency, and accountability of infrastructure reconstruction, as well as implementing large-scale projects funded through both domestic budgets and external financial sources. Thus, the recovery and development of economic infrastructure is a complex and multifaceted process involving the implementation of tens of thousands of projects across various sectors and regions throughout Ukraine.

Aim and tasks. To analyze and substantiate the key directions for the restoration and development of Ukraine's economic infrastructure following the damage caused by direct aggression from the Russian Federation.

Materials and methods. The research foundation consists of the results of theoretical generalizations of developments and scientific approaches to identifying the priority pathways and opportunities for restoring Ukraine's damaged economic infrastructure. These are reflected in publications of a fundamental, analytical, and practical nature, as well as official statistical data and analytical materials from the World Bank, USAID, the Ministry of Communities and Territories Development of Ukraine, and the State Agency for Restoration and Development of Infrastructure of Ukraine.

Research results. The article provides a detailed characterization of the priorities and opportunities for the restoration of economic infrastructure based on a macro-regional approach, the country's resource potential, prospects for integration with the EU, and the need to form a new economic structure. It examines and analyzes the state of Ukraine's economic infrastructure and assesses the damage caused by shelling and massive attacks by the aggressor.

Given the ongoing threat from Russia and Belarus, it is proposed to divide Ukraine into three macro-regions for effective recovery planning and strategic development: the Eastern Region (frontline), the Central Region (support), and the Western Region (rear). This macro-regional approach facilitates the determination of each region's specialization, optimization of the regional economic structure, planning of industrial facility placement and settlement systems, and allows for a revision of transport corridors and logistical connections between Ukraine's macro-regions.

The restoration and development of Ukraine's economic infrastructure require a comprehensive approach aimed at overcoming the consequences of the war and ensuring stable economic growth. To this end, the article presents a detailed analysis of priority areas and opportunities for restoring this infrastructure, grounded in a macro-regional approach, the country's resource potential, EU integration prospects, and the necessity to create a new economic structure. Key directions and prospects for the development of Ukraine's economy highlighted in the article include: 1) Adaptation of the agricultural sector to new market conditions, focusing on the development of biotechnology, innovative methods of

cultivation and processing, which ultimately will enhance the country's export potential; 2) Development of an innovative economy and technological progress, which should serve as a foundation for sustainable long-term recovery. The growth of the IT sector, formation of startup ecosystems, and technological incubators in the western and central regions will contribute to stable economic growth; 3) Regional diversification of the economy, which will reduce dependence on specific industries. Industrial production, energy, agriculture, and technological innovations are key elements of this strategy. Within these outlined recovery priorities, the article thoroughly examines the stages of economic infrastructure restoration.

Conclusion. Based on the outlined directions for the development of Ukraine's economic sectors, recommendations have been proposed for planning the recovery of economic infrastructure, which include three key areas: 1) Establishing a resilient institutional framework to coordinate the reconstruction and development process. This involves the creation of national and regional institutions responsible for attracting investments, coordinating international assistance, and implementing recovery projects; 2) Developing a new risk management policy to protect critical infrastructure. The conditions of war and threats from Russia and Belarus require enhanced mechanisms for monitoring, response, and protection; 3) Improving workforce qualifications in line with new working conditions and the development of technological industries. Professional training programs tailored to modern labor market demands should foster the development of human capital as a foundation for economic growth. Thus, given the numerous challenges Ukraine faces, the process of restoring economic infrastructure must be accompanied by the implementation of innovative technologies, economic diversification, and the optimization of industrial facility placement. This approach will ensure the country's stable and sustainable development in the context of prolonged threats of war.

Keywords: Priority areas, Ukraine's economic infrastructure, development, restoration.

Problem statement and its connection with important scientific and practical tasks. The open aggression of the Russian Federation against Ukraine, which escalated into a full-scale war, has caused significant destruction of cities and villages, the devastation of critical infrastructure in many communities and regions, and forced millions of people to become displaced, dramatically altering the demographic situation in various parts of the country. In these challenging wartime conditions, local self-government bodies of territorial communities, as well as the selfless assistance of communities and regions to the affected territories, have demonstrated the validity of previous policies in decentralization and regional development.

The recovery of Ukraine will pose a major challenge not only for the country itself but also for the global community. The scale of destruction is so vast that no single state or organization can manage the reconstruction process alone. This process will require close coordination between governments, international institutions, non-governmental organizations, the private sector, and other stakeholders. Moreover, the recovery effort will introduce new tools, organizations, and partnerships to address these challenges effectively.

Analysis of recent publications on the problem. The issues of restoring and developing Ukraine's infrastructure are being addressed by research institutions with the support of USAID, the Office of the President of Ukraine, as well as studies and recommendations from the Ministry of Communities and Territories Development of Ukraine, the State Agency for Restoration and Development of Infrastructure of Ukraine, non-governmental organizations, and others. The characterization of economic infrastructure based

on a macro-regional approach is highlighted in the works of authors such as O. Bulik (Bulyk, 2023), B. Burkinsky, A. Shcherbak, V. Horyachyk, O. Laiko, N. Shlafman, S. Ilchenko, I. Topalova, T. Umanets, S. Danylina, M. Shapovalov and others. This macro-regional approach facilitates the identification of each region's specialization, optimization of the regional economic structure, and enables a revision of transport corridors and logistical connections between Ukraine's macro-regions.

Allocation of previously unsolved parts of the general problem. Despite the large number of scientific studies, certain aspects remain underexplored. It is necessary to comprehensively substantiate and sequentially present recommendations for planning the restoration of Ukraine's economic infrastructure. This process should be accompanied by the implementation of advanced technologies, economic diversification, and optimization of industrial facility placement, ensuring stable and sustainable development of the country under the ongoing threat of war.

Formulation of research objectives (problem statement). To identify and substantiate the priority directions for the restoration and development of Ukraine's economic infrastructure following the damage caused by direct aggression from the Russian Federation, and to propose recommendations and stages for implementing measures to restore Ukraine's infrastructure.

Materials and methods. The research is based on the results of theoretical generalizations of scientific developments and approaches to identifying priority directions and opportunities for restoring Ukraine's damaged economic infrastructure. These are presented in fundamental,

analytical, and practical publications, as well as official statistical data and analytical reports from the World Bank, USAID, the Ministry of Communities and Territories Development of Ukraine, and the State Agency for Restoration and Development of Infrastructure of Ukraine.

An outline of the main results and their justification. During the hostilities, Russia destroyed thousands of infrastructure facilities, and the destruction continues, making it impossible to accurately assess the scale of the damage. Among the destroyed objects are airports, bridges, residential buildings, and social infrastructure, which are critically important for Ukraine's recovery and the return of its population. The total damage to Ukraine's infrastructure is estimated at nearly \$155 billion, with the housing sector suffering the greatest losses—by early 2024, over 250,000 buildings were either damaged or destroyed. This figure also includes the losses from the destruction of the Kakhovka Hydroelectric Power Plant by the aggressor on June 6, 2023. The housing sector has been the hardest hit in terms of the scale of damage.

Due to ongoing hostilities and regular shelling, the number of damaged and destroyed residential buildings continues to rise. As of early 2024, more than 250,000 buildings have been destroyed, including 222,000 private houses, over 27,000 apartment buildings, and 526 dormitories (Ministr finansiv Serhii Marchenko, 2024).

The largest direct losses are attributed to residential buildings, accounting for 37.5% of the total damage, amounting to \$58.9 billion, as well as infrastructure, which represents 23.4% or \$36.8 billion. Losses to businesses and industrial assets have reached at least \$13.1 billion and continue to rise. The agricultural sector and land resources have suffered direct losses of \$10.3 billion due to the war. Meanwhile, losses in the energy sector are rapidly increasing, currently estimated at \$9.0 billion. The total damages to public sector facilities (social institutions, educational, scientific, medical, cultural, sports facilities, administrative buildings, etc.) are approximately \$13.7 billion (Report on direct infrastructure, 2024).

In 2024, the largest direct losses were recorded in the following sectors: the housing sector – \$50.4 billion; transportation infrastructure – \$35.7 billion; trade and industry – \$10.9 billion; energy and mining sectors – \$10.6 billion; and the agricultural sector – \$8.7 billion. It is noted that the total direct losses during the first year of the war amounted to \$135 billion, while the overall damages are estimated at approximately \$290 billion. The level of direct damage caused by Russian aggression is estimated at \$135 billion, with a significant portion of these losses attributed to the housing sector. Specifically, \$50.4 billion, or 37.3% of the total, is linked to housing damage (Fig. 1) (Kubrakov, 2023).

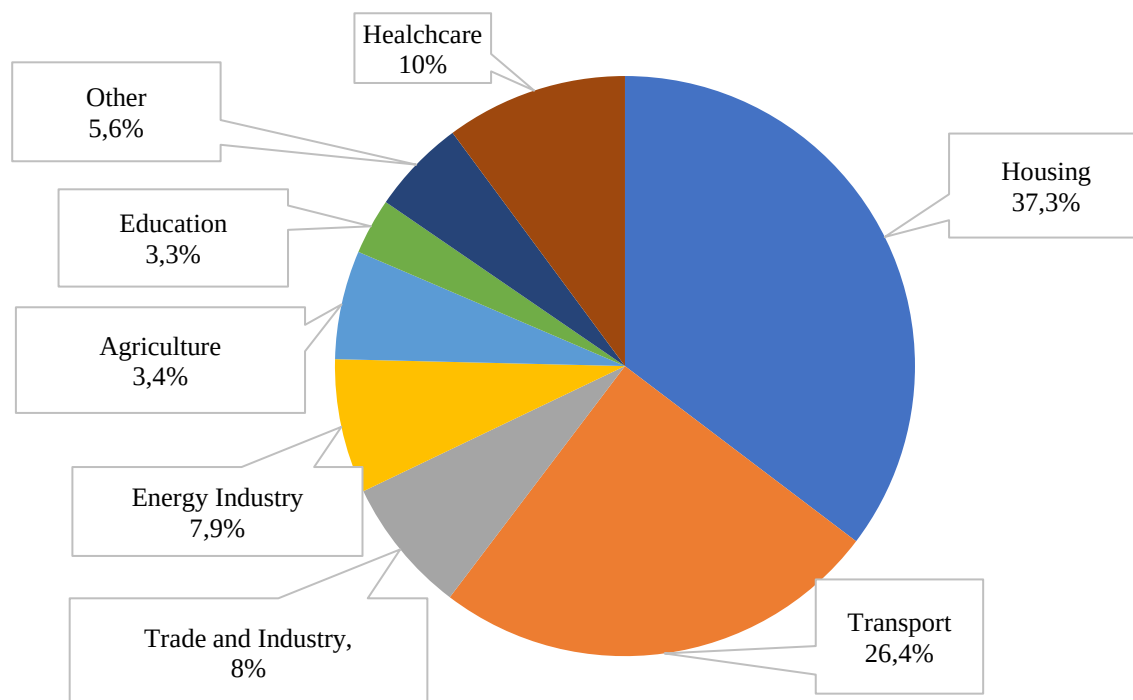


Fig. 1 - Damage and Recovery Needs

Source: compiled by the author based on (Kubrakov named the priority areas of recovery of Ukraine, 2023)

The most significant damage to residential buildings has been recorded in Kyiv and Kharkiv regions, as well as in the eastern regions. As of 2024, infrastructure losses have reached \$36.8 billion, while losses to industrial enterprises amount to \$13.1 billion.

Additionally, 426 public and private organizations of various levels have been destroyed or damaged. Losses in the energy sector have reached \$9 billion, in the agricultural sector – \$8.7 billion, and in the housing and utility sectors and healthcare – \$4.5 billion and \$3.1 billion, respectively.

Since the beginning of Russia's large-scale aggression in Ukraine, 16,000 units of municipal transport, 3,800 educational institutions, 160,000 units of agricultural machinery, 580 administrative buildings at state and local levels, 1,800 cultural institutions, 48 social facilities, 426 healthcare institutions, 348 religious buildings, 50 administrative service centers, 31 boarding schools, 31 shopping centers, and other infrastructure facilities have been damaged or destroyed. Additionally, 1,711 cultural objects have been affected. The most extensive destruction has been recorded in major regions of Ukraine.

Since the invasion began, nearly 3,600 environmental crimes committed by Russia have been documented, causing damage estimated at 2.2 trillion UAH (Shapovalov, 2023).

For example, in Mariupol, key metallurgical plants – Illich Steel and Iron Works and "Azovstal" of the Metinvest group – were destroyed, and the total loss of tax revenues from the destroyed enterprises could reach approximately 50 billion UAH. The Lysychansk and Kremenchuk oil refineries, as well as numerous enterprises and their workshops in Kharkiv, Kyiv, Chernihiv, Mykolaiv, Sumy, Okhtyrka, and many other cities, have been destroyed or severely damaged. Due to the threats of war and the potential capture of equipment and workers, more than 1,500 enterprises are being relocated to central and western regions of Ukraine. This has led to the deindustrialization of areas that once served as the backbone of the country's industrial potential. Such changes significantly impact the current and future redistribution of Ukraine's productive forces and will influence the possibility of people returning to these industrial cities and regions (Russia caused almost 155 billion dollars' worth of damage to Ukraine's infrastructure, 2024).

Thus, the military actions on Ukraine's territory bring not only human and economic losses but also long-term negative consequences that constrain the country's future development for an extended

period. For this reason, the primary task of the Ukrainian government is to develop pathways for the recovery and reconstruction of Ukraine's infrastructure.

Despite ongoing hostilities, it is already critical to develop strategies for rebuilding destroyed areas and creating conditions and opportunities for the prompt return of displaced persons to Ukraine and most internally displaced citizens to their places of residence. Additionally, it is necessary to restore local, regional, and national economies.

These measures require revisiting current strategic documents, including the State Regional Development Strategy until 2027, accounting for new constraints caused by the war, and utilizing additional opportunities opened by Ukraine's prospective membership in the European Union. Practical and strategic sustainable development programs for regional policy, as a key part of the country's recovery, must be created.

It is also essential to focus on stabilizing the economies of rear regions, which are a key factor in maintaining resilience during wartime.

The recovery of Ukraine involves not only the reconstruction of infrastructure damaged by the aggressor but also the restoration of normal functioning for the population and businesses in communities, as well as the creation of a renewed economic model that addresses modern challenges, including the constant threat from the neighboring aggressor, Russia.

Even before the war, Ukrainians – politicians, experts, and citizens – understood that Ukraine's regions differed significantly in terms of objective indicators. However, a new key factor has emerged that greatly affects the future development of regions – their proximity to the Russian and Belarusian borders, which determines the risk of potential attacks. The closeness to these borders has become a significant limiting factor for the return of displaced persons and the establishment of new enterprises in these border areas.

Given the persistent threat from these neighbors, it is advisable to consider dividing Ukraine into three macro-regions for further reconstruction efforts:

1. Eastern Region (Frontline): This region requires priority investments in rebuilding critical infrastructure, including industrial facilities, transportation networks, and social institutions, due to the significant risk of direct military invasion. The placement of military facilities and defensive fortifications is essential for ensuring the region's stability and security, which could gradually encourage the return of the population and stimulate economic activity.

2. Central Region (Support): This region can serve as a support zone for both the Eastern and Western regions due to its production capacities and moderate risk of military intervention. Priorities here should include the restoration of transportation corridors and the development of agricultural and processing industries oriented toward both domestic and European markets.

3. Western Region (Rear): This region has the greatest potential for economic and investment integration with the EU. It should become a hub for new enterprises located closer to EU markets and serve as an economic backbone for the recovery of the entire country.

This macro-regional approach enables the

determination of each macro-region's specialization, the optimization of regional economic structures, planning of industrial facility placement and settlement systems, and the revision of transport corridors and logistics between Ukraine's macro-regions.

The restoration and development of Ukraine's economic infrastructure require a comprehensive approach focused on overcoming the consequences of war. Priority directions and opportunities for restoring economic infrastructure, based on the macro-regional approach, the country's resource potential, EU integration prospects, and the need to create a new economic structure, are presented in Table 1.

Table 1.

Priority directions and opportunities for the restoration of economic infrastructure

Priority directions and opportunities for the restoration of economic infrastructure	Characteristics and features
Priorities for the restoration of economic infrastructure	The development of transport and logistics infrastructure is a key task for improving connectivity between macro-regions and with EU countries. Following the destruction of the transportation network, the priority should be the restoration of railway and road networks, especially corridors linking western regions with Europe. Industrial reindustrialization using energy-efficient and high-tech solutions is a strategic direction for restoring the country's economic potential. Investments in manufacturing enterprises and processing industries that meet European standards will expand the labor market and contribute to GDP growth. The modernization of energy infrastructure will enable the reduction of dependence on external resources, ensure energy independence, and enhance the country's energy security. The implementation of renewable energy sources (RES), as well as the reconstruction and modernization of nuclear power plants, is essential to support the stable operation of industry.
Opportunities and challenges in restoring economic infrastructure	The implementation of European standards in industry opens access to the European market, requiring significant modernization of production processes, improvement of workplace safety, and increased environmental responsibility. International support and investments are key resources for recovery. Financing programs and technical assistance from the EU, international financial organizations, and foreign governments can significantly accelerate infrastructure restoration, particularly in the energy and industrial sectors. Challenges related to security and stability remain critical, especially for eastern and central regions. Reconstruction planning must incorporate long-term security measures and the implementation of early warning systems to protect civilian and industrial infrastructure.

Source: compiled by the author

Among the directions and prospects for the development of Ukraine's economy, the following can be highlighted:

- adaptation of the agricultural sector to new market conditions – this may include the development of biotechnology, implementation of innovative methods of cultivation and processing,

which will enhance Ukraine's export potential\$

- the introduction of an innovative economy should become the foundation for long-term recovery. The development of the IT sector, startup ecosystems, and technological incubators in western and central regions will ensure stable economic growth\$

- regional diversification of the economy – this will reduce dependence on specific industries. Industry, energy, agriculture, and technological innovations can become the main elements of this strategy.

Based on Table 1 and the outlined directions for the development of Ukraine's economic sectors, recommendations for supporting infrastructure reconstruction planning can be considered. These recommendations are focused on three areas:

1) establishing a resilient institutional framework to coordinate the reconstruction and development process. This includes creating national and regional institutions responsible for attracting investments, coordinating international assistance, and implementing recovery projects;

2) developing a new risk management policy to protect critical infrastructure. The conditions of war and threats from Russia and Belarus necessitate the improvement of monitoring, response, and protection tools;

3) enhancing workforce qualifications for new working conditions and the development of technological industries. Professional training programs that meet labor market demands should contribute to developing human capital as the foundation for economic growth.

Thus, considering the aforementioned challenges facing Ukraine, the recovery of economic infrastructure should be accompanied by the implementation of new technologies, economic diversification, and the optimization of industrial facility placement. This will ensure stable and sustainable development of the country under the ongoing threat of war.

The recovery plan announced by the president of Ukraine is based on five key principles:

- 1) rapid start and gradual growth;
- 2) ensuring equitable prosperity;
- 3) deepening integration with the EU;
- 4) recovery with improvements at the national and local levels;
- 5) attracting private investments (Ukraine Recovery Plan, 2022).

Within the outlined recovery priorities, let us examine in detail the stages of restoring economic infrastructure.

One of the key factors ensuring Ukraine's spatial cohesion is a reliable network of major cities: Kyiv in the north, Lviv in the west, Kharkiv in the east, Dnipro in the center, and Odesa in the south. The aggressor's strikes on these cities are not random, as the restoration of this connecting framework, strengthening ties between these cities, and maximizing the integration of their economic, educational, and cultural capacities are crucial for

ensuring Ukraine's unity and dynamic growth. This task is the primary priority in the recovery process.

The initial stage is critical for implementing the following urgent steps:

- restore communication networks in the capital region.

- reconstruct aviation routes and airport equipment in the capital to handle critical cargo and resume international air connectivity.

- rebuild bridges around Kyiv and clear and repair road surfaces on international highways leading from Kyiv to the west, Odesa, and Kharkiv.

- restore logistics hubs around Kyiv capable of receiving and storing international cargo.

2. Reconstruction of the regions will require the rapid delivery of essential goods and adequate connections between key logistical hubs, Kyiv, and other countries. Accordingly, a top priority is restoring the capacity of airports in Kharkiv, Odesa, Dnipro, Lviv, and Vinnytsia to accommodate cargo aviation (Restoration of Ukraine. Regional aspect, 2022).

3. A new definition should be introduced into regulatory frameworks: "zones of destruction," which would encompass territorial communities or their specific parts affected by hostilities and missile strikes. These areas should be classified based on the scale of destruction and demographic losses, including the displacement of the population. Each category must have clear criteria and be represented on a map with a detailed description of each area to facilitate optimal decisions regarding reconstruction or potential abandonment.

The reconstruction of affected regions should be based on an objective assessment of the prospects for the return of citizens who were forced to leave these areas. It is essential to involve sociological agencies to analyze the willingness of displaced persons to return and to determine the conditions under which their return would be possible (Burkynskyi & Shcherbak, 2024).

4. The reconstruction of destroyed areas will require a significant amount of building materials. It is crucial to establish a network of modular enterprises for producing modern construction materials in Ukraine, placing them as close as possible to the most affected areas. This approach will allow the use of local resources and provide employment for people who have lost their jobs due to the war.

Additionally, the production of modular elements for constructing residential and social buildings using dry technologies should be organized. These methods enable rapid adaptation of structures to local conditions and allow for their construction in the shortest possible time.

5. Restoring the housing stock and creating new residential facilities for internally displaced persons in new residential districts is a priority. It is essential to expedite the return of people who have fled abroad or relocated to other regions of Ukraine due to the war. However, it is important to recognize that with each passing month spent away from their former place of residence, the willingness to return diminishes. This is particularly true for cities and villages near the aggressor, which, due to the constant risk, may become less attractive for returning residents.

In contrast, western regions may face a housing shortage for individuals who choose to stay, necessitating the development of solutions to provide housing for internally displaced persons (IDPs) both in the western and eastern regions, using different approaches.

The construction of new residential facilities should incorporate climate adaptation, the creation of public spaces, and convenient access to essential services, including public, cultural, commercial, recreational, and wellness facilities. The development of reconstruction plans for settlements should be based on an understanding of their economic potential, with an emphasis on integrating housing, work, and leisure (Goryachyk et. al., 2024).

6. Reconstruction of social infrastructure facilities should meet current needs and standards. The repair of damaged schools should take into account modern requirements for educational spaces. Additionally, it is advisable to consider using other public buildings, such as cultural centers or shopping malls, to organize the educational process.

The restoration of healthcare facilities should be based on modern approaches to the system, emphasizing decentralization, a high level of technological equipment, and recognizing the vital role of private medical institutions.

7. In the energy sector, the priority is to restore damaged electricity and gas networks, as well as to maximize the transition from traditional gas supply to electric energy, including nuclear and green energy. It is also essential to develop enterprises for processing coal, peat, and corn into liquid and gaseous fuels.

Given the challenges in exporting grain abroad and Ukraine's significant dependence on imported petroleum products, it is advisable to promptly organize the production of biofuels at small innovative plants located in various regions. These plants would process agricultural crops into energy resources.

In areas near the Russian border, where the

population has declined and business development and construction are complicated, efforts should focus on afforestation with fast-growing tree species. These trees can serve as both fuel and raw materials for furniture production (Topalova, 2023).

8. In the manufacturing sector, priority should be given to restoring food industry enterprises focused on the domestic market, as well as high-tech and defense-industrial facilities. It is essential to maximize the closure of technological chains for the production of finished military goods at Ukrainian production sites, incorporating cooperation with allied countries. The restoration of defense enterprises should involve developing partnerships in production with American arms manufacturers and European partners, particularly Polish companies.

In the Central and Western macro-regions, a network of design and production platforms for the development and manufacturing of modern military equipment should be established. This effort should engage Western partners and leverage industrial and technological parks. Special attention must be given to relocating the production of critical military resources from the northern and eastern regions to the central and western parts of the country.

The restoration of industry should incorporate measures to increase its resilience to missile attacks by organizing networks of small-scale cooperative productions as an alternative to large enterprises. Additionally, the standardization of design solutions is necessary to ensure the interoperability of components for machinery, mechanisms, and equipment, particularly for defense purposes.

In the eastern regions of Ukraine, which have suffered significant destruction due to military conflicts, it is crucial to provide support to small businesses and self-employed individuals who work with local resources, employ local personnel, focus on the domestic market, and are less vulnerable to aggressive actions (Umanets & Danylina, 2022).

The Ministry is working on amending regulatory acts to transform the State Regional Development Fund into a financial instrument that will facilitate the implementation of the World Bank's recommendations outlined in the Diagnostic Report on Public Investment Management. This also aligns with the provisions of the EU Regulation «On the Establishment of the Ukrainian Fund», which aims to provide financing for the recovery, reconstruction, and modernization of Ukraine's regional authorities.

Funding for recovery initiatives at the local level will be aligned with strategic planning materials. At the national level, the foundation is the updated National Regional Development Strategy for 2021–

2027, implemented at the regional and local levels through respective regional development programs, territorial community development plans, and implementation measures. This will help achieve key national objectives and ensure alignment at the regional and local levels.

The Ministry, in collaboration with international organizations and support initiatives, is currently working on the technical modernization of local planning documents, ensuring their alignment with the programmatic approach to recovery and future financing from the European Union.

Achieving the objectives established in the State Regional Development Strategy and related strategic regional policy documents is essential. Local and regional councils can apply for funding through the DREAM ecosystem (State financial support of communities through the DFRD, 2024).

The formation of this fund should rely on various sources, including confiscated Russian assets, contributions from international partner countries, and loans from international financial institutions.

This fund will finance diverse regional recovery programs developed in accordance with the Recovery Plan, which is part of the State Regional Development Strategy. To allocate funds for reconstruction and, over time, regional development, donors will require guarantees of accountability and the allocation of aid for public interests; a fair distribution of resources based on agreed-upon and well-developed planning documents under the condition of «funding only with a plan»; and the swift and effective use of funds.

A key aspect of ensuring efficiency is practicality and flexibility in management, which supports the creation of a specialized State Regional Recovery Fund. Financial partners may also seek appropriate branding of their assistance, for example, «Demining funded with EU support» (Reconstruction of Ukraine: principles and policies, 2022).

Ukraine must demonstrate its capability to efficiently manage reconstruction funds in advance. Recognition of the government's effective financial practices will be a critical step in the preparation process for EU membership. An essential aspect is the establishment of funding principles closely aligned with European standards, which govern the allocation of resources from the EU's pre-accession and structural funds. This alignment offers two significant advantages: strengthening donor trust and preparing for integration with the European Union.

Given that EU policies are regularly updated to address priority tasks defined for the new planning

period or to prepare candidate countries for membership, Ukraine should develop its own funding rules in collaboration with authorized EU institutions. The period of national reconstruction must also serve as preparation for future EU integration.

EU investment funds finance regional initiatives (or Cohesion Policy), which form the cornerstone of the EU's investment activities. This policy aims to ensure harmonious and balanced development across all territories and to strengthen the EU's economic, social, and territorial cohesion. Its primary goal is to reduce disparities in regional growth and eliminate imbalances in diverse territories.

Special attention is given to rural communities undergoing industrial changes and areas with unique natural or demographic conditions, such as the EU's northernmost regions with low population density, as well as isolated cross-border and mountainous areas. The EU's budget for regional policy during 2021–2027 is approximately half a trillion euros (€392 billion from EU funding, with the remainder provided by co-financing from member states).

The Instrument for Pre-Accession Assistance (IPA) serves as a mechanism through which the European Union provides financial and technical support to candidate countries, assisting them in implementing necessary reforms. This instrument has been in operation since 2007 and is designed to prepare nations for EU membership. The EU's pre-accession funds represent significant investments that contribute to the future development of candidate countries. They support the implementation of essential political and economic reforms required to meet the obligations and responsibilities of EU membership (In Ukraine, more than 70% of all generation has been destroyed, damaged or captured, 2024).

EU member states are required to comply with European Union legislation in all areas, such as public procurement, competition rules, and environmental protection, during the selection and implementation of projects. Additionally, they must have a developed institutional structure and sufficient administrative capacity to ensure proper planning, implementation, monitoring, and evaluation of regional development programs. These activities must be carried out reliably and economically efficiently, adhering to management and financial control standards.

In essence, the preparatory regulations for EU accession are designed to encourage Ukrainian authorities to adopt approaches and practices that align as closely as possible with European standards

in the planning process for the recovery of regions and affected areas. Ukraine already has a foundation that can be utilized to gradually implement the necessary changes.

Ukraine must urgently create conditions for investment in green energy (especially biomass, biomethane, and bioethanol) to reduce dependency on imported energy resources (particularly gas and petroleum products) and leverage its substantial agricultural sector potential. One way to support this direction is through partial compensation of investment capital costs for companies, such as state guarantees or interest rate subsidies. Simplifying and coordinating biomethane connections to gas infrastructure will further stimulate investment activity.

Overall, Ukraine needs to begin preparations for cooperation with the EU under the framework of the «Green Deal» by conducting technical analyses of pipeline adaptation for water transportation and assessing the potential for renewable energy resources in regions with lower risks (e.g., Poltava and Volyn regions).

In the context of the military conflict, Ukraine must establish a resilient and secure investment environment. A deliberate policy is essential to provide investors with confidence in the stability and profitability of their assets.

In the long term, Ukraine has the potential to become a key player in the European energy transition to renewable sources, supplying «carbon-free» energy in significant volumes under attractive conditions. Efficient production from renewable sources, a well-developed infrastructure, and the prospects for hydrogen economy development create a strong foundation for Ukraine to become a crucial "green energy partner" of the European Union.

For Ukraine, this means not only establishing a stable energy system but also attracting significant foreign investments that will stimulate economic development. Approximately one-third of the €1.8 trillion Next Generation EU fund is allocated for the implementation of the EU's «Green Deal» goals, part of which could be invested in Ukraine's energy sector, fostering mutually beneficial cooperation for both parties (Bulyk, 2023).

Ukraine possesses at least three key strengths for a reliable partnership with the European "Green Deal":

1. Low-carbon energy. Due to significant deindustrialization following the collapse of the Soviet Union, Ukraine has surplus electricity generation capacity, particularly in carbon-neutral nuclear energy. The country also holds vast potential for expanding renewable energy

generation, provided reliable export capabilities are established. Certain regions, such as Dnipropetrovsk, Zaporizhzhia, and Poltava, offer highly favorable conditions for onshore wind power. With stable investments and low capital costs, electricity production in these regions can compete with Central European countries. Additionally, Ukraine has considerable hydroelectric potential, particularly on the Dnipro and Dniester rivers. Private investment will be a critical factor for the success of the green transition, providing not only necessary capital but also access to advanced technologies. Wind and solar energy sources are also more decentralized and resilient to attacks, enhancing the security of Ukraine's energy system.

2. Developed infrastructure. Ukraine boasts a well-developed energy network, including capacities for transporting electricity and gas to European countries. In March 2022, Ukraine completed integration with ENTSO-E, which opened new opportunities for integrating Ukraine's electricity sector into the European market and laid the groundwork for exporting clean energy. Additionally, Ukraine has the potential to repurpose its gas transportation infrastructure for hydrogen transport, following the model of the Italian company Snam. In the future, a robust gas transportation network could serve as the foundation for hydrogen exports.

3. Advanced infrastructure prospects. Ukraine has the resources to develop cutting-edge technologies and expand exports of clean products to European markets. Current renewable energy generation can serve as the basis for hydrogen synthesis. Economic sectors such as metallurgy, ammonia production, and agrochemicals can effectively utilize hydrogen, increasing the country's value-added output. For instance, in the field of "green" metallurgy, Ukraine has an opportunity to integrate into the European value-added chain. Responding to global trends, many European manufacturers have focused on decarbonizing steel production, creating additional demand for low-carbon metallurgy. Ukraine is well-positioned to meet this demand, leveraging its significant iron ore reserves and prospects for hydrogen generation.

Regulatory Adaptation and the EU Partnership. As Ukraine seeks EU membership, it must align its regulatory framework with European standards. This includes the gradual implementation of European carbon emissions regulations and integration into the EU Emissions Trading System (ETS).

A phased introduction of mechanisms to monitor

CO2 emissions and participation in the ETS will be critical. While carbon emissions represent a global challenge and Ukraine requires extensive reconstruction, it will need sufficient time and financial resources to gradually reduce emissions and align carbon quota prices with European benchmarks.

Although revenues from carbon taxes or emission trading quotas could serve as funding sources for reconstruction, they may also impose significant economic burdens on Ukrainian businesses, particularly in energy-intensive sectors like metallurgy.

Investment Allocation and Transition Oversight. Most of the funding will be directed towards creating new zero-emission generating facilities (including several nuclear but predominantly renewable sources), increasing hydrogen production (approximately 1.5 megatons for export to Europe), expanding gas-based generation (including biomethane), and modernizing energy networks.

Who will oversee Ukraine's transition to clean energy? Based on consultations with the Ministry of Energy, the government must establish a transparent and equitable legislative framework (including standards for energy-efficient construction, electric transport, carbon emission regulations, etc.) that aligns with EU standards.

By leveraging its unique strengths and aligning its policies with European benchmarks, Ukraine can position itself as a vital partner in Europe's green energy transition (State Agency for Reconstruction and Development of Infrastructure of Ukraine, 2024).

Private and public enterprises, alongside national and international organizations, must collaborate on initiatives to implement this transition. Supporting decentralized projects and fostering competitiveness will provide a robust foundation for "green" development.

The benefits of successfully implementing these proposals will be substantial. Reducing dependence on oil and gas imports will enhance Ukraine's economic stability, shield it from fluctuations in resource prices, strengthen its energy independence, and significantly reduce CO2 emissions, aligning with the EU's green transition efforts.

Improving energy efficiency and advancing green energy, combined with encouraging market competition, will position Ukraine's energy sector as a driving force for post-war economic growth — an opportunity that must not be overlooked.

Conclusions and perspectives of further research.

The war has inflicted severe losses on every

Ukrainian and caused significant destruction across regions and communities of Ukraine, necessitating immediate and comprehensive planning for post-war recovery. This process must begin without delay. Considering Ukraine's potential accelerated accession to the EU, recovery and regional development plans should align with European standards, thereby strengthening the trust of international allies in our projects.

Given the weakened capacity of executive authorities and local self-governance due to the war, there are risks regarding the timeliness, comprehensiveness, and realism of recovery projects. Thus, it is essential to establish coordinated actions among all stakeholders under the leadership of the National Recovery Council of Ukraine. However, this council should not replace executive bodies responsible for implementing recovery measures.

The war has revealed numerous complex challenges, which offer opportunities for swift integration into the European community and for building a nation focused on the well-being of its citizens and the peace and prosperity of Europe. Since the war may persist for an extended period, with its consequences felt for decades, recovery efforts must not be postponed until its end. Mobilization is required both on the frontline and at the local level. Central and western Ukraine must become integrated industrial and economic hubs: despite months of war, many enterprises capable of producing goods for both the frontline and the home front remain inactive or are operating inefficiently, which is unacceptable during wartime. These regions should foster new production facilities, revive closed enterprises, and develop a diversified agricultural sector to meet domestic market needs. This calls for mobilizing labor, investment, innovation, and organizational resources to accelerate economic growth in the rear regions. Effectively utilizing rear resources to support the frontline and stabilize the economy will facilitate the faster recovery of war-affected regions.

Modernizing the economic sector and organizing rear support now will ensure the accelerated recovery of other regions in the future. New construction projects and repairs in communities should focus on resilience and cost-efficiency, prioritizing critical needs. Investments should target infrastructure that enhances sustainability, including decentralized electricity generation, small hydroelectric power plants, wind energy, heat pumps, and solar generators for public institutions.

Expensive local road construction is less advisable; interim solutions like patchwork repairs and gravel surfacing can suffice. Landscaping

should use native flora adapted to climate change and requiring minimal water.

New multi-apartment housing projects should consider reduced building heights, lower density, access roads, shelters, and backup water supply

systems.

Recovery planning must focus on the future, but the most critical task today remains supporting daily life in communities and preparing for new challenges arising from the war.

REFERENCES

Bulyk, O.V. (2023). Stratehiia vidnovlennia ekonomiky Ukrainy pislia viiny. [Strategy for recovery of Ukraine's economy after the war]. *Economy and society*. № 48.

Burkynskyi, B.V., & Shcherbak, A.V. (2024). Mechanisms of self-regulation in the formation of a favorable institutional environment for the development of goods markets. *Economic innovations*. 26 (1(90), 7-15.

Derzhavna finansova pidtrymka hromad cherez DFRR (2024). [State financial support of communities through the DFRD]. <https://mtu.gov.ua/news/35640.html>

Derzhavne ahentstvo vidnovlennia ta rozvytku infrastruktury Ukrainy : ofitsiina storinka [State Agency for Reconstruction and Development of Infrastructure of Ukraine]. <https://restoration.gov.ua/>

Goryachyk, V. F., & Layko, O. I., & Shlafman, N. L., & Ilchenko, S. V. (2024). Assessment of the technological level of enterprises and branches of the processing industry of the Ukrainian. *Economic innovations*, 26 (1(90), 61-73.

Kubakov nazvav priorytetni napriamy vidnovlennia Ukrainy (2023). [Kubakov named the priority areas of recovery of Ukraine]. <https://www.ukrinform.ua/rubric-vidbudova/3686878-kubakov-nazvav-priorytetni-napriami-vidnovlennia-ukraini.html>

Ministr finansiv Serhii Marchenko: na nastupnyi rik maiemo nepokrytu potrebu vid 12 do 15 miliardiv dolariv (2024). [For next year, we have an unmet need of 12 to 15 billion dollars]. <https://www.epravda.com.ua/publications/2024/05/24/714160/>

Plan Vidnovlennia Ukrainy (2022). [Ukraine Recovery Plan]. <https://recovery.gov.ua/>

rosiia zavdala zbytkiv infrastrukturi Ukrainy na maizhe 155 miliardiv dolariv (2024). [russia caused almost 155 billion dollars' worth of damage to Ukraine's infrastructure]. https://lb.ua/society/2024/02/12/598044_rosiya_zavdala_zbitkiv.html

Shapovalov, M. O. (2023). Kontseptualni zasady pisliavoiennoho vidnovlennia ekonomiky Ukrainy [Conceptual principles of the post-war recovery of the economy of Ukraine]. *Young Scientist*. 6(118), 99-104.

Topalova, I. A. (2023). Functioning of the components of a reflective-active environment and management of business processes based on digital platforms. *Economic innovations*. 25 (4(89), 104-112.

Umanets, T. V., & Danylina, S. A. (2022). Structural shifts in social and industrial relations in the conditions of digitalization. *Economic innovations*. 24 (4(85), 159-172.

V Ukraini zruinovani, poskodzheni abo zakhopleni ponad 70% usiei heneratsii (2024). [In Ukraine, more than 70% of all generation has been destroyed, damaged or captured]. <https://www.ukrinform.ua/rubric-economy/3861654-v-ukraini-zruinovani-poskodzheni-abo-zakhopleni-ponad-70-usiei-generacii-ekspert.html>

Vidbudova Ukrainy: pryntsypy ta polityka: paryzkyi zvit. (2022). [Reconstruction of Ukraine: principles and policies: Paris report]. [reconstruction book_Ukrainian_0.pdf](#)

Vidnovlennia Ukrainy. Rehionalnyi aspekt (2022). [Restoration of Ukraine. Regional aspect]. <https://rpr.org.ua/news/vidnovlennia-ukrainy-rehionalnyi-aspekt/>

Zvit pro priami zbytky infrastruktury ta nepriami vtraty ekonomiky vid ruinuvan vnaslidok viiskovoi ahresii rosii proty Ukrainy ta poperednia otsinka potreb Ukrainy u finansuvanni vidnovlennia (2024). [Report on direct infrastructure damage and indirect economic losses from the destruction caused by russia's military aggression against Ukraine and a preliminary assessment of Ukraine's needs for reconstruction financing]. https://kse.ua/wp-content/uploads/2024/04/01.01.24_Damages_Report.pdf.