

THE CONCEPTIONS OF POST-WAR RECONSTRUCTION OF UKRAINE BASED ON SUSTAINABLE DEVELOPMENT

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UDC 658.338
JEL Classification: N44

Zhaldak H. P., Bukan L. V. The Conceptions of Post-War Reconstruction of Ukraine Based on Sustainable Development

This article examines the conceptions of post-war reconstruction of Ukraine based on sustainable development, focusing on investments, innovations, and digitalization as key elements for ensuring long-term prosperity. Investments are crucial for financing reconstruction and modernizing infrastructure, supporting social and economic sectors. Strategic investments will restore infrastructure and create a foundation for future growth by developing key sectors such as energy, transportation, and healthcare. The role of innovations in strengthening the competitiveness of the Ukrainian economy is also highlighted. Innovation-driven industries, such as IT and green energy, will be central to building Ukraine's competitive advantage in the post-war global economy. Digitalization is considered an important factor in reforming public administration and increasing transparency in reconstruction processes. Attention is focused on sustainable development, which combines environmental, social, and economic components, fostering a responsible and balanced recovery. Integrating sustainability ensures economic growth without harming the environment, maintaining a balance between development and ecological preservation. The article discusses the advantages of a comprehensive approach to integrating these conceptions, enabling Ukraine not only to restore its infrastructure and economy but also to ensure a high standard of living for the citizens. Thanks to international support and strategic use of domestic resources, the country will be able to become competitive on the world stage, achieving sustainable development in the future. Such an integrated approach will ensure that Ukraine emerges from its reconstruction not only stronger but also more resilient, ready to face future challenges and opportunities.

Keywords: economic recovery, sustainable development, social stability, innovation, investment, digitalization.

Fig.: 2. **Bibl.:** 20.

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УДК 658.338
JEL Classification: N44

Жалдак Г. П., Букань Л. В. Концепції післявоєнного відновлення України на засадах сталого розвитку

У статті розглядаються концепції повоєнної відбудови України на основі сталого розвитку, зосереджуючись на інвестиціях, інноваціях і цифровізації як ключових елементах забезпечення довгострокового розвитку. Визначено, що інвестиції мають вирішальне значення для фінансування реконструкції та модернізації інфраструктури, підтримки соціального та економічного секторів. Стратегічні інвестиції відновляють інфраструктуру та створюють основу для майбутнього зростання шляхом розвитку таких ключових секторів, як енергетика, транспорт і охорона здоров'я. Також висвітлено роль інновацій у посиленні конкурентоспроможності української економіки. Інноваційні галузі, такі як IT і «зелена» енергетика, можуть бути центральними для створення конкурентних переваг України в післявоєнній глобальній економіці. Цифровізація вважається важливим фактором реформування державного управління та підвищення прозорості процесів реконструкції. Увага зосереджена на сталому розвитку, який поєднує екологічну, соціальну та економічну складові, сприяючи відповідальному та збалансованому відновленню. Інтеграція сталого розвитку забезпечує економічне зростання без шкоди навколишньому середовищу, підтримуючи баланс між розвитком і екологією. У статті розглядаються переваги комплексного підходу до інтеграції цих концепцій, що дозволяє Україні не лише відновити свою інфраструктуру та економіку, а й забезпечити високий рівень життя громадян. Завдяки міжнародній підтримці та стратегічному використанню внутрішніх ресурсів країна зможе стати конкурентоспроможною на світовій арені, досягнувши в майбутньому сталого розвитку. Такий інтегрований підхід гарантує, що Україна вийде з реконструкції не тільки сильнішою, але й стійкішою, готовою протистояти майбутнім викликам і можливостям.

Ключові слова: відновлення економіки, сталий розвиток, соціальна стабільність, інновації, інвестиції, цифровізація.

Рис.: 2. **Бібл.:** 20.

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The post-war reconstruction of Ukraine is one of the large-scale challenges of our time, which should be based on economic, social, and environmental aspects. The devastation wrought by the conflict has led to substantial economic losses for Ukraine. In 2022, the country's gross domestic product (GDP) contracted by approximately 30%, marking the largest recession in Ukraine's history [17, p. 1]. Additionally, direct damages from the war have been estimated at \$152 billion as of February 2024 [18]. These figures underscore the immense financial and infrastructural challenges that lie ahead. The reconstruction will require both financial and human resources, and the integration of innovative approaches to restore the infrastructure, and reanimate society and the economy as a whole. The relevance of this study lies in identifying and substantiating the main concepts of post-war reconstruction, which can become the basis for building not only a new infrastructure but also a modern management model, an innovation-oriented economy, an effective social system, and environmentally friendly development. Such approaches can not only help Ukraine recover but also become an example for other countries facing similar challenges.

The purpose of this work is to identify key aspects of Ukraine's post-war reconstruction, based on the principles of sustainable development, and to explore their role in ensuring the country's long-term prosperity. The study analyzed the importance of investment, innovation, and digitalization as key elements of this process. Achieving this goal demonstrates that it is the integration of these components that allows for the creation of a comprehensive strategy for Ukraine's reconstruction that meets modern challenges and global trends.

Attention to sustainable development emerged after the UN Conference on Environmental Development in 1992 and remains widely discussed. This concept arose in response to the rapid economic growth of the mid-20th century, which led to environmental degradation, resource depletion, and social crises. The need for a new, balanced development model became evident.

V. I. Vernadsky emphasized the planetary impact of human activity and the urgency of addressing global environmental challenges. In his work *A Few Words about the Noosphere* (1944), he wrote: "The historical process is radically changing before our eyes. For the first time in history, the interests of the masses and the free thought of individuals determine the life of humanity" [11].

Key contributions to sustainable development theory include works by the Club of Rome (Behrens, Pestel, Daly, Meadows, Forrester), particularly *The*

"Limits to Growth", which analyzed the consequences of uncontrolled economic expansion [12]. The Brundtland Commission later defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [13, p. 4].

The term combines "development" – an irreversible, directed change – and "sustainable," meaning long-term and within the planet's capacity to recover [14, p. 12]. This suggests that progress should align with nature's regenerative abilities while ensuring social well-being. As Vernadsky warned, delaying concern for sustainability risks future well-being: "We cannot postpone concern for the great and eternal until the time when everyone will be able to satisfy their needs. Otherwise, it will be too late" [15, p. 48–51].

Although awareness of sustainable development is growing, Ukraine faces challenges in its post-war recovery, requiring significant human, financial, and institutional resources. Beyond reconstruction, it is essential to ensure environmental, economic, and social sustainability. As I. Smilyansky notes [16], "Sustainability and sustainable development are more relevant than ever, but they have taken on a different meaning. Now it's about having a model and infrastructure that allows development under any conditions: with or without electricity, with or without communication, with a sufficient number of employees or with minimal resources."

Despite significant research on post-war recovery, gaps remain in Ukraine's reconstruction. While economic revitalization and investment strategies are widely discussed, there is insufficient analysis of mechanisms for attracting long-term foreign direct investment in a high-risk environment. The role of international financial institutions and public-private partnerships in mitigating investment risks requires further exploration.

Second, innovation and digitalization are acknowledged as crucial elements of Ukraine's recovery, yet the integration of these factors into an overarching economic strategy is not fully defined. There is a lack of comprehensive studies on how Ukraine can transition from a war economy to a sustainable innovation-driven economy while ensuring resilience against potential future crises.

Third, the social aspects of reconstruction, particularly the reintegration of displaced populations and the development of a skilled workforce, require additional attention. The war has led to mass migration and demographic shifts, raising concerns about labor shortages and the need for educational reforms. The effectiveness of current policies in addressing these issues remains unclear.

Finally, while environmental sustainability is often mentioned as a priority, specific approaches to balancing rapid industrial reconstruction with green energy transitions need to be more thoroughly examined. There is a need to develop frameworks that integrate environmental, economic, and social sustainability to create a holistic recovery model for Ukraine.

The primary objective of this article is to identify and analyze key aspects of Ukraine's post-war reconstruction based on the principles of sustainable development. Specifically, this study aims to:

Examine the economic, social, and environmental challenges associated with Ukraine's post-war recovery and propose strategies for sustainable economic growth.

Assess the role of innovation and digitalization in rebuilding Ukraine's economy, including their potential impact on productivity and global competitiveness.

Analyze workforce reintegration strategies, labor market transformations, and the role of education in ensuring a skilled workforce for the future.

Evaluate the significance of international cooperation, policy reforms, and institutional support in fostering a resilient and future-oriented economy.

By addressing these objectives, this article aims to contribute to the development of a strategic roadmap for Ukraine's sustainable recovery, providing insights for policymakers, investors, and researchers involved in post-war reconstruction efforts.

Investment is critically important for Ukraine's post-war recovery, providing financial resources to rebuild infrastructure, create jobs, and stimulate economic growth. With an insufficient state budget, attracting private capital, international aid, and strategic

investors is key to sustainable recovery. Investments help develop sectors such as agro-industry, energy, logistics, and IT while introducing new technologies and management standards.

Due to the full-scale invasion, attracting foreign capital has worsened. In 2023, direct investment, net, decreased to -4.68 billion USD, much lower than in 2022 (-187 million USD), while portfolio investment, net, increased to 2.73 billion USD. Foreign direct investment, net outflow, improved in 2023, reaching 129 million USD compared to 34 million USD in 2022 [8–10]. These indicators for 2004–2023 are presented in Fig. 1.

The suspension of certain agreements led to a reduction in investment volumes. In 2023, attracting foreign investment remained difficult. To increase investment attractiveness and support innovation and digitalization, it is necessary to accelerate liberalization, reform bureaucratic processes, and ensure the rule of law in Ukraine [6].

Key investment sectors include energy (for “green” electricity), the defense-industrial complex, logistics, and infrastructure. The Advantage Ukraine initiative, launched in 2022, helps attract investments in these critical sectors. Many investors have already shown interest in innovations, technologies, and infrastructure development [7].

Investment is a foundation for Ukraine's post-war recovery, stimulating economic growth, creating jobs, and introducing advanced technologies. To achieve sustainable recovery, Ukraine must ensure legal stability, government transparency, and innovative financing. Investment is key to the effective implementation of reconstruction strategies and the country's long-term development.

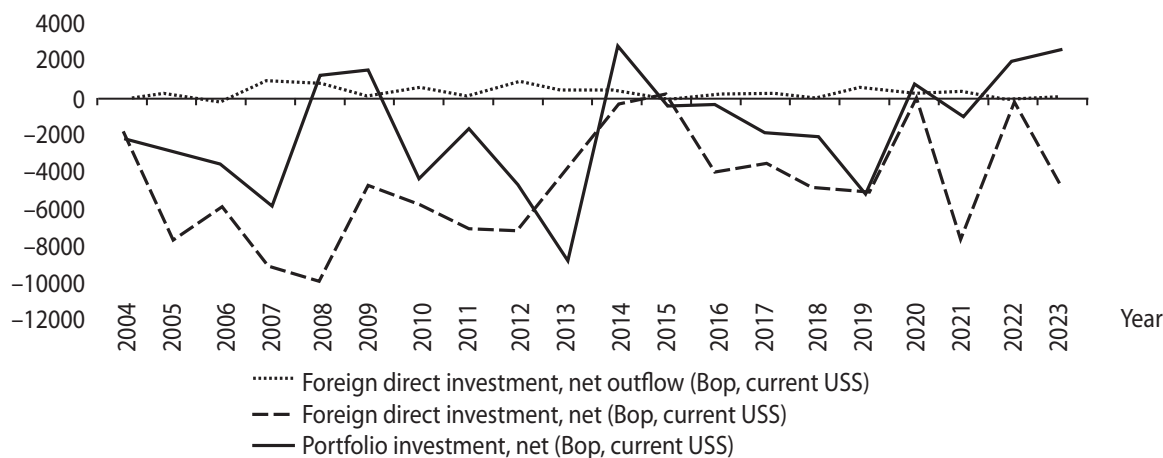


Fig. 1. Dynamics of “Portfolio investment, net”, “Foreign direct investment, net” and “Foreign direct investment, net outflow” in 2004–2023, million USD

Source: [8–10].

Innovation is a key element in building a competitive economy in Ukraine. Thanks to them, modern technologies are introduced, resources are optimized, and industries are created that are oriented toward the future. Innovative approaches, such as “green” energy, defense technologies, and digital solutions, allow for development leaps while avoiding past mistakes. Innovations increase productivity and support science in creating conditions to return qualified personnel who have migrated abroad.

To regain its global ranking, Ukraine can tap into international funding and collaboration. Through programs like Horizon Europe, Ukrainian researchers can access funding and expertise, boosting innovation. The EBRD and IFC support Ukraine’s digital infrastructure, accelerating technological advancement and attracting skilled professionals [19].

Analyzing WIPO’s Global Innovation Index (GII), which assesses economies by innovation potential, Ukraine ranked 60th in 2024, dropping from 55th in 2023. This decline may be linked to war, economic instability, and insufficient financing of innovation projects. In 2023–2024, Ukraine ranked 78th in inno-

vation resources and 54th in innovation output, down from 42nd in 2023. This suggests challenges in commercializing ideas, technology implementation, and fostering a favorable business environment. To address this, innovation policy should focus on improving infrastructure, stimulating research, supporting startups, and fostering business-science cooperation [1, p. 1].

Ukraine has strengths in knowledge and technological results (34th place), business complexity (45th), and human capital and research (54th). However, weaknesses include institutions (107th), market development (85th), and infrastructure (82nd), which could hinder innovation growth if not addressed. Notably, Ukraine leads in utility models by origin (1st place), highlighting strong engineering and technological potential crucial for post-war reconstruction [2, p. 65].

According to Ukrstat, innovation expenditures in 2022 amounted to UAH 7.640.659.92 thousand, lower than in 2021, and further decreased to UAH 6.989.180 thousand in 2023. This decline may be due to war-related financial redirection, reduced business activity, and crisis factors [3].

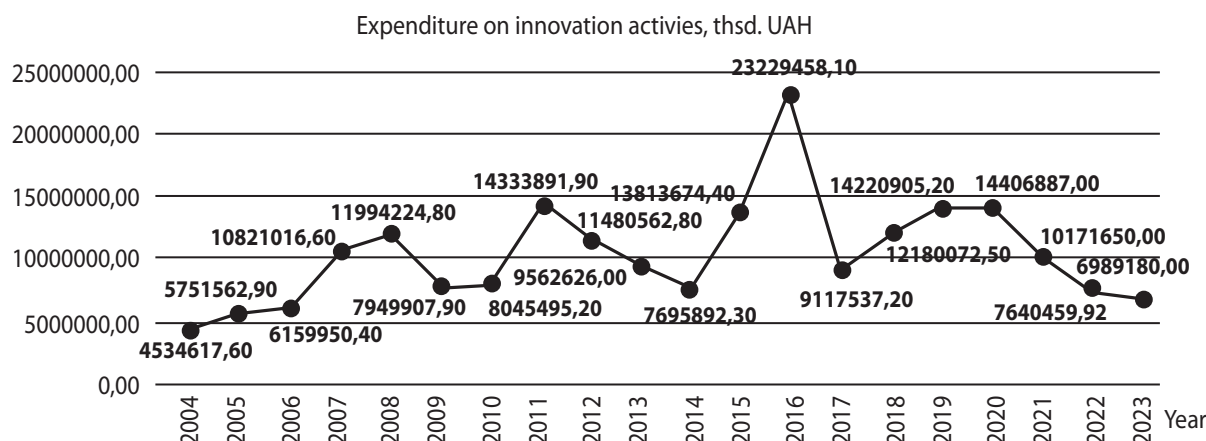


Fig. 2. Dynamics of innovation spending in Ukraine in 2004–2023, thousand UAH

Source: [3].

However, in 2023, research and development expenditures accounted for 30.2% of total spending, underscoring Ukraine’s commitment to innovation despite instability.

The military situation has complicated innovation programs, but scientific research remains a priority. Post-war, restoring investment in innovation will be crucial for sustainable development. Support from the state, international partners, and businesses will be needed to expand funding, develop new technologies, modernize production, and strengthen human capital.

The basis for effective management of recovery processes is digitalization, as it provides transparency, accountability, and efficiency in project implementa-

tion. During the war, when infrastructure was damaged, digital platforms became essential for providing public services and financial assistance. They maintained contact with displaced citizens and organized emergency measures. In response to Russian cyber operations, Ukraine developed a “digital blockade” to limit Russia’s access to technology and created an “IT army” for cyber defense. The integration of Starlink ensured stable connectivity for the military and civilians. The demand for digital services stimulated the expansion of new technologies and IT volunteer involvement [20, p. 2–4].

Modern technologies enable centralized platforms to monitor reconstruction, attract financing,

and manage resources. Digitalization develops the IT sector and supports new industries like e-commerce. It is also a tool for Ukraine's integration into the EU through standardization and infrastructure development. The full-scale invasion accelerated digital transformation to improve economic sustainability, support businesses, and increase productivity. However, challenges include a lack of qualified personnel, low public awareness, and restrictions on digital expansion [4].

According to the OECD (2024), small and medium enterprises (SMEs) play a crucial role in Ukraine's economy, making up 99.9% of all enterprises and employing 81.6% of workers. The invasion has shaken both the economy and society by destroying infrastructure, causing migration, and creating supply chain disruptions. Despite this, IT development stabilizes the economy and aids recovery. A key example is the "Diya" application, which expands e-governance services, including the e-construction initiative [4].

Ukraine's government has introduced strategies for SME development until 2027, focusing on innovation, digital transformation, and the "green transition." These initiatives involve smart specialization, industry clusters, and science parks. AI, instant payments, and electronic invoicing will enhance economic efficiency, transparency, and cybersecurity [5].

The state also supports business recovery by improving financial access, reducing regulatory burdens, and providing grants such as "Made in Ukraine" (for manufacturing) and "Affordable Loans 5–7–9" (for financing) [5]. Ukraine ranks 4th in software spending, highlighting its strong IT sector, which drives digital transformation. AI, cybersecurity, and business automation will modernize the economy and enhance competitiveness [1, p. 7].

CONCLUSIONS

Therefore, supporting small and medium-sized enterprises in Ukraine is crucial for economic recovery. The integration of digital technologies helps adapt to new market conditions, expand internationally, and improve business processes. Modernizing infrastructure is essential for a favorable business environment.

Additionally, developing human capital through digital literacy and professional training will provide access to qualified personnel, vital for innovation. These strategies will boost economic growth, social stability, reduce unemployment, and enhance the quality of life. International cooperation, financial support, and technological expertise are essential for Ukraine's reconstruction. Policy reforms to streamline regula-

tions, promote investment, and foster innovation will create a favorable environment for recovery.

A comprehensive approach – supporting businesses, investing in human capital, modernizing infrastructure, and fostering international cooperation – will form the basis for Ukraine's sustainable development amid global challenges. ■

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