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Areas and tools for regulating spatial and structural changes in the economy of Ukraine's regions in the process of post-war recovery

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Abstract. The relevance of the study was conditioned by the fact that the large-scale invasion of the Russian Federation in Ukraine caused significant imbalances and spatial and structural shifts in the economy of regions, especially front-line ones, which will require the search for effective tools for their regulation in the post-war perspective. The purpose of the study was to investigate the main areas and tools of geographically oriented regulation, which are aimed at stimulating and creating favourable conditions for the post-war modernisation of the structure of the economy of the regions of Ukraine. A number of research methods were used, namely, structural and statistical analysis, and the graphical method. The study focused on the differences in the priorities of post-war economic recovery in the regions of Ukraine, considering the damage caused to them due to military operations. Key problems and priority tasks for regulating the structural and spatial transformation of the post-war economy of Ukraine were identified. In particular, attention was focused on the need to: intensify the use of mineral resource potential of regions; stimulate investment activity and measures to ensure capital investment; increase innovation activity of regions, and develop centres of innovative entrepreneurship. The paper analysed the losses of the resource potential of the regions of Ukraine caused by the war. The main obstacles to the activation of investment activity in Ukraine, both before the large-scale invasion and in 2022-2024, were highlighted. The paper analysed a number of legislative documents developed since the beginning of Russia's large-scale military invasion of Ukraine, aimed at stimulating investment activity, restoration of industrial production, and filling of local budgets. The study focused on the need to improve and expand the innovation infrastructure. In particular, the role and place of start-ups in enhancing the innovative development of regions was analysed; regional centres of start-ups' activities were identified in terms of their key areas of application; the role and place of digitalisation in the post-war economic recovery of Ukraine's regions was determined. The practical significance of the highlighted trends in spatial and structural changes in the Ukrainian economy and proposals for regulating these processes lies in the possibility of considering them in the development of strategic documents on the post-war reconstruction of the country

Keywords: structural shifts; structure of the economy; spatial development; transformation; management tools; resources; digitalisation of the economy

Introduction

The war exacerbated the existing structural imbalances in the Ukrainian economy and caused transformation processes. Against the backdrop of war, new structural changes are emerging due to the need for military

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production, business relocation, and changes in trade models. The success of the post-war economic recovery of Ukraine will depend on the effectiveness of structural reforms and the sequence of regulatory measures aimed at restoring and creating a new infrastructure to ensure the life of Ukrainian society, stimulating the development of entrepreneurship, its innovation and investment activity, and increasing the resource productivity of the economy. Along with preserving the country's agricultural potential, it is necessary to encourage the development of innovative types of economic activity and those that will contribute to strengthening the country's security and sustainability.

Considerable attention of researchers is paid to the problems of studying trends and features of spatial and structural shifts in the economy, determining priority tasks and means of regulating spatial and structural imbalances. Research pay attention to the study of the essence of spatial and structural shifts, the analysis and trends of changes in the specific structure of the economy, and the search for priority tasks and means of regulating them. Thus, S.M. Illyashenko *et al.* (2022) noted the impact of Ukraine's international image on the prospects for its post-war innovative development and structural transformation of the regional economy. The researchers also considered the methodological foundations of the functioning of innovative development strategies. M.V. Kunytska-Ilyash & Ya.P. Berezhivskiy (2023) focused considerable attention on the study of the impact of the international image of Ukraine, on the possibility of its post-war innovative development and structural changes in the economy of the regions, and on the development of the national policy to strengthen the financial and economic security of key sectors of the national economy of Ukraine. V. Levytskyi & S. Radynskiy (2023) emphasised the importance of structural reforms that can transform Ukraine after the end of the war, as it is these reforms that strengthen the market foundations of economic activity. M.I. Melnyk *et al.* (2023) noted that the change in the spatial structure of the economy is associated with a decrease in the business activity of agricultural enterprises whose business is tied to a specific territory. V.V. Mykytenko (2023) investigated the role of critical infrastructure in the post-war recovery of Ukraine's economy. In this paper, the researcher considered an algorithm for the development of critical infrastructure in Ukraine with a detailed selection of tools. V.A. Omelyanenko (2022) considered a wide range of topical issues of recovery and development of countries after armed conflicts and ways to solve them based on innovations. N.M. Pokrovska (2022) investigated various stages of the post-war reconstruction of Ukraine. V.Ye. Khaustova *et al.* (2022) analysed the role and place of the IT sector in the post-war recovery of the Ukrainian economy, the researchers considered the main promising areas of IT development in the world. S. Petran &

V. Shamota (2023) examined the role of innovation in Ukraine's post-war economic recovery. The researchers noted that the study of innovation activities can be useful for developing strategies to support innovative enterprises in the future. N. Shadura-Nykyporets *et al.* (2023) analysed the impact of war on the structural shifts of the modern economic system of Ukraine, investigated the impact of military operations on this process, and determined the prospects for structural adjustment of the economy in the context of post-war recovery. However, despite a significant range of research on this topic, it remains relevant and requires further research, given the large-scale invasion of Russia on the territory of Ukraine, which provoked spatial and structural transformations in the regions. Therefore, it is advisable to examine the main problems and identify priority tasks for regulating the structural and spatial transformation of the post-war economy of Ukraine.

The purpose of the study was to investigate priority areas and tools for regulating spatial and structural shifts in the economy of the regions of Ukraine in the post-war period.

The study used a number of research methods, namely: structural and statistical analysis – to investigate the processes and phenomena of transformation of the economic space of the regions of Ukraine; graphic methods – for visual representation of tools to support the development of start-ups and sectors of the economy in which strategic investment projects are implemented.

Intensification of the use of mineral resource potential in the regions of Ukraine

As of 2024, Ukraine, being heavily dependent on international financial assistance, demonstrates the desire to maximise its own resource opportunities and competitive advantages of the regions, including those related to their location. This also applies to the mineral resource potential of the territories, which in the pre-war period played an important role in the localisation of production and economic specialisation of the regions. In the conditions of a significant share of low- and medium-tech industries, and energy- and resource-intensive industries in Ukraine, the raw material specialisation of the country's economy was formed, which affected the decrease in the level of its diversification. In addition, in the context of the world-declared transition to low-carbon energy in Ukraine, the needs of the economy for the use of mineral raw materials will increase.

Military actions in Ukraine led to the loss of resources of the occupied and close to the areas of military operations of the regions, in particular, a significant number of deposits of gas, oil, coal, lithium, rare earth metals, 70% of which were concentrated in Donetsk, Luhansk, and Dnipropetrovsk oblasts. Almost 50% of all renewable energy sources, including 89% of wind farms and 80% of offshore hydrocarbon reserves, are under the control of the Russian Federation. In addition, in

2022, Russia seized the deposits of the Bilozersky and Priazovsky iron ore districts in Zaporizhzhia and Donetsk oblasts and the Velyko-Tokmatske manganese ore deposit in Zaporizhzhia oblast (Polyovik, 2023). As a result of military operations, more than half of the iron ore deposits are located in uncontrolled territories, or have significant damage as a result of military operations. In addition, in terms of the cost of losses and lost funds, the extractive industry ranks third after infrastructure and destruction of housing stock.

The withdrawal of these resources from economic activities will lead to changes in the structure of the economy not only in the occupied industrial regions, but also in other regions. Solving these problems requires strategic management decisions on the development of the mining industry, in particular, on improving the legislative framework on the use of mineral resources, diversification of mining, in particular, by attracting foreign investment and technologies in the development of the industry. However, according to the guidelines of the Ukraine Facility reform plan, the development of the critical materials and raw materials sector involves increasing its contribution to the national economy by increasing production and investment, strengthening Ukraine's position in the global market for critical materials and value-added products (Ukraine Facility Programme..., 2024).

Even in the conditions of war, during 2022-2024, the interest of foreign investors in the field of subsurface use and extraction of Ukraine significantly increased. An example is a number of facts. For example, the Turkish firm "Onur Group", which in 2023 acquired the company "Rokytné Specialised Quarry", produces granite in the Rivne oblast and announced its intentions to invest USD 50 million in the development of a graphite deposit in the north of Khmelnytskyi oblast. A "BGV Group Management", which has started sand mining in Zhytomyr oblast, is interested in developing uranium deposits in Mykolaiv oblast (Orynychak, 2024).

In favour of the existence of the potential for the development of the extractive sector, it is evidenced by the fact that in 2023 the total income of enterprises in the extractive industry increased by 13% compared to the first year of the war in 2022. Two state-owned companies earned half of the total income of the leaders of the extractive industry – Ukrnafta and UkrGasVydobuvannya. The main enterprises of the industry that ensured the growing dynamics of revenues were also business entities located in Dnipropetrovsk (DTEK Pavlohraduhillya, Northern Mining and Processing Plant), Poltava (Poltava Mining and Processing Plant, Yeristovo Mining and Processing Plant) and Donetsk (Pokrovske Mine Administration, Svyato-Varvarinska Processing Plant) oblasts (Opendatabot, 2024). Enterprises located in the Donetsk oblast may suspend their activities in the context of modern changes at the front, which will have a negative impact on the development of the industry.

The importance of this priority of sectoral reforms is evidenced not only by its potential ability to attract investment, but also by the introduction of innovative technologies. Thus, the reduction of the country's coal potential due to the occupation of the eastern regions will require the transition from the direct use of coal for electricity generation and the development of new technologies for coal gasification and non-energy use of this resource.

In 2021, Ukraine developed National Programme for the Development of the Mineral Resources Base of Ukraine for the period up to 2030 (Draft of the Law of Ukraine, 2021), the implementation of which should meet the country's needs for mineral resources based on its own production, reduce dependence of Ukraine from their import and increase its export potential through the extraction of minerals that are in great demand on the world market. However, the current programme requires improvement, and the policy in the field of subsurface use and extraction requires changes, in particular, to improve the legislative and regulatory framework for simplifying the procedure for obtaining special permits for the use of subsurface resources, rules for the development of gas and oil fields, and other aspects of the process of organising subsurface extraction, creating conditions for attracting investment in the development of minerals "strategic raw materials" and further digitalisation of the industry. This process began in 2022 with the launch of the subsurface user's e-cabinet, state geological web portal, conducting electronic auctions and auctions, etc. As part of Ukraine's European integration progress, it will be crucial for Ukraine to join the implementation of the EU's 2030 Raw Materials Strategy (European Critical Raw Materials Act 2030, 2019).

B. Danylyshyn (2022), noted that given the significant mineral resource potential of Ukraine, such resource-intensive industries as nuclear power, energy production, heavy and transport engineering, titanium, lithium, and aluminium production, ferrous metallurgy, agricultural production and construction will play an important role in accelerating the post-war economic recovery. Each of these areas was a specialisation of the resource-intensive economy of the Ukrainian regions. Thus, the highest values of the resource intensity coefficient of the economy are typical for Dnipropetrovsk (0.18), Kirovohrad (0.17), Rivne (0.16), Vinnytsia (0.13), and the coefficient for Mykolaiv, Poltava, and Khmelnytskyi oblasts was 0.11. Naturally, the leading regions in terms of resource intensity of the economy include agricultural regions and regions with significant deposits of mineral resources.

Structural and regional economic policies will play an important role in the strategy and tactics of post-war reconstruction of Ukraine. These priorities are declared in the reform plan Ukraine Facility. Programme of financial support of Ukraine from the European Union 2024-2027 (2024) which was developed by the European Union to implement the programme of financial support for Ukraine and should become the foundation for

further recovery and development of the country's economy and its successful integration into the EU. According to this document, strengthening the capacity of regions depends on sectoral reforms, which requires the development of strategic management decisions both at the national, regional, and local levels. As part of direct state support, which is a priority of the programme, 20% of grant funds (EUR 1.05 billion) should be directed specifically to the needs of the regions.

Despite the identification and classification of a significant number of factors of spatial development, the impact of war remained almost ignored (military and political factors are mostly limited to the destruction of industrial potential) (Kyzym *et al.*, 2022). As noted by T.A. Zaiats (2023), in order to modernise the system of strategic planning for the development of territories, it is necessary to move from small, inefficient local projects with low efficiency to projects of real strategic importance that will give a new impetus to development during the post-war reconstruction.

In this context, the urgent task will be to attract territorial-oriented regulatory tools that will stimulate and create conditions for post-war modernisation of the regional economy structure in the context of both its traditional and innovative specialisation, which will contribute to improving the economic capacity of regions and territorial communities.

The issue of spatial development is very complex, since it depends on many factors, ranging from the geographical location of the territory to the availability of qualified labour and the level of innovative development of the business entity. Therefore, it is necessary to identify problems and priorities for regulating the structural and spatial transformation of the post-war economy of Ukraine.

Thus, a necessary step in the context of restoring the country's economy should be to improve institutional support in the field of subsurface use. An important aspect of the implementation of the reform strategy to improve the use of the mineral resource potential of the territories is to ensure that national interests, the interests of regions and territorial communities are aligned. This problem raises a number of issues that also need to be clearly resolved. In addition, the development of the list of strategic industries should take place based on intersectoral research on the availability of prospects for the development of certain types of economic activity, considering the situation of internal and foreign markets and the available resource potential of regions and territorial communities.

Investment promotion and measures to ensure capital investment

It is worth noting that the military actions caused different damage to the regions, which in the future will lead to a difference in their priorities for post-war reconstruction. These priorities will be based on an assessment of the degree of infrastructure destruction, the state of

the local economy, distance from the front line, etc. For the "rear regions" of Ukraine bordering the European Union, the diversification of the structure of the economy is partly influenced by relocated enterprises, and the development of the IT sector, creative industries and services, and therefore they can become key areas of post-war reconstruction of these regions. This includes the possibility of attracting foreign investment in joint projects with European partners to develop transport, logistics and border infrastructure, tourism, trade, and consumer services. And the growth of investment attractiveness in these areas will contribute to the construction of new car ports, exhibition centres, transit hubs and modernisation of existing infrastructure.

During 1991-2024, Ukrainian businesses faced the problem of attracting investment. The main volume of investment was attracted in the service sector – in trade, the financial services sector (bank recapitalisation), real estate operations, and the primary and secondary sectors experienced a lack of investment. Thus, in 2021, 69% of the total capital investment was made at the expense of enterprises and organisations' own funds. The main obstacles to the activation of investment activity included: unsettled protection of intellectual property rights; fiscal policy; low level of freedom to move financial resources (Law of Ukraine No. 3497-IX, 2023).

In the context of a full-scale war, the problem of insufficient investment and creating a favourable investment climate in the country has become extremely acute. Despite the war, Ukraine still attracts significant investments in the development of certain sectors and types of economic activity from foreign companies. During 2022-2024, investments are received in: mining and metallurgical complex ("ArcelorMittal Kryvyi Rih" – Kryvyi Rih); mining industry ("Onur Group", Turkey – Khmelnytsky and Rivne oblasts); mechanical engineering ("Amsted Rail", USA – Lviv oblast), energy ("Onur Group", Turkey – Zakarpattia oblast); chemical industry ("Bayer", Germany – Zhytomyr oblast; "Henkel", Germany – Kyiv oblast); building materials industry ("Kingspan Group", Ireland; "Fixit", Germany – Lviv oblast; "Greenmix", Israel – Kyiv oblast), food industry ("Nestlé", Switzerland – Volyn oblast; "Alsberg Ukraine", Denmark – Lviv, Kyiv, Zaporizhzhia; "Philip Morris", USA – Lviv oblast).

Modern investment activity is directly related to the participation of businesses in various European and global platforms. Thus, in July 2024, Ukraine's investment opportunities were presented at the URC MARKET-PLACE in London, where strategic investment projects and opportunities to attract debt and equity capital in six key sectors were declared (Fig. 1).

To attract investment in war conditions, it is necessary to introduce measures in the field of debt financing, in particular, to provide state guarantees for their protection. In order to stimulate investment activity and further steps to restore industrial production and fill local budgets, on January 1, 2024, the Law of Ukraine

"On Amendments to the Law of Ukraine "On Financial Mechanisms for Stimulating Export Activities" Concerning Investment Insurance in Ukraine against Military Risks" came into force, which regulates insurance and reinsurance of export loans both international and

Ukrainian for the creation of facilities and infrastructure for the processing industry and export of goods (works, services) of Ukrainian origin, and insurance and reinsurance of direct investments in Ukraine against military or political risks (Law of Ukraine No. 3497-IX, 2023).

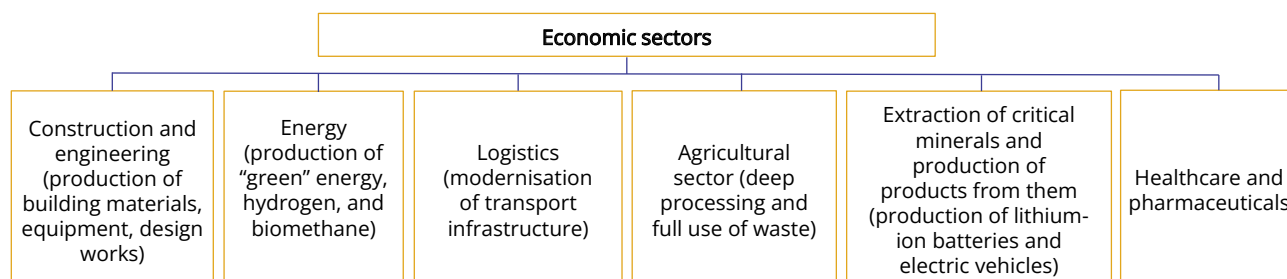


Figure 1. Sectors of the economy between which strategic investment projects were distributed

Source: compiled based on Ukraine recovery digest No. 66. Weekly media review, regulatory acts and statements on the subject of recovery of Ukraine (2023)

According to the Law of Ukraine "On Financial Mechanisms for Stimulating Export Activities for Investment Insurance in Ukraine against Military Risks", Ukraine is introducing a mechanism for insurance of non-property military and political risks, which will be carried out by the export credit agency (ECA), the founder and shareholder of which is the state represented by the Cabinet of Ministers of Ukraine (Law of Ukraine No. 3497-IX, 2023). The purpose of this institution is to support and stimulate large-scale expansion of exports of goods (works, services) and protect exporters from the risks of non-payments and financial losses, and strengthen the credit policy of enterprises. It is worth noting that the specified mechanism is a component of the state economic policy "Made in Ukraine", within the framework of which Ukrainian producers should actively use state support for business activities related to the supply of goods to foreign markets. In 2024, exporters from Kyiv (UAH 1.15 billion of supported exports), Lviv (UAH 1.1 billion), and Vinnytsia (UAH 243 million) oblasts were actively using ECA insurance (Official website of the Ministry of Economy of Ukraine, 2024).

According to the developed insurance mechanism, export-oriented enterprises in Ukraine will be able to obtain an insurance policy that is included in the list of acceptable loan collateral by the National Bank of Ukraine. For foreign companies, this policy is available through the export credit agencies of the UK, Japan, Germany, France, Canada, Australia, Israel, Poland, and specialised organisations ("Support for Ukraine's Reconstruction and Economy" (SURE) trust funds of MIGA, DFC, UKEF, EBRD).

For example, the National Export Credit Agency of the United Kingdom (UKEF) has allocated 200 million pounds to Ukraine to insure political and military risks for British investors who intend to invest in Ukraine. The American International Development Finance Corporation (DFC) has publicly announced a resource of USD

1 billion (Will the insurance..., 2023). This policy has already been used by an industrial park in Lviv oblast and an industrial enterprise in Kyiv oblast (Official website of the political party "Sluha Narody", 2024).

The Cabinet of Ministers of Ukraine considers common insurance risks in international practice: military conflict, in particular, war and armed conflict; armed aggression; military actions; mass uprisings; violent change or overthrow of the constitutional order; seizure of state power; terrorist acts and/or sabotage; occupation; annexation. Political risks include: forced seizure of property or deprivation of ownership of property at the initiative of the state authorities of Ukraine; groundless or illegal revocation of the license by the market regulator or forced termination of the business entity's activities by a court decision that has entered into legal force, except for cases when the termination of activity is caused by a violation of the law by the subject himself; non-fulfilment or refusal of the state to fulfil obligations defined by legislation, strategic or programme documents approved in accordance with the established procedure, or an investment agreement, if the subject has the right to demand the fulfilment of such obligations; introduction by the state of prohibitions on payments (embargoes, moratoria); inability to convert or currency transfers abroad, except in cases stipulated by law (Law of Ukraine No. 3497-IX, 2023).

The use of this tool can have a positive impact on the investment activity of a business, increase investment volumes in difficult business conditions, and provide opportunities. Protecting investments, introducing guarantees for investors, improving transparency and fighting corruption are the main tasks to improve the investment climate. Experts of the insurance market note that the scale of application of the described insurance mechanism will depend on the cost of the insurance policy, which will consider the size and nature of the

investment, the level of risk and the ability of enterprises to pay for them, the solvency of the state and political stability. However, its positive impact on regional and local businesses is undeniable.

It should also be noted that there are different risks for different types of investments, so the set of tools for regulating investment processes will be comprehensive and will include measures to insure risks, provide tax benefits, and ensure transparency in their distribution and use.

In general, attracting investment in the creation of new production chains, new products and the inclusion of the country in complex value chains and the restoration of destroyed and construction of new facilities will contribute not only to investment activity in the regions, but also the level of technological efficiency of the economy and its innovation.

Increasing the innovation activity of regions and developing centres of innovative entrepreneurship

Regional development is significantly affected by the deepening of globalisation, the transformation of production, and the introduction of new technologies that should become the engine of economic growth (Miklova & Horvat, 2021). Under the influence of global digital transformation and the demands put forward by the European Union in the context of European integration, the Ukrainian economy was focused on the development of digital technologies even before the start of the full-scale invasion in 2022. This increased the level of automation of production processes and labour productivity, reduced costs, increased revenues and the overall competitiveness of Ukrainian regions (Pichkurova, 2023).

Modern changes in the structure of the economy of the regions of Ukraine are caused by the introduction of innovations in production, management, educational, and other types of economic activities. Ukraine is an outsider among countries in terms of the level of knowledge intensity of GDP, which is decreasing annually during 2013-2024. Thus, the state budget of Ukraine for research and development in 2024 provides only 0.17% of GDP, or a tenth of the legally established figure, while the average for OECD countries this figure is 2% of GDP; in Switzerland – 3.4%; Korea – 4.2%; Israel – 4.3% of GDP (State Statistics Service of Ukraine 2024; Eurostat, 2024).

The main attention of the authorities should also be focused on improving the innovation infrastructure, stimulating the development of venture entrepreneurship. In addition to activating their own innovative developments, it is also necessary to create special conditions for expanding foreign economic activity and establishing relations between businesses and scientific institutions with partners from advanced countries of the world, and encourage them to transfer technologies. A network of creative industries and modern information and educational centres should be actively developed, which will ensure a systematic exchange of information between

local governments, businesses, and foreign companies. The priority areas of such cooperation should be: transfer of innovative technologies; exchange of experience in the field of energy modernisation of public utilities and the economy as a whole, which will help to reduce the energy costs of business and housing and communal services; development and modernisation of transport and logistics, information, marketing, institutional and innovative infrastructure, and the spread of the practice of creating start-ups.

Start-ups that are a source of new ideas and technologies play an important role in creating innovation centres around the world. Thus, a high concentration of start-ups per capita is typical for Israel, where they are actively developing in the fields of cybersecurity, artificial intelligence, and medical technologies. Among European countries, Estonia is actively developing start-ups.

The development of start-ups in Ukraine is connected with the development of innovative infrastructure, that is, the creation of new incubators, accelerators, coworking spaces that support their development on the ground. The positive aspects of the spread of these entities include an increase in investor interest and a focus on solving local needs. The active development of start-ups will contribute to the establishment of modern information and educational centres, which will allow for a large-scale exchange of information between local governments, business representatives, and foreign companies.

The development of start-ups is also influenced by negative factors, namely: imperfection of the intellectual property rights protection system, unfavourable investment climate, termination of contracts due to the risks of high instability, loss of main partners and suppliers as a result of military operations, and high investment risks and lack of specialists as a result of emigration and mobilisation.

According to a survey conducted by Gradus Research Plus, since the beginning of the war, 47% of projects started face a lack of orders due to market restrictions, 26% called personnel leakage a problem. However, among 18% of the surveyed start-ups in Ukraine, they started their activities from the beginning of a full-scale war, compared to 2% of the openings of new traditional businesses (Shevchenko, 2024)

During 2021-2024, there was an uneven representation of start-ups in different regions of Ukraine, and their high concentration is mainly conditioned by the presence of powerful universities and research institutes, access to various sources of capital (venture funds, state and other grants, etc.) and the development of network connections with investors, mentors and other participants.

In 2021, the largest share of start-ups in Ukraine accounted for three regions: Kyiv city (53.2%), Kharkiv oblast (10.8%) and Lviv oblast (8.2%) (Ukrainian start-up fund, 2024). Table 1 shows the largest centres of concentration of start-ups. The table shows that the activities of start-ups were organised not only in regional centres, but also within regions.

Table 1. Regional centres of activity of start-ups funded by the USF (Ukrainian start-up fund) and their specialisation

Region	Scope of application
Vinnitsia	Artificial intelligence, IT
Dnipro	Healthcare, artificial intelligence, IT, energy and ecology, educational technologies, industry, media and advertising, cybersecurity and security, renewable energy
Donetsk oblast	Retail trade
Zhytomyr	IT, Media and advertising
Zaporizhzhia	Industry, cybersecurity and security
Zaporizhzhia oblast	IT, retail, artificial intelligence
Ivano-Frankivsk	Energy and ecology, industry, retail trade
Kyiv	Educational technologies, IT, industry, artificial intelligence, agricultural technologies, retail trade, media and advertising, healthcare, blockchain, energy and ecology, cybersecurity and security, infrastructure recovery
Kyiv oblast	IT
Lviv	Healthcare, artificial intelligence, educational technologies, IT, retail, smart home, e-commerce, energy and ecology, cybersecurity and security, IT
Lviv oblast	Educational and medical technologies
Odesa	IT, media and advertising, artificial intelligence, industry, retail, blockchain, energy and ecology
Rivne	IT, e-government, healthcare, educational technologies
Ternopil	Healthcare
Kharkiv	Media and advertising, retail trade, educational technologies, healthcare, IT, artificial intelligence, e-government, cybersecurity and security, energy and ecology, agricultural technologies, blockchain
Kherson	Processing industry
Cherkasy	Retail trade
Chernihiv	Retail trade, energy and ecology

Source: compiled by the authors based on research by Ukrainian start-up fund (2024)

Since the beginning of a full-scale war in 2022, start-ups have mostly focused on the needs of: security and cybersecurity (development of tactical military radio systems, mobile applications for cybersecurity); healthcare (manufacturing of bionic prostheses, development of personnel optimisation systems, mobile applications); development of agricultural technologies (development of automatic drones for introduction of plant protection products and integrated solutions based on unmanned aerial vehicles); infrastructure restoration (development of systems for searching and identifying mines and shells).

In 2022, the Ukrainian start-up foundation launched a new programme for grant support for the creation of innovative dual-use products: technologies, processes that distinguish such products from existing analogues on the market or meet the existing demand simultaneously from both individuals and the state. The grant is provided in the amount of up to USD 35000 for the development of start-ups in areas such as: defence; cybersecurity; healthcare; education; infrastructure recovery (Ukrainian start-up fund, 2024). According to the Ministry of Digital Transformation of Ukraine, almost 30% of all applications submitted for a new grant programme from the Ukrainian start-up foundation are military-tech projects. Since 2022, start-ups aimed at the

needs of the Armed Forces of Ukraine (Himera, Zvook, Falcons, Drone Space, Frontline) have been actively developing, and in 2023 the defence-tech cluster Brave1 was created, which combined more than 800 projects for the military-defence complex and cyber-security (Nahorna, 2024). Venture companies are also an important resource for supporting and developing innovative projects in Ukraine, investing heavily both in the initial stages and in the process of developing and scaling projects (Davydenko & Volkov, 2022).

In addition to international support, regional and local authorities should play a decisive role in the development of start-ups, in particular, through the use of a mechanism for voucher support or reimbursement of interest on loans. For example, Lviv City Council has launched a competition for voucher support for business entities that develop, create, implement and sell innovative dual-use products for use in both civilian and military purposes (in the field of healthcare, security, and defence: rehabilitation, prosthetics). Such a voucher for dual-use projects in the amount of up to UAH 300 thousand will be available to legal entities and individuals registered in the Lviv oblast (Official website of Lviv City Council, 2024). Figure 2 shows a list of key tools for supporting start-up activation and development by regional and local authorities.

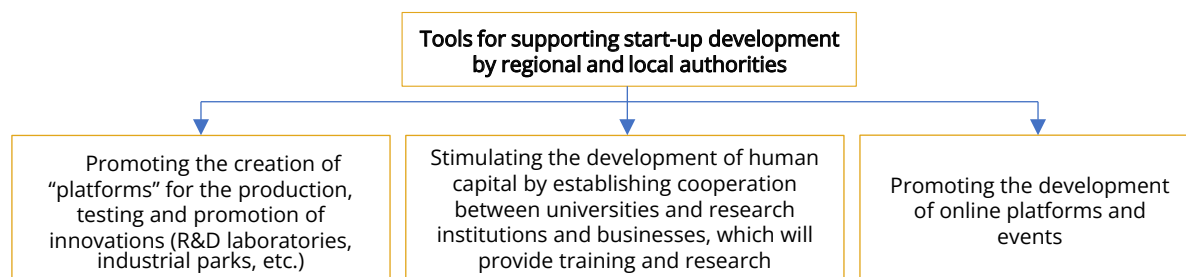


Figure 2. Key tools for regional and local authorities to support start-up activation and development

Source: compiled by the authors

A key aspect of Ukraine's rapid and effective recovery is timely financial support from international partners. Investments in the reconstruction of Ukraine are investments in the security and economic stability of both Europe and the world. Therefore, the main digital products of Ukraine should be aimed at increasing transparency in the use of funds, which will strengthen confidence and contribute to increasing the flow of investment in economic recovery (Pizniak & Turchyna, 2023).

Despite the existing challenges, the prospects for the development of start-ups in the regions of Ukraine remain positive. The growth of the ecosystem, increased investment and focus on local needs will create favourable conditions for the emergence of new successful projects and the establishment of centres of innovative entrepreneurship.

Digitalisation of the economy, state and public administration will be a powerful innovation driver and an important factor in the effective post-war recovery of the regional economy. The digital economy offers many advantages. Digital technologies act as a tool of social elevators, contributing to the growth of social activity of citizens and increasing the accessibility, quality and convenience of public services, and services in key areas such as medicine, education, and culture (Cherep & Sarbiei, 2023).

The introduction of digital technologies in various sectors of the economy should be a catalyst for effective economic recovery and spatial and structural shifts, given that: digital tools will contribute to the reform of industries and sectors of the economy affected by the war (healthcare, education, and professional development); digital transformation in all types of economic activity will contribute to improving the quality of manufactured goods and services while reducing costs for them; the creation of new digital platforms to increase financial support and coordination of innovative projects will make the recovery process more transparent, efficient, and suitable for monitoring by both the authorities and the public and business entities. In addition, the use of digital platforms will facilitate operations, create modern networks of communication and information exchange; the development of the military-tech industry and the use of innovative solutions in this area is important for ensuring the security and defence capability of the

country; improving information support for state and public administration will increase the level of transparency of government actions, improve communication links between the government and the population, and increase the intensity of information exchange between them. In turn, the Ukrainian Institute of Scientific and Technical Expertise and Information has identified the most relevant digital developments in the military sphere, including military robotics, the Internet of Things for the military, combined drones and artillery systems, invisible armour materials (Bolila, 2023).

The Ministry of Digital Transformation of Ukraine has been operating in Ukraine since 2019 and the process of digitalisation of the economy, state and public administration has been launched. After the start of the full-scale invasion, the Ministry of Digital Transformation initiated a number of new digital technology projects in the field of defence and security, such as the digital diplomacy front (in cooperation with global industry leaders such as Meta, Palantir, Amazon), the "Army of Drones", the "IT Army of Ukraine", new features of the Diia application (eVorog, eBayraktar game), and the NFT project "Museum of War". Digital platforms such as Damaged.in.ua, which digitises data for damage assessment and planning of recovery projects, and UNITED 24, created to implement targeted projects to support the army, medicine, and reconstruction of the country (Official website of the government platform UNITED24, 2024).

During 2023, with the assistance of the Office for Entrepreneurship and Export Development in Ukraine, about 70 digital services and more than 3.5 thousand projects were implemented to support business development and 6 educational programmes were introduced for them (Business in 2023..., 2024). Relevant digital projects are implemented at the level of state, regional, and local authorities in the form of creating analytical portals for posting information for business, the scientific and expert community, and the public. This information relates to data on social and economic processes in the regions. These include the Opendatabot, which provides access to various state registers in real time, regional information dashboards, which provide maps of regional investment objects, data on internally displaced persons, a register of functional territories

of regions, analysis of the implementation of regional target programmes, information on the provision of administrative services.

Notably, the Ministry for Communities and Territories Development of Ukraine plans to develop and improve more than 10 new digital tools for a transparent and accountable process of rebuilding Ukraine. These are primarily online platforms, portals, and electronic registers that will allow monitoring the restoration process, receiving services in the field of urban development, etc.

In the field of digitalisation, Ukraine needs to extend and update the current "Strategy for Digital Transformation of Ukraine until 2025" to strengthen measures to protect data and digital infrastructure from cyber-attacks and ensure digital inclusion, and to replenish financial and human resources and build technical infrastructure (Resolution of the Cabinet of Ministers of Ukraine No. 1467-p, 2021). Further digitalisation of the economy and management will contribute to ensuring progressive structural shifts by reducing the use of material resources and switching to information resources, which will help to reduce production costs, produce new technological products, and enter the world market with them, increase the level of competitiveness of territories.

Conclusions

The war worsened the existing structural imbalances and increased spatial and structural changes in the Ukrainian economy. In the pre-war period, structural changes in the Ukrainian economy took place in accordance with global trends, such as an increase in the share of employees in the service sector, a significant differentiation in the level of technological efficiency of economic sectors, and a strategic focus on the development of low-carbon industries. During the war, the spatial and structural imbalances of the country's economy increased and new opportunities were formed to diversify the structure of the economy, including through the development of the military-defence complex.

Highlighting the significant impact of the resource factor and investment and innovation processes on the structural transformation of the regional economy during the post-war development of Ukraine and their regions, it should be noted that the key priorities of economic policy aimed at positive structural shifts in the regional economy should be: focusing structural policy on

priority sectors of the economy and types of industrial activities with significant innovation potential (IT, green energy, biotechnologies, agricultural sector); creating an ecosystem for innovation (development of research institutes, incubators and accelerators, etc.); stimulating external and private investment by introducing tax incentives for investors who invest in innovative projects; introduction of programmes to support start-ups and the development of digital infrastructure.

Overcoming the devastating consequences of the war and building a sustainable, competitive economy of Ukraine requires deep structural reforms and consistent implementation of a comprehensive recovery strategy, the priority tasks of which should be: intensification of the use of mineral resources in the country's regions by improving the legislative framework on the use of mineral resources, diversification of production, attracting investment, in particular foreign ones, in the development of minerals of "strategic raw materials", digitalisation of the industry to increase the efficiency and transparency of its operation. The issue of coordinating state interests, interests of regions and territorial communities in the field of subsurface use becomes significant; stimulating investment activities by introducing measures to guarantee investment protection, in particular, in the field of debt financing and using investment insurance mechanisms against military and political risks. An important area for reviving investment activity should be support for exporters through export credit insurance and other forms of state support; development of innovative and capacious industries based on the introduction of state programmes to support innovation and research activities. Also creating a favourable environment for the development of start-ups and innovative enterprises, state support for technology transfer and implementation of innovative solutions in the production, and preservation, and development of human capital and training of qualified personnel for innovative industries. The prospects for the post-war recovery of the Ukrainian economy will require the search for effective tools for implementing structural reforms.

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Conflict of Interest

None.

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Напрями та інструменти регулювання просторово-структурних зрушень в економіці регіонів України в процесах повоєнного відновлення

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Анотація. Актуальність тематики статті зумовлена тим, що широкомасштабне вторгнення Російської Федерації в Україну зумовило значні дисбаланси та просторово-структурні зрушення в економіці регіонів, особливо прифронтових, що вимагатиме пошуку дієвих інструментів їх регулювання в повоєнній перспективі. Метою статті було дослідження основних напрямів та інструментів територіально орієнтованого регулювання, які націлені на стимулювання і створення сприятливих умов для повоєнної модернізації структури економіки регіонів України. У статті використано низку методів дослідження, а саме структурного і статистичного аналізу та графічний метод. У дослідженні акцентовано увагу на відмінностях пріоритетів повоєнного відновлення економіки регіонів України, з огляду на завдану їм шкоду, зумовлені військовими діями. Визначено ключові проблеми та пріоритетні завдання щодо регулювання структурно-просторової трансформації повоєнної економіки України. Зокрема, акцентовано увагу на необхідності: інтенсифікації використання мінерально-сировинного потенціалу регіонів; стимулювання інвестиційної діяльності та заходи щодо забезпечення капітальних інвестицій; підвищення інноваційної активності регіонів та розвиток центрів інноваційного підприємництва. Проаналізовано втрати ресурсного потенціалу регіонів України, зумовлені війною. Виокремлено основні перешкоди активізації інвестиційної діяльності в Україні, як до широкомасштабного вторгнення, так і у 2022-2024 роки. Проаналізовано низку розроблених з початку широкомасштабного військового вторгнення Росії в Україну законодавчих документів, націлених на стимулювання інвестиційної діяльності, відновлення промислового виробництва та наповнення місцевих бюджетів. У статті акцентовано увагу на необхідності удосконалення та розширення інноваційної інфраструктури. Зокрема, проаналізовано роль і місце стартапів у підвищенні інноваційного розвитку регіонів; виокремлено регіональні центри діяльності стартапів в розрізі ключових сфер їх застосування; визначено роль і місце цифровізації в повоєнній відбудові економіки регіонів України. Практична цінність висвітлених тенденцій просторово-структурних зрушень в економіці України та пропозицій з регулювання цих процесів полягає у можливості їх врахування при розробці стратегічних документів з питань повоєнної відбудови країни.

Ключові слова: структурні зрушення; структура економіки; просторовий розвиток; трансформація; засоби керування; ресурси; цифровізація економіки