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Problems of the transition of the Ukrainian economy to a “green economy” based on sustainable technological change

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Abstract: The article reveals the problems of the transition to a “green” economy based on sustainable technological changes, which are caused by global ecological pollution of the ecosystem, which leads to warming and ecological changes and the insufficiency of the natural resource potential to meet the needs of the population of the planet, which does not contribute to development. The essence of the study is to determine the impact of a green economy on economic growth and development, in which natural assets continue to provide resources and environmental services. It is shown that the green economy provides a practical and flexible approach to achieving concrete, measurable progress in all its economic and environmental principles, while at the same time fully taking into account the social consequences of greening the dynamics of economic growth. Green economy strategies aim to ensure that natural assets can fully realize their economic potential in a sustainable manner. This potential includes the provision of vital life support services—clean air and water, as well as the sustainable biodiversity needed to support food production and human health. Natural assets cannot be replaced indefinitely, so the policy of the green economy should take this into account. It is characterized that the green economy provides a practical and flexible approach to achieving concrete, measurable progress in all its economic and environmental principles, while at the same time fully taking into account the social consequences of greening the dynamics of economic growth. The problems of the post-war revival of Ukraine’s economy are systematized and proposals for their solution are substantiated, which is the scientific contribution of the authors to the coverage of this problem. The global problems of the transition to a green economy, which are closely related to Ukrainian realities, are revealed. The practical content is determined by the fact that the theoretical and methodological provisions, conclusions and scientific and practical recommendations constitute the scientific basis for the development of a new holistic concept of the development of the green economy of Ukraine. The conclusions that it is the “green” economy that is able to most closely link the ecological and economic aspects of the national economy, acting as a key direction for ensuring the sustainable “green” development of the region and the state as a whole, actualize the prospects of creating a green economy in Ukraine and become necessary and quite achievable in the post-war period.

Keywords: green economy; circular economy; green technologies; innovation activity; bioeconomy; consumption; biomonitoring; sustainable development

1. Introduction

The rapid growth of the planet’s population and its needs in the current conditions significantly exceed the possibilities of providing them with natural resources. According to forecasts of the Organization for Economic Cooperation and Development (OECD), with the current method of production and level of

consumption, by 2050, compared to 2000, the world will lose 61% to 72% of flora and fauna, and the preservation of natural territories will be irreversibly disturbed by 7.5 million km² (Bousquet and Fayard, 2001).

The fourth technological revolution requires drastic changes in the actual economic system, a transition to a new business model and the implementation of the basic principles of sustainable “green” development. The European Green Course, launched by the European Commission in 2019, became an example of a sustainable green transition aimed at achieving climate neutrality by 2050 (Dimitrov, 2016). Ukraine is among the countries that joined this concept of sustainable “green” development. Experts estimate that Ukraine will need more than 200 billion euros to gradually replace the “brown” industrial economy with a new “green” one (Tsyganok, 2021). Currently, according to the results of 2022, Ukraine took 52nd place (out of 180 countries in the world) according to the global index of environmental efficiency (EPI, 2022). However, there is a problem of returning to life previously occupied territories, which means not only the physical reconstruction of the infrastructure, but also providing people and nature with the basic natural resources for prosperity: clean water, air, healthy soil. The Ukrainian environment has suffered damage that cannot even be compared with the damage caused during the Second World War. According to the State Inspection of Ukraine for the period 24 February 2022–7 July 2023, 280,000 m³ of soil were contaminated with toxic substances and 11 million m³ were contaminated with exploding ammunition and other remnants of war. Greenhouse gas emissions amounted to 150 million tons of CO₂ eq. This is more than the annual GHG emissions of a highly industrialized country like Belgium. Damages caused to the atmosphere amount to more than 2 trillion hryvnias (51.5 billion US dollars) (SEIU, 2023).

In order to at least restore these areas, efforts should be made to expand protected areas by at least 20% of land and 10% of water space through their conservation and restoration during the next decade (Saha et al., 2022). The Communiqué on aid and reconstruction of Ukraine adopted by the European Commission on 18 May 2022 states that the post-war reconstruction must be in line with the European green and digital agenda, and the support mechanism will have a specific governance structure that will at the same time ensure full ownership of Ukraine and ensure that investments are aligned to climate and environmental policies and standards of the EU (EC, 2022). Therefore, the post-war green reconstruction should be considered as an economic necessity for the future development of Ukraine. The green reconstruction of Ukraine can become the key to creating new, high-paying jobs, which is an important argument for the return of Ukrainians and the attraction of foreign investments. All this leads to the deepening of the theoretical, methodological and applied foundations of the conceptualization of the “green” economy at the national level, which strengthens the relevance of this research and its practical orientation.

2. Literature review

The theoretical and practical aspects of the “green economy” concept were studied by foreign scientists: Patrick Soderholm (Söderholm, 2020), Magali Malerbe, Fanny Simon (Malherbe and Simon, 2021), problems of the transition of certain

countries to a green economy, Ina Bjerke, Sarah Johansson (Bjerke and Johansson, 2022). In addition, international institutions are engaged in the development and implementation of the green economy concept: the United Nations Environment Program (UNEP), the Organization for Economic Cooperation and Development (OECD), the Directorate General of the European Commission for the Environment, IFOAM (International Federation of Organic Agriculture Movements).

The following Ukrainian scientists made a significant contribution to the study of theoretical and practical aspects of the “green” economy: B. Burkynskyi and others. The prerequisites and innovative directions of the development of the “green” (environmentally oriented) economy as a modern paradigm of transformational shifts in Ukraine are considered (Burkynskyi et al., 2011), T. Galushkina et al. (Galushkina et al., 2012), V. Potapenko, V. Reutov, N. Khumarova open the bar trends on the way to “green” modernization of small and medium-sized businesses and possible ways to overcome them (Potapenko et al., 2013), T. Sukhorukova et al. (Sukhorukova et al., 2019) substantiates the priority areas of development of the green economy in Ukraine. Pechenyuk A.V. reveals the main ecological and economic problems of the state’s development under the conditions of European integration (Pecheniuk, 2023).

The main principles and tasks, as well as existing trends and prospects for the development of the “green” economy in Ukraine are analyzed by Sych K., Bugaichuk V., and Grabchuk I. (Sych et al., 2021). Bondar O., Galushkina T. and Unguryan P. analyze directions of greening of territorial communities local policy based on the ideology of “green” economy in accordance with modern global and national challenges (Bondar et al., 2018). H. Butsko reveals the consequences of Russia’s military aggression and shows the prospects for their elimination. He believes that it will take a century (Butsko, 2022). The world experience of the development of the concept of “green economy” is given and revealed in the writings of foreign scientists, including: A. Cameron and S. Klaut (Cameron and Clouth, 2012), Meadows D. et al. (Meadows, 1974) and others.

However, the insufficient level of theoretical research of the environmental component in the economic growth of the economy and the stimulation of ecologically oriented business, the lack of a scientific and methodological base require in-depth scientific and theoretical developments and practical implementation regarding the determination of the relationship between environmental factors and the economic development of Ukraine.

3. Data and methodology

The purpose of this study is to deepen the theoretical, methodological and applied foundations of the conceptualization of the “green” economy and the practice of subjects of the real sector of the economy of Ukraine.

To achieve the goal, the work uses methods of logical and systemic analysis, as well as synthesis (for the analysis of the environment and innovative business activities in the direction of the “green” economy), grouping and typology, modeling (for the formalization of the indicator of the achievements of the development of the “green” economy and systematization of behavioral factors of innovative decision-making), economic-statistical analysis (to analyze the behavior of innovative business

in the conditions of a “green” economy), principles of scientific abstraction and dialectical logic (to clarify the logic of innovative decision-making for the development of a “green” economy).

4. Results and discussion

Over the past 50 years, there has been an intensification of the use of planetary resources, which has led to the Earth’s physical capacity being exceeded by almost 20% (EU, 2020). One of the most persistent environmental problems is air pollution. WHO data show that almost all of the global population (99%) breathe air that exceeds WHO guideline limits and contains high levels of pollutants, with low- and middle-income countries suffering from the highest exposures (WHO, 2023). The overall level of atmospheric air pollution in Ukraine according to the air pollution index (AIP) in 2021 was 7.1 (in 2020 – 7.0) and was assessed as high (MEPRN of Ukraine, 2023). Therefore, most of its regions have already been declared ecological disaster zones, and the economic aspect of this has affected almost every fifth person on the planet (UN, 2022).

Almost 22% of the occupied Ukrainian agricultural lands have undergone environmental changes due to being mined and contaminated by shell explosions (Pechenyuk, 2023). According to the experts of the public organization “SaveDnipro”, in certain territories of Ukraine the environment will never be able to recover to its previous state, and in some areas the natural environment is radically degrading. Moreover, the consequences of the environmental disaster caused by the war will be felt by a number of European countries. Since, occupying less than 6 percent of the area of Europe, Ukraine possesses about 35 percent of its population biodiversity and is ahead of almost all European countries by this indicator (REPORT, 2023). Ukraine has a significant biodiversity potential and can be considered as one of the powerful reserves for the restoration of biodiversity in the whole Europe. Therefore, the future of Ukraine lies in the transition to a green economy, where business and nature exist in harmony.

At the international level, the United Nations Environment Program (UNEP) defines a “green economy” as one that leads to improved human well-being and social justice, while significantly reducing environmental risks and environmental deficits (UNEP, 2020). It is the green economy that stimulates green growth, which, according to the OECD, consists in identifying more environmentally friendly sources of growth, developing new environmentally-oriented industries, creating jobs and technologies (OECD, 2019). From the authors’ point of view, in the simplest terms, a “green” economy can be seen as a low-carbon, resource-efficient and socially inclusive economy. The basis of green growth is ecological modernization. According to forecasts of Ukrainian analysts, it will contribute not only to the restoration of the ecosystem, the provision of at least one million jobs, but also has a social aspect, providing at least one million jobs (Romanko, 2023).

At its core are the mechanisms for changing today’s dominant national economic model, which exacerbates inequality, encourages waste, causes resource scarcity, and creates massive threats to the environment and human health. Her theory is based on three important axioms for the new model of economic development:

- it is impossible to infinitely expand the sphere of influence in a limited space;

- it is impossible to demand the satisfaction of endlessly growing needs in conditions of limited resources;
- everything on the surface of the earth is interconnected. And it is built on the following principles: the principle of well-being; principle of justice; the principle of planetary borders; the principle of efficiency and sufficiency; the principle of good governance (UN.GEC, 2020). Therefore, a new model of green (or sustainable) recovery of Ukraine should be considered as an economic necessity for the future development of Ukraine, as one of the possible concepts of post-war recovery, building a new, more effective and competitive model of the economic system. This, quite rational goal, can be achieved, if the vision of post-war reconstruction is green.

Today, the degree of technological load on the environment in Ukraine is 5–6 times higher than the similar indicator of economically developed countries of the world. Potentially hazardous productions for the environment make up almost 40% of the total industrial production, agricultural production accounts for 23% of anthropogenic greenhouse gas emissions (Gobela, 2020). However, despite the fact that the share of relatively ecologically clean territories of our country is only 7% of the total area of the country, conditionally clean—about 8% (Vasyukov et al., 2009) there are food security and environmental sustainability reserves. For example, the use of pesticides and fertilizers (the cause of significant pressure on the environment) in Ukraine is far below the “ambitious” reduction targets set by the European Union.

The concept of the “Green” economy is not a one-time act, but a large-scale political project and a tool of the new economy to support the achievement of sustainable development of rural areas, with an emphasis on the reconciliation of economic goals with social and environmental ones. It should be based on the potential of new sustainable innovative technologies and green sectors, which should become the engine of a new path of national economy development. Delays in the transition to a green economy can have negative consequences for the entire economy of the country. Climate change and its damage will begin to manifest in the near future, in 20–30 years. The loss can reach 20% of the gross domestic product (Kovalchuk, 2019). According to some forecasts of experts, Ukraine is moving into a phase of extremely high temperatures and weather cataclysms due to climate changes. In addition, to a large extent, the cause of aridization in Ukraine is destructive human economic activity: intensive deforestation, non-observance of crop rotation, high level of soil plowing, excessive use of pesticides and agrochemicals, etc. Only the terrorist attack at the Kakhovskaya HPS affected ecological changes on 120,000 hectares (Kyrychenko, 2023). If such trends are maintained, the country is threatened with desertification of a considerable part of the territories already in 30–40 years (Pechenyuk, 2023). Ukraine is a part of world development where it has already tested the appropriate necessary conditions for the development of the green economy and the appropriate mechanisms for its stimulation.

In the future, an example for Ukraine should be the approach of the EU countries, where 25% of all investments are directed to the development of “green” technologies (Berezhna, 2012) in accordance with the Sustainable Development Strategy for the period until 2030 and its 17 goals (Sinay, 2021). This new worldview paradigm is taken as the basis of the political and practical development model of Ukraine as well. Currently, mutually structured strategic sectoral solutions (Strategies, by definition) and corresponding national plans with their financial support and institutionalization

of multilateral joint actions are necessary for Ukraine (Draft Law of Ukraine, 2018).

Thus, the goals of sustainable “green” development also establish a real connection between ecological and economic systems. They also reinforce the need for a transition to a green economy, that is, a fundamental transformation to more sustainable ways of production and consumption in the post-war period, which requires the formation of an innovative system (a socio-technical system (Rohracher, 2018)) based on a new institutional order and the strength of the state. These socio-technical systems consist of networks of subjects, knowledge possessed by these subjects, as well as relevant formal and informal institutions, where the role of effective economic policy of the state is growing. The latter should be aimed at stimulating the achievement of sustainable technological changes and social adaptation of these green innovative technologies. The formation of this system will take a certain period, let’s remember that the formation of the system of converting electricity into production took almost 50 years from the period of invention (1870s) to active use (Paul, 1990). It is still functioning today and should ensure the growth of electricity production by 2050, which is estimated to be twice as much as in 2020, when renewable energy sources will dominate (Wang et al., 2020). Since 2015, it has contributed to the preponderance of investments in alternative energy sources (Kuzio, 2018).

The Government of Ukraine also approved the Energy Strategy of Ukraine for the period up to 2035 “Security, Energy Efficiency, Competitiveness” dated August 18, 2017 No. 605-r, which provides that by 2025 the reform of the energy complex of Ukraine will be mostly completed, and priority targets will be achieved on safety and energy efficiency, its innovative renewal and integration with the EU energy sector are ensured. Its implementation was hindered by Russian aggression, as of June 2022, 90% of wind energy capacity and 30% of solar energy capacity in Ukraine were decommissioned, 5% of hydroelectric power (undermining of the Kakhovskaya HPS) (Gamalii, 2022), however, the tasks remain relevant even during the period of national reconstruction economy.

As for development prospects, the following factors should become Ukrainian drivers of the European energy transition: gas production and gas supply, new energy infrastructure, rare earth metals (REM) and production parks.

In the coming decade, gas and atom will be “green”. Our reserves of gas fields in Ukraine amount to about 1.5 trillion m³. This would be enough to cover domestic needs and to export part of the gas to Europe for at least 15–20 years (Zurian and Liashok, 2019). But most of the wells are already exhausted, so a large-scale program of geological exploration, exploratory drilling, and increasing the number of deposits is needed.

Even during the period of military operations, Ukraine remains one of the exporters of munitions and critical minerals, our country has significant reserves of these resources. For example, the confirmed reserves of lithium are the largest in Europe, the demand for which, according to the Net Zero Emissions scenario, will increase by 1600% by 2030 (Kolisnyk, 2022). In addition to lithium, we have explored reserves of titanium, uranium, zirconium, nickel, cobalt, beryllium, and graphite. Most of them are used in the production of renewable energy sources (RES) and in the production of chips and microcircuits. And this is our historic chance. According to

experts (Savytsky, 2022), with international support, Ukraine can create a global showcase of a new decarbonized economy based on renewable energy sources, electrification, digital solutions and industrial innovations.

One of the tasks of the Strategy in the field of environmental protection should be to ensure compliance with high environmental standards of energy production, transportation, transformation and consumption; financing of investment projects within the framework of the National plan to reduce emissions from large combustion plants in accordance with the legislation of Ukraine and obligations to the Energy Community. Therefore, thermal modernization now and in the post-war period will play a strategic role in the process of green transformation of the national economy, taking into account the 34% share of the building sector in the energy balance of the final consumer and the destruction of heat networks (Recovery Plan of Ukraine, (draft) 2022). A newly created effective system for building a “green” economy is necessary to fulfill the tasks of the Strategy. It will be recalled that almost a century passed from the idea and invention (1887) to the active implementation (1980s) of wind energy (Bennett, 2019). That is why it is necessary not to delay, but to implement an active state policy of promoting the development of the “green” economy of the country, active development of its architectural institutions, even in conditions of war. The driver of the process of transition to green technologies should be economic benefits. In practice, the state and business entities benefit from the introduction of green technologies (**Table 1**).

Table 1. Benefits of applying green technologies for the state and business entities.

For the state	For business entities
<ul style="list-style-type: none"> ● a significant decrease in the dependence of the national economy on the external supply of raw materials and price fluctuations; ● effective implementation of energy- and resource-saving technologies; ● expansion of sales markets due to clean technologies; ● attraction of direct foreign investments and private capital; ● improvement of the ecosystem and preservation of own natural resources; ● formation of a positive “green” image of the state. 	<ul style="list-style-type: none"> ● reduction of specific costs for consumption of resources; ● implementation of the latest technologies in the production process; ● obtaining additional income based on the use of available resources (due to waste disposal); ● conquest of new sales markets by increasing the quality and competitiveness of products; ● the opportunity to use state benefits; ● diversification of the asset structure and reduction of strategic risks associated with traditional production.

Source: suggested by the authors.

The policy of the transition state to the development of a green economy should take into account the following five most pressing general global challenges: the fight against diffuse—and increasingly global—environmental risks; achieving radical, and not just gradual, sustainable technological changes; promoting the development of green capitalism; development of appropriate stimulating factors for the development of the green economy; assistance in solving the problem of its implementation.

Their analysis shows that the first two challenges of modern economic policy in the direction of promoting the development of the green economy relate to different types of structural tasks that are necessary to achieve sustainable technological changes in production and institutional barriers that must be overcome during the implementation of these tasks. The rest of the problems relate to the role and

responsibility of various institutions and key participants in the process of transition to a green economy: private companies and state and local self-government bodies. Modern civil society should also be aware of these problems, which is prompted by the fact that Ukraine is a party to more than 20 international conventions and bilateral agreements related to environmental protection. One of them, adopted by almost 200 countries in the capital of France on 12 December 2015, is the Paris Agreement, which provides for the creation of a “climate neutral” world by the middle of the century. According to UNEP estimates, the need for annual financing for the “greening” of the world economy is from 1.05 to 2.59 trillion. dollars USA, which is less than 1/10 of all annual world investments (world gross accumulation of fixed capital) or 2% of world GDP (UN, 2011).

On 30 July 2021, the Government of Ukraine approved the updated Nationally Determined Contribution to the Paris Agreement, which aims to reduce greenhouse gas emissions to the level of 35% compared to 1990 and achieve carbon neutrality no later than 2060 (MEPNR of Ukraine, 2021). Ukraine has unique opportunities during the period of reconstruction of the economy destroyed by Russian aggression to implement this Program with the help of foreign investors, only the principle of state strength is needed in the implementation of this policy.

The biggest problem for Ukraine is the organization of control over diffuse emissions, which, as a rule, are difficult to control, and therefore also to regulate. Many hazardous substances, including chemicals such as solvents and phthalates, are found in consumer products, many of which are imported. Monitoring the potential spread of these substances to humans and the natural environment at the national level also remains difficult. The Department of Environmental Sciences, University of South Africa (UNISA) Biomonitoring Study has clearly demonstrated in various locations that the effects of phthalate-contaminated water on both humans and aquatic organisms are widespread (Tekere et al., 2021).

Equally challenging is carbon capture and utilization (CCU), an area of key new technologies. These technologies require sufficient funding from the state, as Germany does, for example (Mennicken et al., 2016). To promote innovation, the state supports a wide variety of CCU-related R&D projects. CCU technologies as elements of the future “green economy” can contribute to the achievement of Ukraine’s ambitious goals of sustainable development in terms of climate protection, as well as increasing the productivity of the use of raw materials. Therefore, in the post-war period, every project that is financed from the Ukrainian budget or an international financial organization must be checked, including through the prism of the “green” economy”. Therefore, instead of regulating emissions as close as possible to the damage caused, public economic and agricultural policies should aim to support specific activities (e.g. recycling of materials) and/or technologies (e.g. low-carbon production processes) that, as possible supposed to be correlated with a reduced environmental load on the national ecosystem.

An equally important problem of post-war reconstruction will be the problem of clearing the territories. Currently, only as a result of land pollution with household waste and sewage, about 50 thousand hectares of arable land are removed every year (Schmidt et al., 2022). Today (2020), almost 92 percent of the world’s resources, including metals, plastics, wood, concrete, chemicals, and all other materials in

circulation, are used only once, in a single product, before becoming waste (European Commission, 2018). This waste represents a huge amount of resources that can be used with minimal impact on the environment, encouraging recycling and reuse of products by supporting product design. Improved recyclability can also benefit from the modular structure of the product. For example, in Germany, packaging makes up 50% of all plastic waste, which is growing at an average annual rate of 3.3%. The adopted Packaging Act (VerpackG), which entered into force in 2019, stipulates that the level of mechanical recycling should be 63% (Vivcharenko, 2016). To overcome this plastic problem, the EU adopted the “Strategy for Plastics in a Circular Economy (CE)” program in 2018 (Collings, 2021). It stipulates that by 2030, all plastic packaging entering the EU market must be suitable for reuse or recycling in a cost-effective way. In 2014, Ukraine signed the Association Agreement with the European Union, and in 2017 approved the National Waste Management Strategy (European Commission, 2018). According to the Strategy, Ukraine has committed to recycle up to 65% of packaging by 2030. We will remind that currently (2021) Ukraine processes only 12%–14% of packaging waste, which is a consequence of the loss, according to a study commissioned by the American Chamber of Commerce, of about 2 million tons of resource-valuable raw materials (Laushchenko, 2021). The implementation of the Strategy, which sets the target indicator for the collection and processing of packaging waste at the level of 70% by 2030 (Cabinet of Ministers of Ukraine, 2017) will provide an opportunity to approach the indicators of the EU countries in this direction. It is important for Ukraine to take advantage of the “green” economy development program in the post-war period to create a system of enterprises for the disposal and processing of this waste, including pollution caused by the war. This approach aims to break the current prevailing linear flow (open cycle) of plastics along the value chain from production to use and disposal, as it is one of the main sources of CO₂ emissions and pollution (Directive, 1994).

Finally, the increased focus on circular economy solutions will mean that different sectors of the economy must become more interdependent in the overall economic architecture. This interdependence really makes possible the desired increase in the efficiency of using the natural resource potential of Ukraine. One such example is the use of excess heat from various processing industries, which can be used to supply energy for heating residential premises or greenhouses. According to Sweden’s Comprehensive National Energy and Climate Plan (Regeringen, 2020), such bilateral energy cooperation has practical results, which are ensured by state investments in such cooperation. After all, both technological and organizational innovations and overcoming existing barriers to the implementation of Industry 4.0 technologies are needed (**Table 2**).

Table 2. Barriers to the introduction of green technologies in of the Ukrainian economy.

№	Name	The nature of the manifestation
1	A significant lag in the level of development of ecological culture formed in society and management of natural capital compared to the development of key components of general social Cultures	Information on the prospects and advantages of “green” modernization of the domestic economy: <ul style="list-style-type: none"> • local self-government bodies; • public organizations • international organizations • increasing the environmental awareness of the business environment and civil society
2	Lack of understanding of promising future operational processes of the globalized world	The scientific elite should be more actively involved in determining whether the introduction of Industry 4.0 technologies is only a short-term reaction to world changes and is a temporary effect, or indicates the emergence of a permanent trend in the modern globalized world.
3	Significant limitation of institutional and infrastructural provision of green transformation, which is in the process of its formation	The need to develop a comprehensive state strategy for conducting business activities based on innovative green technologies. Proving the economic attractiveness and technological possibility of implementing the project of increasing energy and resource efficiency. According to the data of the Kyiv International Institute of Sociology, currently only a third of Ukrainian communities have a strategic recovery document, which hinders both the planning of work and the determination of donors’ priorities (KMIS, 2023).
4	Large costs for financing the production of ecological products goods and services and long payback period of renewable sources	Under the conditions of uncertainty, it is difficult to attract a significant amount of financial resources for the introduction of new technologies in connection with the lack of own and the lack of sufficient stimulating state policy to promote innovative business through the preferential lending scheme.
5	Significant lack of clearly institutionalized mechanisms of production processes and management “greening” of strategic development of the national economy	<ul style="list-style-type: none"> • Development of effective mechanisms for regulation and state stimulation of innovative developments in nature management, in particular, in the development and implementation of innovative mechanisms for rational nature management and environmental protection with the implementation of ecological innovations on the basis of the state and regional innovation system in the state administration; • institutional support of the specified process at the levels of management and development of innovative infrastructure.
6	Lack of necessary professional skills in implementation environmental management systems (degradation of rural areas)	Organization of environmental management training
7	Resistance to changes/resistance of the established culture of the company, the consumer, a complex bureaucratic system when receiving loans for “green” modernization	Simplification of the procedure and development of the legislative framework, deregulation.

Source: suggested by the authors.

Despite the numerous existing problems that stand in the way of the implementation and development of the “green” economy, there are certain technological prerequisites for its development in Ukraine. A necessary condition for the integration of Ukraine into the European community in the post-war period is the awareness of the ecological imperative as one of the development main foundations of the national economy.

In fact, according to the European Commission’s assessment, Ukraine’s alignment in the environmental sphere with the EU acquis “is at an early stage of preparation.” (EU Commission, 2023).

5. Conclusions, recommendations and future directions

Therefore, the “green” economy is able to most closely link ecological and economic aspects of the national economy, acting as a key direction of ensuring

sustainable “green” development of the region and the state as a whole.

For the successful implementation of the green revival program, it is necessary to:

First, even under the conditions of existing uncertainties, the “green” modernization of enterprises in Ukraine should be strengthened. There is already an understanding in the business environment that under the conditions of European integration, there is no other way to make Ukraine’s economy competitive and bring it closer to the environmental requirements of the European continent, which strives to become climate neutral in less than three decades. In addition, it is only through prioritizing environmental innovations that it is possible to become an investment-attractive country in the global dimension and attract human capital under the conditions of Ukraine’s depopulation due to the outflow of refugees.

Secondly, under the conditions of war and the destruction of industrial enterprises third. Ukrainian business mostly does not have sufficient resources for significant green innovations. Therefore, the green recovery of Ukraine will require not only unprecedented financial support and investment, but, above all, the determination of the government and people of Ukraine, as well as the EU and other partners to achieve economic sustainability and low-carbon growth. From a testing ground for modern weapons, Ukraine should become a place for the introduction of the most modern technologies of green modernization of industry, transport, etc.

Thirdly, Ukraine has a huge potential for development in terms of energy efficiency of industrial production, renewable energy sources (wind, sun, biomethane and others), organic agriculture, ecologically clean transport, reconstruction of already “green” cities, etc. On the part of state institutions, it is necessary to stimulate the creation of new green business enterprises and the transition of existing enterprises to greener ones through the implementation of appropriate tax, price, financial and investment policy instruments. It is also appropriate to introduce state certification of green enterprises, services, technologies and products to provide them with incentives for obtaining loans and investing, which can be a turning point not only for the green transformation of the economy, but also for society and its environmental awareness.

Fourth, green recovery must encompass all aspects of the economy and social life, including changes in policy, regulatory framework, development planning, financing, etc. At the same time, the participation of communities and public administration bodies is of decisive importance for ensuring the completeness of reforms and overcoming corruption. To carry out information campaigns in order to explain to the population the importance and necessity of the transition to resource conservation in everyday life, to promote the recycling of resources and compliance with the rules of rational waste management, the implementation of a joint green project.

The further development of the “green economy” requires a scientific solution to the contradictions of the greening of production, the justification of effective state mechanisms for stimulating green investments and innovations, the creation of conditions for increasing the competitiveness of national producers of green products, and the informational component of the formation of a new attitude of the population to the environment, which should become a priority of future of research.

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