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The impact of the Russian-Ukrainian war on the green transition and the energy crisis: Ukrainian scenario of circular economy development

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ABSTRACT

The aim of the article is to minimise the impact of the energy crisis on the environment as one of the ways of getting rid of carbon footprints resulting from the growth of the russian energy and building a circular sustainable ecosystem in Ukraine. Therefore, the study proposes a classification of green inflation and singles out the following forms of its manifestation: 1) as a reaction to irresponsible management; 2) as a reaction to an attempt to implement large-scale projects aimed at decarbonisation within strict time limits; 3) as a reaction to the strengthening of business standards, which the end consumer will have to pay for. The paper determines the impact that the war has on the practice of applying resource nationalism associated with a wide variety of modern global problems. Discussions focus particularly on the following topics: the 'resource curse', the growing concern of the OECD countries. The paper identifies the dominant diversification tendencies in the EU in terms of the circularity of the economy. The proposed concept of a global inclusive circular economy can be considered as a complex multidimensional system, whose main components are based on the economic, sociological, environmental and circular aspects of life.

Key words: circular ecomomy, green transition, energy crisis, russian -ukrainian war, humanitarian crisis, global inclusive circular ecomomy.

Main part of research paper. Despite a number of internationally initiated large-scale climate agreements defining the commitments to be made by both the public and private sectors in both developed and developing countries, the world community has

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not come close to achieving the zero greenhouse gas emissions planned for 2050. Most of these commitments have not yet been accompanied by proper planning and financing, in part due to the global pandemic, which has already increased global public debt, reduced global GDP by 3.3% and led to rapid inflation around the world. The debate over who will pay for the green transition – governments, companies or consumers – and how to avoid increasing "green inflation" is getting hotter. The term "green inflation" explains the "price vicissitudes" that may occur on the way to the environment in the future (as a result of increased demand for selected resources), as well as the costs associated with reducing carbon emissions as part of "green" packages investment and financing of relevant projects that increase the money supply, or as a result of limited supply of goods due to climate catastrophes or environmental degradation. In other words, green inflation can occur: 1) as a response to irresponsible management (where economic agents have actively created a reality in which environmental degradation and climate problems lead to food, raw materials, energy and other crises that reduce supply and provoke rising prices); 2) as a reaction to the attempt to implement large-scale projects aimed at decarbonisation in a limited time (where economic agents and consumers become "victims" of monetary and fiscal policies of governments); 3) as a reaction to the strengthening of business standards, which will have to be paid by the final consumer (the price of minerals needed for "green" technologies – from wind turbines and solar panels to electric vehicles – will require a "green allowance" (greenium) as a relatively higher demand for them with limited supply, and because the extraction of minerals is usually associated with higher environmental costs, which will be "punished" by taxes). The relationship between climate change and political risks is reflected in growing geopolitical challenges, especially in finding a compromise between the need to fund climate neutrality and the demands of developing countries to give them more leeway in achieving their emission reduction targets, maintaining the pace of economic development needed to lift their populations out of the poverty trap.

Raw materials and energy crises, disruptions in value chains and supply chains have not contributed to progress towards the green transition (Melnyk et al., 2020) exacerbating the risks of deglobalization (Ivashchenko and Reznikova, 2018), despite governments' awareness of their inability to find solutions on their own, including for food problem. The war in Ukraine has exacerbated all these trends, both nationally and globally, by shifting priorities and shifting the focus of world leaders from climate neutrality to national defence, energy, food and humanitarian security. For example, transforming the energy sector and reducing emissions by a third, compared to the BAU scenario (business as usual), may increase India's GDP by 3.9%, China's by 1.4% and Indonesia's by 2.4%, low-income African countries – by 2% and ASEAN countries – by 1.6% (Reznikova, 2021).

The Sixth Expert Report, published a few days after Russia's invasion of Ukraine by a UN government group on climate change (IPCC, 2022) noted that climate change, which has a significant impact on human and natural systems, could in itself increase the risk of future conflicts, within and between countries due to differences in access and distribution of resources such as energy, food and water. As the effects of climate change will scale at unpredictable rates and non-linearly, the possibility of avoiding the catastrophic effects of climate change is rapidly closing. At the same time, the prospect of aggravation of energy shortages is estimated to accelerate the development of the green energy market. Along with this, stimulating investment in renewable energy, energy efficiency and decarbonization, some experts traditionally continue to attribute to the factors of rising energy prices and instability, while others see them as the key to solving these problems. By the end of the decade, global clean energy markets are expected to reach $ 23 trillion through the development of new technologies to support deep decarbonisation, energy storage, semiconductors and nuclear energy.

The energy crisis is creating new fault lines in the world economy. To the usual division of countries according to the level of availability of fossil fuel deposits and available energy resources, the division was added: 1) according to the degree of supply of "green" minerals; 2) the degree of susceptibility to rising energy prices (which depends not only on the level of diversification of energy sources and suppliers, but also on the structure of the economy and the country's specialization in the international division of labour); 3) the degree of transition to production with zero emissions; 4) the degree of participation in the chain of creating the cost of energy transition.

Some countries rich in green minerals, in their quest to move up the value chain of the energy transition, restrict exports of relevant raw materials and minerals, requiring value added to remain in the country. For example, Indonesia's ban on export sales of nickel ore as part of plans to expand the domestic metallurgical industry may be adopted by other countries. Some governments may go even further to establish state control over the production and export of green minerals. Mexico plans to give the state exclusive control over lithium production, and China has announced a state-owned enterprise that will control about 70% of domestic production, which depends on rare earth metals and elements. The fact that the extraction of "green" minerals can lead to significant deterioration of the environment on a global scale is already being used by countries importing such minerals as an argument against the introduction of resource nationalism.

The concept of resource nationalism can easily be linked to a wide variety of contemporary global issues, including: discussions of the "resource curse"; growing concern from OECD countries about the economic importance of sovereign wealth funds; "Good governance" in middle- and low-income countries; trends in risk management in the political sphere; practical efforts to develop a methodology for

measuring the contribution of socio-economic development of extractive industries and a wider range of issues regarding "favourable conditions" for responsible business practice. The context in which resource nationalism is becoming more pronounced includes: high food prices combined with increasing pressure on land fertility in the process of intensifying biofuel production; increasing the economic (and, consequently, political) importance of national oil companies; increasing the problems of security of energy and natural resources; rapid economic growth and domestic consumption in a number of middle-income countries, including India and China.

Given that countries rich in the resources needed for the green and digital transition are essentially the strategic resource for a new technological revolution, but the intermediate technologies for providing it are in capital-rich countries, a web of trade-offs that needs to be unravelled by market participants, only exacerbates the uncertainty of green markets.

According to McKinsey's expert estimates, the transition to zero balance is impossible without taking into account the nine key positions, which are grouped into three categories: 1) the necessary physical infrastructure or the so-called "Structural units" (technological innovations; the ability to create large-scale supply chains and ancillary infrastructure; the availability of the necessary natural resources); 2) economic and social change (effective structures of redistribution of capital and financing; management of changes in demand and short-term increase in unit costs; compensation mechanisms to eliminate socio-economic consequences); 3) governance, institutions and commitments (effective institutions, standards, monitoring system, effective market mechanisms; commitment and cooperation of leaders at public and private levels to support citizens and consumers, including public support for progress in reducing greenhouse gases) (Krishnan et al., 2021).

Awareness of the potential impact of the war on each of these positions will assess the prospects for the transition to zero emissions. Due to the suspension of production processes, destruction of existing industrial facilities and the deployment of large-scale deindustrialization of the Ukrainian economy in the short term, the availability of the necessary physical infrastructure and provision of the above structural units in Ukraine will be reduced. There are signs and consequences of the introduction of economic sanctions against Russia and the blocking of economic cooperation between a number of countries. At the same time, the growth of consumption of energy-intensive goods in the near future will stimulate the demand for high-tech innovations that will be able to compensate for increased emissions through carbon capture and sequestration. Since the beginning of the war on a global scale, there has been a significant influx of capital into the renewable energy sector, which has changed the downward trend in the pandemic period. Along with this, although in the short term the desire to expand zero-emission infrastructure may increase, its implementation may be hampered by

logistical stresses related to market reorganization (sanctions) and rising energy prices (due to industrial and green inflation), which may lead to shocks in the complex hierarchical multinational transport-intensive supply chains of "zero emission" technologies (Samandari et al., 2022).

However, the impact of energy shortages on the level of investment attractiveness of zero-emission technologies cannot be unambiguously assessed, as investments in renewable energy require large one-time capital expenditures but minimal operating costs, which means that rising production costs may affect the energy sector less than sustainable growth prices for energy resources. And while Europe has traditionally been more receptive to rising fossil fuel prices, the current resource supply shocks will be felt in both Europe and the United States, where energy prices are increasing production costs and forcing price and supply chains to be revised. It is noteworthy that some large zero-emission technology countries are not involved in sanctions against Russia and have been able to maintain access to supplies, which affects the costs of their trading partners and the position of competitors who have joined the sanctions.

The transition to zero emissions in the short term depends on such a factor of production as land. Unfavourable climate forecasts for 2022 indicate that yields may fall on their own due to natural causes, which will reduce the supply of a number of agricultural products. Supply shortages and rising prices in agricultural markets could lead to increased deforestation in countries most sensitive to food security.

In the short term, the economic and social changes needed to achieve more orderly climate neutrality (zero emissions) depend on managing changes in demand and unit costs, introducing compensatory mechanisms to address the socio-economic consequences of the green transition and ensuring efficient capital allocation and financing (Zhong and Zvarych, 2022). As a result, rising energy costs are approaching the break-even point of carbon footprint reduction solutions for many industries. At the same time, the supply shock - the shortage of goods - stimulates the movement towards increased processing, and thus the demand for a circular economy and the green transition can move into the practical field of their implementation at a faster pace.

The war in Ukraine will negatively affect the movement of international capital flows from developed countries to countries with the highest level of debt burden. In fact, the movement of capital served as a kind of compensatory mechanisms in the global asymmetries of development. Given that even before the war capital inflows to developing countries were almost 20% lower than previously developed countries' promises of $ 100 billion in annual aid by 2020, further cuts in aid are no longer in doubt.

Given that the preparation and commissioning of renewable alternative energy sources takes time, and rising energy prices are provoking an economic and political

crisis that threatens to provoke mass unrest and destabilization around the world, according to McKinsey experts, growth is expected in the short term funding for fossil fuel extraction to control further price increases. In Europe, rising energy prices will lead to increased short-term investment in fossil fuel production and consumption, especially through existing or recently decommissioned assets. This will help diversify the sources of mineral imports, both in terms of pricing and energy security policy. The abandonment of Russian gas involves finding ways to overcome logistical barriers, develop import capacity and time to sign new contracts to circumvent the limitations of existing pipeline infrastructure. After the invasion of Ukraine, the EU countries have already signed contracts for the purchase of Russian gas worth more than 46 billion dollars. In a situation where lower prices are not possible due to increased domestic production or diversification of sources, a return to cheaper but more emitting fuels, such as coal, is already happening in Germany and Poland. In the short term, the United States will also maintain a trend of increasing fossil fuel production to address rising domestic prices and support diversification of supplies to Europe. At the same time, in the medium term, the United States has the opportunity to reduce fossil fuel consumption through energy efficiency policies. Asia, which has time to enter the markets directly to build alternative pipelines, has already announced its readiness to increase the use of cheap coal, which is less regulated than oil.

The war could jeopardize the further development of international standards, institutions and institutions necessary for a green transition. At the same time, many large economies, including China, use the transition to zero emissions as an excuse to increase the state's presence in the economy given their large-scale investment in the production of "green" technologies and components. For example, China's leadership, which already produces a third of the world's wind turbines, 70 percent of the world's solar photovoltaic power and 75 percent of the world's lithium-ion battery capacity, could be significantly strengthened by recession and unprecedented industrial inflation in Europe.

Thus, according to McKinsey, the war in Ukraine will delay the transition to climate neutrality, and a broken transition, in turn, could exacerbate the catastrophic effects of global warming and lead to new conflicts between countries that will affect the energy crisis and climate change. Exit from the post-conflict transition is possible only if there is a unity of perception of the climate threat and the price of energy security.

Depending on the scale and duration of market failures, the timeliness and effectiveness of government support and changes in central bank policies, consumer and business responses, McKinsey identified two most likely potential scenarios for Russia's war against Ukraine on EU developments (White et al., 2022):

Moderately optimistic scenario – in the event of the end of hostilities within a few weeks and moderate sanctions against the aggressor country was expected in 2022 to

restore GDP growth to pre-pandemic levels, controlled inflation by reducing monetary incentives ECB, recovery of European investment and consumer already in the second quarter;

Pessimistic scenario – describes a set of strong market failures due to prolonged hostilities and strong sanctions that will lead to the cessation of oil and gas exports from Russia to Europe and includes, in particular, the following: migration crisis in Europe; reduction of economic growth and post-pandemic recovery; inflation over 7%; return to coal use and suspension of green initiatives; creation of a new infrastructure for export/import of liquefied gas; reduction of real incomes and consumer spending.

As we can see, the moderately optimistic scenario was not justified, so, according to McKinsey experts, the war in Ukraine will cause 12 shocks that will change the world (White et al., 2022).

The invasion of Ukraine is causing a large-scale humanitarian crisis.

According to UN estimates, by the end of 2022 more than 8.3 million Ukrainians may be refugees. Given the capacity of governments that receive forced migrants from Ukraine to provide financial assistance and humanitarian support, including accommodation, food, access to basic health services, and employment promotion, there is a growing demand for new international humanitarian assistance programs, such as the United Nations Regional Refugee Response Plan (RRP). The RRP consolidates measures to support countries' efforts to protect and assist refugees coming from Ukraine and includes the initial financial needs of 12 partners (including UN agencies, national and international NGOs and civil society) for six months (UNOCHA, 2022). In the long run, Ukrainians who integrate into society and the labour market will be able to enjoy the benefits of immigration.

Vulnerable groups will suffer the most from the war.

It is estimated that the food price index compiled by the United Nations Office on Food and Agriculture may increase by 45% in 2022. Typically, rising prices of this magnitude have historically pushed millions of people into low- and middle-income countries into poverty. These countries will be the first to feel the effects of the war, such as the slowdown in world trade, currency devaluation and debt service problems.

Energy policy will provide for the diversification of energy sources and ensuring uninterrupted access to them.

Governments will work to build infrastructure for liquefied natural gas and biofuel production, while diversifying supplies by phasing out Russian gas. Industrial consumers may face a reduction in gas supplies earlier than households. There will be a reduction in the use of gas in the production of electricity, and private consumers are invited to get used to energy asceticism.

Food security on the global agenda.

Ukraine and Russia account for about a third of the world's exports of the main fertilizer ingredients, ammonia and potassium, supplying about 30% of world exports of wheat and barley, 65% of oil and 15% of corn. In the first weeks after the invasion, prices for fertilizers and some foodstuffs rose by 20-50%. Ukraine and Russia provided about 20% of the total volume of food purchased under the UN World Food Program in 2020. As a result, food aid recipient countries will experience food shortages. Global fertilizer shortages can also hamper food production. This will force governments to implement programs to increase supplies to countries that may be on the brink of starvation, as well as to look for ways to increase regional agricultural production. Governments are expected to use the tool to subsidize consumers and control the prices of agricultural products.

Increasing competition for the most important materials, equipment and goods.

The war accelerated the growth of prices for dozens of goods exported by Ukraine and Russia (e.g. coal, steel, nickel), which ranged from 10 to 50% on various commodity items (in particular, 48% of world trade in palladium). Automakers expect spot prices to increase by 15–25% due to higher prices for key materials such as aluminium, copper and steel. It is believed that iron ore will fall in price, while the price of anthracite will increase significantly. Prices for automotive products will not return to pre-war levels.

A new era of supply chain management.

Supply chain managers have begun to shift their focus from optimizing deliveries on time to preparing for unforeseen circumstances just in case. Reorganizing supply chains to increase their sustainability can mean managing a large number of relationships between manufacturers, distributors and consumers. For example, due to the interdependence between the participants in the supply chain, a change in the source of supply or manufacturer may cause fluctuations throughout the chain. There is a demand for two different suppliers – **double sourcing**, although both in terms of supply management and planning, it will not only complicate the supply process, but also increase the cost of goods. A new phenomenon is emerging – **"friendshoring"**, which is a process of cooperation, which is based on the commitment to work with countries that are firmly committed to democratic norms and values.

Coexistence of different and sometimes competing technological standards.

Many countries that have used the tools of digital neoprotectionism, the conscious use of the Internet to control e-commerce to manage consumer demand, will continue to implement excellent technical standards (Internet protocols), but security issues are now at the forefront. The mass exodus of many leading Western companies from Russia means that Russia is effectively excluded from much of the global high-value chain. About 80% of Western technology companies have left Russia or are reducing their

presence. The introduction of excellent technology standards will mean more expensive services for consumers and lower productivity growth worldwide.

Uncertain impact on the financial system.

The war exacerbates the risks to the financial system that emerged in 2021, such as: the recession caused by inflation; growth in dollar-denominated borrowing by emerging market countries; speculative bubble in China's real estate sector; increasing risk of non-repayment of loans circulating in the shadow banking sector. However, the recession caused by inflation may be the greatest threat to the stability of the financial system.

Rising defence spending.

Fifteen NATO countries and Sweden have announced increased defence spending since the invasion of Ukraine, and five (including Denmark, Germany, Italy, Spain and Sweden) will exceed the 2% target set at the 2014 NATO summit in Wales. McKinsey's analysis shows that the increase in costs in many countries is likely to go to equipment, as many weapons programs have been reduced. If that happens, countries will have to choose between immediate or long-term investment in armaments. If they decide to buy immediately, this could be a problem for manufacturers, who will have to deal with supply chain disruptions that will only intensify due to the need to scale production, as well as the potential lack of materials such as titanium, platinum group metals and more.

Cyber conflicts.

The risk of cyberwar between countries (attacks on energy systems and telecommunications systems) and cyber attacks in the commercial sector are forcing cybersecurity budgets to increase the availability and value of a range of services and goods.

The reaction of the corporate sector to the war as a manifestation of consolidated resistance to Russian aggression.

Of the 281 Fortune 500 companies that worked in Russia before the war, about 70 percent either cut or shut down after the war. Almost 85% of companies headquartered in Europe, the United Kingdom or the United States have left or reduced their operations in Russia, compared to 40% of companies based in other regions.

Volatility as a new norm.

Although instability in energy supplies and rising energy prices could have serious consequences for the global economy, according to the McKinsey Global Survey, the war has led to significant volatility in the risks that business leaders see for economic growth. In March 2022, geopolitical risk was identified as a major threat to growth, suppressing the pandemic and inflation.

Green Recovery and Circular Economy For World and Ukraine

The transition from a linear to a circular economy is determined by the change in the positioning of global risks from year to year, which determines the vectors of such a change. Thus, the main risks for 2020 are those related to the environment and occupying the first positions in the rating for the last 3 years (in particular, in 2019, the risk of extreme weather events). The gradual increase in awareness of this risk has led to a change in the sentiment of both producers and consumers. Experts have assessed climate change as a major risk in 2019, outpacing cyberattacks, financial instability and terrorism. Thus, to mitigate this risk in 2020, the global business community has been proposed to implement circular "designs", reducing resource use and prioritizing low carbon materials. The potential effects of the transition to a circular economy on greenhouse gas emissions are significant, mainly achieved by improving resource efficiency, increasing the useful life of buildings and assets, increasing recycling and reuse, and completely reducing primary raw material use. Thus, the circular economy can be seen as an effective strategy for promoting climate change mitigation.

The poly-paradigmatic nature of economic-theoretical knowledge from the standpoint of the existential nature of the imperatives of economic development in the context of responsibility to the global future causes certain paradigm shifts, and greening is the mainstream and imperative that reflects the heterodox beginning of this methodological approach. Multidisciplinary epistemological perspective for the analysis of economic phenomena from the standpoint of the new pragmatism in the context of the "triad" of sustainability (economic, social and ecological components), distinguishes the humanitarianism of economic science and positions "in the foreground" the role of values in the economic activity of people and society.

Acceleration of exploitation of natural resources; climate change; the formation of a new environmental order; environmental and food security) and the dominant paradigm formation and (exceeding the environmental limit; Paris agreement; changing public sentiment of fossil producers and businesses; global economic losses; UN sustainable development goals with strong circular practices; WTO involvement in supporting new technologies, minimizing waste production and promoting circular trade). The methodological features of the paradigm of a global inclusive circular economy from the standpoint of postmodernism are the strengthening of socio-humanistic orientations (reflecting its ideology and creating the basis for an inclusive-oriented society); ontological nonlinearity (emphasizes circularity); consensus (the need for a global consensus to achieve a goal) emulated using the economic-mathematical method.

The conceptual provisions of the theoretical and methodological model of global inclusive circular economy are substantiated in the work. System characterises by the sustainable development; stability; inclusive growth; expansion of opportunities of creation of own capital; equality of access to resources and distribution of goods.

This approach gave the opportunity to substantiate the basic concepts of paradigm formation of the global inclusive circular economy: global chains of value creation (supply of recyclables), sharing platforms, circular trade, circular product life cycle, circular cities and circular cores.

The theoretical and methodological model of global inclusive circular economy is developed based on: system characteristics (sustainable development; stability; inclusive growth; expansion of opportunities of creation of own capital; equality of access to resources and distribution of goods) and principles of circular self-organization (conservation of resources and conservation of resources) rationalization of their use; counteraction to management dysfunction), determined by the critical constraints of corporate culture, communications in global chains.

The paper identifies dominant tendencies of diversification of the European Union in terms of circularity of the economy. In particular, the highest level of household waste recycling is identified in Germany. Belgium, Denmark, France, Italy have consistently high positions. In general, the EU (28) is characterized by an average level of waste recycling (50–60%). The highest value is characteristic of Luxembourg (90%), Belgium (80%), Slovenia (60–70%), the Netherlands (70%), Italy (60–70%). The lowest rates are found in Greece (10–20%), Bulgaria (15–20%), Estonia (20–22%). The countries with the highest positive dynamics are distinguished: Croatia (25 → 40%), Latvia (40 → 61%) and Slovenia (50 → 75%).

For the most comprehensive consideration of the full range of global inclusive circular economy opportunities, an integrated index of global inclusive circular economy (*Igice*) development by ecological, economic, social and circular components with isolated weakly correlated individually ranked indices is developed and analyzed accordingly, on the basis of which the circular cores are separated: the social component (Belgium, Czech Republic, USA, China, France, Greece, Austria, Australia); environmental component (Japan, Denmark); economic component (Germany, China), which became the basis for the model of formation of global inclusive circular chains. The conducted cluster analysis based on the components of the indexes of the global inclusive circular economy confirmed the formation of a large circular gap

in environmental and circular components. Graphical data visualization clearly reflected the circular circle that the index forms.

The systematic analysis of the spatial-component structure of the waste and scrap trade has been carried out and the leading countries, development priorities in the sectors (pharmacy, clinical, household, rubber, polymers, silk and cotton waste) have been identified. The main problematic aspects are illegal waste trading and growing smuggling, which cause serious negative social consequences and actualize the inclusive component in justifying the paradigm of a global inclusive circular economy (Shnyrkov et al., 2019). It has been researched that waste reduction coupled with rational use of resources has the potential to close the gap due to scarcity of natural resources and global population growth or consumption. It is substantiated that the formation of circular trade will contribute to: determination of priority materials for trade and the required level of processing capacity; harmonization of quality standards of materials; promoting the demand for used goods and recyclables; eliminating unnecessary regulatory barriers and avoiding environmentally damaging activities such as non-compliance, poorly regulated nature and informal recovery.

According to the proposed concept of a global inclusive circular economy, it can be considered as a complex multidimensional system, the main components of which are economic, sociological, environmental and circular aspects of life. To fulfil this task, the indicators of the relevant countries and statistics of the Organization for Economic Cooperation and Development for 28 member countries from 1995 to 2017 were used: Australia, Austria, Belgium, Great Britain, Greece, Denmark, Estonia, Israel, Canada, China, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, Germany, New Zealand, South Africa, South Korea, Poland, USA, Turkey, Hungary, Ukraine, Finland, France, Czech Republic, Japan. The analysis is based on the GNU Regression, Econometrics and Time-series Library - an application software package for econometric modelling, part of the GNU project.

Thus, Table 1 shows the results of the economic component of the indicator, in particular, the regression functions and uncorrelated indicators, respectively, for each country studied. Therefore, based on the analysis for Australia, the eigenvalue of the correlation matrix (i.e. the characterizing number at which a solution can be obtained to describe the global inclusive circular economy), which characterizes the absolute contribution (significance) of the main principal component, is $\lambda\_y (\vec{x}\_1) = 3.6582$ and describes the solution of the problem by 73% of all processes, which indicates its sufficient adequacy.

Table 1. The results of the economic component of the indicator (the regression functions and uncorrelated indicators)

Country	Regression function% comp.	% comp.	Low-correlated indicators[5]
Australia	$y(\vec{x}_1) = 0.485 \cdot x_{11} + 0.475 \cdot x_{12} + 0.5 \cdot x_{13} - 0.454 \cdot x_{15} + 0.284 \cdot x_{16}.$	73%	x_{14}
Austria	$y(\vec{x}_1) = -0.5 \cdot x_{11} - 0.364 \cdot x_{12} - 0.493 \cdot x_{13} - 0.494 \cdot x_{15} + 0.36 \cdot x_{16}.$	76%	
Belgium	$y(\vec{x}_1) = 0.483 \cdot x_{11} + 0.473 \cdot x_{12} + 0.5 \cdot x_{13} + 0.362 \cdot x_{14} + 0.4 \cdot x_{15}.$	76%	x_{16}
Greece	$y(\vec{x}_1) = 0.494 \cdot x_{11} + 0.483 \cdot x_{12} + 0.382 \cdot x_{13} + 0.437 \cdot x_{14} + 0.431 \cdot x_{15}$	73%	x_{16}
Denmark	$y(\vec{x}_1) = 0.508 \cdot x_{11} + 0.504 \cdot x_{12} + 0.499 \cdot x_{13} + 0.177 \cdot x_{15} + 0.455 \cdot x_{16}$	76%	x_{14}
Great Britain	$y(\vec{x}_1) = 0.517 \cdot x_{11} + 0.52 \cdot x_{12} + 0.521 \cdot x_{13} + 0.437 \cdot x_{16}$	89%	$x_{14}. x_{15}$
Estonia	$y(\vec{x}_1) = 0.513 \cdot x_{11} + 0.467 \cdot x_{12} + 0.514 \cdot x_{13} + 0.316 \cdot x_{14} + 0.393 \cdot x_{16}$	72%	x_{15}
Israel	$y(\vec{x}_1) = -0.587 \cdot x_{11} - 0.52 \cdot x_{12} - 0.52 \cdot x_{13} - 0.276x_{14} + 0.339x_{15}$	67%	x_{16}
Canada	$y(\vec{x}_1) = -0.538 \cdot x_{11} - 0.551 \cdot x_{13} + 0.558 \cdot x_{15} + 0.307 \cdot x_{16}$	97%	$x_{12} . x_{14}$
China	$y(\vec{x}_1) = -0.452 \cdot x_{11} + 0.443 \cdot x_{12} - 0.462 \cdot x_{13} + 0.455 \cdot x_{14} + 0.423 \cdot x_{15}$	92%	x_{16}
Latvia	$y(\vec{x}_1) = 0.482 \cdot x_{11} + 0.482 \cdot x_{12} + 0.483 \cdot x_{13} + 0.16 \cdot x_{14} + 0.327 \cdot x_{15} + 0.411 \cdot x_{16}.$	66%	
Lithuania	$y(\vec{x}_1) = -0.516 \cdot x_{11} + 0.514 \cdot x_{12} + 0.520 \cdot x_{13} - 0.428 \cdot x_{15} + 0.122 \cdot x_{16}.$	72%	x_{14}
Luxembourg	$y(\vec{x}_1) = -0.476 \cdot x_{11} - 0.4 \cdot x_{12} - 0.477 \cdot x_{13} - 0.054 \cdot x_{14} + 0.459 \cdot x_{15} + 0.416 \cdot x_{16}$	72%	
Mexico	$y(\vec{x}_1) = 0.493 \cdot x_{11} + 0.461 \cdot x_{12} + 0.499 \cdot x_{13} + 0.483 \cdot x_{15} + 0.248 \cdot x_{16}.$	77%	x_{14}
Netherlands	$y(\vec{x}_1) = 0.435 \cdot x_{11} + 0.444 \cdot x_{12} + 0.432 \cdot x_{13} + 0.467 \cdot x_{14} + 0.457 \cdot x_{15}.$	88%	x_{16}
Germany	$y(\vec{x}_1) = -0.446 \cdot x_{11} - 0.423 \cdot x_{12} - 0.442 \cdot x_{13} - 0.299 \cdot x_{14} + 0.344 \cdot x_{15} + 0.38 \cdot x_{16}.$	83%	
New Zealand	$y(\vec{x}_1) = -0.462 \cdot x_{11} - 0.499 \cdot x_{12} - 0.425 \cdot x_{13} - -0.427 \cdot x_{15} + 0.417 \cdot x_{16}.$	75%	x_{14}
South Africa	$y(\vec{x}_1) = -0.556 \cdot x_{11} + 0.132 \cdot x_{13} + 0.576 \cdot x_{14} + 0.585 \cdot x_{15}$	67%	$x_{12} . x_{16}$
South Korea	$y(\vec{x}_1) = 0.516 \cdot x_{11} + 0.524 \cdot x_{12} + 0.521 \cdot x_{13} + 0.433 \cdot x_{15}.$	87%	$x_{14} . x_{16}$
Poland	$y(\vec{x}_1) = 0.453 \cdot x_{11} + 0.455 \cdot x_{12} + 0.451 \cdot x_{13} + 0.435 \cdot x_{14} - 0.438 \cdot x_{15}.$	79%	x_{16}

[5] x_11 - GDP, million $;
x_12 - employment, %;
x_13 - real GDP per capita, $;
x_14 - GDP growth, %;
x_15 - environmental taxes, % of total tax revenues;
x_16 - subsidies for the development of environmental technologies related to the environment, % of total aid.

Table 1. The results of the economic component of the indicator (the regression functions and uncorrelated indicators) (cont.)

Country	Regression function% comp.	% comp.	Low-correlated indicators[6]
Turkey	$y(\vec{x}_1) = -0.536 \cdot x_{11} - 0.529 \cdot x_{12} - 0.531 \cdot x_{13} + 0.389 \cdot x_{15}.$	85%	x_{14} . x_{16}
Hungary	$y(\vec{x}_1) = -0.468 \cdot x_{11} - 0.474 \cdot x_{12} - 0.466 \cdot x_{13} - 0.474 \cdot x_{14} + 0.34 \cdot x_{15}$	76%	x_{16}
Finland	$y(\vec{x}_1) = 0.536 \cdot x_{11} + 0.492 \cdot x_{13} + 0.478 \cdot x_1 + 0.379 \cdot x_{15} + 0.315 \cdot x_{16}.$	62%	x_{12}
France	$y(\vec{x}_1) = -0.522 \cdot x_{11} + 0.112 \cdot x_{12} - 0.514 \cdot x_{13} - 0.497 \cdot x_{14} - 0.014 \cdot x_{15} + 0.451 \cdot x_{16}$	79%	
Czech Republic	$y(\vec{x}_1) = -0.433 \cdot x_{11} - 0.435 \cdot x_{12} - 0.436 \cdot x_{13} - 0.364 \cdot x_{14} + 0.436 \cdot x_{15} + 0.334 \cdot x_{16}$	80%	
Japan	$y(\vec{x}_1) = -0.489 \cdot x_{11} - 0.503 \cdot x_{12} - 0.476 \cdot x_{13} + 0.205 \cdot x_{14} + 0.49 \cdot x_{15}$	76%	x_{16}

Similarly, a study was conducted for all proposed countries. The following indicators turned out to be weakly correlated indicators for the economic component:

GDP growth, %:

Australia, Denmark, the United Kingdom, Canada, Lithuania, Mexico, New Zealand, South Korea and Turkey.

Environmental taxes, % of total tax revenues:

Great Britain, Estonia.

Subsidies for the development of environmental technologies related to the environment, % of total aid:

Belgium, Greece, Israel, China, the Netherlands, South Africa, South Korea, Poland, Turkey, Hungary, Japan.

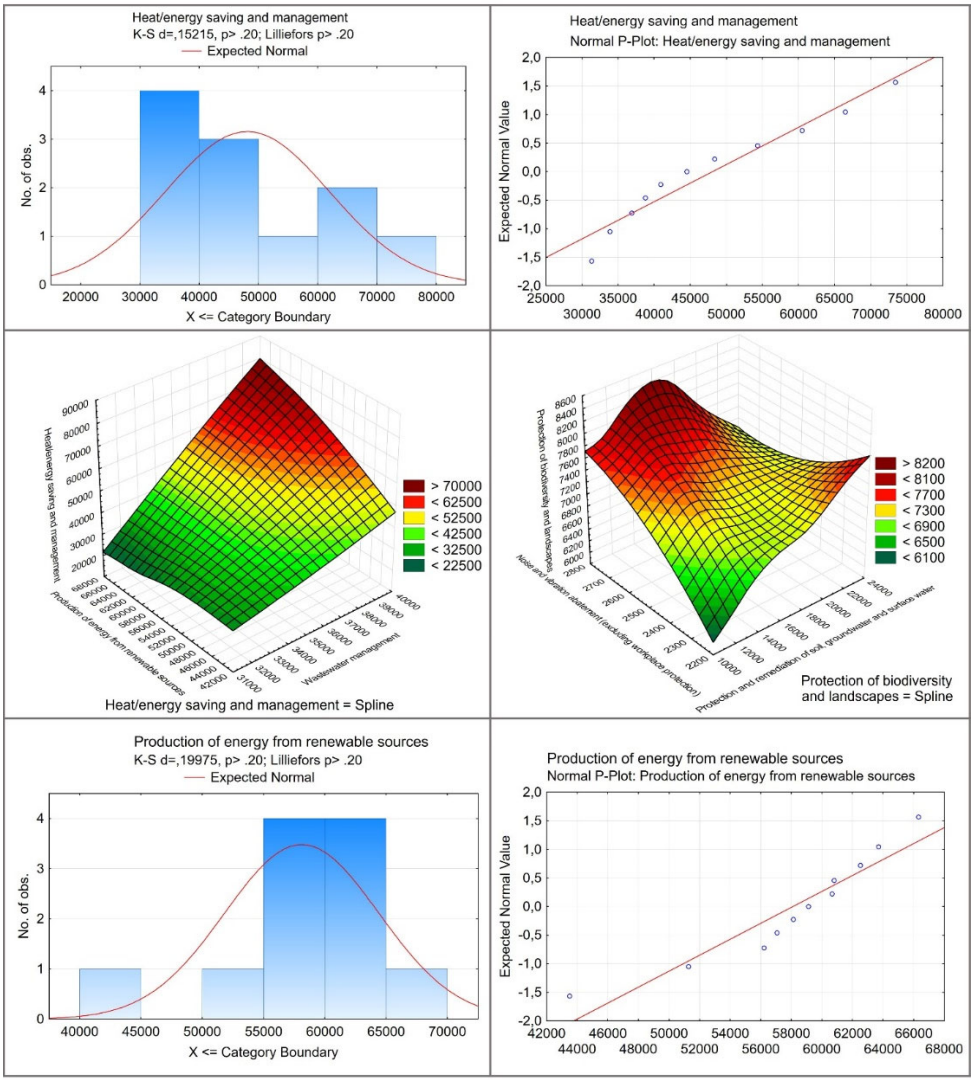
Employment, %:

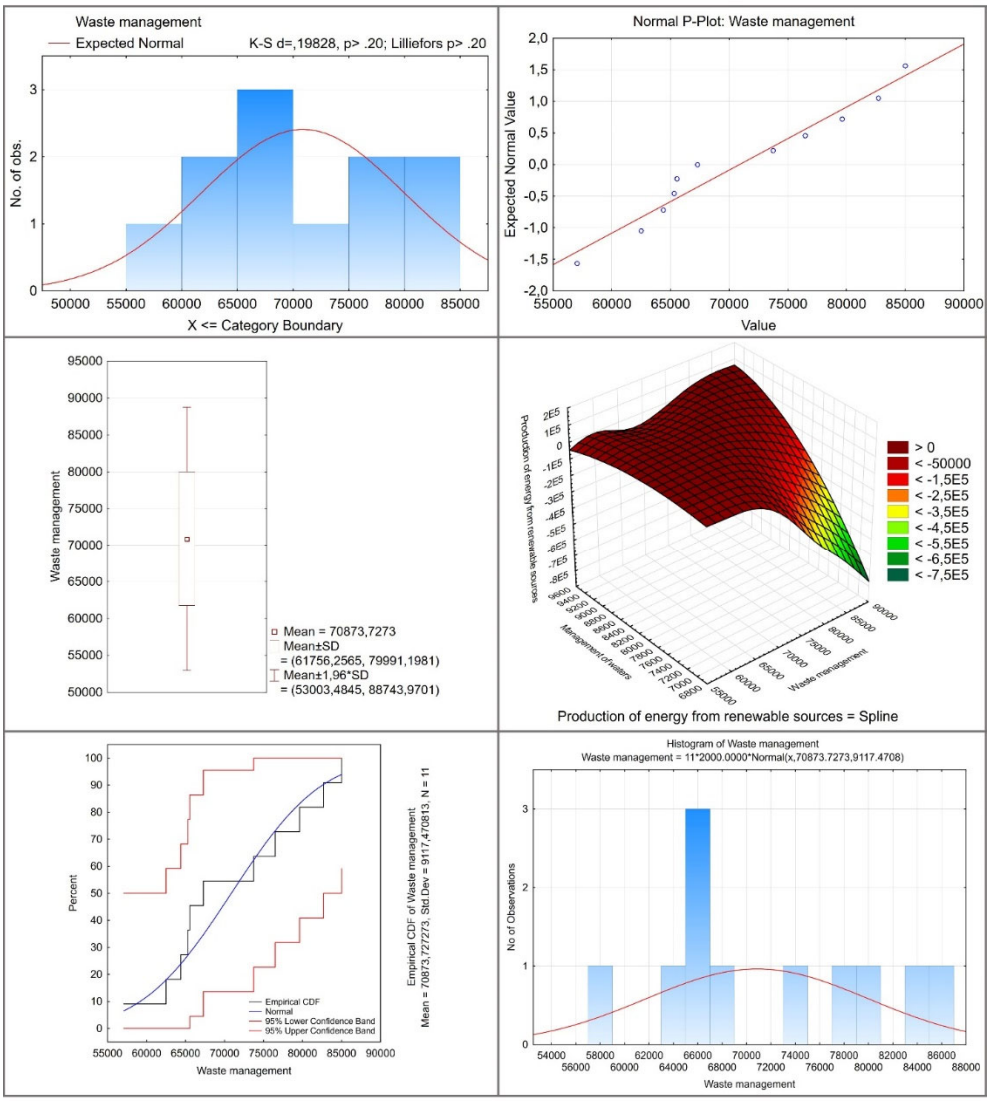
Canada, Finland.

The following indicators lead to a decrease in the impact of the economic component in the overall integrated indicator of the global inclusive circular economy in the following countries.

[6] x_11 - GDP, million $;
x_12 - employment, %;
x_13 - real GDP per capita, $;
x_14 - GDP growth, %;
x_15 - environmental taxes, % of total tax revenues;
x_16 - subsidies for the development of environmental technologies related to the environment, % of total aid.

That is, the increase in the weight of reflected indicators affects the main component among the many indicators of the economic component, which generally frees up space for other components in the integrated indicators of a global inclusive circular economy, such as circular, environmental or social (or inclusive) components.





The link between the Sustainable Development Goals and the opportunities for the formation of a circular environment in Ukraine for the period up to 2030 is apparent. Emphasis is placed on addressing the issue of circular circuit consumption in the areas of local collection, establishment of food hubs and recycling outsourcing. The role of extended responsibility for accepting returned products and wastes remaining after using such manufacturer's products as a necessary element in shaping Ukraine's circular policy has been established.

Conclusion

The war in Ukraine will affect all forms of international economic relations, highlighting the problem of asymmetric economic interdependence in the green transition to climate neutrality, accompanied by raw materials, energy and food crises. The trap of green development is that stimulating investment in renewable energy, energy efficiency and decarbonisation, some experts have traditionally continued to attribute to rising energy prices and instability, while others see them as the key to solving these problems. Since the beginning of the war on a global scale, there has been a significant influx of capital into the renewable energy sector, which has changed the downward trend in the pandemic period. At the same time, although in the short term the desire to expand zero-emission infrastructure may increase, its implementation may be hampered by logistical stresses related to market reorganization (sanctions) and rising energy prices (due to industrial and green inflation), which may to lead to shocks in complex hierarchical multinational transport-intensive supply chains of zero-emission technologies green transition. Some large zero-emission technology countries are not involved in sanctions against Russia and have been able to maintain access to supplies, which affects the costs of their trading partners and the position of competitors who have joined the sanctions. According to McKinsey, the war in Ukraine will cause twelve upheavals that will have a fundamental impact on international economic development: the invasion of Ukraine is causing a large-scale humanitarian crisis; vulnerable populations are most affected by the war; energy policy will include diversification of energy sources and ensuring uninterrupted access to them; food security will be high on the global agenda; increased competition for critical materials, equipment and goods will exacerbate global inequality; a new era of supply chain management will lead to higher prices for goods and services; the coexistence of different and sometimes competing technological standards will exacerbate the technological asymmetries of international economic development; uncertain impact on the financial system will be a trigger for financial shocks; rising defence spending will exacerbate budget deficits and require a revision of spending, which will affect social policy; cyberconflicts will be a challenge for digital platforms and governments; sanctions against Russia have affected the corporate sector; volatility will become a new norm in the world economy.

Reorganizing supply chains to increase their sustainability can mean managing a large number of relationships between manufacturers, distributors and consumers. There is a request for double sourcing. A new phenomenon is emerging – "friendshoring", which is a process of cooperation, which is based on the commitment to work with countries that are firmly committed to democratic norms and values.

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