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Circular economy as an imperative for sustainable development

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Abstract. The lack of resources in the modern world necessitates the reorganisation of the conventional linear economy into a new, circular model of economic development, and this requirement is even more urgent for a country at war. The purpose of this study was to prove the necessity and possibility of achieving sustainable development goals even in a crisis, using evidence from Ukraine. Using such methods as statistical analysis, comparison, and synthesis, the dynamics of sustainable development in the European Union and Ukraine were investigated. In addition, relevant experts were interviewed via an online survey. The study obtained and analysed statistics on the transition of European countries to clean energy sources, conducted a detailed investigation of the current legislative framework and state institutions of Ukraine related to recycling war waste, strengthening the digitalisation of Ukrainian society, and studied wartime circular recycling measures. Statistics on the factual destruction and pollution of the environment as a result of hostilities and the temporary occupation of some territories were also examined. Furthermore, information was collected and systematised from the management of Ukrainian manufacturing enterprises on the factual implementation of circular economy principles during the war. The analysis of the data obtained led to the conclusion that the crisis only increases the need to save resources. The practical significance of the study lies in proving that there is no alternative to the goals of sustainable development in the future and emphasising Ukraine's competitive advantages in this area during the post-war reconstruction. These proposals will be useful for private investors who can profitably finance Ukraine's future recovery in line with the principles of the circular economy

Keywords: clean energy; sustainable development goal; pollution of territories; waste of war; digitalization of society; post-war reconstruction

Introduction

In recent years, the impact of the agricultural sector on the global economy has increased substantially, as the threat of global hunger and climate change have increased the significance of the industry for sustainable development and its vulnerability. However, the greatest risks to the food market in the entire Eastern Hemisphere are associated with Ukraine – after the start of the full-scale military invasion in February 2022, a substantial part of arable land in the South was either temporarily occupied or under the negative technological impact of hostilities. Furthermore, maritime logistics routes for transporting grain also ended up at risk. Looking at the issue of sustainable development more broadly, it is worth mentioning other economic sectors as well – the lack of resources and the need to use them carefully makes humanity move faster to introduce the circular economy ideology and create additional value with new techniques and intelligent solutions. In Ukraine, the circular economy has been applied in a rather limited and gradual manner, but unprovoked military aggression and, consequently, additional restrictions on available resources have forced a review of the programmes for implementing circular economy solutions and stimulated the acceleration of these processes.

With the outbreak of a full-scale war, research on the specific features of applying the principles of a circular economy has increasingly been found in the studies of Ukrainian scientists. O. Dovgal (2022) supplemented the existing principles of the circular economy with her own findings, which more broadly revealed the possibilities of transition to a circular economy. These include the main stages of implementing a circular business model in practice, current obstacles to such a transition, and socio-economic benefits from it. In another study, O. Dovgal *et al.* (2022), returning to the topic of the circular economy concept, emphasised the negative impact on the modern world of such factors as depletion of natural resources, environmental pollution, and climate change. Having analysed statistical data using evidence from the Black Sea region, the researchers prove that currently, when developing regulatory documents, due attention is not paid to industrial waste management, which hinders the further implementation of the principles of a circular economy (Sinyashchyk *et al.,* 2023).

Another essential aspect of the development of the modern economy that is consistent with the principles of sustainable development is the extrapolation of resource-saving technologies to such rather conservative areas as accounting and financial accounting. N. Potryvaieva & A. Palieiev (2023) covered the advantages and disadvantages of outsourcing accounting services compared to the conventional work of full-time employees. As a result, it was proved that outsourcing accounting saves the company's resources and is more in line with the principles of the circular economy. In another study on a similar topic, N. Potryvaieva *et al.* (2022) examined the specific features of digitalisation of accounting reports solely on the example of the agro-industrial complex (AIC) and concluded that the introduction of full-fledged modern accounting in rural areas requires considerable time and investment in the acquisition of relevant technologies. Therefore, such a programme can only be implemented with the full support of the state.

Thus, it has been repeatedly proved that the issues of the circular economy are fundamentally important for modern Ukrainian realities. However, the relationship between sustainable development goals and military action has not been investigated in detail. Therefore, the purpose of this study was to prove that there is no alternative to the circular economy as a critical requirement for sustainable development, even under martial law.

Materials and Methods

The study employed the comparison method to compare the indicators of annual factual clean energy production in the European Union (EU) and the forecast of their dynamics. This method was also used to assess trends in the use of fossil fuels in Europe. Considering them in dynamics made it possible to assess further development and understand trends more objectively. The analysis identified the challenges facing Ukraine's circular economy during the hostilities, including the amount of destroyed housing, the amount of contaminated arable land, and the additional burden on energy systems. Separately, the phenomenon of "war waste" was investigated using the synthesis method and its impact on the achievement of sustainable development indicators in Ukraine was considered.

An assessment was also made of the impact of the digitalisation of Ukrainian society and economy on the restoration of normal life and minimisation of the damage caused by the war. The analysis, based on data obtained from the portal of the Ministry of Environmental Protection and Natural Resources of Ukraine (n.d.; 2024), identified the country's key steps towards a circular economy, including the implementation of waste management reform, compliance with emission permits, digitalisation of metering, and other current trends.

The materials used for this study included, apart from the above, the Decree of the President of Ukraine No. 266 "Issues of the National Council for Restoration of Ukraine from the Consequences of War" (2022), Draft Law of Ukraine No. 2679-VIII "On the Basic Principles (Strategy) of the State Environmental Policy of Ukraine for the Period Up to 2030" (2019), and recovery plan by the National Council for the Reconstruction of Ukraine from the Consequences of War (2022), operational data of the Ministry of Digital Transformation of Ukraine (2023). The study was conducted in the format of an online survey using the Computer Assisted Web Interviewing method. A specially designed three-question questionnaire was sent to the heads of 100 Ukrainian manufacturing companies that continued to operate after the start of full-scale aggression:

1. Assess the impact of full-scale hostilities on the government's resource recovery policy on a 10-point scale, where "10" is continuation of existing measures to implement sustainable development policies, and "1" is complete abandonment of any programmes.

2. Assess the implementation of circular economy programmes at your company after February 2022 in a form convenient for you.

3. Assess the impact of digital technologies on the achievement of sustainability goals at your company on a 10-point scale, where "10" is a full connection between these phenomena, and "1" is a complete absence of such a connection.

The requests were sent by email to publicly available email addresses. Within the agreed timeframe, 87 completed questionnaires were returned, 82 of which contained answers in the required format. For security reasons, the authors of this study undertook to publish the responses based on personal anonymity. In addition, using the forecasting method, based on the data obtained, respondents' answers, and relevant conclusions, the further development of the circular economy in Ukraine was predicted and described, as well as the main trends that will bring the country closer to the full implementation of the principles of sustainable development and post-war recovery.

Results

In the past few years, the principles of sustainable development have become critical around the world, as awareness of the exhaustibility of available resources has forced humanity to use them more rationally and carefully. One such approach to resource management is the introduction of a circular economy, which, unlike the linear economy, operates on the concepts of reuse and recovery. Generally, the circular economy aims to solve such pressing problems of modern times as the loss of biodiversity, climate change, and environmental pollution caused by industrial and human waste through systemic solutions. Among the environmental issues, the demand for clean energy production stands out. The development of this trend in EU countries is well-illustrated in Figure 1, which shows the dynamics of resource saving processes in terms of clean energy use.

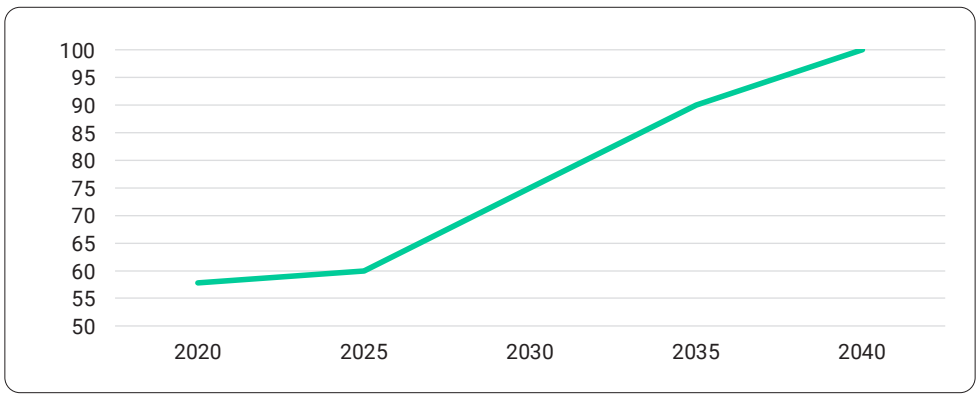

Figure 1. Clean energy production in the EU, fact and forecast, %
Source: compiled by the authors of the study based on Europe: Uneven progress towards clean electricity (2023)

According to the graph, at this stage, the share of clean energy in the EU energy system is about 60%, which is quite high. However, the EU leadership, within the framework of the general trend of sustainable development principles, plans to fully switch to clean energy sources by 2040 and provide 100% of demand with it. At the same time, the share of outdated, carbon-intensive energy sources, on the contrary, should be constantly decreasing. Figure 2 shows the factual indicators for energy production from non-environmentally friendly fossil fuels and the EU's plans to reduce this dependence.

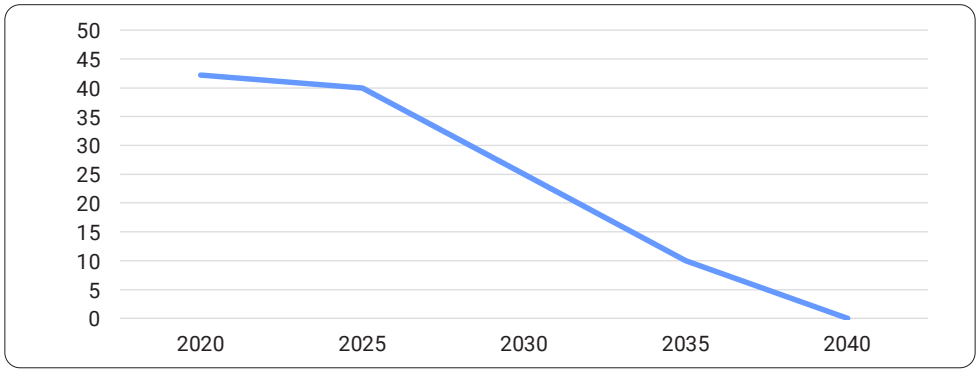

Figure 2. Energy production from fossil fuels in the EU, fact and forecast, %
Source: compiled by the authors of the study based on Europe: Uneven progress towards clean electricity (2023)

As Figure 2 shows, while at this stage the EU has to meet about 40% of its energy needs with outdated and harmful carbon sources, such as oil and coal, by 2040 the EU countries plan to completely abandon them in favour of renewable clean energy. Until February 2022, Ukraine also created linear schedules for the gradual transition of the power system to a circular basis, but with the outbreak of full-scale military aggression and the increase in the area of the temporarily occupied territories, other sustainable development tasks became more urgent. Specifically, completely destroyed houses and entire towns, contamination of arable land, and the forced relocation of hundreds of thousands of people have become an additional challenge to the circular economy in Ukraine. On the other hand, it is in the context of the country's upcoming post-war recovery that large-scale circular economy programmes will be in great demand and Ukrainian projects could become a centre of gravity for the entire European system of sustainable development (Subačienė *et al.,* 2023).

The introduction of digital technologies will play a significant role in optimising these processes. For instance, the Ministry of Digital Transformation, in coordination with the State Statistics Service, is creating a special analytical platform using artificial intelligence for quality management decisions (Ministry of Digital Transformation of Ukraine, 2023). The system, called Government BI, will be able to handle large amounts of data and enable government agencies to consider relevant information when making decisions. In the future, it is planned to create an integrated Big Data system where all information from government agencies will be integrated, which will prevent logical errors and substantially accelerate decision-making on Ukraine's reconstruction.

Within the framework of the activities of the special working group "Digitalisation", established under the auspices of the National Council for the Reconstruction of Ukraine from the Consequences of War (2022). According to the analytical data provided in the document, before the start of the full-scale aggression, Ukraine was a leader in the development of open data in Europe and was ranked 6th in the European Open Data Maturity ranking in 2021. Furthermore, the level of 4G mobile internet coverage in the populated areas reached almost 90%, which also placed Ukraine among the world leaders in digital integration. However, in February 2022, with the outbreak of full-scale hostilities, the digital infrastructure faced severe challenges. As of 1 June 2022, 22% of optical networks and almost 11% of mobile phone towers were destroyed, and in 2023, several frontline cities were completely destroyed along with the entire infrastructure. Furthermore, the large number of IDPs has caused an increased demand for the services of administrative service centres, specifically, the restoration of documents, recording the circumstances and timing of displacement.

The restoration of all essential elements of the digital economy is a prerequisite for the country's post-war reconstruction and further implementation of sustainable development programmes. The aggressor's actions have demonstrated the system's vulnerabilities, which need to be strengthened within the framework of the creation of an updated cybersecurity structure. These key elements include the competencies of management and staff, metrics for measuring the level of cybersecurity of organisations, algorithms for behaviour in emergency situations, and protocols for data transmission, storage, and processing. Thus, the renewal, improvement, and relaunch of Ukraine's digital infrastructure will be an essential element in the further development of the country's circular economy. Apart from purely digital aspects, the war has a critical negative impact on the environmental situation. Waste generated by the

destruction of physical objects has reached a scale not seen in Europe since the Second World War. Blown up and burned buildings, communications, contaminated water bodies and agricultural land represent a major environmental problem that Ukraine will need to address in the future to return to the goals of sustainable development and the concept of a circular economy (Szaryszová *et al.,* 2023). The volume of war waste, including that from destroyed military equipment and burnt buildings, is so large that it is even causing certain climate changes.

The introduction of circular economy principles during martial law is not only appropriate, but also necessary, as the implementation of these processes will reduce the burden on the resources of the warring country and further stimulate the movement towards sustainable development goals. Another aspect of the impact of the aggressor country's attacks is the targeted destruction of Ukraine's energy system in 2022-2023. The lack of electricity and heat caused by missile and drone strikes forced citizens to buy petrol and diesel generators, flashlights with large batteries, and powerful batteries. As a result, air pollution in cities has increased substantially, and many new appliances with toxic content have not always been recycled or disposed of properly. Waste from the damage and destruction of urban and rural infrastructure, residential buildings, and enterprises is also a serious environmental problem (Reshetilov, 2022). In an interview with Ukrinform, Oleksii Chernyshov, Minister of Communities and Territories Development of Ukraine, said that as of June 2022 alone, about 120 thousand private households and more than 20 thousand multi-storey buildings had been damaged or destroyed, and this number is growing almost daily (120,000 private and…, 2022).

To effectively manage war waste, Ukraine has developed a range of regulations and, with the help of partners and donors, is taking steps to clean up the de-occupied territories from the consequences of the occupation, such as landmines and infrastructure destruction. The key stages of implementing a circular economy, considering the realities of war and post-war reconstruction, are declared in the Law of Ukraine No. 2320-IX "On Waste Management" (2023). The reform primarily involves the implementation of a model that favours the reuse of resources. The priority is to recycle, replace components, and increase the service life of goods. Most developed European countries started waste sorting processes several decades ago, and their experience is crucial for Ukrainian realities – cooperation and exchange of best practices with the UK, Sweden, and Germany will help avoid many mistakes and misconceptions on the way towards a circular economy (Shubalyi *et al*., 2023).

According to the Ministry of Environmental Protection and Natural Resources of Ukraine (2024), before the start of the full-scale war in Ukraine, only 5.6% of solid household waste was recycled, another 1.5% was incinerated, and the rest, i.e., almost 93% of waste, was taken to landfills, which caused substantial environmental damage. Following the legislative substantiation and launch of the waste management reform, the industry introduced a clear management hierarchy, decentralised key functions and established new, more environmentally friendly standards for landfill operations. The updated financing principles contained in the National Waste Management Plan should be emphasised separately – now there are transparent and attractive financial instruments for investors, which should attract additional funds for infrastructure development. In the future, it is planned to set up cluster-type waste recycling plants in the regions, which should finally bring the solid waste management sector to the circular economy.

A very telling example of waste recycling is directly related to the assistance provided to the Armed Forces of Ukraine: after the technology was mastered to turn the charging units of disposable e-cigarettes into systems for dropping ammunition from drones on the enemy, points were opened across the country, often by amateurs, to collect charges from disposables. K. Sergatskova (2022), in her interview with the co-founder of the sorted waste recycling station "No Waste Ukraine", provides several other examples of increased waste recycling during the war, including the procedure for creating temporary mobile waste shredding stations for waste from the destruction of buildings and promoting a culture of waste sorting among the population. Such promotion should cover all segments of the population, starting from childhood – even board games can act as a means of communication. The No Waste Ukraine project, for instance, offers its customers a game for the whole family called Sorting Against Garbage Trucks, which aims to introduce the principles of the circular economy to even the youngest Ukrainians.

However, to obtain up-to-date information on the implementation of circular economy principles at enterprises during the war, it is necessary to contact the management of Ukrainian production facilities directly. Within the framework of this survey, a questionnaire with three questions was sent to the managers of 100 large enterprises. In the first question, industry experts were asked to assess the impact of full-scale hostilities on the state policy on resource recovery on a 10-point scale. The answers were distributed as follows (Table 1).

Table 1. Assessing the impact of war on state policy towards the circular economy

Assessment	Number of such assessments
10	12
9	15
8	8
7	15
6	10

Table 1, Continued

Assessment	Number of such assessments
5	12
4	4
3	5
2	0
1	1

Source: compiled by the authors

Generally, there is a high average assessment of the state's actions to support the principles of sustainable development even during hostilities. The second question asked the managers of Ukrainian manufacturing enterprises to subjectively assess the implementation of circular economy programmes at their company after February 2022. More than half (55 respondents) said that recycling measures are integrated into existing production processes and, accordingly, continue to be carried out without changes. In 23 questionnaires, it was stated that the company was forced to relocate in one form or another and that circular economy programmes were temporarily suspended, in most cases along with production. However, it was noted that the status quo was eventually restored. Another 4 managers stated that they were forced to stop recycling activities. The scores on the 10-point system for the impact of digital technologies on production, which were included in the answer to the third question, were distributed as follows (Table 2).

Table 2. Assessing the relationship between modern digital technologies and manufacturing

Assessment	Number of such assessments
10	20
9	26
8	5
7	8
6	8
5	10
4	1
3	0
2	3
1	1

Source: compiled by the authors

As the table above shows, the representative group directly responsible for the production processes of the warring state is overwhelmingly convinced that Ukraine's further sustainable development depends on modern digital technologies. Thus, it can be summarised that despite the full-scale hostilities and the environmental problems caused by them, the circular economy continues to function in Ukraine. Moreover, paradoxically, the current critical situation in some areas stimulates further approximation to the principles of Ukraine's sustainable development and European integration.

Discussion

As the results above suggest, the issues of the circular economy and sustainable development goals are critical in the modern world, especially in countries whose economies are experiencing the impact of the crisis. However, even developed countries' industries require substantial resource savings, which will be needed in the coming decades as they phase into the next technological order.

The future of the circular economy, its prospects, the need for recycling and resource conservation have been the subject of research by researchers from around the world, which once again underlines the global significance of these issues. V. Obrenovic *et al.* (2023) proved the ability of companies to maintain their operations and economic efficiency even during military conflict or political instability. In the face of resource constraints, organisations can improve their economic position by diversifying their sources and learning to manage environmental constraints, as discussed in the present study.

F. Treffers (2023) also discussed the scale of the destruction in Ukraine, the statistics of which were cited above. The researcher sees a certain potential for reconstruction in the current critical situation, primarily in the context of urbanisation principles. Carefully planned cities with modern residential complexes and comfortable public spaces should be built on the principles of sustainable development on the site of destroyed settlements and districts. B.S. Zellen (2022) considers the war in Ukraine and the related challenges to the circular economy as an obstacle to the work of the Arctic Council. The researcher believes that the actions of the aggressor country, which carried out an unprovoked attack on a neighbouring country and destroyed entire cities along with their inhabitants, cannot be ignored when it comes to climate change. At the

same time, considering the facts presented in this study, it is unacceptable to encourage a terrorist, and the boycott of the Arctic Council by seven democratic countries since March 2022 is justified and necessary.

G.E. Halkos & P.S.C. Aslanidis (2023) discussed difficulties with access to energy and the energy crisis caused by the war in Ukraine. As renewable energy prices are volatile in times of crisis and inflation adds to the uncertainty, solutions must be found to protect the population from energy poverty. Such instruments may include "green support" from the state, national projects, subsidies for renewable energy producers, and legislative initiatives. The present study provided examples of such laws regulating waste management. According to M.Z. Chishti *et al.* (2023), the full-scale brutal war in Ukraine has affected not only the energy market, as noted above, but also the agricultural sector and the metal market. Specifically, due to the war and the decline in metal production by Ukrainian producers, the global aluminium and copper markets are expected to experience noticeable losses in various quantities, and global grain prices could rise substantially due to the contamination of considerable area of arable land in southern Ukraine by war waste. These negative consequences of war also challenge the principles of sustainable development and require global mechanisms to address them (İsmayilov *et al.,* 2022).

Following S. Makdisi & R. Soto (2023), who investigated military conflicts in the Arab world, post-war reforms considered in the economic agenda should be based on several preconditions – reducing inequality, promising and transparent investment, and a significant reduction in unemployment, especially among young people. Furthermore, a post-war society that has experienced forced restrictions on rights and freedoms usually tends to seek a new form of social contract based on the principles of democracy. This experience will need to be considered during the post-war reconstruction of Ukraine. It is also important to be guided by the global principles of sustainable development (Urban *et al.,* 2023). Generally, 80 years have passed since the last military conflict that took place on Ukrainian soil. Since then, the economics and logic of war have undergone substantial changes, and it is therefore important to investigate the experience of countries that have undergone war in recent history – Israel, Croatia, and Iraq.

The history of the reconstruction of the state of Israel in the 20th century made the leadership of the Israel Defense Forces (IDF) a permanent consultant in most economic decisions – limited resources and the need to constantly maintain the country's defence capability at a high level gave the army a voice even in matters of the circular economy. Y. Fried (2023) notes that, given the mental and value differences between Israelis and their traditional enemies, the IDF creates civil-military planning units to assess the potential of such areas of the national economy as morale, education, civil defence, resource conservation, and the circular economy. Unlike Israel, Croatia's military experience is a thing of the past, and over the 30 years since the war, the country has fully integrated into the community of developed European countries. However, according to M. Barić & M. Alić (2021), there are still difficulties at the level of society in the transition from a linear to a cyclical model of the economy, which are manifested, specifically, in the unwillingness of some citizens to sort waste. Analogous problems, as noted in the present study, are noticeable in Ukrainian society.

B. Neimark *et al.* (2023) addressed the problem of contamination of territories with war waste in Iraq. During 2003-2008, coalition troops conducted combat operations in the country and demonstrated all the negative environmental consequences of modern warfare. For instance, the carbon emissions from the construction, transport, and installation of 412 km of blast-resistant concrete walls in Baghdad were ten times higher than the permissible standards. Moreover, after the end of the acute phase of the war, the barriers themselves also turned into harmful construction waste. Ukraine should use this experience to plan further disposal of protective structures.

The negative impact of the war in Ukraine is being felt around the world. The pollution and mining of arable land discussed in this study puts some African countries at risk of famine. D. Mhlanga & E. Ndhlovu (2023) note that Africa is currently experiencing food and energy shortages and, consequently, rapid inflation. All this is moving the continent further away from achieving sustainable development goals. Climate initiatives are also under attack – F. Qureshi & M. Abdul Kamal (2023), describing the key factors of uncertainty, include hostilities as one of the most influential. Another dimension of the dependence of the circular economy and, consequently, the Sustainable Development Goals, on military operations is the resource dimension. S. Wang *et al.* (2023), having investigated the relationship between natural resource income and economic growth, proved that in the modern world these concepts may have an inverse relationship. Exploring a similar topic, M. Ali *et al.* (2023) also concluded that the surge in oil and gas prices that occurred at the beginning of the large-scale invasion led to an increase in coal consumption, which worsened the environmental situation and delayed the achievement of sustainable development goals.

Thus, the analysis of the global scientific literature shows that the war in Ukraine is a factor that affects the development of the entire global system, both economic and social.

Conclusions

This study proved that in the modern world, a circular economy is a basic condition for the entire system of sustainable development. Given the scarcity of resources, only those countries that have mastered the principles of recycling will be able to develop steadily. Despite a range of fundamental challenges related to full-scale aggression, Ukraine manages to combine military operations and the liberation of the temporarily occupied territories with the support of circular economy principles.

The most devastating war in the last eighty years has had a substantial impact on the environmental situation in Ukraine: carbon emissions from destroyed buildings and equipment, land and water poisoned by oils and combustion products, thousands of hectares of mined agricultural land, and the consequences of the occupiers' blowing up the dam of the Kakhovka Hydroelectric Power Plant. However, despite the extremely difficult situation, the country does not abandon the principles and goals of sustainable development, the necessary institutions are being formed at the state level, laws are being passed, waste recycling programmes are in place, and various segments of the population are involved in waste sorting. Managers and owners of Ukrainian manufacturing enterprises, acting as primary sources, also overwhelmingly confirm the sustainable state policy on the circular economy and the relevance of recycling measures.

Ukraine, which has faced military aggression, can paradoxically become a European leader in implementing the principles of the circular economy, as many things will be rebuilt almost from scratch during the post-war recovery. For instance, towns and villages completely destroyed by the aggressor will be rebuilt immediately, considering all modern principles of urbanism, ecology, energy saving, restoration, and sustainable development. The competitive advantage of such new smart cities over other European analogues will be the construction from scratch, rather than the reorientation of existing infrastructure. The development of preliminary planning for such ecological settlements that fully comply with the principles of sustainable development may be the subject of further research.

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Conflict of Interest

None.

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Анотація. Дефіцит ресурсів у сучасному світі зумовлює необхідність реорганізації традиційної лінійної економіки в нову, циркулярну модель економічного розвитку, і ця вимога є ще більш актуальною для країни, що перебуває у стані війни. Метою цього дослідження було довести необхідність і можливість досягнення цілей сталого розвитку навіть в умовах кризи на прикладі України. За допомогою таких методів, як статистичний аналіз, порівняння та синтез, було досліджено динаміку сталого розвитку в Європейському Союзі та Україні. Крім того, за допомогою онлайн-опитування було проведено інтерв'ю з відповідними експертами. У ході дослідження було отримано та проаналізовано статистичні дані щодо переходу європейських країн на чисті джерела енергії, проведено детальне дослідження чинної законодавчої бази та державних інституцій України, пов'язаних з утилізацією відходів війни, посиленням діджиталізації українського суспільства, а також вивчено заходи з циркулярної утилізації відходів воєнного часу. Також було проаналізовано статистичні дані щодо фактичного руйнування та забруднення довкілля внаслідок воєнних дій та тимчасової окупації окремих територій. Крім того, було зібрано та систематизовано інформацію від керівництва українських виробничих підприємств щодо фактичного впровадження принципів циркулярної економіки під час війни. Аналіз отриманих даних дозволив зробити висновок, що криза лише посилює потребу в економії ресурсів. Практичне значення дослідження полягає у доведенні безальтернативності цілей сталого розвитку в майбутньому та підкресленні конкурентних переваг України у цій сфері під час післявоєнної відбудови. Ці пропозиції будуть корисними для приватних інвесторів, які можуть вигідно фінансувати майбутнє відновлення України відповідно до принципів циркулярної економіки

Ключові слова: чиста енергетика; цілі сталого розвитку; забруднення територій; відходи війни; діджиталізація суспільства; повоєнна відбудова