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Circular Economy in Ukraine on the Way to European Integration: Directions for Sustainable Management during the War and Post-War Recovery

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Abstract:

The results of the research show that in developed countries, where approximately 16% of the world's population lives, more than 2 times more solid waste per capita than one Ukrainian, but more than half of this waste is subject to recycling and composting. The results of the correlation analysis have shown that the circular economies of Ukraine and EU countries are very closely connected. Accordingly, the increase in the level of the circular economy in Ukraine in the future will be able to positively affect the environmental situation of other countries of the world. But there are lenient administrative penalties and fines for environmental pollution in Ukraine, as well as low environmental fees, which, in turn, does not encourage producers to move to more expensive principles of circular production on the one hand and does not protect against violating government restrictions on the other hand. Besides, the situation with the development of the circular economy in Ukraine is relevant because of the aggression of the Russian Federation against Ukraine, when, due to the destruction of infrastructure, including critical one, there is a very strong shortage of energy resources, in particular during the winter period. The paper proposes to develop and implement in Ukraine a targeted comprehensive program for solid waste management, that should provide the main ways to achieve goals and objectives of after-war circular economy development, including the principles of improving and legal, economic and organizational control mechanisms in Ukraine.

Keywords: circular economy; solid waste management; environment; the Circular Economy Index.

JEL Classification: O13; F64; Q50; Q53; R11.

Introduction

In the conditions of constant growth of global environmental challenges and socio-economic instability, the problem of implementing the circular economy is one of the central ones for the modern world. For Ukraine, the additional relevance of the study is that the war unleashed by the Russian Federation created a number of national environmental and economic challenges. In the conditions of martial law, the tasks of implementing the circular economy have expanded significantly, in particular, the issue of disposal of waste generated as a result of hostilities has become more relevant. 2014–2015 radically changed the economic situation in Ukraine. Annexation of Crimea, armed aggression of the Russian Federation against Ukraine created significant long-term development threats for the country and Donetsk and Luhansk regions, in particular, in the form of losses of production facilities, destruction of infrastructure, deterioration of the financial situation of citizens.

All these problems, as well as the associated shortage of energy resources and raw materials, logistical problems and the shutdown of key industrial enterprises in the east of the country, in combination with accumulated internal structural development problems (a significant dependence on trade relations with one country) and a deterioration of foreign economic conditions caused the deployment of an economic crisis, which was characterized by the loss of part of the development potential: the reduction in GDP in 2014 was 6.6%, and in 2015 – more 9.8%, including production of industrial products – 10.1% and 13.0%, respectively.

According to estimates of the Ministry of Economic Development, the negative contribution of Donetsk and Luhansk regions in 2014 to industrial production amounted to -7.6 pp, in 2015 -7.8 pp decrease. The national currency devalued in 3 times during 2014–2015, and the peak growth rate of consumer prices was reached in April 2015 up to 60.9% (calculated by April 2014). In general, the growth of consumer prices in 2014 was 24.9% (in the calculation until December of the previous year), in 2015 – 43.3%. There were processes of reduction of investments and deterioration of the balance of payments.

Value exports of goods and services decreased by 19.9% compared to the previous year (according to the National Bank), in 2015 – by 26.9%, in particular, the volume of exports of goods and services to the Russian Federation in 2014 decreased by 42.2%, in 2015 – by 45.4%, the volume of imports of goods and services in Ukraine as a whole – decreased by 28.1% and by 28.3%, respectively. According to estimates of the Ministry of Economic Development the decrease in exports of goods and services to the Russian Federation is estimated at - 5.7 pp and -5.6 pp GDP in 2014 and 2015, respectively. The crisis of 2014–2015 revealed the inherent instability of the Ukrainian economy.

Income growth in the decade leading up to the crisis was largely supported by favorable prices for export commodity groups (in particular, steel and chemical products), and not by increased productivity and competitiveness. Inconsistency in the implementation of structural reforms and frequent political instability delayed the economy in transition and too opened it to external shocks. However, according to the results of 2016, the general situation in the economy made it possible to state that the crisis of 2014–2015 did not destroy the potential for development, but only changed its character. The growth of 2.4%, in the context of the deterioration of the external price situation in the world markets, and the decrease in the inflation rate to 12.4% for the year was the result of a dynamic recovery in domestic investment and consumer demand, fiscal consolidation and tough actions of the National Bank of Ukraine.

Since 2016, thanks to the chosen course for European integration and fundamental reform of the economy, Ukraine has been demonstrating economic growth for three years in a row in the face of constant new challenges from the Russian Federation. In 2017, a new test was the temporary suspension of the movement of goods through the line of contact with railway and road routes within the Donetsk and Luhansk regions in response to the aggravation of hostilities. The effect of this factor complicated the work of the mining and metallurgical complex and energy. At the same time, the growth of industrial production at the end of the year amounted to 0.4% and was largely provided by the growth of machine building in response to the continued expansion of domestic investment demand, including domestic defense industry enterprises. In general, GDP growth was 2.5%, and inflation was kept within safe limits – 13.7% for the year.

In 2018, negative pressure from the Russian Federation continued: (1) restrictions on the movement of large-tonnage ships were introduced due to the construction of the Kerch Bridge, as well as blocking the activities of seaports of the Sea of Azov; (2) at the end of the year, special measures were applied against economic entities of Ukraine according to the list providing for freezing non-cash funds, non-documentary securities and property in the territory of the Russian Federation, a ban on transferring funds outside the territory of the Russian Federation. Due to the reorientation to new foreign markets, the economy of Ukraine is no longer so keenly affected by aggressive actions by the Russian Federation. In 2018, GDP growth accelerated to 3.3%, and

inflationary processes in the consumer market slowed to single digits for the first time after 2013 and amounted to 9.8% in December.

At the moment, global economic growth is slowing down due to Russia's invasion of Ukraine more than it was predicted a few months ago, as the energy and inflation crisis risks a recession in large economies. While global growth was still expected at 3.0% this year, it is now forecasted to slow to 2.2% in 2023, compared with a forecast in June of 2.8%. Next year's global output is expected to be 2.8 trillion USD lower than before Russia attacked Ukraine. The global economy has lost momentum after Russia's unprovoked, unjustified and illegal aggressive war against Ukraine. GDP growth in many economies has stalled, and economic indicators indicate a slowdown. The OECD forecasts that Eurozone economic growth will slow from 3.1% this year to 0.3% in 2023, meaning the Eurozone will spend at least some of the year in recession. In view of the current situation, the development of the circular economy is especially relevant for Ukraine, which would speed up and reduce the cost of post-war country's recovery.

To form a new model of economy, the governments of developed countries are reforming legislation, implementing special support programs and projects for the development of the circular economy and its individual elements. Non-governmental organizations are also very active in uniting the efforts of the government, leading companies and scientists in the field of circular economy development.

Adoption of the principles of circular economy, development of related innovative business models, introduction of new technologies of closed-loop production imply not only timely and consistent modernization of state regulatory mechanisms in the country and, accordingly, creating adequate framework conditions for business, but also require companies of qualitatively new approaches to substantiation and the decision of questions of development of circular economy at strategic and operational levels. However, the formation of circular productions encounters considerable obstacles and barriers, among which, first of all, it should be noted the following: lack of advanced technologies and equipment for efficient reuse, recovery and recycling of waste; low innovation activity in the field of circular production development; lack of education and training system for the recycling industry, as well as underdeveloped environmental awareness of consumers. The above determines the relevance of the chosen research topic.

The authors of the work (Reike, Vermeulen and Witjes 2018) propose to distinguish three stages in the evolution of circular economics and argue that the concept of circular economics is not new. The authors believe that high levels of circular economic development have already been achieved in various parts of the globe regarding options for longer conservation of cycle costs, such as energy recovery and recycling.

The authors of the work (Viles *et al.* 2022) believe that the concept of sustainable production is evolving with changes caused by the emergence of new economic and industrial models, such as circular economics and industry 4.0. The work revises the principles that should regulate sustainable production operations during the transition to a circular economy and smart industry models. The authors, thanks to the use of the ISM technique, determined which principles are independent of each other or dependent on each other, and established a relationship between the given principles. The results demonstrate that the principle of prioritizing worker well-being, the principle of increasing management commitment to sustainability, the principle of measuring and optimizing sustainable processes, and the principle of promoting the use of sustainable technologies help to create an ideal context for intensifying the development of other principles that characterize sustainable production within the circular economy.

Circular economics emerged as an alternative model of a linear system that now reaches its physical constraints. To transition to a circular economy, companies need to rethink and innovate their business models and ways that they offer to their customers while simultaneously considering environmental and social aspects. The paper defines the main areas of research and proposals for assistance to the movement to the circular economy (Suchek *et al.* 2021).

The circular economy is a new paradigm for sustainable development. Similarly, eco-innovation is recognized as one of the most important mechanisms to ensure the transition from linear to circular economy in production processes, as there is a strong link between eco-innovation and circular activity of the economy. However, the relationship between eco-innovation and circular economics is a problem that has been isolated and little analyzed in the scientific literature. Thus, the study fills this gap by exploring the interdependence between eco-innovation and circular economics (Korhonen, Honkasalo and Seppälä 2018).

The authors of the work (Maldonado-Guzmán, Garza-Reyes and Pinzón-Castro 2020) consider that circular economics is currently a popular concept promoted by the EU, several national governments and by many businesses around the world. The authors believe that circular economics is a collection of vague and separate ideas from several fields and seminary concepts. Accordingly, a critical analysis of concepts of circular

economics in terms of environmental sustainability is carried out in the work. The given analysis identifies six problems, for example, such as thermodynamics and system boundaries, that need to be addressed to enable circular economies to contribute to global clean resilience.

The work (Völker, Kovacic and Strand 2020) declines that circular economics contributes to a future in which linear the use-disposal culture has been replaced by circular model. In this context, the concept of socio-technical images is used, describing the process collecting and stabilizing the imaginary cycle that uses creative resources and identifies goals, priorities, benefits and risks in combining with discourse of innovation, sustainability and growth. Actually, monitoring system and the function of developing indicators contributes to the development of "circular" futures. These futures represent new opportunities for private sector to create jobs and economic growth against the background of improving the state of the natural environment, measured with individual environmental indicators.

The work (Skene 2018) emphasizes that over the past 10 years, the concept of circular economics has become an important school in the field of sustainable economics. The work critically analyzes the key principles underlying the concept of circular economics, in particular, considers the thermodynamic and environmental foundations on which these principles are based. The authors consider issues related to recycling, biological and technical nutrients, recovery, energy use, waste disposal, environmental efficiency, product life and economic growth in three areas: the waste pyramid, short cycles and environmental efficiency. The authors suggest that nature's economics is based on an open system rather than a closed system, that nature operates using short cycles rather than extended lifespan, that nature is suboptimal rather than optimal, and that nature is ecologically inefficient rather than eco-efficient.

The analysis defines the following components of viable business models of remanufacturing: raw materials processing, management of used components, development of production technologies and processes, marketing. Several modern obstacles are summed up from four points of view: political barriers and insufficient state support; lack of consumer awareness; related product quality; and technology. The study also identifies future directions and opportunities for the recycling of automotive parts industry. This research contributes to the circular literature of business models by reflecting barriers and opportunities in remanufacturing. The results help managers to develop viable circular business models in different contexts (Unal and Shao 2019; Shao, Huang, Lemus-Aguilar and Unal 2020).

In the study (Mishra, Jain and Malhotra 2020), the company case data is collected through trading media and semi-structured interviews with founders and designers. The results of the study revealed that the key drivers for the closed-loop fashion value chain are collaboration with partners, innovation, waste management system, customer connection and changing usage patterns. Based on the analysis of the case, it is concluded that to include the principles of circular economy, namely: reduction, repair, reuse and recycling into current business models, rethinking existing value proposals and transformation of various elements of the business model is necessary.

The transition of business from linear to circular economy brings with it a number of practical challenges for companies. The following question is considered: What should be the product design strategies and business models for companies that want to move to the circular model of the economy? This work develops a framework of strategies for the management of designers and business strategists in the transition from linear to circular economy. The terminology of slowing, closing and narrowing of resource loops is introduced. A list of product design strategies, business model strategies and examples for key business decision makers has been introduced to facilitate the transition to a circular economy. This structure also opens up a future research program for circular economics (Bocken, de Pauw, Bakker and van der Grinten 2016).

The authors of the work (Velenturf and Purnell 2021) argue that circular economics has become a potential solution for more efficient use of resources. Positioned as a technologically oriented concept that can deliver economic benefits while mitigating environmental pressures, circular economics enjoys positive perceptions from public, private and civil sector organizations and, increasingly, academia. However, the paper expresses concern that some alleged circular economic practices are promoted as "sustainable", which nevertheless damages the environment and society.

In work (Stein, Spinler, Vanthournout and Blass 2020) a discrete choice experiment was conducted with the best and worst scaling and focusing on the effect of circular economics through experience of website perception by ranking nine online attributes grouped into three subsets. Accordingly, the work reveals online attributes that are perceived as favorable for an enterprise operating in a circular economy mode, and it is discovered how participation in the activities of a circular economy affects the perception of these attributes. Accordingly, the author proves that a successful circular economy can work exclusively online.

Some authors devote their research to individual countries and regions. Thus, the authors (Shao, Huang, Lemus-Aguilar and Únal 2020; Rattalino 2018; Verbeek 2016) argue that the new concept of organizing industry is necessary in order to separate the growth of resource consumption from the growth of wealth. This concept needs to go beyond making significant efficiencies in order to successfully effect change – an idea known as circular economics. The growing focus on environmental issues and stakeholder pressure is forcing businesses to consider the complexity and interdependence between stock value and sustainable value, which in turn increases interest in the circular economy. The accelerated economic development of the twentieth century and the demographic growth of the world population, which has increased from 3 to 7 billion people in just one hundred years, have pushed on the consumption of fossil energy resources, causing two problems: depletion of energy resources and pollution (Morselli, Arsini and Di Vincenzo 2021).

1. Materials and Methods

The purpose of the article is comparison of the circular economy in Ukraine with the countries of the world in the context of the destruction of critical infrastructure and resource shortages due to the invasion of Ukraine by the Russian Federation and development of the directions of management of Ukraine's circular economy during and after the war.

The theoretical and methodological basis of the research are regularities and principles of development of circular economy. To solve the problems set in work, the following scientific methods were used:

- analysis and synthesis, induction and deduction – to detail the subject of the research;
- generalization and comparison – to study the regularities of circular economy development in Ukraine and other countries of the world;
- systematic approach – to substantiate the definition of the indicator of circular economy;
- structural approach – to determine of waste production of Ukraine and the countries of the world;
- structural-logical and descriptive analysis – to determine the components of the indicator of circular economy;
- retrospective analysis – to assess the dynamics of the change in the indicator of the circular economy of Ukraine to the EU countries in recent years;
- correlation analysis method – to determine the degree of relationship between indicators of circular economy of Ukraine and some EU countries.

2. Results and Discussion

First of all, it should be noted that the structure of waste management in the EU in recent years is as follows (Table 1). In recent years in the EU countries the situation with regard to waste management has significantly improved.

Table 1. The structure of waste management in the EU countries

Variety of waste management	Percentage of total waste	
	in recent years	in the previous decade
Recycling	30	24
Composting	17	13
Incineration	28	21
Burial in landfills	24	43

Source: developed based on the New EU policy on "circular economy" (New EU policy on "circular economy" (2022), available at: https://dixigroup.org/wp-content/uploads/2020/09/dixi_pb_circular-economy_ukr_full_3.pdf).

From 25 countries mentioned in the Eurostat report, the largest amount of waste is produced by the following ones (Table 2). As we can see, Denmark produces the largest amount of waste among EU countries (781 kg of waste per person).

Table 2. EU countries that produce the most garbage

Country	Volumes of waste, kg / person
Denmark	781
Cyprus	637
Germany	633
Luxembourg	607
Malta	604

Source: developed based on the New EU policy on "circular economy" (New EU policy on "circular economy" (2022)

Several indices have traditionally been used to assess the level of development of the circular economy. However, it should be noted that they are not complete in assessing the set of elements and processes occurring in the circular economy, and some of them are subjective. Thus, the indices the regional circular economy index system and The Material Circularity Indicator are aimed at assessing the principles of circular economy in the field of municipal solid waste management. The Circular Economy Performance Index uses special Key Performance Indicators (KPIs) to assess the circular economy, but no clear selection criteria are used when selecting KPIs and companies for interviews.

Therefore, to reduce uncertainty and assess the current level of development of the circular economy, we use the Circular Economy Index (CEI), which corresponds to the theoretical model of the circular economy (Khmilevska and Voitko 2021). It reflects the main elements of the theoretical model, namely production and consumption, reuse, recovery and processing in quantitative terms of production and waste, which, in aggregate, indicates progress of the circular economy implementation at the national and global levels. The specified Circular Economy Index based on 13 indicators, which are grouped in 4 clusters, namely production and consumption, waste management, secondary raw materials and competitiveness and innovation (Khmilevska and Voitko 2021). CEI assesses the importance of waste management and end-of-life products to prioritize their use. The final environmental and economic effects will be different depending on the choice of one or another way to transform the linear supply chain into a closed one (repair, restoration or processing of spent products and waste).

Accordingly, it makes sense to analyze the values of the Circular Economy Index of the above given countries and Ukraine (Table 3).

Table 3. The value of the Circular Economy Index for some countries and Ukraine over the past 5 years

Country	2017	2018	2019	2020	2021
Denmark	0.476	0.316	0.487	0.309	0.506
Cyprus	0.315	0.180	0.340	0.203	0.365
Luxembourg	0.529	0.356	0.530	0.352	0.491
Malta	0.356	0.132	0.366	0.135	0.354
Germany	0.637	0.567	0.642	0.535	0.635
Sweden	0.480	0.370	0.484	0.357	0.502
Ukraine	0.263	0.204	0.295	0.221	0.290

Source: calculated based on the UNECE (UNECE (2022). Circular economy, available at: <https://unece.org/circular-economy-0>)

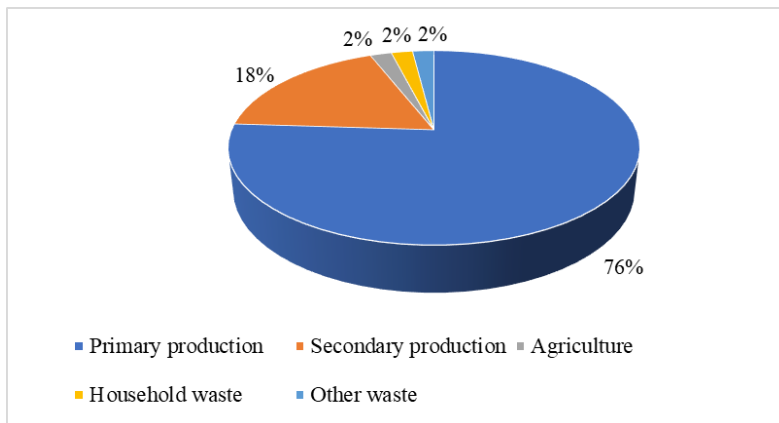
It can be seen from Table 3 that Germany is the leading one among the EU countries concerning development of the circular economy (the average value of the indicator of the development of the circular economy over the past 5 years is 0.6). The circular economy is also well developed in Luxembourg (0.45), Sweden (0.43), Denmark (0.42).

It should be noted that in the EU there are the following amounts of fines for non-compliance with environmental legislation: for minor disturbance by households – 450 Euro, garbage littering by individuals – 850 Euro (Circular Economy – Made for Circular Economy (2022), available at: <https://circlesolutions.com>). At present, the EU countries have established norms on mandatory separate collection of household waste: plastic, glass, metal, paper – 30%, biowaste – 37% of total waste (Circular Economy – Made for Circular Economy (2022), available at: <https://circlesolutions.com>). In 2015 the EU adopted a package of measures for waste recycling within the circular economy in order to bring the level of recycling to 65% by 2035.

Ukraine is among the Top 10 countries that produce the largest amount of different types of solid waste. At the same time, it is a world leader in the production of hazardous waste, which accounts for 94% of all waste generated. According to the assessment of the State Statistics Service of Ukraine, the distribution of waste is as shown in Figure 1.

Analyzing Figure 1, we can see that the vast majority of waste in Ukraine is primary production waste (76%). In second place are wastes of secondary production – 18%. Agricultural waste and household waste account for 2% each (approximately 12 million tons each).

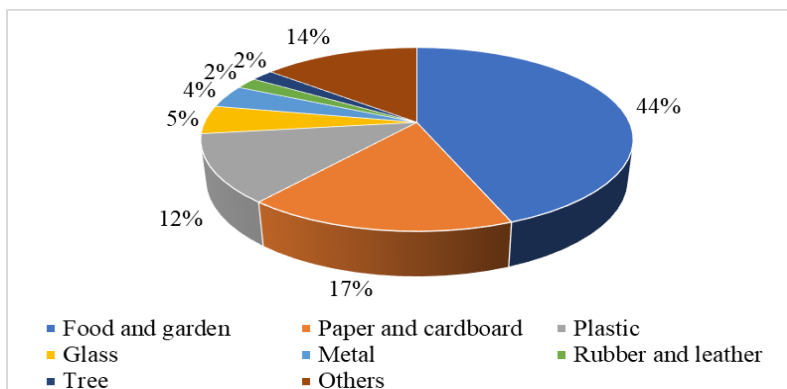
Figure 1. Distribution of waste production in Ukraine



Source: developed based on the State Statistics Service of Ukraine (State Statistics Service of Ukraine (2022), available at: <http://www.ukrstat.gov.ua>)

If we analyze the structure of global waste, it looks like Figure 2. This diagram shows that the first place in the world is food and garden waste – 44%. In second place – paper and cardboard (17%). The third place is occupied by plastic – 12%. In last place are waste from wood and rubber and leather.

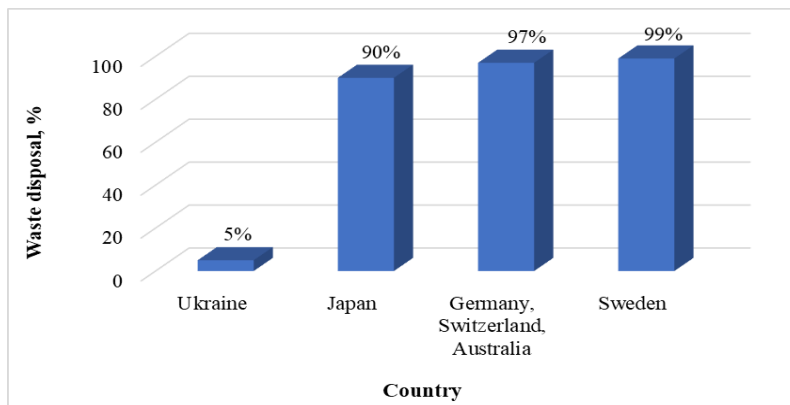
Figure 2. Distribution of waste production in the world



Source: developed based on the OECD statistics (OECD statistics (2022), available at: <https://stats.oecd.org>)

In Ukraine, only 5% of all waste is sorted, of which 1% of this sorted waste is incinerated at the Enerгия plant (Kyiv) (Figure 3). Most of the waste in our country is subject to disposal in legal and illegal landfills. In particular, only 6.5 thousand tons of garbage are subject to burial in legal landfills. While 35.0 thousand tons of garbage are to be buried in illegal dumps.

Figure 3. Comparative characteristics of waste disposal in Ukraine and other countries



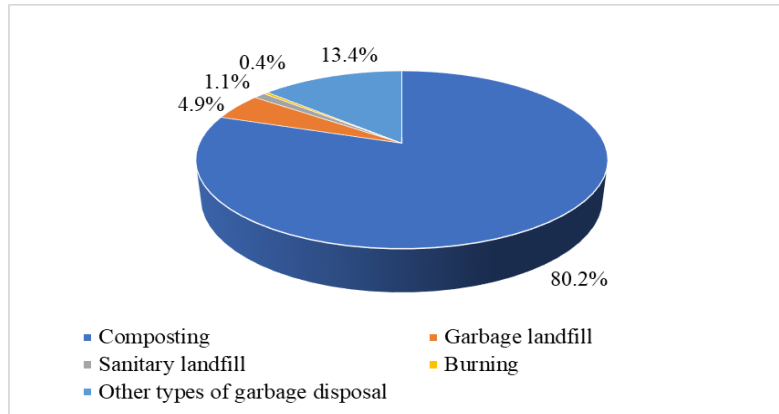
Source: developed based on the State Statistics Service of Ukraine & OECD statistics (State Statistics Service of Ukraine (2022), available at: <http://www.ukrstat.gov.ua>; OECD statistics (2022), available at: <https://stats.oecd.org>)

In 2014, solid waste incineration plants were active in Kyiv, Kharkiv, Dnipro, Rivne and Sevastopol, now

only the Energia plant in Kyiv remains, which provides thermal energy to residential buildings through their incineration. All other garbage is taken to landfills, the total area of which on a legal scale is 100 thousand km².

If we compare the corresponding data with the world, in developed countries, where approximately 16% of the world's population lives, more than 2 times more solid waste per capita than one Ukrainian, but more than half of this waste is subject to recycling and composting. In particular, Japan is the leader among the countries involved in solid waste composting (Figure 4).

Figure 4. Distribution of solid waste disposal methods in Japan



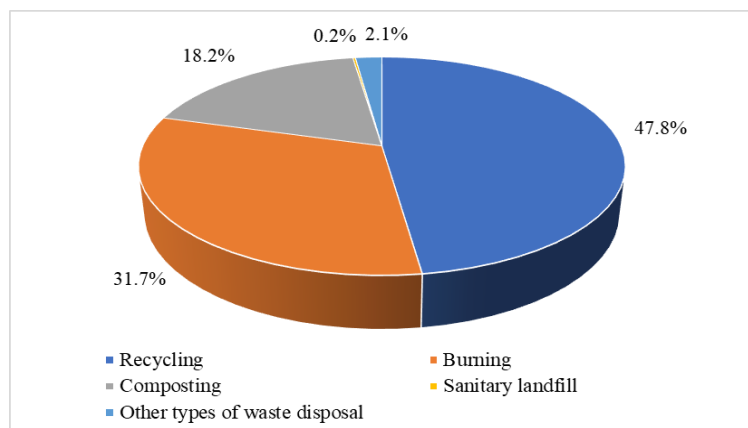
Source: developed based on the OECD statistics (OECD statistics (2022), available at: <https://stats.oecd.org>)

From Figure 4 it can be seen that the predominant method of solid waste disposal in Japan is composting (80.2%), and waste incineration is only 0.4%.

Among the countries that are actively involved in the processing of solid waste, we should mention Germany, the United States and Sweden (Figure 5–7 respectively).

Thus, in Germany, 47.8% of solid waste is recyclable (Figure 5) and actively used composting of solid waste (18.2%).

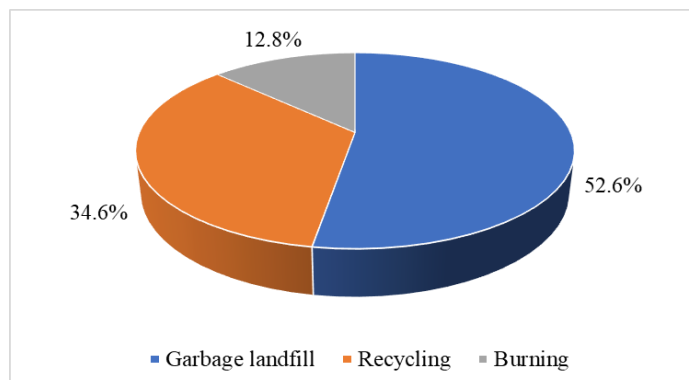
Figure 5. Distribution of solid waste disposal methods in Germany



Source: developed based on the New EU policy on "circular economy" (New EU policy on "circular economy" (2022), available at: https://dixigroup.org/wp-content/uploads/2020/09/dixi_pb_circular-economy_ukr_full_3.pdf)

Figure 6 shows that in the United States, along with recycling, even exaggerating it by 20%, the removal of solid waste to landfills is used.

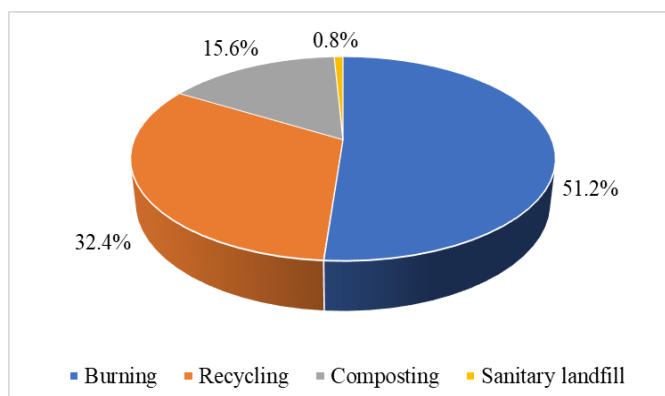
Figure 6. Distribution of solid waste disposal methods in the United States



Source: developed based on the OECD statistics (OECD statistics (2022), available at: <https://stats.oecd.org>)

From Figure 7 it follows that similarly to the United States in Sweden is actively used solid waste incineration.

Figure 7. Distribution of solid waste disposal methods in Sweden



Source: developed based on the New EU policy on "circular economy" (New EU policy on "circular economy" (2022), available at: https://dixigroup.org/wp-content/uploads/2020/09/dixi_pb_circular-economy_ukr_full_3.pdf)

It should be noted that, according to the decisions of the Coordinating Council on the implementation of the National Strategy for Waste Management in Ukraine until 2030, more than 70% of waste in Ukraine must be recycled or reused. However, currently only 3% of solid household waste is recycled in Ukraine.

The accumulation of solid waste in the industrial sector and the private sector is too large and may actually be part of the production process. In particular, with regard to packaging, only 12–14% of such waste is recycled, and the rest is subject to disposal, despite the fact that its components are valuable raw materials for recycling. According to the National Strategy for Waste Management in Ukraine until 2030, 65% of packaging and 70% of solid waste in general should be recycled.

It should be noted that if we compare statistics in Ukraine and the EU, we can see that we burn only 2.7% of solid waste, while in the EU this figure reaches 26%. The rate of recycling of solid household waste in Ukraine is 3.2%, while in the EU countries it is in average of 43%. On the contrary, the volume of solid waste disposal in Ukraine reaches 90% compared to the EU countries, where this figure is 31% (New EU policy on "circular economy" (2022), available at: https://dixigroup.org/wp-content/uploads/2020/09/dixi_pb_circular-economy_ukr_full_3.pdf; State Statistics Service of Ukraine (2022), available at: <http://www.ukrstat.gov.ua>).

Accordingly, the priority for Ukraine is to reduce this level of backlog and achieve the targets set in the National Waste Management Strategy of Ukraine until 2030, in particular by focusing on municipal solid waste and the creation of regional centers for their recycling.

At the same time, it is advisable to conduct a correlation analysis reflecting the influence of the circular economy of Ukraine on the circular economies of EU countries based on the value of the Circular Economy Index (Table 4). It can be seen from Table 4 that the circular economies of the countries of the world are very closely connected. Accordingly, the increase in the level of the circular economy in Ukraine in the future will be able to positively affect the environmental situation of other countries of the world. It should be noted that the projected

volume of garbage discharged annually in Ukraine by 2030 should be 30%, while now it is 95% (State Statistics Service of Ukraine (2022), available at: <http://www.ukrstat.gov.ua>).

Table 4. Correlation relationships of the circular economy of Ukraine and other countries of the world

Country	Ukraine	Denmark	Cyprus	Luxembourg	Malta	Germany	Sweden
Ukraine	1.00						
Denmark	0.96	1.00					
Cyprus	0.98	0.99	1.00				
Luxembourg	0.90	0.96	0.92	1.00			
Malta	0.95	0.99	0.97	0.99	1.00		
Germany	0.89	0.97	0.92	0.97	0.97	1.00	
Sweden	0.94	0.99	0.98	0.95	0.99	0.97	1.00

Source: calculated based on the UNECE.

According to the Ministry of Environmental Protection and Natural Resources of Ukraine, for six months armed aggression of Russia recorded more than 2 thousand facts of environmental damage. Besides, it should be noted that damage to the nature of Ukraine from the Russian armed aggression in six months reached 395 billion UAH. In particular, the damage due to air pollution amounted to 176 billion UAH, water resources – 106.3 billion UAH, soils – 8.8 billion UAH.

The prolonged full-scale invasion of the Russian Federation in Ukraine caused a significant increase in the amount of waste generation of all types. Due to the energy crisis caused by military actions and fuel shortages, there is an urgent need to exploit the bioenergy potential of waste (Tokarchuk, Pryshliak, Yaremchuk and Berezyuk 2023).

The main elements of the mechanisms of solid waste management and environmental safety in Ukraine are a set of administrative, control and economic instruments. In Ukrainian practice, an extremely narrow range of methods and tools for regulating the processes of solid waste management is used. The use of modern methods of ecological and economic analysis is restrained due to the unavailability or lack of data collection on the waste management system, the most valuable ecosystems, etc.

Given the results of the above research, it should be noted that Ukraine needs to develop and implement a targeted comprehensive program for solid waste management, which should be a long-term concept of solid waste management, which is an alternative to some separate options for waste disposal. Its goal is to gradually solve the most acute problem of waste – the return of solid waste to recycling and disposal of solid waste that is not recycled, the most environmentally friendly and cost-effective methods.

The targeted comprehensive program (TCP) should provide the main ways to achieve goals and objectives, including the principles of improving and developing legal, economic and organizational control mechanisms. The procedure for construction and sequence of measures during the development of the target comprehensive program should be as follows:

- (1) definition of strategic goals, objectives of solid waste management;
- (2) definition of methods, approaches, means of achievement of the purposes of the program;
- (3) providing measures with conditions and resources;
- (4) justification of expected results and their further adjustment.

The development and implementation of the TCP should be based on the examination of environmental impacts at all stages of the waste life cycle and ensure comprehensive consideration of the negative consequences of quantitative and qualitative losses before making a decision. The effect will be not only cost savings, but also economic damage to the environment from possible environmental damage as a result of avoidable waste management.

The leading directions of formation of TCP as a whole and its separate subsystems are as follows.

Block 1. Formation of the program concept. Defining strategic goals and objectives of solid waste management.

Adequate management decisions can be made with a huge amount of objective information about the problem (level of information received), moreover, all data must relate to the dynamics. This means that there should be a system for collecting current information and displaying it using modern methods of waste monitoring and information technology. The method of multifunctional integration of information structures in the system of environmental monitoring of waste is the basis of economic use of funds and resources. Such information may be information about:

- quantitative and qualitative characteristics of waste art;

- sources of waste generation;
- available methods and practices of waste management;
- regulatory framework for solid waste management.

Decision-making on complex issues of solid waste management must be preceded by systematic analysis and assessment of the impact of waste (as a result of economic activities) on all levels of the ecosystem and society.

The level of assessment of the situation. At this level of need:

- inventory of sources, types, volumes of MSW formation, forecast assessment of their quantitative and qualitative composition;
- analysis of existing methods of solid waste management, determination of the level of utilization;
- systematic analysis and systematic assessment of losses (risks) caused by household waste to the environment, human health and society as a whole;
- formation of program goals.

Block 2. Methods, approaches and means of achieving the goals of the program. Level of decision making.

This block envisages the development and substantiation of measures for solid waste management and management based on the hierarchy of levels of the integrated waste management system, which is based on a hierarchical scheme, according to which priority is given to methods that reduce waste generation, reuse and recycling. the ability to reduce the amount of waste that needs to be disposed of or destroyed (incinerated).

Block 3. Ensuring the implementation of the program. The level of decision making. CCP measures can be implemented and implemented on the basis of the following interrelated management methods and measures:

- regulatory and legal regulation;
- organizational and managerial methods;
- scientific and technical, technological methods;
- information-analytical mechanism;
- economic mechanism;
- information and educational support;
- control regulators.

The development and implementation of the proposed program will determine the main directions of sustainable waste management during the war and post-war reconstruction. It is quite obvious that the implementation of the developed set of measures for the implementation of the principles of the circular economy requires adequate financial support. In this regard, the results of the study on potential sources of financing the circular economy in the agricultural sector and modeling the factors influencing the formation of financial support for the implementation of innovative circular projects are useful (Kucher, Kucher, Morozova and Pashchenko 2022). This is especially important because agriculture is a leading sector of the Ukraine's economy and produces significant amount of waste. Scientists found that the potential volume of biogas production from agricultural waste can replace 36.1% of natural gas consumption in Ukraine (Tokarchuk, Pryshliak, Shynkovych and Mazur 2021). Similar studies should be conducted for other branches of the economy.

Conclusions

The results of the research show that in developed countries, where approximately 16% of the world's population lives, more than 2 times more solid waste per capita than one Ukrainian, but more than half of this waste is subject to recycling and composting. Besides, the damage to the nature of Ukraine from the armed aggression of russia in six months reached 395 billion UAH.

A comparative analysis of EU and Ukrainian environmental legislation shows the leniency of administrative penalties and fines in Ukraine, as well as the low level of environmental fees, which, in turn, does not encourage producers to move to more expensive principles of circular production on the one hand and does not protect against violation of the government's proposed restrictions on liability for manufactured products at the end of its use on the other hand. All this indicates the need to strengthen environmental legislation in Ukraine to further transform the linear model of the economy into a circular one, as the development of the latter in Ukraine can solve not only the accumulated environmental problems associated with inefficient spending and waste management, but also positive socio-economic effects.

In addition to gaps in environmental legislation, the formation of a circular economy in Ukraine is hampered by economic and technological barriers, expressed in the absence of innovative processing technologies and processes related to environmental product design, as well as low investment activity of

Ukrainian business in creating closed supply chains and the inefficiency of the institutional environment. While in the EU the government and non-governmental organizations, business representatives and scientists are actively involved in shaping the institutional environment for the development of the circular economy, in Ukraine even research activity in the development of circular economy is low and the high level of waste disposal indicates the predominance of linear models of production and consumption. The given recommendation will help to reduce the projected volume of garbage discharged annually in Ukraine by 2030 should to 30%, while now it is 95%.

The originality of this scientific research consists in the fact that using the Circular Economy Index, the correlation between the circular economy of Ukraine and other countries of the world was determined. It has been established that due to the Russian invasion of Ukraine, which causes significant losses to the environment and critical infrastructure, as well as due to the critical shortage of resources in a war, it is necessary to develop a targeted comprehensive program for solid waste management, which should be a long-term concept of solid waste management, which is an alternative to some separate options for waste disposal.

The main results of the research can be used to develop a circular economy in the post-war period in Ukraine to quickly restore critical infrastructure and eliminate damage to the environment of Ukraine due to the invasion of the Russian Federation. Accordingly, the systems of strategic ecological and economic modeling of solid waste management, which will allow to comprehensively analyze possible directions of development, should be constructed. It should provide for different collection methods, processing technologies, processing capacity and spatial distribution of anthropogenic pressure on the environment, which will ultimately contribute to sound decisions on the organization of this system aimed at achieving sustainable development of the country and its regions.

In the context of the prospects for further research, it should be noted that the Ukrainian practice uses an extremely narrow range of methods and tools for regulating the management of solid household waste. The application of modern methods of environmental and economic analysis is restrained due to the inaccessibility or lack of data collection on the waste management system, the most valuable ecosystems, etc. Accordingly, in the future it is advisable to create systems of strategic ecological and economic modeling of solid household waste management, which will allow to comprehensively analyze possible directions of development of circular economy in the post-war period. At the same time, various methods of collecting solid household waste, processing technologies, building processing capacities and spatial distribution of anthropogenic load on the environment should be provided, which will ultimately contribute to making informed decisions on the organization of this system aimed at achieving sustainable development of the country and its regions.

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References

- [1] Bocken, N. M. P., de Pauw, I., Bakker, C., and van der Grinten, B. 2016. Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, 33(5): 308–320. DOI:<https://doi.org/10.1080/21681015.2016.1172124>
- [2] Khmivska, A. and Voitko, S. 2021. Formation of the Circular Economy Index for comparative analysis of the European countries transition to the circular economy. *Economy and society*, 32: 1–6. DOI:<https://doi.org/10.32782/2524-0072/2021-32-58>
- [3] Korhonen, J., Honkasalo, A. and Seppälä, J. 2018. Circular economy: the concept and its limitations. *Ecological Economics*, 143: 37–46. DOI: <https://doi.org/10.1016/j.ecolecon.2017.06.041>
- [4] Kucher, L., Kucher, A., Morozova, H. and Pashchenko, Yu. 2022. Development of circular agricultural economy: potential sources of financing innovative projects. *Agricultural and Resource Economics*, 8(2): 206–227. DOI: <https://doi.org/10.51599/are.2022.08.02.11>
- [5] Maldonado-Guzmán, G., Garza-Reyes, J. A., and Pinzón-Castro, Y. 2020. Eco-innovation and the circular economy in the automotive industry. *Benchmarking*, 28: 621–635. DOI: <https://doi.org/10.1108/bij-06-2020-0317>
- [6] Mishra, S., Jain, S., and Malhotra, G. 2020. The anatomy of circular economy transition in the fashion industry. *Social Responsibility Journal*, 17(4): 524–542. DOI: <https://doi.org/10.1108/SRJ-06-2019-0216>

- [7] Morselli, A., Arsini, V., Di Vincenzo, A. 2021. Behavioural Analysis of Stakeholders towards Socio-Economic Change: The Energy Transition Journey in the Area of Gela. *Theoretical and Practical Research in the Economic Fields*, Volume 12, Issue 2(24). DOI: [https://doi.org/10.14505/tpref.v12.2\(24\).04](https://doi.org/10.14505/tpref.v12.2(24).04).
- [8] Rattalino, F. 2018. Circular advantage anyone? Sustainability-driven innovation and circularity at Patagonia, Inc. *Thunderbird International Business Review*, 60(5): 747–755. <https://doi.org/10.1002/tie.21917>
- [9] Reike, D., Vermeulen, W. J. V., and Witjes, S. 2018. The circular economy: new or Refurbished as CE 3.0? – exploring controversies in the conceptualization of the circular economy through a focus on history and resource value retention options. *Resources, Conservation and Recycling*, 135: 246–264. DOI:<https://doi.org/10.1016/j.resconrec.2017.08.027>
- [10] Shao, J., Huang, S., Lemus-Aguilar, I. and Ünal, E. 2020. Circular business models generation for automobile remanufacturing industry in China: barriers and opportunities. *Journal of Manufacturing Technology Management*, 31(3): 542– 571. DOI: <https://doi.org/10.1108/JMTM-02-2019-0076>
- [11] Skene, K. R. 2018. Circles, spirals, pyramids and cubes: why the circular economy cannot work. *Sustainability Science*, 13: 479–492. DOI: <https://doi.org/10.1007/s11625-017-0443-3>
- [12] Stein, N., Spinler, S., Vanthournout, H. and Blass, V. 2020. Consumer perception of online attributes in circular economy activities. *Sustainability*, 12: 1914. DOI: <https://doi.org/10.3390/su12051914>
- [13] Suchek, N., et al. 2021. Innovation and the circular economy: a systematic literature review. *Business Strategy and the Environment*, 30(8): 3686-3702. DOI: <https://doi.org/10.1002/bse.2834>
- [14] Tokarchuk, D., Pryshliak, N., Shynkovych, A., and Mazur, K. 2021. Strategic potential of agricultural waste as a feedstock for biofuels production in Ukraine. *Rural Sustainability Research*, 46(341): 1–12. DOI:<https://doi.org/10.2478/plua-2021-0012>
- [15] Tokarchuk, D., Pryshliak, N., Yaremchuk, N., and Berezyuk, S. 2023. Sorting, logistics and secondary use of solid household waste in Ukraine on the way to European integration. *Ecological Engineering and Environmental Technology*, 24(1): 207–220. DOI: <https://doi.org/10.12912/27197050/154995>
- [16] Ünal, E., and Shao, J. 2019. A taxonomy of circular economy implementation strategies for manufacturing firms: analysis of 391 cradle-to-cradle products. *Journal of Cleaner Production*, 212: 754–765. DOI:<https://doi.org/10.1016/j.jclepro.2018.11.291>
- [17] Velenturf, A. P. M. and Purnell, P. 2021. Principles for a sustainable circular economy. *Sustainable Production and Consumption*, 27: 1437–1457. DOI: <https://doi.org/10.1016/j.spc.2021.02.018>
- [18] Verbeek, L. 2016. A Circular Economy Index for the consumer goods sector. Master Thesis. Utrecht University, Netherlands. Available at: <https://studenttheses.uu.nl/handle/20.500.12932/23729>
- [19] Viles, E., et al. 2022. Theorizing the principles of sustainable production in the context of circular economy and industry 4.0. *Sustainable Production and Consumption*, 33: 1043–1058. DOI:<https://doi.org/10.1016/j.spc.2022.08.024>
- [20] Völker, T., Kovacic, Z. and Strand, R. (2020). Indicator development as a site of collective imagination? The case of European Commission policies on the circular economy. *Culture and Organization*, 26(2): 103–120. DOI: <https://doi.org/10.1080/14759551.2019.1699092>
- [21] *** Circular Economy – Made for Circular Economy (2022). Available at: <https://circlesolutions.com>
- [22] *** New EU policy on "circular economy" (2022). Available at: https://dixigroup.org/wp-content/uploads/2020/09/dixi_pb_circular-economy_ukr_full_3.pdf
- [23] *** OECD statistics (2022). Available at: <https://stats.oecd.org>
- [24] *** State Statistics Service of Ukraine (2022). Available at: <http://www.ukrstat.gov.ua>
- [25] *** UNECE (2022). Circular economy. Available at: <https://unece.org/circular-economy-0>

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