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СУЧАСНИЙ СТАН РОЗВИТКУ ЦИРКУЛЯРНОЇ ЕКОНОМІКИ В УКРАЇНІ THE CURRENT STATE OF CIRCULAR ECONOMY DEVELOPMENT IN UKRAINE

***Анотація** Метою статті є дослідження сучасного стану розвитку циркулярної економіки в Україні. Вивчено стан поводження з відходами в Україні. Проаналізовано показники розвитку сфери охорони навколишнього природного середовища в Україні. Статистичний аналіз засвідчив необхідність реалізації принципів та інструментів циркулярної економіки як концепції сталого розвитку національної логістичної системи в Україні. Доведено, що трансформація виробничих екосистем може надати підприємствам різноманітні конкурентні переваги.*

***Abstract.** The purpose of the article is to study the current state of circular economy development in Ukraine. Currently, the Ukrainian economy functions mainly within the linear economic model, but has already started implementing green economy initiatives, which in particular includes the approaches and goals of the circular economy. The state of waste management in Ukraine was studied, which is divided into three categories of operations: utilization, incineration and removal to specially designated places and objects. In the structure of the total volume of waste by categories of management during the entire analyzed period, disposal in specially designated places and objects takes the largest share. This method of waste management includes burying in the ground or dumping (dumping) on the ground, dumping in specially equipped landfills (in landfills), burying waste in special containers in a mine, etc., that is, it is a common tool of waste management under the linear model. The financial and economic indicators of the development of the sphere of environmental protection in Ukraine are analyzed. The analysis of statistical data shows that the "green" transformation of the national logistics system of Ukraine in the conditions of the circular economy is not effective enough. The*

statistical analysis proved the need to implement the principles and tools of the circular economy as a concept of sustainable development of the national logistics system in Ukraine. It has been proven that the transformation of production ecosystems can provide enterprises with various competitive advantages. Among the most common strategic advantages are differentiation and cost leadership. However, we argue that the main benefit of ecosystem transformation is to enhance the ability of ecosystems to achieve good triple bottom line outcomes by providing clients with social, financial and environmental benefits. It is worth taking into account the best experience of Finland, which effectively implements practical solutions of the closed cycle economy. The essence of the transition is to rethink value chains and develop new business models.

Key words: *circular economy, waste management, environmental protection, recycling, ecosystem transformation, disposal, amount of accumulated waste, investments*

Ключові слова: *циркулярна економіка, поводження з відходами, охорона навколишнього природного середовища, рециклінг, трансформація екосистем, утилізація, обсяг накопичених відходів, інвестиції*

Statement of the problem. As of today, Ukraine has already started implementing green economy initiatives, which in particular includes the approaches and goals of the circular economy. The key drivers of this process were the signing of the Association Agreement between Ukraine and the EU, the implementation of sustainable development goals at the national level, the ratification of the 2015 Paris Climate Agreement, and joining the UNIDO Green Industry Platform. The provisions of the above documents and agreements were implemented by the Cabinet of Ministers of Ukraine in 2017 in the National Waste Management Strategy in Ukraine until 2030 and in 2019 in the National Waste Management Plan until 2030. However, the issue of circular economy is reflected in these documents rather superficially. They provide general measures for the development of waste management infrastructure; creation of

an information system that includes data on waste volumes and waste management operations; the adoption of laws and by-laws establishing requirements, procedures and rules, as well as the creation of a central executive body that will resolve issues of waste management, implementation of technical regulations and standards of relevant processes [1; 2].

Analysis of the latest research and publication. The theoretical aspects of the circular economy as a new paradigm of sustainable development in the modern globalized world have attracted the attention of many scientists and practitioners since the second half of the 20th century, in particular, this topic was studied by the following scientists: Ellen MacArthur, A.Müller, H. Wilts, D. Carrez, P. Van Leeuwen, M. Heisdorfer, P. Savage, N.Boken, S. Short, T. Kojvisto, E. Gultinck, W.Haas, F.Krausman, D. Wiedenhofer, M. Hynes, N. Millar, E. McLaughlin, T.Berger, Z.Yuan, J. Bi,

Y. Moriguichi, A Babak, A.Tarantsova, D. Sergienko, I.Zvarych, R.Zvarych and others.

Purpose of the article is to study the current state of development of the circular economy in Ukraine.

Results. Ukraine has not yet adopted relevant laws on waste management that would comply with EU directives on the management of used batteries, accumulators, electrical and electronic equipment waste, and petroleum waste. There are also no clear rules and laws regarding waste disposal, handling of mining waste, decommissioning of vehicles. Existing regional environmental programs provide for the construction of new landfills, which is contrary to the principles of the circular economy. Another systemic flaw is the lack of focus on the formation of a public institution of the environmental reputation of enterprises, as well as an assessment of the regulatory impact of regional environmental factors [3].

Incineration occupies an insignificant share in the overall structure of waste management during 2016-2020 in Ukraine. Waste incineration often releases chemicals harmful to humans and the environment into the atmosphere, and the energy from the incineration process is not used in any way. Therefore, this method of waste management cannot be called circular. Another category of waste management in Ukraine is waste disposal.

According to the data of the State Statistics Service of Ukraine waste disposal operations include:

a) use of waste in the form of fuel (except for direct burning) or in another way to obtain energy;

b) utilization / regeneration of solvents and other organic substances;

c) composting and fermentation of organic waste;

d) processing of paper and cardboard;

e) recycling / disposal of metals, their compounds and other inorganic materials;

e) recovery of components (return of part of materials for reuse) used to reduce pollution, as well as catalyst components;

e) re-distillation of used petroleum products or their other reuse;

g) soil treatment that has a positive effect on agriculture or improves the ecological situation;

g) waste sorting;

h) mechanical and biological processing of waste;

i) disassembly of unusable vehicles; collection and preliminary processing of scrap metal and waste containing metals.

The annual amount of new waste generation increased by almost 56.3% from 295.9 million tons in 2016 to 462.4 million tons in 2020, while the share of annually disposed waste remained almost at the same level during the analyzed period, and in 2019 and 2020 decreased compared to 2016 by 4.2 pp and 6.9 pp, respectively.

The above indicators signal a gradual increase in the volume of unprocessed waste, which is reflected by the data of the State Statistics Service of Ukraine.

The total volume of accumulated waste during the period 2016-2020 increased by 26.2%, namely by 3241.3 million tons. The total amount of accumulated waste in Ukraine in 2020 was equal to 15,635.3 million tons,

which in terms of per person is 373.1 thousand tons of waste per person - 83.3 thousand tons more than in 2016.

The analysis of statistical data shows that the "green" transformation of the national logistics system of Ukraine in the conditions of the circular economy is not effective enough. Thus, according to the data of the Ministry of Finance of Ukraine, the specific weight of budget expenditures on

environmental protection (EP) is insignificant and in 2019 was only 0.7% of the total volume of state budget expenditures. This, in turn, does not correspond to the Sustainable Development Goals of 2016-2030. The share of total costs for environmental protection in the total volume of GDP is insignificant and amounted to 4.2% in 2019 (table 1).

Table 1 Financial and economic indicators of the development of the sphere of environmental protection in Ukraine

Years	GDP at constant prices of 2010, UAH million	Aggregate costs for EP		Budget expenditures for the EP	
		million hryvnias	specific weight in the volume of GDP, %	million hryvnias	specific weight in the total volume of budget expenditures, %
2010	1079346,0	13128,1	1,2	2872,4	0,8
2011	1138338,0	18490,4	1,6	3890,7	0,9
2012	1141055,0	20514,0	1,8	5297,9	1,1
2013	1140750,0	20377,9	1,8	5594,2	1,1
2014	1066001,0	21925,6	2,1	3481,7	0,7
2015	961821,0	24591,1	2,6	5529,7	0,8
2016	985299,0	32488,7	3,3	6255,4	0,7
2017	1010173,0	31492,0	3,1	7349,3	0,7
2018	1043272,0	34392,3	3,3	8242,1	0,7
2019	1037299,1	43735,9	4,2	9731,1	0,7

Source: compiled according to data [5]

The specific weight of the total costs of EP in the field of transport and warehousing decreased for 2012-2019 by 4.3 percentage points, or from 6.2 to 1.9% of the total volume of total costs of EP. During this period, there was a tendency to reduce the share of capital investments in the development of the transport and warehousing sector by 51 percentage points. or from 58.8 to 7.8% of the total volume of aggregate expenditures for the EP in this area. The

specific weight of current expenses for EP in the field of transport and warehousing, respectively, increased by 51 percentage points. or from 41.2 to 92.2% of the total volume of aggregate costs for the EP in this type of economic activity.

The share of current expenditures on public transport and warehousing in the field of transport and warehousing decreased by 1.2 percentage points in 2012-2019 or from

3.7 to 2.7% of the total volume of current costs for environmental protection. The specific weight of expenses for the protection of atmospheric air and climate in the field of transport and warehousing decreased by 1.6 percentage points, or from 2.4 to 0.8% of the total volume of these costs for all types of economic activity. At the same time, the specific weight of expenses for the protection of atmospheric air and climate in the field of transport and warehousing decreased by 3.1% in the total volume of current expenses for EP in this area, or from 6.1 to 3%.

In 2012-2019, the specific weight of capital investments for environmental protection in the field of transport and warehousing decreased

by 10.9 percentage points, or from 11.3 to 0.4% of the total volume of capital investments in the EP for all types of economic activity.

During the researched period, the specific weight of investments in equipment and installations related to ecologically clean technologies in the field of transport and warehousing decreased by 18.2 percentage points, or 21.7 to 3.5% of the total volume of these investments. The share of investments in complex technologies for the protection of atmospheric air and climate in the field of transport and warehousing decreased by 22.8 percentage points, or 44.2 to 21.4% of the total volume of relevant investments (table 2).

Table 2 Dynamics of investments in equipment and installations, which is connected with complex ecologically clean technologies

Years	Total volume, million hryvnias	Including in the field of transport and warehousing		Among them are investments for atmospheric air and climate protection, million hryvnias	Including in the field of transport and warehousing	
		million hryvnias	share, %		million hryvnias	share, %
2012	3714,8	806,6	21,7	1112,2	491,5	44,2
2013	3233,9	191,7	5,9	1094,2	142,7	13,0
2014	4638,2	70,8	1,5	428,5	11,0	2,6
2015	4952,2	49,2	1,0	436,0	10,0	2,3
2016	7783,7	82,0	1,1	528,9	25,4	4,8
2017	4183,4	47,5	1,1	300,1	12,0	4,0
2018	3519,4	125,7	3,6	514,1	114,0	22,2
2019	3519,4	121,9	3,5	514,1	110,2	21,4

Source: compiled according to data [6, p. 134]

During the period 2010-2019, the volume of emissions of pollutants into the atmosphere from mobile sources of pollution decreased by

35.2%, and their specific weight in the total volume of emissions of pollutants increased by 1.9 percentage points (table 3).

Table 3 Volumes of pollutant emissions into atmospheric air from mobile sources of pollution

Years	Total volume, thousand tons	Including mobile sources of pollution, thousand t	Specific gravity in the total volume of pollutant emissions, %
2010	6678,0	2546,4	38,1
2012	6821,1	2485,8	36,4
2013	6719,8	2424,7	36,1
2014	5346,2	1996,2	37,3
2015	4521,3	1663,9	36,8
2016	4236,0	1608,5	38,0
2017	3968,7	1645,7	41,5
2018	4043,9	1612,9	39,9
2019	4119,0	1648,8	40,0

Source: compiled according to data [5, pp. 26, 28]

As the analysis shows, the total volume of emissions into the atmospheric air from road transport decreased by 28.3% in 2010-2019, or from 2313.8 to 1659.5 thousand tons. The volume of emissions of carbon dioxide into the atmospheric air from road transport increased by 13.4% or from 1782.7 to 2021.1 thousand tons [5, pp. 26, 28]. In Ukraine, there is a negative trend in the development of the waste recycling system. Thus, according to the State Statistics Service of Ukraine, the amount of generated waste increased in 2019 compared to 2010 by 4.5%. At the same time, the total amount of waste accumulated during operation in specially designated places and facilities increased by 16.5%. At the same time, the volume of disposed waste decreased by 25.5%, and the volume of waste removed to specially designated places and facilities decreased by 23.3%. The share of recycled waste in the total amount of generated waste decreased for 2010-2019 by 9.8 percentage points or from 34.3 to 24.5% (table 4).

So, the statistical analysis indicates the need to implement the

principles and tools of the circular economy as a concept of sustainable development of the national logistics system in Ukraine.

A circular economy investment strategy from a macroeconomic point of view can lead to a 10% reduction in the cost of raw materials and a 7% increase in GDP in the European Union in 2030 compared to the usual business model [7]. However, such a leap in development undoubtedly requires strategies that are focused on the specific potential of the economy, as well as the corresponding infrastructure and administrative capacities. An important long-term opportunity for a circular economy is the reduction of direct and indirect environmental costs. Direct costs associated with waste management. However, indirect costs of using natural resources are also relevant. On a global scale, according to the estimates of the international group of experts on resources within the framework of the UN Environment Program, these costs are up to 2.4 trillion dollars. USA [8]. In addition, it should be emphasized that the development of the circular economy

contributes to obtaining a social effect due to the creation of jobs. According to the study of the European Commission [9], depending on how waste is treated, a different number of jobs can be created: one job can be

created for 10,000 tons of used products during incineration, six jobs during burial, 36 of jobs - during waste recycling and up to 296 jobs during their recovery and reuse.

Table 4 Dynamics of indicators that characterize the development of the system of waste recycling in Ukraine

Years	The amount of generated waste, million tons	Volume of disposed waste, million tons	Volume of waste removed to specially designated places and objects, million tons	The total amount of waste accumulated during operation in specially designated places and facilities, million tons
2010	422,5	144,9	311,6	13219,9
2011	443,8	153,4	251,4	14372,1
2012	446,7	143,1	263,6	14856,6
2013	445,3	146,7	264,7	15111,6
2014	355,0	109,3	203,7	12205,4
2015	312,3	92,5	152,3	12505,9
2016	295,9	84,6	157,4	12393,9
2017	366,1	100,1	169,8	12442,2
2018	352,3	103,7	169,5	12972,4
2019	441,5	108,0	238,9	15398,6

Source: compiled according to the data of the "Environment" section of the official website of the State Statistics Service of Ukraine

It is worth taking into account the best experience of Finland, which effectively implements practical solutions of the closed cycle economy. The essence of the transition is to rethink value chains and develop new business models. Currently, there are several solutions developed by specialists of the Finnish innovation fund Sitra, which help accelerate the transition to a circular economy [10]. These include:

- "product-service" systems and sharing models;
- methods of value attitude to the field of nutrition;
- sustainable delivery models;
- roadmaps for carbon-neutral industries (important for the future

development of Finland's industry; for example, an investment of EUR 300 million in a battery cluster, as well as the first multifunctional textile recycling center in Northern Europe that allows processing 10% of textile waste; for due to resource efficiency and recycling Betolar creates value by transforming waste from the construction industry into concrete-like building materials with up to 90% less carbon footprint than conventional concrete); circular economy education.

Conclusions. Thus, the transformation of production ecosystems can provide enterprises with various competitive advantages. Among the most common strategic advantages are differentiation and cost

leadership. However, we argue that the main benefit of ecosystem transformation is to enhance the ability of ecosystems to achieve good triple

bottom line outcomes by providing clients with social, financial and environmental benefits.

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