

[https://doi.org/10.31891/2307-5740-2022-312-6\(1\)-30](https://doi.org/10.31891/2307-5740-2022-312-6(1)-30)

UDC 33.332.338

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CIRCULAR ECONOMY – THE FUTURE OF SUSTAINABLE DEVELOPMENT

The work is devoted to the analysis of the main principles and approaches to the introduction of the circular economy concept at the state level. The article contains both the theoretical foundations of the introduction of the circular economy, the conceptual apparatus and the analysis of practical cases of the successful introduction of the principles in the global space. In addition, the main problems that may stand in the way of the successful implementation of the circular economy at the state level are outlined. The paper considers the main aspects of the introduction of the concept of circular economy at the state and regional levels. The conceptual apparatus of the circular economy is presented and illustrated, the differences and advantages in comparison with the generally accepted system of the linear economy are noted. Also, the structure of the circular economy at the micro, macro, and meso levels is considered in detail in the work, the key aspects of implementation in the spheres of production, consumption, waste management, and development support are noted. Considerable attention was paid in the study to the tools for the introduction of the circular economy both at the state and regional levels and at the level of other subjects of economic activity. The circular economy toolkit proposed for analysis was considered both in terms of the economic effect of its introduction, and from the point of view of the presence of a certain number of problems for each of the tools. The identified problems on the way to successful application of circular economy tools outlined the vector of further research in this direction with the aim of accelerating the transformation processes of the transition from a linear to a circular form of economy.

Keywords: circular economy, green economy, linear economy, green economy, circular economy implementation levels, circular economy tools.

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ЦИРКУЛЯРНА ЕКОНОМІКА – МАЙБУТНЄ СТІЙКОГО РОЗВИТКУ

Робота присвячена аналізу основних принципів та підходів запровадження концепції циркулярної економіки на державному рівні. Стаття містить як теоретичні основи запровадження циркулярної економіки, понятійний апарат, так і аналіз практичних кейсів успішного запровадження принципів в світовому просторі. Крім того, окреслено основні проблеми, які можуть стати на заваді успішного запровадження циркулярної економіки на державному рівні.

Ключові слова: циркулярна економіка, зелена економіка, лінійна економіка, зелена економіка, рівні запровадження циркулярної економіки, інструменти циркулярної економіки.

Introduction

The need for rapid development of the Ukrainian economy was and remains a priority issue. For more than a decade, Ukraine has been striving to catch up with the leading European countries in terms of GDP per capita, strives to provide Ukrainians with jobs with an appropriate level of wages, strives to develop light and heavy industry, agriculture. Along with this, the state strives for the formation of a healthy nation that will breathe clean air and drink the cleanest water. Is it possible to combine all these components to ensure both the rapid development of the country's economy and the preservation of natural resources and the improvement of environmental conditions. Yes, there is such a way, and it is called the circular economy. The trend of the state's economic development, which is based on the principles of circular economy, has been moving confidently through European countries for a long time and is slowly but surely beginning to gain a foothold in Ukraine. Reformatting the Ukrainian economy from linear to circular will have a significant number of advantages, including the creation of new market niches, for example, processing, service, industrial design, as well as the development and introduction of new business models. Along with this, it will be extremely necessary to develop a state incentive program, introduce technological innovations and attract investments. The benefits of introducing a circular economy for both the state and society cannot be overestimated, including general renewal and improvement of the economy, energy and resource conservation, reduction of unemployment through the creation of new jobs, reduction of carbon emissions and general improvement of the environmental situation.

So, we see that the issue of the transition to a circular economy is very relevant in terms of the development of our country both at the national and regional levels. And this indicates the need for active involvement of scientists in conducting research in this direction.

Analysis of recent research and publications. Many foreign and Ukrainian scientists are dealing with the issue of introducing a circular economy within the country. Among the scientists of the foreign arena, the works of Boken N., Olivetti E.A., Ghisellini P., Fletcher K. and others can be singled out [1-7]. Domestic research - presented by such scientists as S. Miroshnychenko, A.A. Tovstenko, N.L. Avramenko, K.M. Barytska and others [8-11].

The topic of research in the direction of the circular economy is immersed in such issues as social and economic consequences, problems and prospects of the introduction of the circular economy. But, despite the sufficient amount of research in this direction, the topic is so acute and new that the available amount of research has not formed the final concept of the transition to a circular economy both at the level of the state and regions in particular, and therefore the initiation of further research in this direction remains relevant.

The purpose of this paper is to determine the prerequisites for the introduction of the concept of circular economy at the state and regional levels, to identify a number of problems that may stand in the way of a successful transition to a circular economy, and to outline further prospects in this direction.

Experimental part

The circular economy (circular economy, closed-loop economy, circular economy) is an alternative to the classical linear economy based on the principle of "production - use - disposal". In a linear economy, most of the extracted natural resources turn into waste.

In a circular economy, the chain "resource extraction - production - consumption - disposal" is closed in a continuous cycle in which waste serves as a renewable resource for production. The repeated use of the same raw material reduces environmental damage and reduces waste generation by up to 80%.

Circular Economy Principles

1. Producing durable and reliable products, moving away from "planned obsolescence" where a short-lived product is created to encourage new purchases that quickly breaks down, goes out of fashion, or loses manufacturer support.

2. Possibility of repair. Things can be repaired and used for as long as possible without buying new ones, although the "fast" economy has taught us to throw away what is broken.

3. Reuse. Many goods can serve repeatedly.

4. Modernization and updating. Many technical devices can be replaced with new ones not completely, but partially, updating certain parts, for example, in order to increase energy efficiency.

5. Recycling and reuse. Most of the waste, including packaging waste, can be recycled and returned to the production cycle. Secondary raw materials are more accessible, save natural resources and reduce carbon dioxide emissions.

6. Sharing, renting and sharing.

7. Virtualization of goods and services (reduces the consumption of resources for production).

According to research by the Ellen MacArthur Foundation, on a global scale, the transition to a circular economy will:

- Reduce energy and resource consumption by 25%;
- Replace 50% of primary resources with secondary ones;
- Double the life of your products.

Based on the principles of the circular economy, both state programs for the separate collection and processing of waste, and programs of private companies, for example, for the use of their own production as recyclable materials, are built.

Where did the circular economy come from and how is it developing?

The foundations of this concept were formulated by the American economist and sociologist Kenneth Boulding in 1966 in his essay "The Economics of the Future Spaceship Earth". True, he called his theory "open economy", and the term "cyclical" appeared later, in the works of Western economists in the 1970s and 80s.

Over the past decades, interest in the circular economy has grown markedly against the backdrop of oil crises, the depletion of easily accessible natural resources and environmental pollution.

Today, the approaches of the circular economy are actively used by both businesses around the world and governments, most systematically in Europe, due to which by 2030 the total annual income of their countries will increase by €1.8 trillion.

The achievement of many of the Sustainable Development Goals adopted by the UN in 2015 depends on the introduction of circular economy approaches, especially "Responsible consumption and production", "Affordable and clean energy", "Sustainable cities and towns", "Combating climate change", "Conservation of marine and terrestrial ecosystems".

Criticism of the cyclical model of the economy

The current industrial economy is largely based on a linear model of resource consumption, which follows the principle of "withdraw - produce - throw away". As a result, the industry-based economy loses significant value and has a negative impact along the entire value chain. It is clear that there is an urgent need for a new industrial model that would reduce dependence on primary energy sources and inputs and help restore natural capital. The desire for significant improvements in resource efficiency across the economy is forcing businesses to look for ways to reuse products or their components and recover more of the material, energy and labor inputs. The concept of the circular economy has been recognized as an effective solution, and since the late 1970s it has become increasingly popular.

Unlike the traditional linear model of production and consumption, in which goods are made from raw materials, sold, used, and then discarded or incinerated as waste, the cyclical economy implies no waste and promotes the continuous use of resources. The Ellen MacArthur Foundation defines a circular economy as "an industrial system that is restorative or regenerative in design and structure". It replaces the concept of "end of life" with the concept of recovery and transition to renewable energy sources, eliminates the use of toxic chemicals that prevent recycling, and aims to eliminate waste through improved design of materials, products, systems and, in light of the above business-models 1.

The concept of "circular economy" can be broadly interpreted as a system in which the value of goods, materials and resources is maintained in the economic cycle for as long as possible. This model offers a profitable opportunity to move away from resource-intensive processes, increase the return on existing assets, and create new revenue streams, thus making production and consumption processes more sustainable and competitive. The ultimate goal is to delink global economic development from the consumption of scarce resources.

The circular economy is based on the following backgrounds:

a) Preserving and improving natural capital by managing scarce reserves and balancing renewable flows. The use of appropriate technologies and processes allows, wherever possible, to use renewable sources or resources with a higher rate of return, for example, replacing fossil fuels with renewable energy sources;

b) optimization of resource productivity by introducing goods, components and materials into both technical and biological cycles with maximum impact at all stages of such cycles. This is expressed in the fact that the development of products provides for the possibility of its re-production,

With all the obvious advantages of the cyclical economy, of course, it also has disadvantages:

- Increasing the production of biological materials will lead to changes in land cover, and this will put additional pressure on the planet's ecosystem and biodiversity;

- Uncontrolled recycling and recycling of materials on a massive scale will make people more vulnerable to the toxic substances contained in these raw materials;

- The principle of sharing can lead people to deliberately abandon environmentally friendly behavior (for example, traveling by private car will become more popular than using public transport). In addition, with the money saved thanks to this method, citizens are intensively beginning to purchase and consume new products.

However, it should be emphasized that it is not correct to understand the circular economy only as the disposal of waste. This concept includes many more key aspects that consist of a certain number of radical changes in the very mechanism of economic processes. This includes changes in the choice of raw materials in favor of more ecological, recyclable ones; these are also changes in the methods of product development and the introduction of fundamentally new service concepts in which waste from one production becomes a full-fledged primary raw material for another. From an economic point of view, the approach of cyclic movement from waste to raw materials, which is based on the principle of circular economy, solves not only environmental issues, but also such acute economic problems as a constant shortage of natural resources and too high prices for raw materials, reducing the dependence of the country as a whole on imported raw materials and materials. All this could be observed very clearly in recent times during the quarantine, when the borders were closed and many domestic industries were forced to stop their activities. That is, we can come to the conclusion that the concept of circular economy is now more relevant than ever, because with this form of economy, supply and sales chains are most often located within the borders of one country. With this form of economy, regions become key nodes of supply, sales and processing chains. Circular economy is something that should be emphasized and strived for at all levels, from state to regional.

Level approaches to the concept of the circular economy allow for a more detailed understanding of the chains of interaction. Thus, the figure presents the circular economy algorithm at the micro, macro, meso, and mega levels in the areas of production, consumption, waste management, and development support.

Yes, the transition from the widespread and familiar concept of the classical economy to the circular one is not easy and long-term. According to the 2019 global report on the circular economy The circularity Gap report [15], which was presented at the economic forum in Davos, only 9% of materials in the world are used as recycled raw materials. Indeed, this is too small a number for humanity to experience all the positive consequences of the transition to the circular economy, but still, we have a certain number of powerful global companies that have already put the principles of the circular economy at the core of their activities, and the number of such examples are increasing every year.

In modern conditions of state development, when there is a comprehensive limitation of resources under quarantine conditions, the formation of a regional network of interaction of industrial sectors of the economy as a basis for building a new, more effective circular economy becomes an important issue. However, in order for the region, which chose the circular economy as the vector of its development, it is necessary to start introducing the 7 main tools of the circular economy. These tools have their own specific features and possible implementation problems.

The potential of the circular economy

It is often coming across the opinion that the circular economy is unprofitable: it is difficult for people to imagine that a decrease in production can be an advantage for producers, consumers and the economy as a whole. That is why it is so important to assess the business potential of the circular economy.

In 2014, at the World Economic Forum, the Ellen MacArthur Foundation and the consulting company McKinsey & Company presented a report stating that the production cycle could bring the world economy one trillion dollars a year by 2025 and create 100,000 new jobs over the next five years, saving \$500 million on materials and preventing 100 million tons of waste.

To demonstrate the benefits of the circular economy, the Sitra Foundation is partnering with the world's leading think tanks, including the Ellen MacArthur Foundation. Thus, the annual business potential of the circular economy in Finland is estimated at 2-3 billion euros by 2030 (Sitra & McKinsey, 2015. The opportunities of a circular economy for Finland). Net profit for Europe by 2030 could amount to 1.8 trillion dollars, and savings for EU enterprises - 600 billion euros (European Commission, 2015. Circular economy package).

And although material gain is a good incentive, it is even better to look at companies that are already operating on the principles of a circular economy today. The Sitra Foundation has compiled a list of the most interesting Finnish companies in the circular economy to inspire the rest of the market. There are 100 companies on the list, but I will talk about four.

Vegetable fuel Neste

You have probably heard of the Finnish oil refinery Neste. Have you heard that Neste receives 50% of its profits from the sale of fuels based on vegetable oils and food waste? And this despite the fact that back in 2007 the company used only fossil fuels. Today, almost 80% of the raw materials in Neste's renewable diesel fuel are vegetable oils and food waste, making Neste one of the world's largest producers of diesel fuel from food industry waste. By the way, carbon dioxide emissions from the production of fuel from vegetable oils and food waste are two times lower.

Mobility without a personal car with MaaS global

Studies show that consumers spend a lot of money on cars that end up being used inefficiently. This is the first problem. The second is harmful emissions. In Finland, cars account for more than 10% of greenhouse gas emissions.

Whim by MaaS Global offers an alternative way to get around the city and provides convenient access to various modes of transport for a monthly fee. Whim offers transport packages for Helsinki residents. For example, for 49 euros per month, a person receives: unlimited travel by public transport within the city; taxi (within a radius of 5 km) - 10 euros / trip (usually 14-17 euros); car rental 49 euros per day (usually 55 euros); city bike rental - unlimited up to 30 minutes.

Catering Lunchie&ResQ - cheaper and without waste

Restaurants generate a lot of food waste every day because they have a hard time predicting sales that change from day to day. The mobile technology used by Lunchie&ResQ offers a convenient way to sell leftover food and reduce waste. Everything works as follows. The user installs a mobile application and can use it to buy food from the restaurant (which would otherwise be thrown away) at a good discount. The restaurant publishes information about the remnants of dishes on a mobile platform, the user orders them and picks them up, say, on the way from work.

Valtra tractors with service

Valtra has recently been not only manufacturing tractors, but also servicing them. In particular, they have a gearbox restoration service. They take them in, take them apart, clean them, repair them, replace parts - as a result, energy and material savings reach up to 85%. A repaired box costs the tractor owner 60-70% cheaper than a new one, while the manufacturer's warranty is the same as for a new one.

The essence of the main tools of the circular economy, problems and prospects of implementation at the level of the region and the end consumer.

Design. This tool is based on the main principle of the circular economy - production based on recycled materials. At the beginning of the introduction of the circular economy concept at the regional level, there will be a problem of finding chains of transformation of waste into raw materials, but over time, when more and more industries will switch to the circular principle of production, the problem will be significantly minimized.

Sharing and virtualization. Ensuring the promotion of platforms for user interaction of a product or service, thereby improving the level of its use. Such a tool is interesting for producers who have a low level of product utilization or capacities that are not fully utilized. The tool also allows competitors to cooperate in order to share the load on fixed costs. But the problem of using this tool may not be the desire of large market players to share their resources with competitors, but a necessary change of ideological views in the direction of positive changes thanks to the application of circular economy principles.

Product as a service. The approach is an alternative to the ordinary model of selling a product or service. Such an instrument is an alternative to both the usual direct sale and leasing or renting, for example. With this approach, the client makes a so-called subscription with a fixed monthly or annual payment for the use of the product or service for the time he needs. The end consumer's trust in product quality on the one hand, and the manufacturer's responsibility for control over ensuring this quality on the other, can become a problem.

Reuse in production. According to this approach, certain parts and individual components of products, the use of which is no longer possible, are used for further production. In fact, a very large number of products produced

all over the world fail and are disposed of in the presence of parts and mechanisms that are not worn at all. The problem may be the need to establish processes for collecting used parts and mechanisms for further use in production. The need for innovative developments in the field of processing and secondary use of raw materials. The need for investments both for carrying out these innovative research and developments, and for the re-equipment of production facilities.

Industrial symbiosis and processing of production waste. The algorithm for using this circular economy tool consists in the interaction of companies with the aim of preserving natural resources and minimizing costs through the use of alternative sources of both energy and other components of production. With this approach, the production waste of one company becomes a source of main or additional income or a component of raw materials in the production of products. The problems of introducing this tool, both on the territory of Ukraine in general and in the regions in particular, include the still insufficient number of such industrial symbioses due to the fact that such interaction requires certain investments at the initial stage, possible modernization and the introduction of innovative developments. But those collaborations that already exist on the territory of our country testify to the indisputable effectiveness of such an approach.

Processing. Recycling is a classic, long-standing, and widely used tool not only in the circular, but also in the conventional form of economy. Recycling refers to the reuse of products that have turned into waste in the process of producing new ones.

Currently, most large state-owned companies are switching to the use of recycled products in the production of new ones. But among representatives of small businesses, the use of recycling is not so widespread. Therefore, the use of processed raw materials in production is currently the prerogative of only large companies. An obstacle to the involvement of small companies in this process may be the need for additional costs for the modernization of the production algorithm and the introduction of innovative developments that will allow the use of secondary raw materials in production. Currently, Ukraine has a draft law on waste management [16], the purpose of which is to stimulate the involvement of an increasing number of producers in the use of recycled raw materials.

Therefore, the tools for introducing the circular economy in Ukrainian conditions have several certain problems. Yes, we cannot now talk about the successful implementation of the circular economy at the state and regional levels, but this does not mean that we do not have strong impulses in this direction. In order to clearly illustrate the current state of circular economy development in Ukraine, we will consider practical examples of its application.

Conclusions

Summarizing the analysis of the application of circular economy tools in Ukraine, efficiency, and problems, it can be noted that:

- the transition to a circular economy should not take place at the level of a separate production or industry, it is a problem at the regional and state level, within the framework of which it is necessary to develop an appropriate strategy and regulation at the legislative level;
- the effect of introducing the concept of circular economy should include: significant saving of raw materials and materials; sustainable resource use; a significant boost in stimulating the introduction of innovative technologies; covering the needs of the population in certain types of products; overall growth of the economy and state revenues due to reuse and increased recycling.
- problems preventing the successful introduction of the circular economy concept in Ukraine may be: insufficient stimulation of the innovative sector; lack of investors; lack of incentives and initiatives from the state in the form of a lack of a licensing procedure, pricing, programs and strategies.

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