
Circular economy of the region: theoretical aspect

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Abstract. The economy of Ukraine's regions is based on a linear model of production and consumption. This does not allow saving resource potential. The socio-economic paradigm of the use of resources in the state, developed for their preservation and mutual renewal, is the circular economy. Currently, a lot of attention is focused around the circular economy, as a new socio-economic doctrine of increasing the efficiency of resource use. The purpose of the article is to study the tools for the implementation of the circular economy, to determine the requirements for the transformation of the current economic system to adapt the cyclical reuse of raw materials. The method of theoretical knowledge, generalization, analysis, synthesis, modeling was used in the research process. The article reveals the essence of the concept of "circular economy" and offers its own definition of this concept as a way of economic development, where the value of products, materials and resources is preserved as long as possible, and waste is significantly reduced or even eliminated. The implementation of the circular economy model, which is based on the R-principles of its implementation, is considered. Therefore, the regional circular economy puts forward a more rational approach in the context of resource management. However, it also requires mass systemic transformations in the regions. Important for the implementation of the circular economy is the creation of urgent management conditions, as well as economic factors. It is substantiated that the main areas of development of the circular economy of the region are construction, mobility and transportation, food, products and services. The advantages of implementing the circular economy of the region are outlined. The scientific value of the work lies in the improvement of the concept of circular economy by the method of its implementation in the economic structure of a specific industry

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INTRODUCTION

The circular economy is receiving more and more attention as a new socio-economic paradigm for optimizing the use of resources in the country. Today, cities, where people live, work, consume and dispose, play a fundamental role in the country's transition to a circular economy, as they are at the center of key decisions that determine economic growth, social well-being and environmental benefits. It is worth noting that it is based not only on the diverse management of resources and the introduction of innovative technologies in production, but also on the rational management of waste. At the same time, the economies of the regions are now locked in a system that favors a linear model of production and consumption. However, this fixation is weakening under the pressure of several powerful disruptive trends. We must take advantage of this favorable alignment of economic, technological and social factors to accelerate the transition to a circular economy. That is why the question of researching the essence of the "circular economy", defining its tools and models for the national economy is gaining relevance.

The study of the problems of implementing the basics of circular economy within the borders of the country, region, and city is of interest to both foreign and Ukrainian scientists. Thus, general theoretical issues of circular economy implementation within the country were studied by N. Avramenko, A. Tovstenko [1], A. Zuev [2], I. Zvarych [3], V. Loiko [4], D. Pierce, R. Turner [5] and others. In their works, M. Varfolomeev [6], A. Babak [7], M. Heisdorfer [8], O. Lozo [9], O. Churikanova [10] pay special attention to the legal regulation of relations regarding waste management, and together with this – the problems of their disposal and the expansion of the producer's responsibility for waste. Scientists such as N. Boken [11], P. Ghisellini [12], M. Guryev [13], O. Dronova [14] contributed to the study of approaches to the implementation of the circular economy at the state level and the determination of its development prospects., I. Kulchytska [15], I. Tymoshenko [30] and others. Socio-economic consequences, problems and prospects of introducing a circular economy in regions and cities are revealed in the works of N. Gakhovich, L. Shinkaruk [16],

S. Miroshnychenko [17], S. Sove, S. Bernard, P. Sloan [18], M. Pilyugin [19], K. Fletcher and others. The topic of research in the direction of substantiating the applied aspects of the concept of circular economy development is revealed in the works of K. Barytska [20], T. Kvasha, O. Paladchenko [21], J. Kircherr, D. Reike, M. Heckert [22], M. Zlotnik, O. Melnyk [23] and others. The scientific works of T. Berger and K. Frey [24] are devoted to the peculiarities of the implementation of the circular economy in industries at the regional level, especially in those where there is sufficient human capital. However, the issue of circular economy implementation at the regional level remains little researched and requires in-depth study.

The purpose of the article is to study the theoretical foundations of the concept of "circular economy", define its models, outline the main advantages of the circular economy at the regional level.

Circular economy as a socio-economic paradigm of resource use

Regions should play a key role as stimulators, mediators and contributors to the development of the circular economy. In contrast to the traditional economy, the circular economy is the most successful way to save resources and materials, and therefore – the way to constant economic growth.

There are many definitions of the circular economy. The circular economy is an economic model that was first proposed in the mid-1960s as a means of ensuring that the resources that enter the economy can remain part of it for as long as possible.

In economic literature, the concept of "circular economy" was first proposed in 1990 by scientists D. Pearce & R. Turner, who noted that the Earth is a closed economic system in which the economy and the environment are not characterized by linear relationships, but by circular relationships. In order to achieve a win-win situation for the economy and the environment, scientists proposed a closed cycle of materials in the economy [5].

To begin with, we note that circularity means the effective reuse and recycling of resources, materials

and products in closed cycles. In other words, circularity is an economic model that represents sustainable development as a transition from a linear model based on consumption and disposal to a model in which the lifetime of products is maximized and materials and waste are minimized. There are three different cycles of circularity, which gradually become wider [25]:

- 1) closure of resource cycles, which is determined relative to the traditional economic system;
- 2) slowing resource cycles and material flows due to continued and increased use of products to maintain their value over time;
- 3) narrowing of resource cycles, which involves more efficient use of materials, natural resources and products in a linear system.

The circular economy can be implemented holistically, but at the same time, the features of the circular economy are at the core of every urban system [26].

According to Ukrainian scientists, in particular V.V. Loiko, the circular economy involves more careful use of both natural resources and things that have already been created and are used in people's daily lives. The author believes that the transition to a circular economy should be based on a change in production technologies, improved use of natural resources, and a change in the general attitude of consumers [4].

The collective of authors J. Kirchherr, D. Reike, & M. Heckert considers the concept of "circular economy" as an economic system based on business models that provide for alternative reuse in order to achieve sustainable development, environmental protection, economic growth and social justice in the interests of present and future generations [22].

I. Kulchytska defines the circular economy as such, which involves the reuse of raw materials and products, which as a result will remain in circulation as long as possible, and their value will be maximum. Thus, the author draws our attention to the fact that the transition to a circular economy will ensure a reduction in the extraction of natural resources, a reduction in production waste and the reuse of those that have already been created [15].

M. Heisdorfer [8] believes that the circular economy is a regenerating system in which resource consumption,

emissions and energy losses are minimized by closing and reducing material and energy cycles.

It is agreed that the definition of W. Haas, F. Krausmann, D. Wiedenhofer, M. Heinz, who consider the circular economy a simple but convincing strategy aimed at reducing both the consumption of raw materials and the release of waste by closing the economic and ecological loop resource flows [27].

The analysis of scientific works on the circular economy [1;11;24;25;27] gave us the opportunity to form our own vision of this concept, which is that the circular economy is a way of economic development where the value of products, materials and resources is preserved as much as possible longer, and waste is significantly reduced or even eliminated. The main purpose of which is to create new alternative economic approaches, the task of which is to minimize the negative human impact on the environment. It offers an alternative model where the value of products, materials and resources is preserved as long as possible, and waste is significantly reduced or even eliminated. Focused on "closing the loop," the circular economy is a practical solution to living within our planetary boundaries. Simply put, a circular economy is an economy in which our consumption of resources and materials is circular, we reuse our resources and put them back into the economy instead of throwing them away.

In the minds of the fourth industrial revolution (Revolution 4.0, Industry 4.0) there is a clear connection with the circular economy, which is based on the reduction of negative human impact on the environment (climate changes, accumulation of huge amounts of waste, depletion of natural resources, environmental degradation, etc. d.) [29].

Circular economy is based on 3R principles:

1. Reduce – reducing the use of natural resources, increasing production efficiency;
2. Reuse – reuse of the product for its main purpose;
3. Recycle – processing of materials to obtain products of the same or lower quality.

Along with this, in 2018, the principles of the circular economy were significantly expanded by the World Economic Forum, and now we have the 10R model, which clearly follows the continuity of the "3R

model”, which is expressed in the preservation of the key elements of the system (Fig. 1.) [14; 31].

4. Refuse – refusal to produce a product for “ecologically dirty” technology, offering another product;

5. Rethink – rethinking the ways of using the product, its exchange or joint use;

6. Repair – repair and maintenance of a defective product with its further use;

7. Refurbish – restoration of an old product for its further consumption;

8. Remanufacture – reprocessing and application of a part of an old product in a new product;

9. Repurpose – reorientation of a part of an old product in a new product for a different purpose;

10. Recover – burning of materials with recovery of energy lost in their production.

Therefore, most choose a simplified version of the circular economy based on the 3-R principles, since not every “R” is suitable for every business process and is more manageable. Thus, the 10-R model works as follows; the higher the R-ladder, the less resource usage.

The transition from the 3-R model to the 10-R model forces us to consciously think about the raw materials we use in the design process.

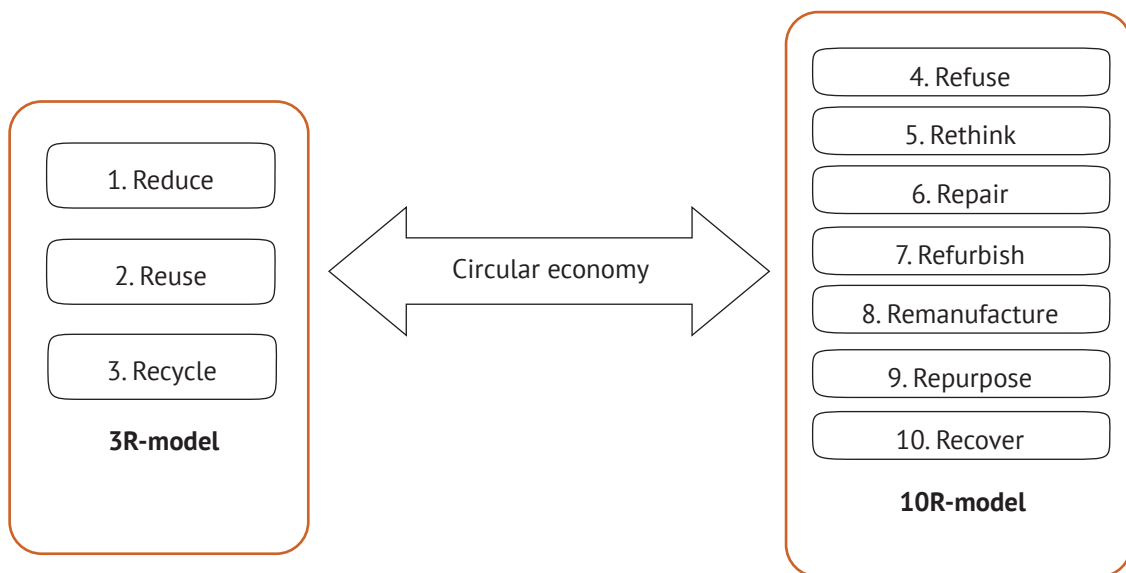


Figure 1. Model 10R – principles of circular economy

The circular economy is transformative, systemic and functional. First, it involves a change in behavior and culture towards different ways of production and consumption, new business models and governance under shared responsibility between levels of government and stakeholders (people). Second, it enables the complementarity of water resources, waste, energy, transport, housing and land use (policy). Thirdly, information and outflows of materials, resources and products require a reflection of the appropriate scale in which the circular economy is applied, as well as functional connections between urban and rural areas (places) [31].

Peculiarities and features of the regional circular economy

Note that the transition to a circular economy affects various policy areas and levels of governance in the region, ranging from mobility, agriculture, land use and waste management, to business development and consumer education, affecting participants in all sectors of the region. After examining the academic sources, we concluded that the circular economy of the region is not something that any institution or company can do alone, by its very nature, the circular economy facilitates connections between individual stakeholders and sectors of the region. Thus, we draw attention to the fact that an effective circular economy of the

region will be achieved through the meeting between bottom-up initiatives (concrete activities involving local organizations that seek synergies with partners at the same level or that wish to expand or diversify their activities) and top-down approaches downward (coordination and planning to facilitate connections between actors at lower levels).

Before spreading to the national and international level, the circular economy must be combined with the development of the regional economy. Only in the case when starting from one settlement, and then spreading to the entire territorial community, then to the region, and on the condition that the regions take responsibility for the rational and efficient use of their own resources, the circular economy will develop properly. It is the development of the circular economy that aims to strengthen the sustainability of the region by limiting its dependence on the influx of resources. Circularity of resources in the region will make it possible to optimize the use of materials and energy for the benefit of the regional economy. The development of the circular economy will allow the region to move towards a more sustainable, inclusive and low-carbon development model.

The European Union produces more than 2.5 billion tons of waste every year. It is currently updating its waste management legislation to facilitate the transition to a more sustainable model known as the circular economy. The European Commission's 2016 study "Circular Economy in Europe" identified the following benefits of promoting the circular economy for EU countries:

- improved security of resources and reduced dependence on imports will lead to a decrease in demand for primary raw materials;
- reducing the impact on the environment, including a sharp reduction in greenhouse gas emissions;
- economic benefits, including new opportunities for growth and innovation, as well as savings related to increased resource efficiency;
- social benefits – from the creation of new jobs at all skill levels to changes in consumer behavior leading to better health and safety outcomes [32].

Regions play an important role in the circular

transition. First, they have core responsibilities in key sectors of the circular economy, such as transport and solid waste. Secondly, they are laboratories for innovation and experimentation. Third, cities in regions can be promoters, facilitators and facilitators of the development of the circular economy, while bearing a shared responsibility with national governments and stakeholders.

In the regions, the circular economy involves a systemic shift in which: services are provided for the effective use of natural resources as primary materials and optimization of their reuse; economic activities are planned and carried out in such a way as to slowly narrow and close the loops in value chains; the infrastructure is designed and built to avoid linear blocking and material waste. The main areas of development of the circular economy of the region are construction, mobility and transportation, food, products and services. This shows that the circular economy of the region is possible.

Considering the huge systemic effort, the implementation of the circular economy of the region should have great advantages in order to pay for itself.

Financial support in the implementation of the circular economy of the region can take different forms, such as grants, loans, tax incentives or investment guarantees, offered directly by the public sector or provided through other actors (for example, business associations or business development agencies).

By exchanging knowledge, organizing events or creating exchange platforms, regions can initiate and promote the activities of other local and regional actors, such as businesses and utilities, universities and research centers, civil organizations in the implementation of the circular economy.

In the process of research, we determined the advantages of the circular economy of the region:

- reduces the use of non-renewable resources, sees that the practice of reusing resources and restoring old products (rather than throwing them away) is the norm. This ensures that we use fewer non-renewable resources;
- reduces carbon emissions – the introduction of material management in the circular economy (for example, production and disposal of materials) contributes

to the reduction of up to two-thirds of greenhouse gas emissions;

- strives for zero waste – reuse of resources and products, leads to a zero-waste model, which in turn benefits everyone. Zero waste means less plastic in the ocean, less trash in our oceans and less landfill. It also means that there is less need to mine limited resources; instead, we reuse them;

- provides benefits to the consumer – by reusing materials, it prevents practices such as planned obsolescence, meaning your products will last longer. Many new industry types will also appear. This means that there will be many new jobs;

- opens up new opportunities for business development – with greater availability of work comes more opportunities for business (eg repairing old things, collecting used resources such as clothes or electronics, etc.).

The circular economy also creates social benefits, especially in low-income countries, as the integration of informal waste pickers into formal waste collection provides job security and fair wages.

At the same time, it has become a well-known and recognized model among companies, regions, cities and non-governmental organizations around the world – from China and Latin America to the EU and the USA. However, it is no less discussed that the concept of circular economy has been heavily criticized by both practitioners and researchers [18]. In this regard, researchers [11;18;23;27;29] identified the following shortcomings (remarks) regarding the implementation of the concept of circular economy in the region:

- due to the widespread nature of this concept, it is impossible to measure its impact on all areas of the region's economy, namely: it includes everything from recycling systems, rental, replacement of products, services to the development of applications for the sharing economy, etc.;

- ignoring, as a rule, previously accumulated materials and resources in the region. In particular, the circular economy boils down to the question of choosing between linear and circular products and ignores physical laws regarding the physical limitations of materials and the complexity of waste;

- enterprises develop circular activities only for a

part of their operational activities. First, this may be due to the difficulty of scaling up pilot projects. Secondly, it is often only a small part of the enterprise's activity that is based on the principles of the circular economy, while the main activity continues as usual;

- weak knowledge about the impact of the circular economy on the environment complicates the process of measuring this impact, especially in the long term and on a larger geographical scale. That is why it is believed that the circular economy only delays, and does not eliminate, the negative impact of the linear economy on the environment;

- this concept has mainly a debatable nature of the problem of resource consumption because there is no connection with how this concept will lead to greater social justice;

- the circular economy depoliticizes industrial and environmental policy while strengthening market and business power. It's an attractive concept that promises to be a win-win for everyone. This enables discussions of synergies, win-wins and opportunities rather than trade-offs, challenges and limitations.

In essence, the circular economy aims to design the process of waste processing. In fact, the idea of a circular economy tells us that there is no such thing as waste. To achieve this in the production of products, it is necessary to use durable, high-quality materials that will be optimized for the cycle of disassembly and reuse, which will simplify their processing, transformation or renewal in the future [14].

Therefore, the concept of the circular economy of the region, in our opinion, should not be limited exclusively to the processing of waste at the end (recycling). On the contrary, it must be constantly expanded due to the proposed innovations at all stages of the life cycle of goods and services in combination with the interaction between all stakeholders. At the same time, the concept recognizes the importance of the region's economy working efficiently at all scales – for businesses large and small, for organizations and individuals, while creating and restoring the overall health of the region's ecosystem.

At its core, the circular economy draws inspiration from natural systems.

For the transition and development of the circular economy in the regions, it is necessary to implement seven principles of transition, which are shown in Fig. 2.

In general, the circular economy is driven by a natural system that seems to have been working effectively for thousands of years. These principles are simple, but require a deep understanding of all parties – governments, companies, individuals, they must work together to make the circular economy a reality. Along with this, the transition to circular principles calls for regional authorities to introduce new business models, new modes of consumer behavior and new decisions to transform waste into resources. If we can reduce congestion, eliminate waste and lower costs, higher economic productivity and new growth will allow cities to thrive. New business opportunities will boost skills

and jobs. Thus, the result of the circular economy of the region will be the creation of ecocities, an ecosociety, and in particular an ecoregion.

The transition to a circular economy requires massive systemic changes in the region. Bringing a true circular economy to the region will require a great deal of effort from individuals, businesses and governments. At the regional level, the transition to a circular economy should begin with legislative regulation, the introduction of technologies and innovations, financing and maintenance of new standards, to the formation of the readiness of society in general to change its habits in the direction of the wide use of circular products, the creation of new platforms and schemes for the interaction of producers and consumers of circular goods [11].

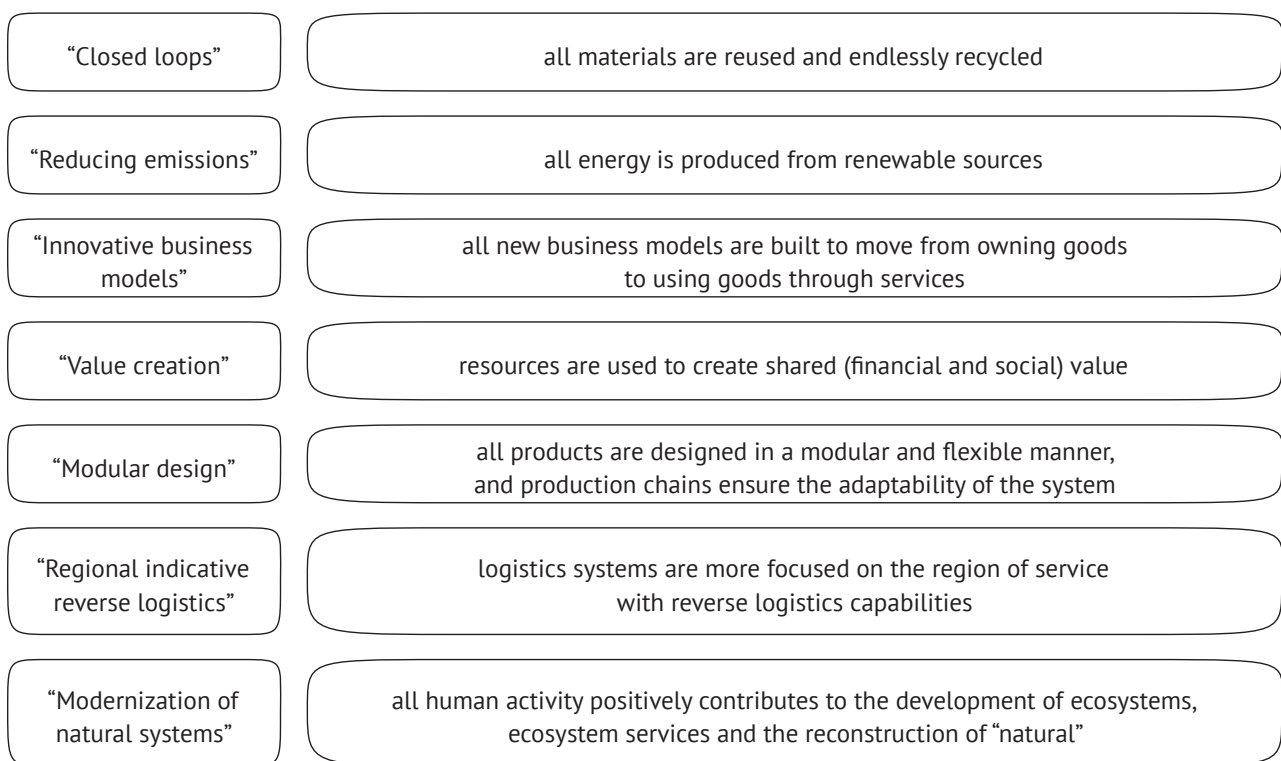


Figure 2. Principles of the region's transition to a circular economy

Along with this, regional authorities play an important role in launching and accelerating the transition to a circular economy by leading by example, setting clear framework conditions or directly supporting local

and regional stakeholders in a greener economy. Without a doubt, the circular model is the most successful way to save resources and materials, and therefore the way to permanent economic growth of the region.

CONCLUSIONS

The circular economy of the region offers a new, more rational approach to handling resources, including waste. A closed-loop economy promotes sustainable management of natural resources and helps shape a more sustainable, prosperous and sustainable future for all. In order to implement the circular economy of the region, it is necessary to ensure the necessary management conditions and existing economic conditions, namely: updating the regulatory and legal framework; agreed policies, informed and engaged stakeholders;

monitoring and evaluating progress and results; clear and reliable business incubators have been created. Now is the time to take full advantage of the region's many opportunities to create a system that can work for the economy, society and environment in the long term.

In the perspective of further research, there are fundamental changes that go beyond the simple "correction" of the environmental consequences of economic activity, to a deep rethinking of the ways of production and consumption by society.

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Циркулярна економіка регіону: теоретичний аспект

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Анотація. У статті розкрито сутність поняття «циркулярна економіка» та запропоновано власне визначення цього поняття, як спосіб економічного розвитку, де цінність продуктів, матеріалів і ресурсів зберігається якомога довше, а відходи значно зменшуються або навіть виключаються. Розглянуто реалізацію моделі циркулярної економіки, в основі якої лежать R-принципи її реалізації. Обґрунтовано, що основними сферами розвитку циркулярної економіки регіону є будівництво, мобільність і транспортування, їжа, продукти та послуги. Окреслено переваги від реалізації циркулярної економіки регіону

Ключові слова: циклічність, циркулярна економіка, регіон, модель циркулярної економіки, переваги
