Circular Economy: Tendencies and Development Perspectives*

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The research represents the analysis of the circular economy and its essential characteristics of circular economy in the modern world. The circular economy makes it possible to "detach" the country's GDP growth from the consumption of natural resources and environmental pollution. It explains how the circular economy should stimulate sustainable development and inclusion in the system of Sustainable Development Goals. The research presents how the circular economy can ensure labor productivity, efficient environmental and energy conservation, and the creation of new jobs. It analyzes principles and tools of the circular economy. This research shows how economies should move from the current linear take, make, use, dispose practice to reuse and longer product life. It shows how current business models change and what principles are used to develop a circular economy. It examines the circular approaches based on the 3-R principle: Reduce: reduce resource use and prioritize renewable materials; Reuse: make the most of the products; Recycle: recover by-products and waste for further use in the economy. The research shows how seven key tools of the circular economy may be applied. It reveals the international experience in implementing the circular economy principles. The research describes the benefits that the transition to a circular economy brings. It analyses major circular economy barriers, such as financial, social, and technical. The research distinguishes the benefits of a circular economy. They include a decrease in costs, a cleaner and safer environment, sensitive use of natural resources, new job creation, reducing dependence on imports. This research presents the examples of Norrköping Industrial Symbiosis Network in Sweden, Latvia's circularity business models.

Keywords: circular economy, sustainable development goals, efficiency, circular economy model, environment, waste, recycling.

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Introduction. Large-scale climate change requires an urgent transition to a circular economy. It is gradually developing, but not fast enough. Many countries worldwide aim to accelerate the growth to the new model, helping leading companies rethink their positions and expand the scope of circular economy solutions. However, systemic changes necessary for all are possible only if each person contributes to the common cause.

Problem. The countries' GDP growth can no longer be ensured by consuming natural resources and environmental pollution. The main task is to stimulate sustainable development

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and ensure the Sustainable Development Goals (SDGs) achievement. What models of economic development can ensure the growth of labor productivity, effective environmental and energy conservation, and the creation of new jobs? The answer can be found in a circular economy. New models of economic development must be environmentally friendly and socially oriented.

Recent research. M. Burger, S. Stavropoulos, Sh. Ramkumar, J. Dufourmont, F. van Oort [5], M. Sillanpää and N. Chaker [6], Ye. Mishenin and I. Koblianska [7], V. Prieto-Sandoval, J. Carmen, M. Ormazabal [8], S. Alexandros and N. Ioannis [9], M. Varfolomieiev and O. Churikanova [12], M. Gurieva [13, 14], V. Hurochkina and M. Budzynska [18], etc. raise the circular economy issues.

Goal of the article. Within the research framework, we highlight the current issues of the circular economy, the best world practices of circular economy implementation, and suggest directions for providing a circular economy in Ukraine.

I. The concept of circular economy.

A circular economy is a closed-loop economy (also called a Cyclic economy; Closed-loop economy). It is a total replacement for the traditional model of the economy and achieving a balance between the economy of resources and the environment.

The circular economy can ensure labor productivity, efficient environmental and energy conservation, and the creation of new jobs. The circular economy makes it possible to "detach" the country's GDP growth from the consumption of natural resources and environmental pollution. At the same time, the circular economy should stimulate sustainable development and be included in the system of Sustainable Development Goals (SDGs), i.e., it must be environmentally friendly and socially oriented.

International documents on the issue of circular economy are:

- Declaration on Green Growth, OECD, 2009 (adopted at the Ministerial Council Meeting on June 25, 2009);
- Global Green New Deal: Report. UNEP, 2009;
- G20 Framework Agreement for Strong, Sustainable and Balanced Economic Growth (Seoul, November 12, 2010) [3];
- Towards green growth, OECD, 2011;
- A course for green growth. Resume for decision-makers. OECD 2011;
- Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication, UNEP, 2011;
- OECD Green Growth Indicators, 2014;
- Energy Efficiency Policies: Best Practices. A structured analysis of existing best practices for improving energy efficiency for climate change mitigation and sustainable development. UNECE 2015;
- Pan-European Strategic Framework for Greening the Economy, adopted by the UNECE Committee on Environmental Policy (Eighth Ministerial Conference “Environment for Europe”, Batumi, Georgia, 8-10 June 2016);
- List of possible measures for a green economy. Explanatory note by the Swiss-led Green Economy Expert Group with the support of the Secretariat and the United Nations Environment Program ((Eighth Ministerial Conference “Environment for Europe”, Batumi, Georgia, 8-10 June 2016).

Circular Economy Package adopted on December 2, 2015: EU Action Plan for a Circular Economy + Action Plan Attachment + Proposals to amend the Waste Directive. Waste Legislative Proposals: Waste Directive; Packaging Waste Directive; Electrical and Electronic Waste Directive; End-of-Life Vehicles Directive; End-of-life directive vehicles and batteries

and accumulators, as well as used batteries and accumulators.

European Environment Agency Scheme on the Interaction of Circular and Green Economies suggests its view of the circular and green economy (Fig. 1).

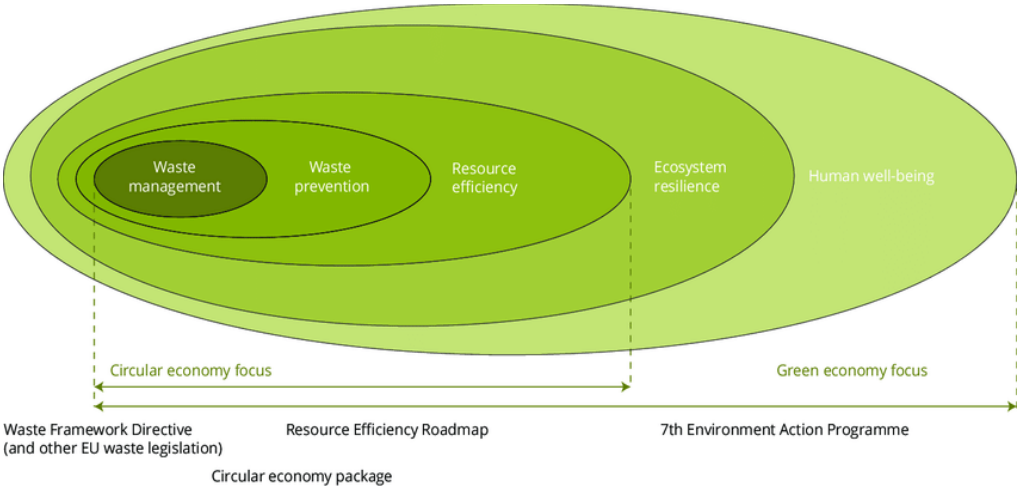

Figure 1. Circular economy and green economy [1]

What is a Circular Economy? "The circular economy is an alternative to the traditional linear economy (Take, Make, Dispose), in which we can use resources for as long as possible, extracting the maximum value from them during use, with the ability to recover and recycle products and materials at the end of the life of each product." (Waste & Resource Action Program – UK).

In 2017, the CE 100 network (Circular Economic 100 platform) was created, uniting businesses, innovators, cities, governments, universities, and leaders to promote the circular economy, removing cultural, social, and economic barriers to its development. The platform aims to develop and accumulate collective solutions, their description to scale up the positive experience of implementing the principles of circular economy [13, 17].

II. Principles and tools of the circular economy.

Moving from the current linear take, make, use, dispose to two loop closures: one loop promotes reuse and longer product life through, for example, refurbishment, refurbishment, refurbishment, and retrofitting. Another loop transforms old goods/waste into new resources by recycling materials into secondary resources.

Circular Economy Principles: The circular approach is based on the 3-R principle:

- Reduce: reduce resource use and prioritize renewable materials.
- Reuse: make the most of the products.
- Recycle: recover by-products and waste for further use in the economy.

According to the report The Circularity Gap [11], which is presented annually at the World Economic Forum in Davos, only 9% of the materials in the world economy are reused [16].

International experience in implementing the CE principles is presented in Table 1.

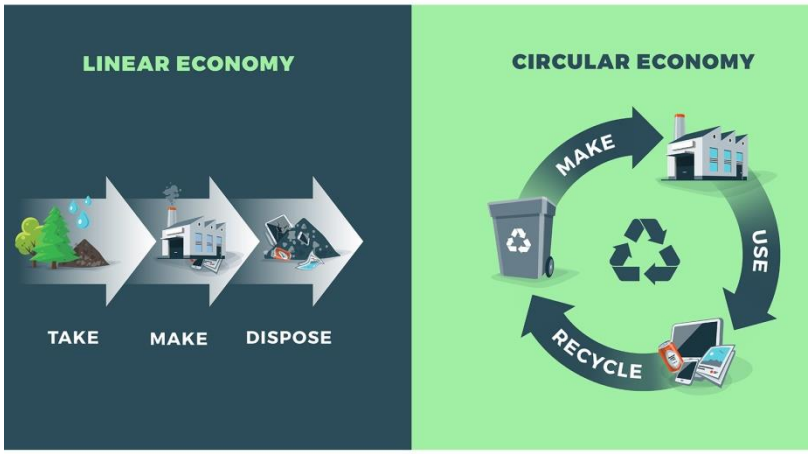

Figure 2. Linear vs. circular economy [10]

Table 1

Experience in implementing the principles of CE

Country	Actions
Netherlands	The goal is to become a leader among countries in the implementation of the CE principles. The Netherlands as a Circular Hotspot campaign in progress
Germany	The CE and Waste Law is based on a hierarchy of principles (Avoidance, Reduction, Disposal)
Great Britain	Waste and Resources Action Program is a government program to stimulate low-waste industries
Roll	Legislation to promote the circular economy
South Korea	Green Growth Strategy
Japan	Construction of the "Society of the Correct Material Cycle"
Kazakhstan	Concepts for the transition of the Republic of Kazakhstan to a "green economy" for 2021 – 2030

Seven critical tools of the circular economy [16]:

1. Design of the future is about creating products in which traditional materials can be replaced with renewable or recycled materials.

2. Sharing and virtualization are standard business models for many. Uber, BlaBlaCar, Airbnb, music streaming services take this approach. From Ukrainian examples, the Oh My Look! The brand is transforming from a dress rental service into a virtual wardrobe by subscription.

3. The product-as-a-service strategy seeks to replace traditional sales models with sales of services. A classic example here is Rolls Royce, which offered the market a similar approach almost 60 years ago.

4. Reuse in manufacturing where used products or components become part of new products. For example, Canon takes back products at the end of the life cycle and uses

ingredients in new devices without compromising the functionality of the materials.

5. Reuse in consumption when, through service optimization, companies can increase the life cycle. For example, the eBay marketplace offers fully functional devices rebuilt after damage or defects on a particular website at discounted prices.

6. Industrial symbiosis and recycling of production waste can significantly increase business efficiency

7. The familiar term "recycling" is also a circular economy strategy. After the end of the product's life cycle, materials are recycled safely.

Priority sectors for implementing the circular economy are plastics, food waste, critical raw materials, construction and demolition, biomass, and bio-products.

III. Models of the circular economy.

Currently, a circular economy model is being formed. The circular economy presupposes a continuous circulation of technical and biological materials in production and conserving valuable natural resources. It covers the production and consumption of goods and services.

The transition to a circular economy has three undeniable benefits:

- reducing the negative impact on the environment due to the reduction in the use of resources in production;
- decrease in production costs due to a reduction in the amount of used primary resources;
- the emergence of new markets means creating new jobs and an increase in the general level of well-being.

Business models of the circular economy:

1. Circular Suppliers – a circular value chain – a model in which fully renewable sources replace limited resources.
2. Resource Recovery – A model that leverages technological innovation and opportunities to recover and reuse resources. Examples include closed-loop recycling, where waste is recycled into new resources.
3. Product Life Extension – Product Life Cycle Extension – a model that allows you to maintain economic benefits for as long as possible through product refurbishment, repair, upgrade, or remarketing of a product. This model also involves a shift from selling things to selling services for using them.
4. Sharing Platforms / collaborative consumption – sharing economy – a model based on exchanging goods or assets with a low utilization rate.
5. Product as a Service – a model in which customers use products by "rent" with payment as they are used.

Table 2 shows Latvia's experience of circularity.

Requirements of new EU directives. Requirements of the new EU directives, the implementation of which requires further development of the waste collection system:

- Objectives set out in draft directives to reduce recycling and disposal of waste at landfills.
- Reuse and disposal of household waste in 2025 – 60 % by weight, 2030 – 65 % (for Latvia – 2025 – 50 %, 2030 – 60 %).
- The amount of buried household waste in 2030 – 10 % (for Latvia – 2030 – 20 %).
- Requirements for the prevention of food waste.
- Development of distributed collection of biodegradable waste.

Table 2

Latvia's experience of circularity

	Circular chains added cost	Resource recovery	Product Life Extension	Sharing economy	Product as a Service
Promoter of resource efficiency	Closed chains materials	Closed chains materials	Slow chains materials	Narrow resource flow	Narrow resource flow
Business model subtype	From the cradle to cradle	Industrial symbiosis Processing Downcycling Upcycling	Direct secondary using Repairs Recovery	General use General access	Result, directed per product / user
Sectors that have already applied	Sector of consumer goods	Metal Paper Plastics	Vehicles Electronics	Short term rent Transport Products popular consumption	transport energy

Industrial symbiosis is the collaboration of two or more manufacturing plants/factories, resulting from which waste and by-products of one company become the raw material of another company. Industrial symbiosis is possible in many industries, for example, Woodworking, Agriculture (for example, greenhouses); Landscaping – compost production; Heating; Construction Materials; Fish and pig farms. Emphasis on cross-sectoral collaboration. Waste from one industry can become a resource for another industry (substitution of raw materials). Figure 3 demonstrates an example of industrial symbiosis in Sweden.

The industrial symbiosis network in Norrköping is a telling example of how synergistically integrated industrial, urban and agricultural activities can play a crucial role in improving regional sustainability. In addition to significantly enhancing resource use efficiency and associated economic and environmental performance, the network in Norrköping reduces regional dependence on fossil resources. It contributes to the development of a bio-based economy [4].

The authors have found the barriers to the implementation of CE:

1. *Financial*: significant costs for the transition to the new model - significant upfront investment; an increase in the price of production at the moment (during the transition to a new model of management); questions of economic feasibility of waste processing.
2. *Social*: lack of knowledge about the importance of introducing circular economy models; resistance to change.
3. Institutional: deep-rooted linear economics model; lack of desire to build long value chains for the production of products; inflexibility of the regulatory framework
4. *Technical*: most modern goods are designed for consumption and other waste; lack of technology for producing high-quality goods from recycled materials.

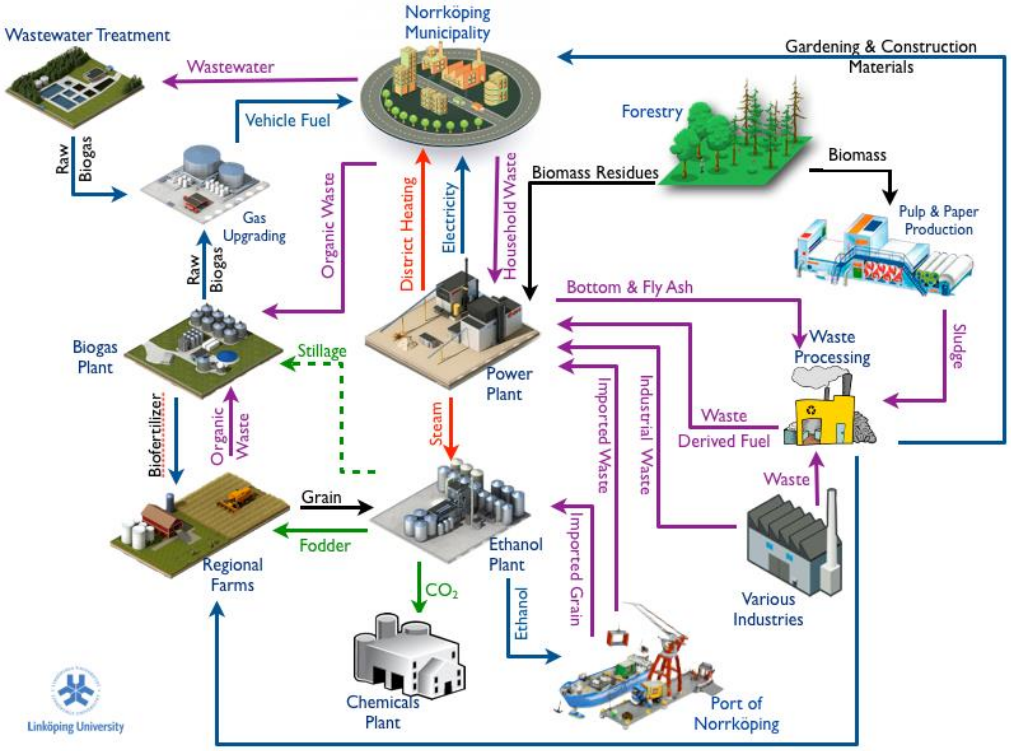

Figure 3. Norrköping Industrial Symbiosis Network, Sweden [4]

Areas of action for the circular economy are eco-design requirements, including information on longevity; extended producer responsibility; support and broader use of green public procurement; development of quality standards for secondary raw materials, especially for plastics; promoting food donations. For business, a circular economy means diversification of resources, training of personnel, new requirements and implementation, costs associated with the introduction of new requirements, new operating principles based on a cyclical economy; access to investments.

What should traditional entrepreneurs do to move to a circular economy? Change the role from the supplier of goods to the service provider. Assess how products are used (how to make them reusable or easily recyclable) and customize the product design for new needs – cooperation and support for joint initiatives. Assess the importance of references and reputation.

The benefits of a circular economy include:

1. Decrease in costs (costs of production materials, energy resources, etc.).
2. A cleaner and safer environment
3. Sensitive use of natural resources
4. New jobs
5. Reducing dependence on imports.

The main stages of implementing a circular economy are legal framework, administrative conditions, economic instruments, public education, and awareness. Implementing a circular

economy requires working in interdisciplinary teams, collaboration and communication skills, systems thinking, creativity, life cycle thinking (from cradle to cradle), environmental design, new approaches to accounting and reporting.

Conclusions. The transition to the circular economy has three undeniable advantages:

a) a reduction in a negative impact on the environment due to a reduction in the use of resources in production creates a cleaner and safer environment,
b) reduction in production costs due to a decrease in the amount of used primary resources,
c) the emergence of new markets means creating new jobs and an increase in the general level of well-being.

It is necessary to rethink the concept of a "circular economy" through the prism of its relevance for many stakeholders:

a) public and private actors,
b) mature and developing industries,
c) cities and regions, small and medium enterprises, and multisectoral corporations.

A circular economy can help governments, businesses, and consumers focus on policies, practices, and ways to achieve sustainable development goals. The economy must adapt to the finite natural resources of our planet.

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Циркуляційна економіка: тенденції та перспективи розвитку

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У статті проведено аналіз циркуляційної економіки та її суттєвих характеристик у сучасному світі. Циркуляційна економіка дає можливість «відірвати» зростання ВВП країни від споживання природних ресурсів та забруднення навколишнього середовища. Пояснюється, як циркуляційна економіка повинна стимулювати сталий розвиток та включатися до системи цілей сталого розвитку. Дослідження ілюструє, як циркуляційна економіка може забезпечити продуктивність праці, ефективне екологічне та енергозбереження, сприяти створенню нових робочих місць. Проаналізовано принципи та інструменти циркуляційної економіки. Дослідження демонструє, як економіка повинна перейти від поточної лінійної системи використання та розподілу до практики повторного використання та продовження терміну служби продукції. Ілюструється зміна сучасної бізнес-моделі, а також основні принципи розвитку циркуляційної економіки. У дослідженні розглядаються кругові підходи, засновані на принципі 3-R: 1) зменшення: зменшення використання ресурсів та встановлення пріоритетів на відновлювані матеріали; 2) повторне використання: максимально використати продукти; 3) утилізація: переробляти побічні продукти та відходи для подальшого використання в господарстві.

Дослідження демонструє, як можна застосувати сім ключових інструментів циркуляційної економіки. Воно розкриває міжнародний досвід впровадження принципів циркуляційної економіки. У статті також описані переваги переходу до циркуляційної економіки. Проаналізовано основні бар'єри циркуляційної економіки, такі як фінансові, соціальні та технічні, визначено основні переваги циркуляційної економіки, серед яких зменшення витрат, чистіше та безпечніше навколишнє середовище, чутливе використання природних ресурсів, створення нових робочих місць, зменшення залежності від імпорту. Також у цьому дослідженні представлені приклади Мережі промислового симбіозу Norrköping у Швеції, бізнес-моделі циркулярності Латвії.

Ключові слова: циркуляційна економіка, цілі сталого розвитку, ефективність, модель циркуляційної економіки, навколишнє середовище, відходи, переробка.

JEL Codes: O21, Q01 Tables: *1*; Figure: *3*, References: *18*

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