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Aleksandar Popović[1]
University of Niš, Faculty of Economics

Vladimir Radivojević[2]
Faculty of Economics, University of Priština in Kosovska Mitrovica

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THE CIRCULAR ECONOMY - PRINCIPLES, STRATEGIES AND GOALS

Abstract

The circular economy is a major challenge for any national economy. It is a modern model of an economy that focuses on a new model of production and consumption that requires less use of limited resources, minimizing waste (products after their lifetime) in landfills, more efficient management of waste as raw material, minimizing pollution, and all that with the aim of protecting the environment and improving the living standards of the population. In the transition to the circular economy, the state and its bodies, economic entities and the population should be of equal importance. The aim of this paper is to point out the role and importance of the circular economy as a new economic system with special emphasis on the principles of the circular economy, drivers of the circular economy, strategies for establishing and maintaining the circular economy and goals achieved by the circular economy.

Key words*: circular economy, linear economy, principles, drivers, strategies*

JEL classification: ***Q56, Q57, M21***

ЦИРКУЛАРНА ЕКОНОМИЈА – ПРИНЦИПИ, СТРАТЕГИЈЕ И ЦИЉЕВИ

Апстракт

Циркуларна економија представља велики изазав за сваку националну привреду. У питању је савремени модел економије који у свом фокусу има нови модел производње и потрошње који захтева мању употребу ограничених ресурса, минимизирање отпада (производа након њиховог животног века) на депонијама, ефикасније управљање отпадом као сировином, свођење загађења на минимум, а све у циљу заштите животне средине и бољег животног стандарда становништва. У транзицији ка циркуларној економији подједнаки значај треба имати држава и њене институције, привредни субјекти и становништво. Циљ рада је указати на улогу и значај циркуларне економије као новог економског система са

[1] aca_popovic109@hotmail.com, ORCID ID 0000-0002-2826-4660

[2] vladimir.radivojevic@pr.ac.rs, ORCID ID 0000-0002-3928-0623

посебним осврtом на принципе на којима почива концепт циркуларне економије, покретаче циркуларне економије, стратегије успостављања и одржавања циркуларне економије и циљеве који се постижу циркуларном економијом.

Кључне речи: *циркуларна економија, линеарна економија, принципи, покретачи, стратегије*

Introduction

The linear model of the economy has shown great shortcomings in recent decades, given the limited raw materials and energy, the accumulation of waste in regulated and illegal landfills, environmental pollution and the deterioration of the quality of human life. Consequently, there is a need for a new model that will partially or completely eliminate the basic weaknesses of the linear economy due to the increased competition at the national and global market. A model that has crystallized itself in recent decades, and which can oppose the dominant model of the economy (so-called linear model) is the circular economy.

The American economist Kenneth Boulding first used the term circular economy in 1966 in his paper "The economics of the coming spaceship earth", in which he pointed out that there are limited resources, and therefore, it is necessary to constantly recycle waste landfills and reintegrate it into production process. In 1974, Swedish economist Karl Goran-Mahler published a book entitled "Environmental Economics: A Theoretical Inquiry" in which he emphasized economic growth accompanied by a quality environment and social well-being. In 1990, the American economists Pearce and Turner published a book entitled "Economics of Natural Resources and the Environment" in which they described in detail the relationship between the economy and the environment. However, the greatest contribution to the development of the circular economy concept at the beginning of the 21st century was made by the Ellen Macarthur Foundation. It was founded in 2010 with the aim of raising awareness about the application of the circular economy in the economic sphere.

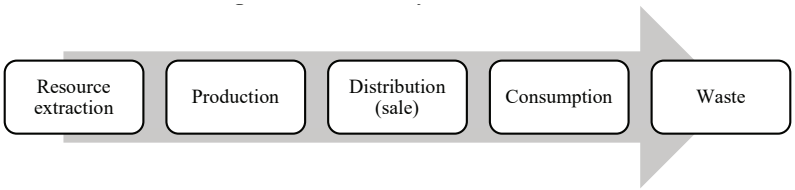
The paper is structured as follows. The first part of the paper points out the most important definitions of the circular economy and its basic elements, while the second part of the paper emphasizes the basic principles on which the circular economy is based. Then, in the third part of the paper, it highlights the basic drivers of the circular economy. Finally, the basic strategies and goals of the adoption and development of the circular economy will be presented.

Key determinants of the concept of circular economy

Contrary to the tendency of the new model of economy to dominate the economic world - the circular economy, the traditional model of the economy, so-called linear model, is dominant in the economic sphere today. The linear model of the economy is based on the following relation: "take-produce-sell-spend-reject" (Mitrović & Manić,

2020, p. 29). The mentioned model starts from the fact that resources are collected directly from nature and that together with energy and work a certain product is produced, then the product is sold on the market to end users, and after its lifetime (impossibility of further use), it is thrown away. The linear production model implies that the product ends up in a landfill. This model is shown in Figure 1.

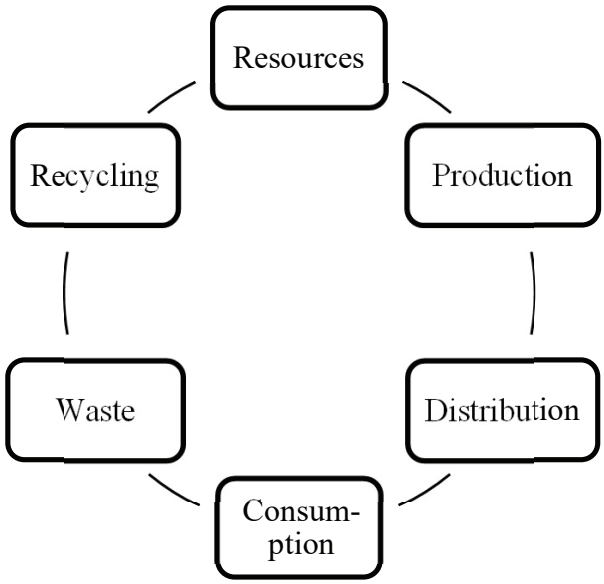
Figure 1. *The basics of the linear model*



Source: According to Vićentijević (2018, p. 79)

Unlike the linear economy model, which ends when the product becomes waste, the circular economy is a continuation of the linear economy. In other words, the circular economy is based on waste as a key resource for the production of new products with as little use of energy and extraction of resources from nature as possible. Unlike the linear economy, the circular economy implies a regenerative economic system based on optimizing the use of natural resources, i.e. saving resources and energy, then reducing waste, using renewable energy sources, all in order to protect the environment and achieve sustainable development. The circular economy model is shown in Figure 2.

Figure 2. *Circular economy model*



Source: According to Agency for Design and Engineering Arh In Green (2019)

The circular economy is an instrument for achieving and promoting sustainable development at the national and global level. The basic idea of the concept is to replace the linear model of the economy, which in modern business conditions becomes impossible due to limited resources, waste accumulation, inadequate waste management and environmental damage. Having in mind that the circular economy is based on the maximum use of products that have completed their life cycle with as little exploitation of new resources as possible, numerous definitions have emerged. Although in recent decades there has been an increasing emphasis on the concept of the circular economy, there is no generally accepted definition of the circular economy. There is an opinion that the comprehensive definition of the circular economy must contain the following four components (Prieta-Sandoval et al., 2017): (1) recirculation of resources, minimization of resource use, recovery of waste values, (2) multidimensional approach, (3) the significance of achieving sustainable development and (4) the close connection with the way society innovates. In this case, in order to understand the concept of the circular economy, we will point out the most important definitions of the circular economy:

- "Circular economy describes an economic system based on business models that replace the concept of 'end of life' by reducing, alternatively reusing, recycling and renewing materials in production / distribution and consumption processes acting at the micro level (products, companies or consumers), meso level (eco-industrial parks) and macro level (city, region, state and beyond) with the aim of achieving sustainable development that includes providing a quality environment, economic prosperity and social equality for the benefit of present and future generations" (Kirchherr et al., 2017, p. 224);
- "Circular economy is a regenerative system in which resource use, waste, emissions and energy consumption are minimized by slowing down, closing and narrowing material and energy loops, which is achieved by long-term design, maintenance, repair, reuse, remanufacturing, renovation and recycling" (Geissdoerfer et al., 2017, p. 766);
- "Circular economy involves turning goods that are at the end of their life into resources for other goods by closing loops in industrial ecosystems and minimizing waste based on the following principles: reuse what can be used, recycle what cannot be reused, fix what is corrupt and reproduce what cannot be repaired" (Stahel, 2016, p. 435);
- "Circular economy seeks to prolong the life of products and materials by taking them over from consumers after their lifetime" (Gregson et al., 2015, p. 9);
- "Circular economy is an economy in which the value of products, materials and resources is maintained in the economy for as long as possible, and waste generation is minimized" (Mihajlov et al., 2019, p. 5).

Based on these definitions, the circular economy can be defined as an economy based on the production of products using waste or products that have ended their life as a basic raw material and as little extraction of necessary new resources as possible, all in order to protect the environment and achieve and improve sustainable development. Regardless of the diversity of definitions of the circular economy, the common elements of all definitions are the following:

- circular economy uses waste as a basic raw material in the production of new products and the provision of new services,

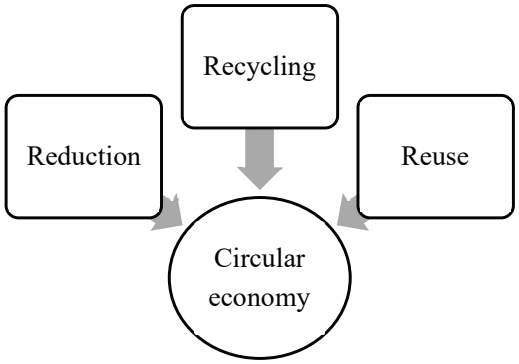
- circular economy emphasizes renewable energy sources,
- circular economy aims to minimize the extraction of resources and energy from nature and waste in landfills through recycling and reuse,
- circular economy extends product life, and
- circular economy encourages economic growth while protecting the environment and establishing sustainable development in order to achieve social well-being.

The transition from the linear to the circular economy is a long, arduous and comprehensive process that requires an interdisciplinary approach. So, it is a process that includes knowledge in the field of economics, ecology, biology, engineering, waste management, etc. As such, it is impossible to expect positive effects at the very beginning of the application of this model in the economy.

Basic principles of the circular economy

The circular economy is based on a basic concept that implies growth by using waste as a basic resource of production, with as little use of energy and new resources from nature as possible, in order to protect the environment and sustainable development. Having in mind the primary goal of the circular economy, the basic principles on which the circular economy is based can be described as "3R" - Reduction, Recycling and Reuse (Yuan et al., 2006). The first "R" principle - Reduction refers to the reduction of use/extraction of new resources from nature in the models of circular economy, while the second "R" principle - Recycling involves the recycling of materials and energy that ended up in waste, and which will revive and become the main resource for product production. Finally, the last, third "R" principle - Reuse implies the reuse of waste as an input in the circular economy. In other words, the "3R" principles are focused on the fact that waste will be recycled and returned to the production process of a new product in the circular economy. Based on the above, we can conclude that recycling plays a key role in the circular economy, since it depends on how much waste will be used as a resource in the production of new products. The principles of circular economy "3R" are illustrated in Figure 3.

Figure 3. *"3R" principles of the circular economy*



Source: According to Feng (2004) and Yuan et al. (2006)

The circular economy is based on the following principles (Ellen Macarthur Foundation, 2019): elimination of waste, circular products/materials and regeneration of nature. Inadequate product design can lead to the accumulation of waste and pollution, therefore, the design should play a major role in the production of products that will allow at the end of their life to be reused in the production of new products and thus minimize waste and pollution. Changing the way we think and use new materials and technologies can significantly reduce waste and pollution. Another principle is that products should be designed for reuse, repair or processing after their service life. The essence of the third principle is that waste does not exist in the circular economy and that each waste serves as a raw material (resource) for the production of a new product.

Drivers of the circular economy

The linear model, in addition to many advantages, brings many disadvantages in terms of environmental pollution, waste accumulation, inefficient waste management, irrational use of resources in nature and energy that has reduced natural capital, unsustainable development, poverty growth and socio-economic inequality. Contrary to this model, the circular economy starts from the tendency to minimize all these shortcomings. Accordingly, in recent decades, the emphasis has been on the introduction of this model within modern companies.

Patwa et al. (2021, p. 726) state that the basic drivers (factors) of the introduction or development of the circular economy model in the national economy are:

- extending the lifespan of the product through "3R",
- ecological balance and protection,
- large flow of data and information,
- state policy and
- consumer behavior.

Extending the product life cycle through "3R" principles is based on the fact that the product that is at the end of its life does not end up in landfill. The solution is in recycling it, which will further lead to its re-inclusion in the production phase of a new product that will meet consumer needs. The point is to move from the "produce-use-discard" relationship to the "produce-use-discard-recycle-reuse-use" relationship. The main factors that will contribute to extending the product life cycle are the following (Patwa et al., 2021, p. 726):

- Product as a service - in this case the product is seen as a service that can be reused by recycling and thus contribute to reducing waste and better management of the same as a basic resource in the circular economy. In other words, the product is accompanied by services that allow you to repair or replace the product. This concept is known as the PaaS concept (Product as a Service);
- Sustainable consumption - the essence of this factor lies in the fact that consumers will use those products and services which do not require irrational consumption of resources and energy, and which will meet their needs for efficient use of resources and energy, better and more quality life, waste minimization and the like;

- Collection – collection of products that ended up in landfills as waste after their lifetime and their inclusion as inputs in the production process will minimize the use of resources and energy from nature, minimize waste at landfills and improve waste management;
- Repair - production of a product with functions that enable its repair or revival contributes to prolonging the product life cycle;
- Distribution and movement of materials - the flow of resources (materials) is important for the introduction and development of the circular economy, and a basic way to achieve an uninterrupted flow of materials is through an integrated (sustainable) supply chain. An integrated supply chain will close the loop that exists between upstream and downstream supply chain participants. Also, inverse logistics, which implies the movement of materials from consumers to producers, is crucial for extending the product life cycle and its reuse by consumers (Zhu et al., 2010).

Another driver of the circular economy is related to ecological balance and protection. The aim of this driver is to reduce the negative effects of the linear economy on the environment by using end-of-life products as basic inputs in the production (or provision) of products (services). Factors contributing to ecological balance and protection are as follows (Patwa et al., 2021, p. 727):

- Energy and resource efficiency - efficient use of resources and energy will enable the production of products that will return to the production system at the end of their life, less waste will be generated and new energy sources, that will result better energy efficiency and less harm to the environment;
- Clean and renewable energy - the so-called green energy sources that come from nature itself, will cause less harmful consequences;
- Waste management - inadequate waste management from the aspect of environmental protection is a global problem. Appropriate waste management, especially hazardous waste, is crucial for achieving ecological balance and protection. The basic principles of waste management are: waste disposal, waste processing, waste reusing and optimization/minimization of the amount of waste at source (Environmental Protection Agency, 2020);
- Waste from energy - the use of waste as energy will reduce waste in landfills and minimize the use of new energy.

The large flow of data and information is the third driver of the development of the circular economy. Fast and efficient data processing plays an important role in the adoption of the circular economy model. The availability of a large amount of information has enabled cloud computing, which allows its users, via the Internet, to meet the requirements in the form of gathering computer resources, such as servers, infrastructure, applications, services and the like (Patwa et al., 2021). Relevant information enables better management of valuable and scarce resources, more efficient use of energy, full monitoring of the product during its lifetime, raising public awareness of environmental protection and so on.

The fourth driver of the circular economy relates to the government policies of one state. Government policies play a key role in the development of the economy whether it is the linear or circular economy. The role of the state in the development of the circular

economy is crucial since it can, through various laws and regulations, direct the behavior of economic entities (on the one hand) and the population (on the other) towards production and consumption that support the basic principles of the circular economy. The goal of every state is to achieve general social well-being (Patwa et al., 2021).

The last driver of the circular economy, but not the least important, is consumer behavior. Consumers in the circular economy are the main link in its development. For the development of the circular economy, the attitude and awareness of consumers towards the principles of the circular economy is of key importance. The state with its regulations can significantly influence the positive attitude of consumers about nurturing the circular economy, but education, communication and cultural factors are important determinants that shape consumer behavior (Patwa et al., 2021). Education is a mechanism which influences the positive attitude of consumers towards nature and environmental protection. Effective communication (advertising, promotion) can influence consumers to participate in the development of the circular economy. How much consumers will accept the new model of economy will largely depend on their cultural environment - ideology, social class, tendency to buy "green" products, the idea of nature conservation.

The success of the introduction of the circular model of the economy will depend on the success of the application of these factors, i.e. the drivers of the circular economy.

Strategies and goals of the circular economy

The concept of the circular economy starts from replacing the current model of economy, the so-called linear model of the economy to ensure economic growth with the reuse of waste as a basic resource in the production of another product, and minimizing the extraction of new resources and energy from nature. Accordingly, the key goals of the circular economy are:

- waste minimization at landfills,
- use of waste as a basic material in the production process,
- rational and efficient use of resources from nature with special emphasis on the use of renewable energy sources,
- production of a product that can be recycled and reused as raw material,
- environmental protection,
- more efficient production models,
- competitiveness of the economy.

Morseletto (2020, p. 3) assumes that, when moving to the circular economy, there are concise goals of the circular economy that are systematized in five main areas of application of the concept: goals related to resource efficiency (water, energy, materials), recycling goals, reduction goals (waste reduction and emissions), recovery goals (waste, water and energy reuse goals) and eco-design goals. These areas of the circular economy are the main areas. However, the basic lack of observation of goals in these areas is wrong because the areas are interconnected (where there is an overlap of goals) and it is impossible to systematically consider all areas and goals of the circular economy. Accordingly, in order to systematically study the goals when moving to the circular economy model, the author starts from the "10R" strategy of Potting et al. (2017). Strategies are defined and systematized based on the following criteria (Morsaletto, 2020, p. 4):

- "useful application of materials,
- extend the life of products and their parts and
- smarter production and use of products".

The first criterion - useful use of materials, means waste that ended up in the landfill, and which by recycling and recovery of the same comes to raw materials and energy for the production of a new product. Within the first criterion, we distinguish two strategies (Potting et al., 2017, p. 5):

- Recovery (R9: Recovery) - recovery involves burning materials (waste) to get energy. The essence of this strategy is that waste (primarily organic waste) is not recycled but used as an energy source;
- Recycle (R8: Recycle) - recycling of waste involves the treatment of waste on the basis of which the material is obtained - secondary material to be used in new production phases as the basic input for production process.

Extending the lifespan of products and their parts is another criterion that aims to define strategies that will contribute to extending the life of products (and their parts) and improve their value (Potting et al., 2017, p. 5). There are five strategies that belong to this main strategy. Those are:

- Repurpose (R7: Repurpose) - repurpose means the use of products and their parts after their use in the production of other products, but which will have a different purpose (function);
- Renewal (R6: Remanufacture) - renewal or reproduction implies the use of parts of discarded products for the production of a new product that will have the same purpose or function and similar quality as the discarded product;
- Overhaul (R5: Refurbish) - overhaul implies constant improvement of the product in order to maintain the quality of the product during the extended life of the product in order to meet the needs of users;
- Repair (R4: Repair) - repair is considered as the servicing of a defective product so that it serves the same purpose (function);
- Reuse (R3: Reuse) – "reuse can be defined as the second or further use (of another user) of a product that is still in good condition and manages to fulfill its original function" (Morsaletto, 2020, p. 7).

Table 1. *Circular economy strategies*

Smarter product use manufacture	R0: Refuse
	R1: Rethink
	R2: Reduce
Extend the life cycle of the product/ product elements	R3: Reuse
	R4: Repair
	R5: Refurbish
	R6: Remanufacture
	R7: Repurpose
Optimal application of materials	R8: Recycle
	R9: Recovery

Source: According to Potting et al. (2017, p. 5)

The third criterion refers to smarter production and use of products that precede previous strategies. The goal of this criterion is to design and develop production systems that will best fit the concept of circular economy (Potting et al., 2017, p. 5). In the field of smarter production and use of products, we distinguish three strategies:

- Reduce (R2: Reduce) - reduce means minimizing the use of new resources, materials and energy from nature, waste in landfills;
- Re-examine or rethink (R1: Rethink) - re-examine means re-elaboration or reconceptualization of ideas, processes, methods, concepts, use and subsequent use of products;
- Reject (R0: Refuse) - reject means to render a product useless with its function (purpose) and abandon the production of such a product, and produce a different product that will have the same function as the product whose production will be suspended (Linder, 2017).

Table 1 shows the basic strategies (criteria) and substrategies that contribute to the adoption of the circular economy and the abandonment of the linear economy. Morsaletto (2020), unlike the original scheme created by Potting (2017) - Table 1, focused primarily on strategies of different levels of circularity, starting from the idea that this order - from R9 to R0, provides identification of the most widespread goals of the circular economy.

Table 2. *Objectives of the circular economy strategy*

Strategies	Substrategies	Aims
Useful application of materials	R9: Recovery	Reduction of waste incineration. The range for waste incineration as a norm in order to establish a circular economy should be from 0% to 10% with a tendency to be as close as possible to 0%. In a perfect circular model, waste does not exist.
	R8: Recycle	Improving environmental performance through high quality recycling, on-site recycling, product content recycling and more. The product concept should be designed in a way that will ensure simple and easy recycling of the same.
Extend the life cycle of the product/product elements	R7: Repurpose	Time aspect of the objectives: to extend the lifespan of products and their elements by abolishing the "planned obsolescence of products", with a mandatory long warranty and reliability. Objectives related to loop efficiency: - cost reduction by improving organization, engineering, supply chain, business processes and spare parts; - improving product design that will enable product longevity, reliability, durability and product disassembly to facilitate product life extension; - cultural factors that imply shorter cycles of innovation, more complex products and various other factors on the supply and demand side.
	R6: Remanufacture	
	R5: Refurbish	
	R4: Repair	
	R3: Reuse	
Smarter product use manufacture	R2: Reduce	Use less material per unit of product (through design). Less use of new resources and energy in nature.
	R1: Rethink	More efficient use of products. Improving environmental performance (reducing emissions, toxicity and other negative effects on the environment). Production of products that can be at low cost "disassembled, repaired and upgraded".
	R0: Refuse	Suspension of production of products that have a harmful effect on the environment.

Source: Morsaletto (2020, p. 4-9)

Table 2 gives the basic goals of the circular economy strategies, from the R9 strategy to the R0 strategy. Morsaletto (2020) assumes that meeting the goals of the R9 strategy and the R8 strategy have the greatest impact on the success of the transition from a linear model to a circular economy, followed by strategies from R7 to the R0 circular economy strategy.

Although the author analyzed the goals separately for each strategy, he also pointed out the connection between the goals of individual circular economy strategies that can lead to compromise, synergy or complementarity between all ten circular economy strategies and their goals.

Achieving the goals of the R strategy of the circular economy will enable a quick and efficient transition from a linear economy to a circular economy model that implies economic growth with minimal use of raw materials and energy from nature and maximum use of waste as basic input in production systems.

Conclusion

The circular economy as a new model of economic system has emerged as a potential solution for the rational and efficient use of limited resources in nature. The circular economy is an economic system based on the production of products using waste as a basic raw material and the least possible extraction of necessary new resources, all with the aim of protecting the environment and achieving and promoting sustainable development. To succeed in its intentions, the circular economy is based on the "3R" principles: Reduction, Recycle and Reuse. In addition to the basic principles of the circular economy, in order to move from the linear to the circular economy, it is necessary to adhere to "10R" strategies - Recovery, Recycle, Repurpose, Remanufacture, Refurbish, Repair, Reuse, Reduce, Rethink, Refuse. The main goals of the circular economy are to minimize waste in landfills and pollution, minimize the use of new resources and energy and their more rational use, improve environmental performance, protect the environment and improve sustainable development.

The development of the circular economy in the near future is crucial for environmental protection and better quality of human life, having in mind the irrational use of resources and negative effects on the environment as a result of the functioning of the linear economy. Establishing and maintaining a circular economy model in the economic sphere brings many benefits to present and future generations.

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