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P. 29-38

SCIENTIFIC REVIEW PAPER

10.5937/ESD2301029A

Received: September 15, 2022

Accepted: December 23, 2022

## SUSTAINABILITY AND PRODUCT LIFE CYCLE IN CIRCULAR ECONOMY

### Abstract

*Circular economy and business according to its principles are gaining in importance in increasingly competitive business conditions. The main goal of the company is to make a profit through respect for the environmental and social dimensions. Through sustainable development and the application of the zero-waste principle, the emphasis is shifted to production that saves resources and uses renewable energy. The aim of this paper is to emphasize the connection between sustainable development and circular economy, as well as the possibility of extending the life of products and raw materials through the concept of the circular economy. The importance of this topic stems from the need to align economic goals with the goals of preserving resources and the environment. The main purpose is to show the connection between sustainable development and the circular economy, as well as to point out how compliance with standards and recommendations can help in the transition from a linear to a circular way of doing business.*

**Keywords:** *sustainability, sustainable development, product life cycle, circular economy, standards*

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

## ОДРЖИВОСТ И ЖИВОТНИ ЦИКЛУС ПРОИЗВОДА У ЦИРКУЛАРНОЈ ЕКОНОМИЈИ

### Апстракт

*Циркуларна економија и пословање према њеним принципима добијају на значају у све конкурентнијим условима пословања. Основни циљ компанија јесте остварење профита, али кроз поштовање еколошке и социјалне димензије. Кроз одрживи развој и примену принципа нула отпада, акценат се*

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*преноси на производњу која штеди ресурсе и користи обновљиву енергију. Циљ рада је указивање на повезаност одрживог развоја и циркуларне економије, као и на могућност продужења животног века производа и сировина кроз концепт циркуларне економије. Важност ове теме проистиче из потребе за усклађивањем економских циљева са циљевима очувања животне средине и ресурса. Основна сврха јесте приказ повезаности одрживог развоја са циркуларном економијом, као и указивање на то како поштовање стандарда и препорука могу помоћи у преласку са линеарног на циркуларни начин пословања.*

**Кључне речи:** одрживост, одрживи развој, животни циклус производа, циркуларна економија, стандарди

## Introduction

As a new business concept of a growing number of countries and international companies, the circular economy contributes to greater competitiveness, with the goal of smart and rational spending of resources and energy. The essence is to take resources from nature, spend them in the process of reproduction to create products that serve the purpose and, after the end of the product life cycle, return them to processing, recycle and get new input for the production process. By investing in the use of waste and the use of renewable energy sources for processing and production, the company uses raw materials and energy from nature, but also protects nature and its environment from excessive devastation, and pollution and behaves socially responsibly to all future generations. The circular economy is a kind of sustainable development strategy based on economical and responsible treatment of the environment and natural resources. For decades, the need to improve and create conditions for sustainable development and coping with increasing environmental pollution and scarcity of non-renewable energy sources and raw materials has been emphasized. Developed economic activity in the world leads to numerous environmental problems that require an urgent solution and eradication of their causes. But the answer to the question of how to stop economic development when it is the engine of development and survival of society is only - to change the way it moves; to direct economic growth and economic activities towards respect for the principles of social responsibility and ecological balance through the more rational use of natural resources and maximal utilization and use of waste and recyclable materials. Such behaviour brings not only increases profits through numerous savings but also creates a good basis for economic prosperity in the future.

Many companies are moving from a linear to a circular economy because of the perceived benefits of this way of doing business. First, there are greater savings in the procurement of raw materials through the use of recycled materials, then energy savings through the use of renewable sources such as sunlight, wind power, construction of its own hydropower plants, and through increased competitiveness and job creation. Above all, a socially responsible business, which means respecting the principles of environmental protection and a responsible attitude towards the population, provides

a better position in the market and respect for such a company by consumers, which ultimately reflects on the company's business results. On the other hand, by constantly "circulating" raw materials and materials through the production process, the value of materials and products is "retained" longer, so even after the life cycle of the product they can either be reused or returned to their original state through the processing of their components.

The field of the circular economy requires a comprehensive, holistic approach to understanding and involving a larger number of stakeholders. Various institutions, economic entities, but also the entire social community, have numerous interests in achieving the positive effects of the circular economy. The application and respect of the principles of circular economy enable the improvement of living standards, living conditions and business results of companies. The basic principle of circular economy is that, within the limits of technological possibilities, waste materials from the production process or after use by consumers are processed and recycled, in order to be found again in the process of reproduction. Along with it, the principle of consuming renewable energy sources and energy savings enables the realization of the principle of social responsibility of each individual or society as a whole. Numerous methods and tools applied to implement the principles of circular economy and combine all three aspects - social, economic and environmental, facilitate the use of analytical frameworks such as LCSA (Life Cycle Sustainability Assessment) which in synergy with circular economy principles can lead organizations to achieve positive business results.

Through understanding the basic characteristics of the relationship between sustainable development and circular economy, it is important to know their synergistic action and orientation towards identical goals that require a well-conceived strategy and measures for their implementation. One way is to retain value within the system, extending the life of products and materials. The education and training of stakeholders, the entire community and individuals are essential issues for the survival of the economy and a healthy environment in the future.

## **1. Interconnection of circular economy and sustainable development**

The world economy and the most developed countries face shortages of resources and the growing negative impact of climate change and environmental pollution. The transition from a linear economy to a circular model of business and reproduction is necessary. The time when raw materials were in abundance and the environment was ecologically unpolluted and full of power is far behind humanity, so the principle according to which the best is extracted from nature, processed and sold for a big profit and then thrown away, is no longer valid. The linear principle is dominant, but the circular economy and the circular flow of business are attracting more and more attention. The reasons for such behaviour and change of consciousness are financial, environmental, but also social (Lewandowski, 2016). Due to increasing competitiveness, as well as the increasingly sophisticated needs of consumers, faced with a shortage of raw materials and energy, many companies are turning to savings through the application

of a circular business model. Profit-oriented, but on the other hand, through this social and environmental dimension and socially responsible, companies accept a new business pattern and think “circularly”. Thus, the question arises of how to process and turn the same resource as many times as possible through the process of reproduction, to make an identical product from waste and thus multiply the value of the material and the waste material itself (De Sousa Jabbour, 2019). The connection between economic development, environmental protection and the development of a social community is the reason why companies harmonize their business development with real social development and consider the impact of their activities on the environment. The Sustainable Development Guidelines strike a balance between the goals of these three important business dimensions - economic, social and environmental.

The concepts of sustainable development and the circular economy are inseparable, and when it comes to implementing one or the other, in fact, all the goals, strategies and tools for their application are closely linked. It is the respect of the ecological, social and economic dimensions of business in the circular economy that leads to the comparative respect of all the principles of sustainable development of society. The circular economy, through the rational use of resources and the use of waste secondary raw materials, with the adequate use of renewable energy sources, acts in the direction of achieving sustainable development, because it behaves responsibly towards the natural environment and the community. The concept of sustainable development strives to achieve economic goals by preserving or improving the quality of the living environment. At the same time, the paradigm of circular economy is based on a production system respecting the principles of sustainable economic development, without harming the environment (Marković et al., 2020).

Economic activities such as industry, mining, energy or agricultural production contain reproductive processes that pollute the environment and, often, products that end up as waste. All this causes serious environmental problems that only increase from generation to generation. It is the Sustainable Development Strategy from 1992, in response to growing environmental problems in the world that emphasizes the achievement of three important goals: preservation of ecological balance, fair distribution of natural resources between generations and insufficient development (Žikić et al., 2016). Viewed in this way, the circular economy is a good framework for the realization of goals and strategies for sustainable development. In fact, it supports and emphasizes the postulates of sustainability, emphasizes the importance of the natural environment and living space and emphasizes the preservation of ecology for future generations, through the rational use of non-renewable and scarce resources, and increasing engagement of renewable energy sources.

There are three possible links between sustainable development and circular economy: 1. Circular economy is a prerequisite for sustainable development; 2. The circular economy is useful for sustainable development; 3. Circular economy and sustainable development have a compensatory relation (Suárez-Eiroa et al., 2019).

It is of crucial importance to note which dimensions of sustainable development are identical to the dimensions covered and affected by the circular economy. The circular economy has predominantly economic and environmental goals, and the overall concept of sustainable development refers to the achievement of economic goals while respecting environmental principles and the principles of environmental protection.

Circular economics pays much less attention to social goals (Sauvé et al., 2016).

Both concepts require the involvement of various stakeholders who have interests for successful implementation - both entities with economic interests and those with non-economic goals, in achieving socio-economic development. Also, with legal regulations and incentives, it is possible to realize and achieve the goals of both concepts in parallel.

Although at first glance these two concepts have a lot in common, there are some differences between them. First, the concept of sustainable development has a significantly higher number of goals. In addition, the circular economy is based on resource efficiency and reducing waste, while the concept of sustainable development is much broader. Circular economy emphasizes at the same time economic and environmental benefits. Compared to linear, it observes the comprehensive benefits of a new way of doing business based on respect for the principles of social and environmental responsibility (Schroeder et al., 2018).

Figure 1: Sustainable development and circular economy goals (Agenda 2030)



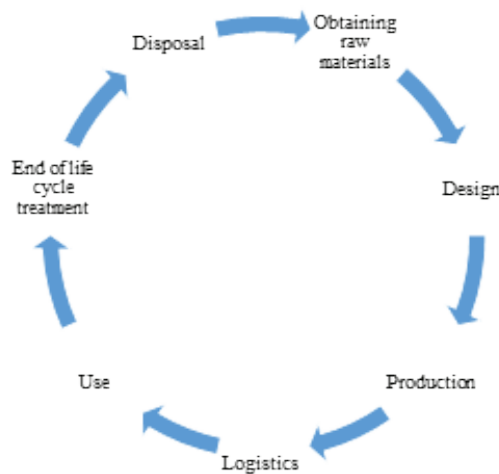
Source: Adapted to the Ministry of Environmental Protection (2020)

The 2030 Agenda for sustainable development is based on 17 sustainable development goals, the main purpose of which is poverty eradication, social and health protection, economic growth and solving climate problems (Ministry of Environmental Protection, 2020). Among the goals of sustainable development, seven goals are directly related to the application of the circular economy and they are declared as the primary goals of this concept. These include Goal 7 – affordable and clean energy, Goal 8 - decent work and economic growth, Goal 11 - sustainable cities and communities, Goal 12 - responsible consumption and production, Goal 13 - climate action, Goal 14 - life below water, Goal 15 - life on land.

## 2. Product life cycle in the circular economy

In the circular economy, products are expected to be designed and engineered in a way that enables durability, repairability and reuse, or recycling of the material from which they are made, after the end of their useful life (Bogetić et al., 2021). Circular economy products can be reused after the end of their life, although in most cases they are recycled and the raw material that is the basis of new production is obtained. This is the essence of the postulates of the circular economy and the product-waste-product relationship, which emphasizes the creation of conditions for uninterrupted production while reducing the amount of waste in the environment and reducing the exploitation of natural resources. The products are therefore purposely designed and engineered in a way that they can be easily dismantled later and that their components can become part of recycling and then the production cycle again.

Figure 2: Product life cycle in the circular economy



Source: Adapted to Balkan Green Energy (2021)

Through product design, a company determines which materials it will use in the production and how to combine resources that can be replaced, reused and finally recycled and reused as a secondary raw material in identical production. Through the

very choice of materials and raw materials for production, it greatly influences the profitability and increase of the company's income, i.e. the reduction of the costs of materials in production.

The circular economy requires action at all stages of the product life cycle, from the choice of design, through the procurement of materials and raw materials, production, distribution and sales, but still - reuse or production and waste management (Figure 2). By applying the principle of circularity, the life cycle of the product is extended, because the product gets a new look after the end of its life cycle, is repaired, and is ready for new use (depending on the type of product, material and purpose) or through disassembly of components by the recycling process serves as an input raw material for new production. Indeed, the percentage of waste that cannot be used in the circular economy is quite small.

For the sake of sustainability and success of a circular economy, economic, environmental and social aspects of circularity are jointly taken into account and, in that sense, the LCSA framework - Life Cycle Sustainability Assessment is used as a framework for estimating the circular economy strategy (Niero & Rivera, 2018). In addition to this framework, there is also an environmental life cycle assessment (E-LCSA), a life cycle cost (LCC) and a social life cycle assessment (S-LCSA). By synergy and joint integration of the LCSA framework and the circular economy, positive results can be achieved at the level of the organization or even the sector. Therefore, the application and integration of the BS 8001: 2017 standard (Niero & Rivera, 2018) entitled "Frameworks for the implementation of the principles of circular economy in organizations" is suggested.

### **3. BS 8001: 2017 standard - Framework for the implementation of the principles of circular economy in organizations**

BS 8001: 2017 is a standard that is not suitable for certification and is not intended for it, but is useful to enterprises as a support in terms of the introduction of the principles of circular economy and sustainability in their business. This standard observes the circular economy as regenerative in order to maintain the utility and value of the materials and components of the product itself at the highest level at all times. Thus, the goal is to have a product of high value and usefulness, made so that even after the end of its useful life, its components and materials retain their value through reuse. The standard suggests that it is important to notice through its application because it is important to think circularly - how to implement the principles of the circular economy within the organization in order to create a higher level and quality through the process of product reproduction or innovation.

This standard is guided by compliance with the minimum principles crucial for achieving the defined objectives, presented in Table 1.

The stated principles of the standard are used to determine and assess the state of circularity in the organization through certain phases of the framework presented in the standard. In the first phase, it is important to realize the importance of the concept of circularity for the organization. Then, in the second phase, the vision and strategic plan

for the implementation of the concept are defined. The third phase is designed to generate ideas and then assess feasibility. In the fifth phase, business models are considered and prototypes are made. This is followed by implementation and monitoring and the audit phase.

There are several ways to apply the principles of this standard in an organization and to improve the process of transition from a linear to a circular economy to be more successful:

1) Sharing platforms’ model instead of buying the product itself - a model based on a platform for providing services and sharing products among consumers, which means that the user of the product is not its owner and has no responsibility for it after use. It is used in the automotive industry, tourism, construction;

2) Resource recovery model - a model that contributes to the disappearance of waste through the reuse of materials and components of products that have expired. This model directly increases the economic efficiency of the use of raw materials and reduces the disposal of either raw materials or waste;

3) Product life extension model - in the model, the value of the product and consumed materials is “retained” longer because various repairs and redesign of existing products affect the extension of its life. The company has significant savings both in materials and in all other costs that occur in the value chain;

4) Product as a service - the basis of this model is the lease agreement, and the product is still the property of the manufacturer. It is especially suitable for all products with a longer useful life (Ministry of Environmental Protection, 2020).

*Table 1: Principles according to the BS 8001: 2017 standard*

<i>Principle</i>	<i>Description</i>	<i>The objective of the principle</i>
<i>Systemic thinking</i>	Applying a holistic approach	Understanding how individual characteristics affect the system of which they are an integral part
<i>Innovation</i>	Undertaking anything that is new and changed and that results in redistribution of value	Creating value through enabling sustainable resource management based on product designs and business models
<i>Management</i>	Management of impacts of the organization's activities within the broader system of which they are part	Considering the economic, environmental and social influence of the organization's activities in the supply chain system
<i>Cooperation</i>	Different forms of cooperation – formal, informal, internal and external	Creating common values between organizations
<i>Value optimization</i>	Storage of all products, their components and materials in greatest value and usefulness	Examine what waste or systemic loss would be, determining opportunities to take into account new potential for new investment through them
<i>Transparency</i>	Be open to decisions and procedures that enable the transition to a circular economy and the readiness to communicate in a clear, timely, and fairway	Building trust at all levels, in public relations, suppliers and customers

*Source: Niero & Rivera (2018)*

Models can be used separately or combined. Companies decide on this based on the analysis of internal characteristics and external opportunities, respecting their own



business strategy and the principles of circularity that they strive for. Manufacturing companies start their circular business mode in the phase of designing products, in which the direction of development of the entire process is determined.

## Conclusion

Business conditions in the world impose the need for reorientation of companies from a predominantly profit point of view to wider aspects, in which there is interest in environmental and social needs. Companies are using the circular economy as a new way of achieving economic and financial goals and are gradually replacing the linear concept with a circular one. In their business so far, they have been forced to invest money every day in materials, distribution channels and other business segments. At the same time, certain types of production and product ranges require the exploitation of scarce resources, the use of expensive energy sources and the storage of waste that had no purpose. Circular economy uses waste as a new raw material, saving on resources, energy and time. In addition, the circular economy supports the concept of sustainable development, a development that does not harm either the current or future natural environment. Therefore, the connection between these two concepts is harmonious - by respecting the principles of sustainable development and striving to achieve its goals, the goals of the circular economy are achieved - according to Agenda 2030, in which 7 out of 17 goals of sustainable development are circular economy goals.

Through recycling and use of already used raw materials or through reuse of products (overhaul, redesign, replacement of product components), the product life cycle is extended. Companies, already in the product design phase, are thinking about how to make the product recyclable, desirable for the environment and assembled in a way that facilitates its use or disassembly into its constituent components. Today, modern materials are used that can be reused. The aspiration is directed towards the use of renewable energy sources, wind, sun, and water, with the necessary respect for ecosystems and the non-disturbance of natural resources.

The application of the LCSA framework enables the integration of the economic, social and environmental dimensions of circularity. The professional literature advocates the application of the BS 8001: 2017 standard, which is more of a recommendation but is useful in introducing and respecting the principles of the circular economy. Its six principles seem simple, but they actually reflect the essence of such an important process: the principle of systemic thinking, the principle of innovation, management, cooperation, the principle of value optimization and transparency. It is important to apply the principles on a personal level, but above all, on the level of the organization, and to be equally committed to each of them, because that is a guarantee of success. Companies can apply some of the business models, such as sharing economy and a service delivery model instead of buying products, reusing resources, extending life, or modelling products as a service. It will depend on the type of production, the type of product and the goals of the company itself.

Major environmental problems in the world, such as climate change, shortages of clean water, and increasing pollution of land, water and air, require not only an urgent response from the public but also a systemic and permanent solution, as offered by the

concept of the circular economy. The transition to new business principles and respect for not only economic but also social and environmental premises is important for business success, and long-term economic development, but also for the health and well-being of the entire society.

#### **Acknowledgements**

This paper is part of the project that has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101059994.

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