

THE REUSE OF WASTE MATERIALS IN THE CONTEXT OF THE CIRCULAR ECONOMY

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Abstract

The aim of this report is to present the possibility of reusing waste materials in the context of the concept of a circular economy. Attention is paid to the closed loop production system and the elements of the 6Rs for the implementation of the principles of circular economy and sustainable development. Emphasis is placed on the possibility of reusing waste materials as a competitive advantage for small and medium-sized enterprises (SMEs).

Keywords: circular economy, sustainable development, waste, competitive advantage, SMEs.

INTRODUCTION

The activity of small and medium-sized enterprises (SMEs) is accompanied by relentless competition in modern times. On the one hand, business is still recovering from the economic turmoil created by COVID-19, and on the other hand, the World is the scene of rapidly developing and unforeseen internal and international conflicts and military actions, economic instability, and migration processes. Considering Europe's desire to limit the use of non-renewable energy sources and the concept of a circular economy that has been imposed in recent years, the SME management strategy needs to be revised. All these factors external to the enterprises have their adverse impact, but also open opportunities for development, which creates the need for quick and adequate management decisions and the creation of strong and sustainable competitive advantages over time.

The object of this study is the concept of circular economy.

The subject of the study is the reuse of waste materials.

The purpose of this study is to present the role of the reuse of waste materials in achieving the goals of the circular economy and sustainable development of society.

To achieve the goal defined in this way, the following **tasks** are set:

- To reveal the essence of the concept of circular economy.
- To present the elements of the 6R concept integrated into the closed production cycle.
- To point out the role of the reuse of waste materials in achieving sustainable development.

The implementation of these tasks allows us to highlight the advantages of applying the principles of the circular economy to form the competitiveness of SMEs.

CIRCULAR ECONOMY AND CLOSED LOOP PRODUCTION SYSTEM FOR SUSTAINABLE DEVELOPMENT

Much has been written about the need to implement the principles of the circular economy. A number of authors [1,2,3,4,5,6, 7,8] offer theoretical and empirical evidence to support the thesis of the urgent end of the application of the linear model, which generates significant amounts of waste and has a negative and irreversible impact on the environment, and its replacement by the concept of the circular economy. The separate definitions of the

circular economy focus on one side or another of the advantages of the circular model, including: achieving economic growth, priority use of renewable energy; reducing the impact on the environment; the connection between circular economy and sustainable development. Therefore, the present work does not aim to systematize and analyze the author's well-known views in the field of the theoretical formulation of the concept, but adheres to the definition we have previously deduced, according to which „*The circular economy is a model of the economy in which the aim is to maximize the utilization of the extracted and used resources while achieving a minimum of unusable waste.*“ [9, p. 3].

The emphasis in the proposed definition here is placed on waste and the possibility or impossibility of its reuse. According to UNEP, waste is „*unintended by-product of consumption and production*“ [10, p. 10]. A basic idea in the circular economy model is to minimize the number of unwanted by-products reaching the environment by applying repeated use of raw materials, and products.

Thus, in the context of the circular economy, several business models (BM) have been developed looking for an answer to the question: *How to achieve minimization of waste materials and maximization of the process of operation and use?* One of the solutions is the implementation of the “Closed Loop Production System” [11] (see Fig. 1), which implies repeated reuse of the materials used in the production or of the final product. [12].

According to Souza, the closed loop production system represents „...*supply chains where, in addition to typical forward flows, there are reverse flows of used products (postconsumer use) back to manufacturers*“ [13, p. 1]. From a management point of view, the closed loop “*is the design, control and operation of a system to maximize value creation over the entire life-cycle of a product with dynamic*

recovery of value from different types and volumes of returns over time” [14, p.1].

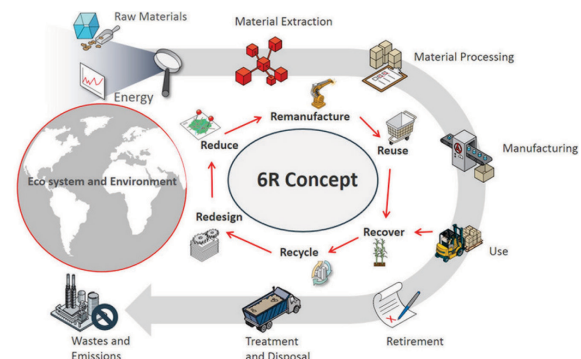


Fig. 1. Closed Loop Production System [15]

Integrating the 6R concept into the closed loop production system (see Fig. 1) creates an opportunity to achieve sustainability [16, 17, 18, 19]. The individual activities of 6Rs (Reduce, Reuse, Recycle, Recover, Redesign, and Remanufacture) are conducted after the end of the first product life cycle and prepare it for its subsequent use [18]. This requires **the recovery** of products at the end of the use phase, after they have been collected and further processed and prepared for subsequent use. Those products that cannot be reused **are subject to recycling** – the process of converting used materials (waste) into new materials or products. **The redesign** is based on the use of components and materials from previous generations of products and their use in innovative products of a newer generation. **Reduction** aims to limit the materials used (raw materials, energy, resources, etc.) to achieve efficient production and effective subsequent use of the manufactured product. **Remanufacturing** refers to products that can be processed and restored to their original state and level of functionality. **Re-use** affects the possibility of using a material, product, or parts thereof for a subsequent life cycle (more than once) without further processing [16].

The integration of this concept into the management of SMEs helps to reduce resource dependency and limit the waste generated, in line with the concept of

sustainable development, which is “...a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations.” [20, p.46]. A significant contribution to achieving higher efficiency in the exploitation of resources is the **process of reuse**.

REUSE OF PRODUCTS AND WASTE MATERIALS

As can be seen from the hierarchical structure of waste activities [21] (see Fig. 2), one of the elements of the 6R – re-use concept is the focus of actions that SMEs need to take to prevent the creation of waste.



Fig. 2. Waste hierarchy [21]

The reuse of products and waste materials is one of the most preferred means to achieve sustainable use of resources and reduce waste. The prerequisites for this are revealed in the minimal need for post-processing and the energy used in this process [22]. Unlike the recycling process, in which the primary product is processed into a functionally new product (in this technique, it is possible to create harmful wastewater and generate other waste), reuse (a completely ecological technique, if the product itself does not have a harmful impact on the environment) extends the life cycle of an already created product.

The possibility of reusing products depends on the application of innovative technologies in production processes that

limit the amount of waste materials. For the remainder, it is necessary to provide conditions for subsequent use as raw materials for another type of production.

By applying reverse logistics, SMEs can obtain the no longer usable products from their customers and make them available for reuse to other customers. This activity implies the development of quality products whose components are reusable, with a design for efficient longevity and an end to unfair manufacturing practices of planned obsolescence of individual product groups [23, 24]. The latter is particularly important in achieving effective waste management, since the physical and technological obsolescence of products planned by manufacturers not only forces the consumer to replace the purchased product before it is inevitable, but also creates prerequisites for the senseless depletion of resources and the accumulation of unusable waste polluting the environment.

BENEFITS FOR SMES OF WASTE REUSE

Both the waste generated by the enterprises and the possibility of creating competitive advantages from its reuse follow the nature of the activity of the enterprise. A key requirement for the development and implementation of the principles of circular economy at the level of SMEs and the inclusion of the 6Rs is the ability of enterprises to create sustainable value.

Several business models are known that justify and represent the way in which enterprises create, deliver and capture value [25]. Business models are a means of boosting competitiveness and, when aligned with the principles of the circular economy and sustainable development, they become an inexhaustible source of competitive advantage for SMEs.

Jawahir & Bradley [18] propose a model for Sustainable value creation by integrating several technological elements (see Fig. 3).

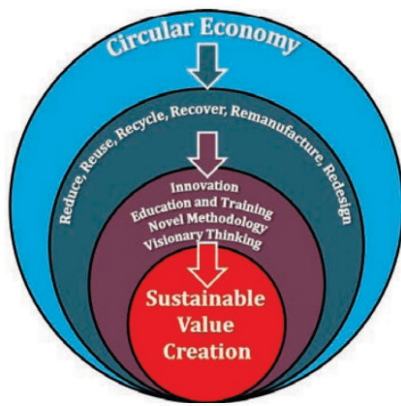


Fig. 3. Circular economy leading to sustainable value creation through its integral technological elements and the associated characteristics. [18, p. 107]

The mechanisms for achieving sustainable value according to the proposed model (see Fig. 3) include product or process innovation, quality education and training, new methodology and visionary thinking [18].

Innovations in products or applied processes require the development of new patentable technologies and optimization of already available product solutions, applied processes and systems used. Education and training are a means of achieving sustainable value creation through investment in the future generation and the development of innovative creative and applied thinking. Linking human creativity to the established technical base is a tool for creating rational and realistically applicable solutions to current and expected problems.

Thus, created in the context of the circular economy and the concept of 6Rs, sustainable product value can be maintained by:

- reducing dependence on primary materials and reusing waste products.
- switching from non-renewable to renewable energy systems.
- adopting more sustainable production practices.
- greening the entire value chain [26].

These activities are also a prerequisite for increasing the competitiveness of SMEs, which, through the introduction of environmentally friendly business models, can achieve several types of competitive

advantages (see Fig. 4), depending on the nature of their activities. Among the more common are:

- reducing resource dependence on non-renewable sources;
- achieving higher efficient production;
- creating high-quality, innovative, and demanded products;
- increasing the recognition of SMEs and their products among certain categories of consumers looking for and following an environmentally friendly lifestyle;
- creating a network of contacts with suppliers, collaborators and consumers who share the environmentally friendly and sustainable principles followed by the company.

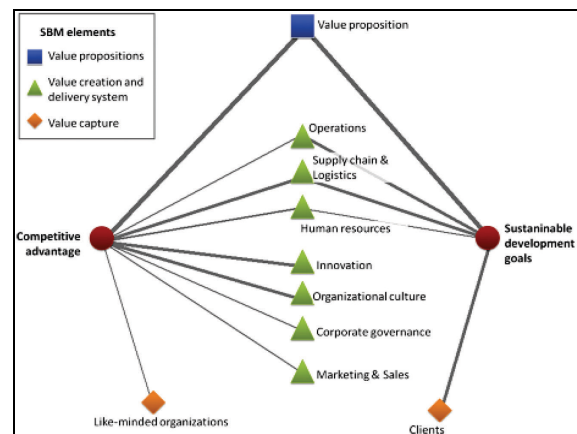


Fig. 4. Connection between SGD's and competitive advantage through SBM elements [27, p. 734]

These advantages, manifested and contributing to the achievement of the Sustainable Development Goals (see Fig. 4), support the creation of sustainable product value, which is also a competitive advantage for SMEs.

CONCLUSION

The proposed development presented the relationship between the concepts of circular economy and sustainable development, expressed through the closed loop production system and the elements of the 6R. The advantages of applying circular business models (CBS) for management and achieving sustainable development of SMEs are presented, as well as the role of

the reuse of raw materials, materials, and finished products for the formation of sustainable value of products.

To address the issue in its entirety, the disadvantages posed by extending the life cycle of products and creating opportunities for their reuse should not be overlooked. Product and process innovations are associated with the cost of time, money, and labor. The reorganization of production processes and the optimal use of raw materials and materials, together with the creation of a method for the reuse of waste materials, requires high investments. As a result, a product is obtained, the price of which corresponds to the significant amount of effort invested in its creation. And while the focus of politicians is on the development of this environmentally friendly product, significantly less attention is paid to consumers, who will be burdened with the price of the product, which may be unaffordable for many of them.

While we strive for a better future for ourselves and our children and are aware of the problems posed by the uncontrolled extraction of non-renewable resources and the global level of pollution with waste of various nature, the actions of everyone depend to the greatest extent not so much on their desires as on their capabilities. Due to this fact, until uniform rules and requirements are applied to the process of obtaining raw materials and their subsequent production to obtain certain groups of products, the consumer will always be faced with the opportunity to choose a product at a lower price that will satisfy his needs over an environmentally friendly product with a higher final price.

This also poses a risk for SMEs, for which uncertainty regarding the sale of "green" products is a sufficient condition for abandoning high-risk and uncertain investments.

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