

## **A PERSPECTIVE OF THE CHALLENGES FACED BY THE CIRCULAR ECONOMY - LIMITATIONS AND OBSTACLES**

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### **Resumo**

The genesis of environmental sustainability and the problem of the exploitation of natural resources are strongly related to the construction of the conventional economic model. Because over the centuries, sustainability has been viewed by society, companies, and governments as something to be achieved by different industrial models and from a linear perspective. However, when it comes to the environmental aspect, it is essential to recognize that any growth is linked to the biophysical environment, local, national, and global, so it affects economic development in several ways, as well as being impacted by it, the more growth increases. Environmental sustainability is a theme that, as a proposal, seeks to redirect the process of building society to question the logic and premises that support and shape economic growth, which until then ignored ecological processes. Based on these premises, the core objective of any sustainable economy is to find opportunities and alternatives to make the economy work, considering the existence of limits on natural resources so that the market efficiently allocates investments following ecological and social restrictions. The theme of sustainability naturally questions the current development model in which the environmental, social, and economic systems do not have the same relevance and consideration to generate a balance that would guarantee a viable model of sustainability. The circular economy is a regenerative chain model where care is taken to minimize losses and waste of materials and energy. It starts from the principle of a vision of integrating economic activity with social and environmental elements. In other words, it aims to generate environmental, economic, and social values. A gap still highlights the need for studies investigating and presenting the barriers and challenges of adopting sustainable practices. Therefore, it is necessary to evaluate the primary studies and compare the evidence to examine which barriers prevent the implementation of a CE. So, what bottlenecks and challenges exist in a circular economy model? Therefore, the article aims to exemplify the main obstacles in implementing the circular economy and demonstrate the challenges of the circular economy model. However, a brief explanation of its origins is needed before we begin to address the concept of a circular economy. In the same way as environmentalist movements, no date coined the circular economy concept since the concept comprises the sum of thinkers who sought to understand economic and ecological relationships within the premise of obtaining a harmonious balance. Supported by these sustainable requirements, a new comprehensive business model emerges as a new alternative called the Circular Economy. CE is a proposal to achieve sustainability, intending to reduce waste, gas emissions, and energy expenditure. The circular economy model is based on transforming the linear pattern of take-make-use-dispose into closed cycles of material flows. CE functions as an umbrella concept in that it brings together a wide range of waste and resource management strategies and focuses on their ability to extend the life of resources while generating

value and preventing material loss and destruction. The diversity in the conceptual formation of CE and the scope of existing definitions encompassing all activities carried out in society may explain the need for more consensus among scholars regarding its interpretation. Although the circular economy presents an unquestionable approach to addressing environmental sustainability, its implementation is not planned. Despite the potential gains, the implementation of CE occurs slowly in practice, and several barriers obstruct its actions. Globally, the degree of circularity in the economy could be higher, and critics also highlight that current interpretations fail to deliver the promised results about the social dimension of sustainability. Instead, economic growth is elevated above more radical socio-environmental transformations. Discussing the concept and its definition, which were covered in previous topics, is essential to analyze the barriers. Therefore, when understanding the comprehensive idea of the circular economy, including the macro, meso, and micro levels associated with production and consumption, it can be seen that the barriers to implementing CE strategies are diverse and complex. It is essential to highlight that the identified barriers to CE may be exhaustive and vary from organization to organization and country to country. In addition to identifying these obstacles to implementation and proposed solutions, it is essential to create support networks between governmental and non-governmental organizations committed to promoting, regulating, and monitoring the implementation of CE. The demographic increase, combined with the expansion of global consumption and the scarcity of resources available in contemporary times, outlines an unsustainable paradigm that is incapable of sustaining its premises, highlighting the imperative need to transition from the current economic model (extraction-production-disposal) to a more sustainable and resilient system. Thus, we see that the challenges of CE require significant changes, both in society and companies, as well as in how public bodies plan and prioritize public policies. Therefore, the challenges permeate aspects of the systemic view on entropy and growth, the relationship between materials, energy, and biodiversity, measuring the impact of the circular economy, social and cultural governance, and alternative means of circularity. The present study lists seven barriers that impact the implementation of CE, categorizing these barriers into four factors according to expert opinion and a detailed review of international literature. It is identified that the obstacles to the implementation of CE are market information, technology, incentives, legislation, management, public awareness, and performance evaluation. A critical analysis of an exemplary nature demonstrates which elements (characteristics) are evident within each of these bottlenecks, in addition to suggesting ways via supply networks to eliminate or mitigate these obstacles upstream and downstream in a production chain. Research on CE is still in its infancy, and knowledge and practical studies are needed to determine which alternatives are necessary or sufficient for a CE to move forward. Based on the review and critical essay, a context of barriers to the circular economy prevails, and some challenges are highlighted. Therefore, both serve as a warning to develop a CE framework that considers socio-ecological and systemic aspects, so this article concludes that relevant research on CE barriers is an active field.

### **Palavras Chave**

Circular Economy, Obstacles, Challenges

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## **1 INTRODUCTION**

The need for a paradigm shift in economic development was driven by the emergence of more evident environmental problems, such as ecological imbalances, increased greenhouse gas emissions, and increased global temperatures, among others. Thus, in recent decades, some environmental policies and actions have gained prominence and relevance in the mainstream: Sustainable Development and Circular Economy (CE).

Therefore, CE is an alternative for managers concerning the multiple coexisting paths to achieve sustainable development. However, CE is still in its infancy compared to the traditional model, as there is still no consolidation in the divergent approaches used, and the model implementation strategies have not yet been standardized and validated in different environments to facilitate implementation (KALMYKOVAA; SADAGOPANB; ROSADOC, 2018).

A gap still highlights the need for studies investigating and presenting the barriers and challenges of adopting sustainable practices. Therefore, it is necessary to evaluate the primary studies and compare the evidence to examine which barriers prevent the implementation of a CE. So, what bottlenecks and challenges exist in a circular economy model? Therefore, the article aims to exemplify the main obstacles in implementing the circular economy and demonstrate the challenges of the circular economy model.

The justification for the research is that practices and concepts are important performance indicators for measuring the environmental maturity status of companies. In other words, studying these actions by companies means understanding which alternatives are adopted by companies as a way of improving economic and financial performance to generate value for shareholders and show socio-environmental responsibility (NEVES; MARQUES, 2022). In addition to the academic relevance, the research, through a critical academic essay, discusses the real challenges that such practices can bring, such as possibilities for business transformation and the best ways and means to mitigate the barriers encountered by the circular economy.

## **2 ANALYSIS AND DISCUSSION**

### **2.1 Circular Economy**

Several countries and organizations are committed to adopting CE approaches to use resources effectively to overcome unsustainable production and consumption systems. The circular economy is becoming a crucial driving force for sustainability and essential to national, international, and business policies. (GEDAM; RAUT; DE SOUSA JABBOUR; TANKSALE; NARKHEDE, 2021). In Schröder, Anggraeni, and Weber's (2019) understanding, CE has significant potential to achieve many Sustainable Development Goals (SDGs), as similar principles guide both. This familiarity of the scientific community with the SDGs has been a determining factor in the recent exponential growth of publications on the circular economy. However, some see and promote CE as an essential tool for sustainable development (MILLAR; MCLAUGHLIN; BÖRGER, 2019).

In the new CE concept, the recovery and valorization of waste allow the reuse of materials back into the supply chain, finally decoupling economic growth from environmental losses (GHISELLINI; CIALANI; ULGIATI, 2016). In essence, the circular economy proposes to extend the life cycle of products, benefiting the environment by reducing waste discarded in landfills, reducing the extraction of primary materials, and mitigating the environmental impact of industrial processing (FELLNER; LEDERER; SCHARFF; LANER, 2017).

In the words of Neves and Marques (2022), materials and resources must remain active in the economy for as long as possible, increasing their useful life and minimizing waste. For Jaeger and Upadhyay (2020), this holistic model aims to develop essentially waste-free systems based on the principle that products and their components are used regeneratively without compromising their quality, thus avoiding inclusion in the waste chain.

The circular economy concept trends among public policymakers and market professionals. The discussion about CE is of great interest because it is seen as a form of operationalization for organizations to implement sustainable development (GHISELLINI; CIALANI; ULGIATI, 2016; MURRAY; SKENE; HAYNES, 2017; KIRCHHERR; REIKE; HEKKERT, 2017). In other words, CE is an economic strategy for generating systemic value, intending to remedy the scarcity of resources, controlling biochemical flows, minimizing climate change and maximizing waste disposal, and enhancing regional economies (HOMRICH; GALVÃO; ABADIA; CARVALHO, 2018; FRIANT; VERMEULEN; SALOMONE, 2020).

Generally, the discourse on CE has been predominantly articulated by non-academic sectors, which defend numerous economic and environmental benefits from circular policies and business models. However, such discourses have failed to build a systemic and holistic understanding of the social and sustainability implications associated with the circular economy (MILLAR; MCLAUGHLIN; BÖRGER, 2019; FRIANT; VERMEULEN; SALOMONE, 2020). Furthermore, there is little discussion about the complex and controversial relationships between the circular economy, energy, resources, biodiversity, entropy, and economic growth (CULLEN, 2017; KORHONEN; NUUR; FELDMANN; BIRKIE, 2018; DESING *et al.*, 2020).

It can be considered that the circular economy is not a theory but an emerging approach to forms of business production and consumption (KORHONEN *et al.*, 2018b). It is more of a plurality of elements; you can say that it is a comprehensive definition, as it apparently provides a new construct capable of solving several problems, but it is still under discussion when it comes to aspects of operationalization where unresolved issues arise (BLOMSMA; BRENNAN, 2017; CORVELLEC; STOWELL; JOHANSSON, 2022).

## **2.2 Obstacles to the application of the Circular Economy**

Obstacles are elements that can delay or prevent the implementation of CE anywhere. The barriers identified are market information, technology, incentives, legislation, management, public awareness, and performance evaluation (SU *et al.*, 2013). These barriers, according to de Jesus and Mendonça (2018) and Grafström and Aasma (2021), can be categorized into technical factors (technology and performance evaluation), economic factors (market information), regulatory factors (incentives, legislation, and management) and social factors (public awareness). In Gedam's view *et al.* (2021), there is an elementary classification with the four factors mentioned, with technical and economic factors being challenging and regulatory and social factors being understood as soft barriers.

Reliability is crucial concerning market information because markets are imperfect. Assertive information is vital so companies can plan and design optimal scenarios for their reduction, reuse, and recycling activities (GENG; DOBERSTEIN, 2008), avoiding high implementation and financing costs (DE JESUS; MENDONÇA, 2018). Therefore, an efficient information system is crucial for decision-making processes to seek more ecological and financially profitable solutions.

The technological issue is a crucial element, as CE requires advanced technology for the best performance and updating of facilities and equipment, as with changes in the production process, old equipment generally consumes more time, energy, and money (SU *et al.*, 2013). For Grafström and Aasma (2021), although several necessary technologies have already been developed, there remains a lack of expertise among professionals who apply these

technological solutions. Another fundamental aspect is a design that extends the product's useful life or facilitates repair opportunities, as some current designs represent a significant obstacle to remanufacturing, reuse, and recycling (MASI *et al.*, 2018).

The obstacle to standardization of performance evaluation must cover the entire process of collecting, calculating, and sending data, generating reliable indicators oriented towards prevention to establish specific and quantitative goals (GENG; FU; SARKIS; XUE, 2012). We see that technical barriers encompass factors related to the availability of adequate technology and gaps in production and control aspects, such as delays between processes and product development, the interval between invention and production, and deficiencies in safety measures: measurement and the lack of adequately trained and specialized personnel (DE JESUS; MENDONÇA, 2018).

The third restriction deals with the aspect of incentives as economic (market) and financial instruments on the part of governments that prevent organizations from innovating (WANG; WANG; ZHAO, 2008). Authors Grafström and Aasma (2021) explain that market barriers constitute obstacles to adopting the circular economy due to the absence or poor functioning of markets, while financial barriers include difficulties in financing CE business models and high initial investment costs. It can be noted that there are two biases regarding incentives: the first regarding insufficient financial support and inadequate public tax subsidies, and the second, few public incentive policies for saving energy, material, and water.

The legislation (regulation) factor includes inconsistent political messages and deficient institutional infrastructures, in addition to poor enforcement or omitted supervision and inadequate punishment where environmental crimes are classified as administrative rather than criminal (WANG, 2007). Implementing CE over time requires integrated management efforts, including leadership, proactive participation of agents at all levels of government, and transparency and predictability in administrative and economic policy instruments (SU *et al.*, 2013).

Public participation is crucial to implementing a CE program, as social sensitivity and business perception are social drivers for a CE model. This participation involves programs and facilities that value environmental management, whether focusing on education for society or training professionals in the areas (GENG; DOBERSTEIN, 2008). For the authors of Jesus and Mendonça (2018), consumer behavior and business practices are evolving very slowly due to the lack of awareness and adequate information about the circular economy concept and inadequate choices related to business models. EC available.

Another relevant aspect in the context of developing countries is that studies on CE still need to be made available. Thus, adopting a circular economy requires identifying a comprehensive list of barriers and their appropriate categorization and prioritization based on appropriate methods for emerging economies (GEDAM *et al.*, 2021).

### **2.3 A Review of the Challenges of the Circular Economy**

The challenges of CE require significant changes in society and companies and in how public bodies plan and prioritize public policies. Thus, the challenges permeate aspects of the systemic view on entropy and growth, the relationship between materials, energy, and biodiversity, measuring the impact of the circular economy, social and cultural governance, and alternative means of circularity.

The prospect of a comprehensive systemic vision of the circular economy may be elusive, even if it were feasible to achieve perfect circularity in material flows. Such a condition would require the imposition of limits on the global use of resources within a sustainable level so that the economy could operate exclusively with recovered and renewable resources (CULLEN, 2017). This becomes evident in the case of materials that deteriorate in quantity and quality with each cycle of recycling or reuse, which cannot be circulated indefinitely. This

implies that to achieve an ideal CE, where all resource inputs derive from recovered or renewable materials, an overall reduction in demand for materials and economic output is necessary (KORHONEN; HONKASALO; SEPPÄLÄ, 2018a; GIAMPIETRO, 2019).

Limiting the use of material resources has significant geopolitical implications and requires a fundamental reconsideration of normative issues related to global justice, well-being, and the equitable redistribution of global wealth (SCHRÖDER; ANGGRAENI; WEBER, 2019). Furthermore, there is a lack of sufficient investigation into whether and how CE could lead to an absolute and global decoupling between economic growth and environmental degradation. For Giampietro (2019), given the inevitability of entropy and the absence of evidence of absolute decoupling, there is no basis for believing that a circular economy can operate within a context of continuous economic growth.

The interconnection between the nexuses of materials, energy, and biodiversity constitutes a critical area that demands further investigation in the circular economy context. The conjunction of factors such as climate change, loss of biodiversity, and scarcity of resources involves several complex compensations and synergies (FRIANT; VERMEULEN; SALOMONE, 2020). Therefore, balancing the increased demand for natural resources and renewable energy with biodiversity conservation and restoration efforts is imperative to preserve the planet's biophysical health and the ecosystem services on which life depends.

Another significant challenge lies in the ability to holistically assess the sustainability impacts of circular systems, given that recent research has revealed that many self-described circular production systems may have more significant environmental impacts than those associated with their linear counterparts (ZINK; GEYER, 2017; VELIS, 2018). This situation arises from the premise that a CE approach focused on eco-efficiency can generate a rebound effect, in which the reduction in the costs of a product or service results in an increase in demand. In contrast, the savings generated encourage consumption in other areas.

Therefore, the development of accurate indicators and evaluation mechanisms to measure circularity, taking into account the rebound effect, constitutes a complex issue that needs to be addressed to ensure that circularity claims effectively translate into ecological benefits (KALMYKOVA; SADAGOPAN; ROSADO, 2018). The ecological nature indicator can serve as a valuable tool in this context, as it measures human activities' general impacts, going beyond isolated improvements in eco-efficiency (NEVES; MARQUES, 2022).

Another critical challenge, which is often little addressed in CE literature to date, is the social dimension, especially concerning issues of governance, justice, and cultural change (GEISSDOERFER *et al.*, 2017; KORHONEN; HONKASALO; SEPPÄLÄ, 2018a). By ignoring social considerations, CE research is proposing a technological path to sustainability that many have criticized for being overly optimistic regarding the speed of technological transitions and society's ability to integrate disruptive innovations that challenge vested interests (MILLAR *et al.*, 2019; SCHRÖDER; ANGGRAENI; WEBER, 2019).

Within the scenario of social and cultural governance in the circular system, research by Kirchherr, Reike, and Hekkert (2017) shows that people (authorities, executives, and managers) involved in the circular economy see cultural and social barriers as the main obstacles to a model transition. That is why it is essential to establish a democratic and deliberative governance system for a CE that can safeguard everyone involved in its construction and that its benefits reach the most vulnerable.

As the last challenge identified, some alternative perspectives on circularity reveal discussions about the concepts of degrowth, steady state, and voluntary simplicity, which converge towards the common objective of promoting a transformation towards regenerative socioeconomic structures (FRIANT; VERMEULEN; SALOMONE, 2020) that are compatible with the circular economy model. In the understanding of authors Ghisellini, Cialani, and Ulgiati (2016) and Schröder, Anggraeni, and Weber (2019), these non-traditional perspectives

could fill the gap in the social dimension of CE and the systemic approach to entropy and biophysical limits.

### 3 FINAL CONSIDERATIONS

In this investigation, the research question addressed the bottlenecks and challenges in a circular economy model? Therefore, the central objective was to highlight the bottlenecks that hinder the implementation of the circular economy and the challenges of the CE model. Within the debate, this article attempts to provide some insights into the main soft and hard factors, as well as the incitement that the role of the circular economy will have over time.

The present study lists seven barriers that impact the implementation of CE, categorizing these barriers into four factors according to expert opinion and a detailed review of international literature. It is identified that the barriers to the implementation of CE are market information, technology, incentives, legislation, management, public awareness, and performance evaluation. A critical analysis of an exemplary nature demonstrates which elements (characteristics) are evident within each of these bottlenecks, in addition to suggesting ways via supply networks to eliminate or mitigate these obstacles upstream and downstream in a production chain.

Therefore, for future investigations, the first point should explain how theoretical knowledge can be disseminated to professionals and how CE promoters can be supported to break down barriers. A check on obstacles to a circular economy should include a comprehensive industry-wide investigation to see if bottlenecks are similar across different sectors. Finally, more cross-area studies are needed on implementing CE in developing countries to address interactions and challenges, as well as trade-offs and incompatibilities, between technological and socio-institutional systems.

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