

## **APPROACH TO THE CIRCULAR ECONOMY AND ITS IMPACT ON ENVIRONMENTAL ISSUES**

ALEXANDRE DE CASTRO CAMPOS<sup>1</sup>

RAQUEL TEIXEIRA CAMPOS<sup>2</sup>

RENATA TEIXEIRA DE ALMEIDA MINHONI<sup>3</sup>

ANGÉLICA GÓIS MORALES<sup>4</sup>

NELSON RUSSO DE MORAES<sup>5</sup>

**Abstract:** Population growth and economic development result in an increase in the urban solid waste generation. Effective management of the waste generated is essential to mitigate the environmental impacts related. Among the various existing management strategies, the circular economy is seen as a promising solution in the management of urban solid waste and in reducing the environmental impacts related. In this context, this work aims to present current approaches of the circular economy and its impact on environmental issues in Brazil. The methodology for this literature review followed a systematic process to ensure the comprehensiveness and relevance of selected sources, following selection and screening criteria for national and international articles. The Brazilian circular economy faces significant challenges, requiring investments in technology, education and effective public policies to overcome these challenges and contribute to reduce the associated environmental impacts. The Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) – Finance Code 001, financed this study in part.

**Key words:** Circular models. Recycling. Solid waste. Reuse. Reutilization. Sustainability.

## **ABORDAGEM DA ECONOMIA CIRCULAR E DO SEU IMPACTO NAS QUESTÕES AMBIENTAIS**

**Resumo:** A expansão populacional e o desenvolvimento econômico resultam em um incremento na geração de resíduos sólidos urbanos. O gerenciamento eficaz dos resíduos gerados é imprescindível na mitigação dos impactos ambientais associados. Entre as diversas estratégias existentes para o gerenciamento, a economia circular é vista como uma solução promissora na gestão de resíduos sólidos urbanos e na redução dos impactos ambientais associados. Neste contexto, objetiva-se com o presente trabalho apresentar abordagens atuais da economia circular e seu impacto nas questões ambientais no Brasil. A metodologia para esta revisão de literatura seguiu um processo sistemático para garantir a abrangência e a relevância das fontes selecionadas, seguindo critérios de seleção e triagem de artigos nacionais e internacionais. A economia circular brasileira enfrenta desafios significativos, demandando investimentos em tecnologia, educação e em políticas públicas eficazes para superar esses desafios e contribuir com diminuição de impactos ambientais associados. O presente trabalho foi realizado com apoio da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) – Código de Financiamento 001.

**Palavras-chave:** Modelos Circulares. Reciclagem. Resíduos sólidos. Reuso. Reutilização. Sustentabilidade.

<sup>1</sup> Mestrado em Agronegócio e Desenvolvimento – UNESP, alexandre.c.campos@unesp.br.

<sup>2</sup> Mestrado em Engenharia de Produção – UNESP, kel\_76@hotmail.com

<sup>3</sup> Doutorado em Agronomia – UNESP, renataminhoni@gmail.com

<sup>4</sup> Doutorado em Meio Ambiente e Desenvolvimento - UFPR, ag.morales@unesp.br

<sup>5</sup> Doutorado em Comunicação e Cultura Contemporânea – UFBA, nelson.russo@unesp.br

## 1. INTRODUCTION

As urban populations grow and consumption patterns increase, so does the amount of municipal solid waste generated. The increase in waste production is driven by factors such as economic growth, rising incomes and the growing consumption of goods and services.

Effective management of municipal solid waste is essential to mitigate environmental impacts and associated climate change. Various strategies can be implemented to reduce the amount of waste generated and increase the recycling rate. These include the promotion of source reduction policies and the improvement of selective collection systems. In addition, the implementation of composting and advanced recycling technologies can transform organic waste and recyclable materials into valuable resources, reducing dependence on landfills and greenhouse gas emissions (Kaza, Yao and Bhada-Tata, 2018).

Other important sustainable urban solid waste management practices that are key to reducing pressure on management systems and environmental impacts are the implementation of technologies such as automated waste sorting and anaerobic digestion for treating organic waste. These methods have shown promising results in minimizing negative impacts. Sorting, for example, allows for the efficient separation of recyclable materials, while anaerobic digestion contributes to the production of biogas, which can be used as a renewable energy source. These approaches help reduce the amount of waste sent to landfills and minimize the associated emissions (Muttamara and Thongra-ar, 2021).

An integrated approach to waste management is essential to deal with the challenges faced by urban areas. Successful strategies include implementing waste reduction programs, promoting circular economy practices and collaboration between different sectors of society (Bortoleto and Wang, 2019).

Silva and Costa (2023) cite the circular economy as a crucial approach to tackling environmental issues in Brazil, which proposes a transition from a linear model of produce, use and dispose, to a closed cycle where resources are continuously recycled and reused. This change not only reduces the pressure on natural resources, but also reduces the amount of waste and pollution generated. Studies show that adopting circular practices can significantly reduce the environmental footprint of industries, promote innovation and create new sustainable business opportunities.

The circular economy is seen as a promising solution for managing solid waste and reducing the environmental impacts associated with production and consumption. This paper therefore aims to show current approaches to the circular economy and its impact on environmental issues in Brazil.

## 2. METHODOLOGY

According to the study by Ferreira, Silva and Almeida (2021), they discuss the importance of the literature review as a fundamental stage in the academic research process. They emphasize that the literature review is not just a compilation of previous studies, but a critical and reflective analysis that allows the researcher to situate their work within the existing context and identify gaps in knowledge.

The methodology for this literature review followed a systematic process to ensure the comprehensiveness and relevance of the sources selected (Souza, Santos and Pereira, 2022). Firstly, inclusion and exclusion criteria were defined for the selection of articles, taking into account national and international publications related to the topic and published in the last five years. The search was carried out in the main academic databases available, Scopus, Capes, Scielo and Web of Science. Keywords related to the topic of study were used. This approach ensures that the review is aligned with the Brazilian context and includes the most recent research in the area.

The article selection process involved an initial screening based on titles and abstracts, followed by a full reading of the selected texts. Only studies with direct relevance to the research

topic were included in the review. In addition, preference was given to articles that addressed both theoretical and empirical aspects, ensuring a comprehensive and critical view of the field of study. This step was essential to ensure that the review reflected both the state of the art and the gaps in the current literature.

The selected articles were analyzed and categorized according to their main findings, methods used and theoretical contributions. This categorization made it possible to identify trends, convergences and divergences between the studies, as well as possible areas for future research. The analysis was conducted critically, comparing the results of the different studies and highlighting the most significant contributions to the advancement of knowledge in the area.

Finally, the review was structured in such a way as to provide a coherent synthesis of the evidence found on circular economy approaches to environmental impacts, making it easier for the reader to understand the current state of the literature. The main challenges and opportunities identified in the studies were discussed, as well as their implications for practice and future research.

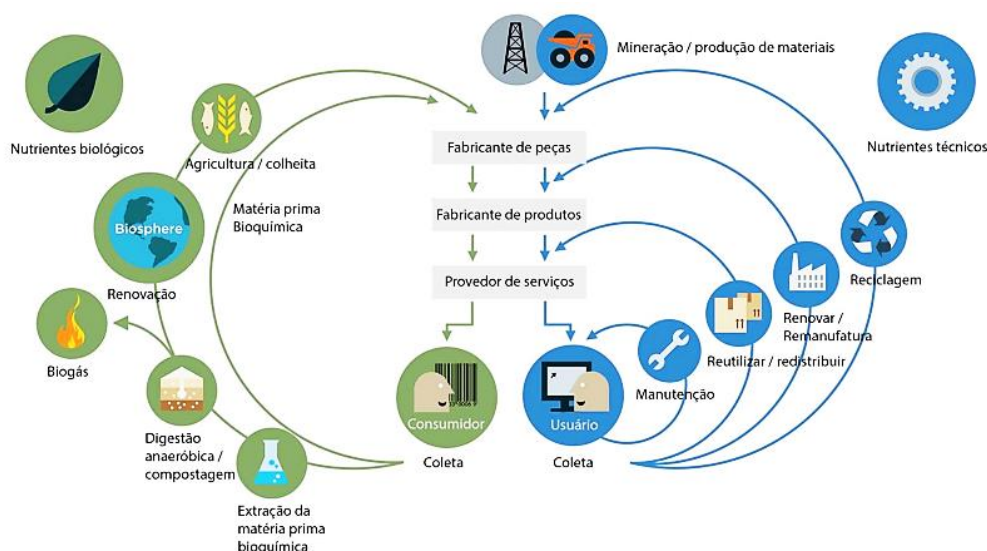
### 3. RESULTS AND DISCUSSION

In the Brazilian context, the circular economy offers an integrated approach to waste management, emphasizing the need to reduce, reuse and recycle materials at all levels of the production chain. This approach not only seeks to minimize the environmental impact associated with the final disposal of waste, but also promotes efficiency in the use of natural resources. Incorporating circular principles into public policies and business practices has the potential to transform the way waste is handled, contributing to the reduction of pollutants and environmental conservation. The successful application of the circular economy can result in significant economic and environmental benefits, aligning with the country's sustainable development goals (Oliveira and Barbosa, 2023).

In the study by Santos and Almeida (2024), they emphasize that the implementation of the circular economy in Brazil faces significant challenges, including the need for structural changes in industrial practices and public policies. However, the opportunities are equally promising, as the circular economy can help mitigate several critical environmental problems, such as pollution and ecosystem degradation. The adoption of circular models offers solutions for waste management, such as promoting recycling and the reuse of materials, which are essential for long-term sustainability. The critical analysis indicates that in order to maximize the environmental benefits of the circular economy, a collaborative effort between governments, companies and civil society is needed to promote practices and policies that encourage circularity.

The circular economy is a concept that focuses on keeping the value of products, materials and resources in the economy for longer, reducing waste and promoting sustainability. This concept has taken on a growing approach in Brazil, reflecting a significant shift from a traditional linear model of “produce, use and dispose” to a more sustainable and efficient system, as illustrated in Figure 1. According to the study by Lima and Farias (2023), this transition is motivated by the need to address environmental challenges and the growing awareness of the impact of waste. Brazil, with its biodiversity and abundant natural resources, is exploring ways to integrate circular practices into its economy.

Figure 1: Circular economy approach model



Source: (CNI, 2018)

In recent years, Brazil has implemented public policies to foster the circular economy, and the National Solid Waste Policy and recent regulations on reverse logistics are important steps in this direction. These policies aim to create a favorable regulatory environment for the adoption of circular practices, encouraging companies to rethink their business models and production processes (Silva and Oliveira, 2023).

Brazilian companies have begun to adopt circular business models. According to the study by Ferreira et al. (2022), large corporations such as Natura and Ambev are integrating circular principles into their operations. Natura, for example, has invested in recyclable packaging and circular economy practices in its products, while Ambev has focused on recycling packaging and using sustainable materials.

Startups and technology companies are playing a growing role in promoting the circular economy in Brazil. Lima and Castro (2023) point out that startups such as B2W and Recyclic have developed innovative solutions for reusing waste and creating new circular business models. These companies are making a significant contribution to innovation and the dissemination of circular practices in the country.

Education and awareness are key to the adoption of the circular economy. Almeida et al. (2023) analyzes how educational programs and awareness campaigns have helped to increase understanding of the importance of the circular economy. Universities and educational institutions have incorporated these themes into their curricula, promoting a new generation of more aware professionals and consumers.

Brazil has learned from international experiences in implementing the circular economy. Castro and Fernandes (2022) compare Brazilian approaches with those of leading circular economy countries such as the Netherlands and Germany. These comparisons help to identify best practices and adapt solutions to the Brazilian context, considering its particularities and needs.

## 4. FINAL CONSIDERATIONS

The adoption of the circular economy in Brazil faces significant challenges. According to Costa and Santos (2022), the lack of adequate infrastructure for collecting and recycling materials, as well as cultural and economic barriers, are critical obstacles. The need for investment in technology and education on circular practices are essential to overcome these challenges.



The circular economy also has a positive impact on environmental and social issues in Brazil. Reducing waste and optimizing resources has contributed to reducing pollution and making better use of natural resources. In addition, circular practices have generated jobs and economic opportunities in sectors such as recycling and reuse.

The integration of the circular economy with Industry 4.0 is an emerging trend in Brazil. It is being explored as digital technologies such as the Internet of Things (IoT) and Big Data are being used to improve the efficiency of circular processes. These technologies enable more effective management of resources and better monitoring of the life cycle of products.

The future of the circular economy in Brazil looks promising, but it depends on a combination of effective public policies, technological innovations and cultural changes. It is clear that collaboration between government, business and civil society will be crucial to the expansion of circular practices and the creation of a more sustainable and resilient economic system.

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