Revista Pensamento Contemporâneo em Administração

CO-PRODUCTION AND CIRCULARITY: INTEGRATING EMERGING INTERNATIONAL PRACTICES

COPRODUÇÃO E CIRCULARIDADE: INTEGRANDO PRÁTICAS INTERNACIONAIS EMERGENTES

Recebido em 14.04.2025 Aprovado em 07.08.2025
Avaliado pelo sistema *double blind review*
DOI: https://doi.org/10.12712/rpca.v.192.67396

Priscilla Cristine Porto Leó Costa
pcplcosta@academico.ufs.br
Programa de Pós-Graduação Profissional em Administração Pública (PROFIAP) / Universidade Federal de Sergipe (UFS) - Brasil
https://orcid.org/0009-0007-8398-9529

Fábio Pinto Cardoso
ofbmfabio@gmail.com
Programa de Pós-Graduação Profissional em Administração Pública (PROFIAP) / Universidade Federal de Sergipe (UFS) - Brasil
https://orcid.org/0009-0001-7843-009X

Kleverton Melo de Carvalho
Kleverton1@academico.ufs.br
Programa de Pós-Graduação Profissional em Administração Pública (PROFIAP) /Universidade Federal de Sergipe (UFS) - Brasil
https://orcid.org/0000-0003-1969-7955

Maria Conceição Melo Silva Luft
ceica@academico.ufs.br
Programa de Pós-Graduação Profissional em Administração Pública (PROFIAP) /Universidade Federal de Sergipe (UFS) - Brasil
https://orcid.org/0000-0003-2713-2700

Abstract

This article analyzes emerging co-production practices in the context of the circular economy (CE), based on a systematic-integrative review of 14 articles (2019–2024) from Web of Science and Scopus. Innovative practices were identified, integrating diverse actors, restructuring organizational processes, fostering cross-sector cooperation, and engaging local communities. Key drivers of CE include collaborative networks, mediating tools, advanced technologies, and community mobilization. The findings provide relevant insights to integrate co-production and CE, strengthening public policies and sustainable initiatives, particularly in emerging economies, emphasizing sustainability promotion through multisectoral collaboration and innovation.
Keywords: Co-production. Circular Economy. Sustainability. Collaborative Networks. Community Education.

Resumo

Este artigo analisa práticas emergentes de coprodução no contexto da economia circular (EC), com base em revisão sistemática-integrativa de 14 artigos (2019–2024) das bases Web of Science e Scopus. Foram identificadas práticas inovadoras que integram atores diversos, reestruturam processos organizacionais, promovem cooperação setorial e engajam comunidades locais. Destacam-se redes colaborativas, ferramentas mediadoras, tecnologias avançadas e mobilização comunitária como impulsionadores da EC. Os achados oferecem insights relevantes para integrar coprodução e EC, fortalecendo políticas públicas e iniciativas sustentáveis, especialmente em economias emergentes, com ênfase na promoção da sustentabilidade por meio da colaboração multissetorial e inovação.
Palavras-chave: Coprodução. Economia Circular. Sustentabilidade. Redes Colaborativas. Educação Comunitária.

Introduction

This article conducts an international integrative analysis of emerging co-production practices within the scope of the circular economy between 2019 and 2024. There are alarming projections regarding solid waste generation, increasing from 2.1 billion tons in 2023 to 3.8 billion tons by 2050. Simultaneously, the global cost of waste management, estimated at $252 billion in 2020, is expected to reach $640.3 billion by 2050. In the Brazilian context, the challenges are equally significant. Brazil ranks as the 4th largest producer of plastic waste globally, generating 11.3 million tons annually, trailing only the United States, China, and India. Of this total, over 10.3 million tons were collected, but only 1.28% is effectively recycled, a rate well below the global average of 9% (World Wildlife Fund [WWF], 2019).

Solid waste generates significant environmental and health impacts worldwide. Each year, approximately 8 million tons of plastic pollute the oceans, threatening marine life and potentially outweighing fish by 2050 (Ellen MacArthur Foundation, 2016). Decomposition in landfills generates 1.6 gigatons of CO_2 equivalent, aggravating climate change (World Bank, 2022). In regions where electronic waste is improperly handled, such as parts of Africa, Asia, and Brazil, local populations, including 18 million children, are exposed to heavy metals like lead, mercury, and cadmium, causing neurological and kidney damage (United Nations International Children's Emergency Fund [UNICEF], 2021).

In Brazil, inadequate waste disposal directly affects 30% of the population, exposing them to risks of soil and water contamination (Brazilian Association of Public Cleaning and Waste Management Companies [ABRELPE], 2022). Globally, 7 million premature deaths from respiratory diseases are associated with air pollution caused by waste burning (World Health Organization [WHO], 2020). Food contamination from polluted water used for irrigation affects 600 million people annually, resulting in 420,000 deaths (WHO, 2020).

In light of this global and national scenario, it becomes imperative to explore solutions that not only reduce environmental impact but also foster social justice and economic efficiency. The integration of co-production and circularity concepts emerges as a promising approach to addressing these global challenges. Co-production, by involving different stakeholders in collaboratively developing solutions, promotes more inclusive waste management that is adapted to local realities (Chambers et al., 2021).

On the other hand, circularity, by focusing on material reuse and waste minimization, offers a practical pathway to decouple economic growth from environmental degradation (Winans, Kendall, & Deng, 2017; Ogunmakinde et al., 2022). The circular economy has the potential to generate a net gain of $108.5 billion annually, highlighting the urgency of integrated and innovative actions in waste management (International Solid Waste Association [ISWA], 2024). From this perspective, which international co-production practices are emerging within the framework of the circular economy?

The use of co-production as a tool for circularity is not new. Several international studies have explored this topic over the years. In Malaysia, for instance, the circular economy has already been consolidated, particularly in the business sector, focusing on resource reuse and recycling, reflecting growing sustainability awareness (Agamuthu & Mehran, 2019). In Ukraine, the transition to a circular economy is grounded in the principles of "reduce, reuse, and recycle," as highlighted in international documents aligned with the United Nations Sustainable Development Goals (Bochko, Bochko, & Kulczycka, 2023). The Cradle-to-Cradle concept, proposed by McDonough and Braungart (2002), emphasizes the continuous reuse of materials and energy.

In a broader analysis, Murray, Skene, and Haynes (2017) examine the multiple dimensions of the circular economy, demonstrating the application and evolution of these principles in different regions.

Another significant example is the Guangdong Silver Island Lake Paper Manufacturing Park (GSIL) in China, which, since its establishment in 2004, integrates paper production with resource reuse, such as recycled materials and energy, promoting economic efficiency and environmental sustainability (Li & Ma, 2014). Additionally, the co-production model in urban waste management in European cities, addressed by Dufour and Huber (2020), demonstrates the effectiveness of this approach in reducing waste generation and promoting sustainable practices. The experience of Amsterdam, which implemented co-production strategies in waste management, shows positive results in community participation and recycling system efficiency (Brennan et al., 2019).

Understanding these new pathways on an international scale can inspire more effective public policies for a sustainable future, especially in developing countries. The relevance of this study is supported by the fact that solid waste management is directly related to 12 of the 17 United Nations Sustainable Development Goals (SDGs). The search for solutions that align economic efficiency, environmental protection, and social inclusion is central to building a more sustainable and resilient future (Negrete-Cardoso et al., 2022).

When effectively applied, co-production and circularity can play a transformative role in achieving these global goals. The present study may assist in designing various public policies that enable the expanded use of circularity through co-produced approaches.

Co-Production – Theoretical Foundations For Circularity

Co-production has deep historical roots, characterized by collaboration between the public sector and citizens in managing services and common goods. Before World War II, Japan exemplified this model, with citizens actively participating in public service delivery, using self-help and mutual support practices (Kudo, 2024).

In other countries, such as the United States and Europe, co-production re-emerged in subsequent decades, particularly in sectors like health and education, where governments sought citizen participation to increase the effectiveness and legitimacy of public services (Bandola-Gill et al., 2023). These practices began to diversify, adapting to local needs and incorporating new approaches, such as community governance and the use of digital technologies to facilitate collaboration (Hedestig et al., 2018).

Elinor Ostrom was fundamental in formalizing co-production theory, emphasizing the importance of citizens in managing common goods. Ostrom argued that co-production can create more inclusive governance, overcoming the dichotomy between market and state. Her theory of polycentricity posits that multiple decision-making centers, operating in a coordinated manner, can deliver solutions more suited to both local and global needs (Lemos & Melo, 2020; Ostrom, 1996).

In contrast, more technological perspectives highlight the potential of digital tools, such as the Internet of Things (IoT) and social networks, to amplify citizen participation and facilitate co-production processes in urban and rural contexts (Hedestig et al., 2018; Matei & Sandu, 2016). Views on co-production vary from approaches emphasizing direct citizen participation to those focusing on collaboration as a means to enhance public service efficiency.

From Ostrom's perspective, the theory of polycentricity underscores the importance of multiple decision-making centers that enable participation from diverse actors in governance, recognizing the heterogeneity of values and the importance of local networks (Lemos & Melo, 2020). Other currents focus on using technological tools to expand inclusion and the effectiveness of citizen participation, as seen in smart city experiences where co-production is facilitated through digital platforms enabling real-time data collection and community engagement (Matei et al., 2016). In European contexts, co-

production has been approached through participatory processes that involve citizens, community organizations, and local authorities, aiming to develop more inclusive policies tailored to local needs, particularly in peripheral regions of Europe (Goulart & Falanga, 2022).

On the other hand, critical perspectives highlight significant challenges in implementing co-production, including the need to ensure representativeness for all social groups and the risk of capture by specific interests. Additionally, the complexity of managing multiple competing interests can generate tensions and coordination difficulties (Fugini et al., 2015). Despite these challenges, co-production is considered a promising approach to fostering social innovation and responding more adaptively to local demands, making it relevant for constructing more participatory and effective public policies (Seravalli et al., 2017).

Ostrom's theory of polycentricity will be used as an analytical framework to examine the data in this systematic integrative review. It offers a valuable structure for analyzing co-production within the context of the circular economy. The polycentric approach helps to understand how different actors, such as local governments, community organizations, and the private sector, can collaborate to co-produce a more inclusive and sustainable waste management system (Ostrom, 1996; Lemos & Melo, 2020).

This theory is particularly relevant when applied to studying circular economy practices, as it recognizes the need for coordination across various levels of governance to promote material reuse, reduce waste, and improve economic efficiency. Analysis based on polycentricity facilitates more effective cooperation between diverse levels and types of actors, resulting in more efficient resource management and collaborative solutions to environmental problems (Morrison et al., 2023).

The theory of polycentricity focuses on four main categories: diversity of actors, organizational change, cooperation mechanisms, and community education. Diversity of actors is essential for effective co-production in circular practices, as it allows for integrating diverse capacities and perspectives, encompassing joint participation from citizens, the private sector, community organizations, and the public sector. This diversity enables solutions to be more precisely adapted to local waste management needs, enriching the process with a more inclusive and contextualized approach (Brennan et al., 2019).

The second variable, organizational change, refers to the process of adapting organizations to incorporate circular economy principles, requiring significant transformations in practices and structures. These changes involve adopting new innovative approaches, aligning organizational values and mindsets to improve performance, responsiveness, and resilience, all fundamental to transitioning to a circular business model (Ferreira et al., 2023). While internal transformation is crucial, some authors highlight that external pressures, such as regulatory structures and market demands, also play an important role in accelerating the adoption of these practices. In some cases, such external pressures may even overshadow internal organizational dynamics, influencing change more rapidly than internal initiatives (Graessler et al., 2024).

Finally, cooperation mechanisms and community education are fundamental to promoting shared responsibility and social engagement in co-production practices. For instance, the Mesa Brasil-SESC Program involves local communities in managing food waste, strengthening social commitment to sustainability and creating a network of support and participation that enriches the circular process (Rodrigues, Freu, & Moretto Neto, 2022). This integrative approach aims to understand how these variables collaborate to strengthen circularity systems in different contexts, promoting a transition toward more inclusive and sustainable practices.

Intersections Between Co-Production and the Circular Economy

Co-production has been adopted across various disciplines, such as health, sustainability, and urban planning, due to its effectiveness in mobilizing resources and addressing complex social challenges (Involving et al., 2023). Since the 2000s, growing environmental concerns have driven its integration into circular economy practices, especially in urban environments where waste management has become central (Cuomo, 2022). This intersection is essential for promoting innovative and sustainable solutions.

On one hand, co-production involves active participation from citizens and non-state actors, fostering innovation and public awareness regarding resource use. In waste management, it contributes to transforming waste into reusable resources, supporting the circular economy cycle (Ezeudu et al., 2021). The involvement of multiple actors strengthens circularity practices, allowing for more effective adaptation to local realities, a trend that has favored creating co-production platforms where local governments collaborate with citizens and organizations to develop innovative circular economy solutions (Cuomo, 2022).

Although promising in theory, the intersection between co-production and circularity faces criticisms that challenge its effectiveness and sustainability. Critics argue that the circular economy (CE) has vague boundaries, lacks clear theoretical foundations, and faces significant structural barriers to implementation. Such criticism suggests that CE can be ideologically driven, focusing on technical and economic aspects that may not necessarily lead to sustainable outcomes (Corvellec et al., 2021).

The theoretical limitations of CE complicate its practical application. Critics emphasize that the focus on material circularity often neglects broader systemic issues, such as social harmony and resilience, which are crucial for sustainable development (Chan, 2022). Moreover, CE is frequently influenced by a neoliberal agenda, potentially conflicting with its social and political implications, particularly within the European Union's political structure, where economic liberalization often takes precedence over social and environmental considerations (Sliwinski, 2021).

Methodology

This study was conducted using descriptive research with a qualitative approach, focusing on co-production as a tool to promote circularity from an integrative perspective on an international scale. The sources of evidence were selected from articles available in relevant databases to meet the objectives of the proposed literature review.

Literature reviews are essential in the field of international business, providing a comprehensive and integrated overview of the existing literature on a specific topic, theory, or method. The review strengthens the knowledge base by synthesizing previous studies, offering a more robust understanding of the areas under investigation (Paul & Criado, 2020).

A systematic literature review is a structured process aimed at synthesizing and critically evaluating the existing knowledge on a specific topic. This process is generally divided into three main phases: planning, execution, and result analysis. During the planning phase, it is crucial to formulate well-defined research questions and establish clear criteria for selecting studies, ensuring that the process is reproducible and minimizes bias. Additionally, involving stakeholders during this phase helps align the review with the sector's practical needs, increasing its relevance and applicability (Budgen et al., 2020).

The execution phase involves the use of explicit and reproducible methods for collecting data from selected studies. This includes conducting comprehensive searches in databases and carefully selecting relevant literature. Assessing the quality of included studies is an essential aspect of ensuring result

reliability, with the use of tools and checklists recommended to evaluate the systematic nature of the reviews (Belle & Zhao, 2022).

Finally, the analysis phase consists of synthesizing and interpreting the collected data, enabling the construction of a comprehensive understanding of findings and the identification of patterns, gaps, and practical implications. Clearly presenting the results is essential for facilitating knowledge dissemination and promoting the practical application of findings. The use of appropriate analytical techniques and the discussion of results in relation to the research context ensure the relevance and robustness of conclusions, as highlighted by Snyder (2019).

In this context, the integrative systematic review method emerges as an approach that not only synthesizes but also integrates knowledge from various sources and methodologies, enabling a comprehensive analysis of a topic. This type of review is particularly useful in complex areas, such as co-production and the circular economy, as it allows the inclusion of different types of studies, both theoretical and empirical.

By combining qualitative and quantitative evidence, the integrative review enriches the analysis and strengthens recommendations for practices and policies, while also identifying gaps in existing knowledge and guiding future investigations (Snyder, 2019). The approach further integrates principles proposed by Grupo Anima Educação (2014), which outlines guidelines for conducting systematic integrative literature reviews, conceptualizing and validating it as an important research tool across various fields of knowledge. Botelho, Cunha, and Macedo (2011) also present the integrative systematic review method with a specific focus on the organizational field.

Based on this theoretical foundation, the present research aims to consolidate studies on the use of co-production as a tool for advancing circularity on a global scale, with the goal of inspiring more effective and sustainable public policies through integrative analysis.

Following Botelho et al. (2011), the work was systematically organized into six stages, as shown in Figure 1. The stages include everything from formulating research questions to the detailed analysis of results, focusing on ensuring methodological rigor and systematicity throughout the process.

Figure 1 - Stages of the Integrative Review

Source: Adapted from Botelho et al., (2011, p.129)

The data were collected from high-impact databases such as Web of Science (WoS) and Scientific Electronic Library Online (Scopus), selected for their broad coverage and rigorous indexing criteria. Complementary searches were also conducted in the Spell, SciELO, and Capes – Theses and

Dissertations databases, but no relevant results were found in the latter. The analysis period was defined between 2019 and 2024, with the search conducted between the months of October and November 2024, aiming to capture the growing academic interest in the subject. A combination of keywords and Boolean operators was used to structure the search rounds, as detailed in Table 1.

Table 1 - Search Structure and Filters

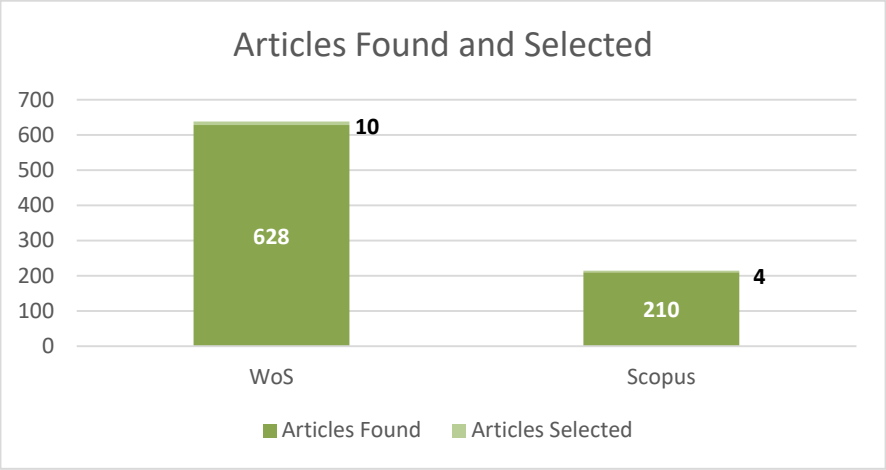
Filter Type/Search Round	Query structures
1st Round: General Keywords	"coproduction" AND "circularity*" OR "circular economy" AND "Practices"
2nd Round: Filter from 1st Category	"coproduction" AND "circularity*" OR "circular economy" AND "Practices" AND "actors" OR "participants"
3rd Round: Filter from 2nd Category	"coproduction" AND "circularity*" OR "circular economy" AND "Practices" AND "organizational change"
4th Round: Filter from 3rd Category	"coproduction" AND "circularity*" OR "circular economy" AND "Practices" AND "cooperation" OR "cooperation tools"
5th Round: Filter from 4th Category	"coproduction" AND "circularity*" OR "circular economy" AND "Practices" AND "community empowerment" OR "local education"

Source: Prepared by the authors (2024).

In addition to the structured search rounds, a bibliometric analysis was conducted to identify trends and patterns in academic production regarding co-production and circularity, using the Web of Science (WoS) and Scopus databases for the period 2019 to 2024.

This stage aimed to provide an initial quantitative overview of the field, contextualizing the increasing relevance of the topic and supporting the systematic integrative review. In WoS, 628 articles related to the topic were found, while Scopus returned a total of 210 publications. Graph 1 illustrates this relationship, highlighting the volume of publications initially identified in both databases.

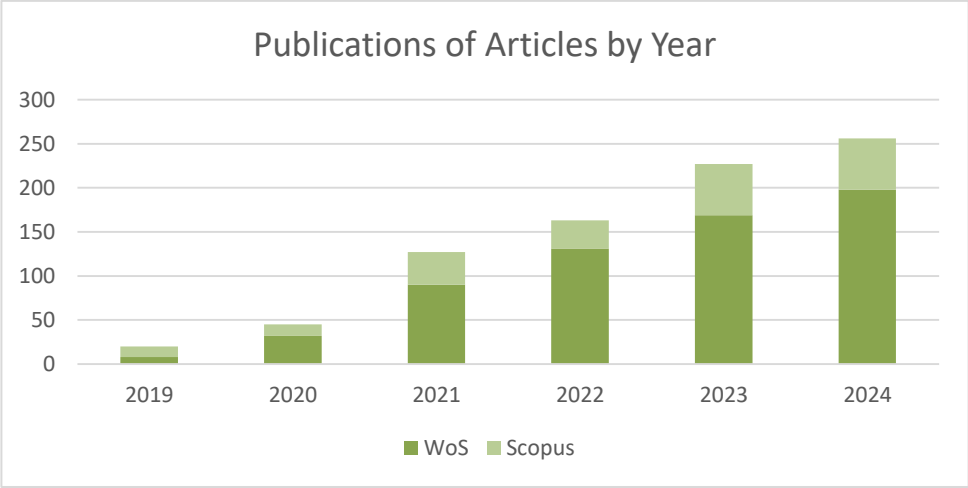
Graph 1 – Search and Selection of Articles



Source: WoS and SCOPUS

The bibliometric analysis also revealed a significant increase in the number of publications over time. As shown in Graph 2, there was considerable growth between 2019 and 2024, with particular emphasis on 2023 and 2024, the years that recorded the highest number of publications. This growth reflects the growing interest of the scientific community in exploring the intersections between collaborative practices and the circular economy.

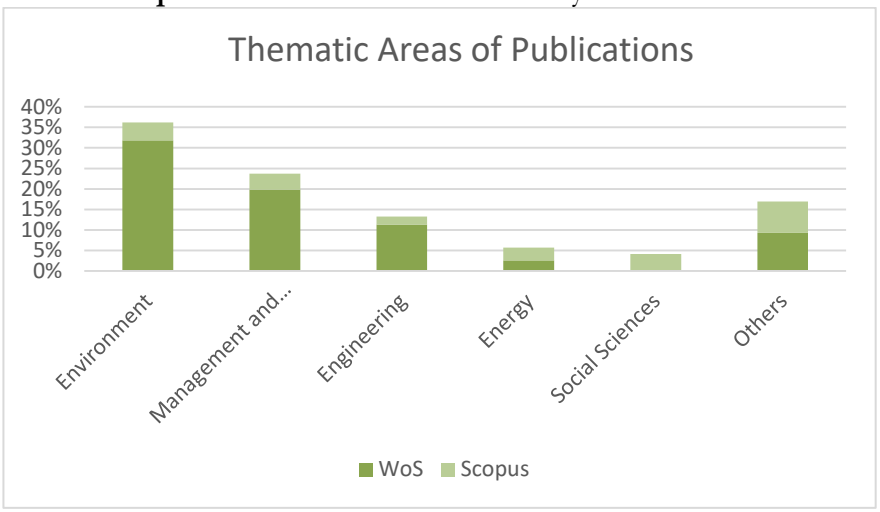
Graph 2 – Number of Publications per Year



Source: WoS and SCOPUS

Moreover, the thematic distribution of the publications highlighted the interdisciplinary nature of the topic. Graph 3 shows the proportion of articles by thematic area in WoS and Scopus, with a predominance of studies focused on Environment, Management and Business, Engineering, Energy, and Social Sciences. These results reflect the broad applicability of co-production and circularity, connecting environmental, social, and organizational issues.

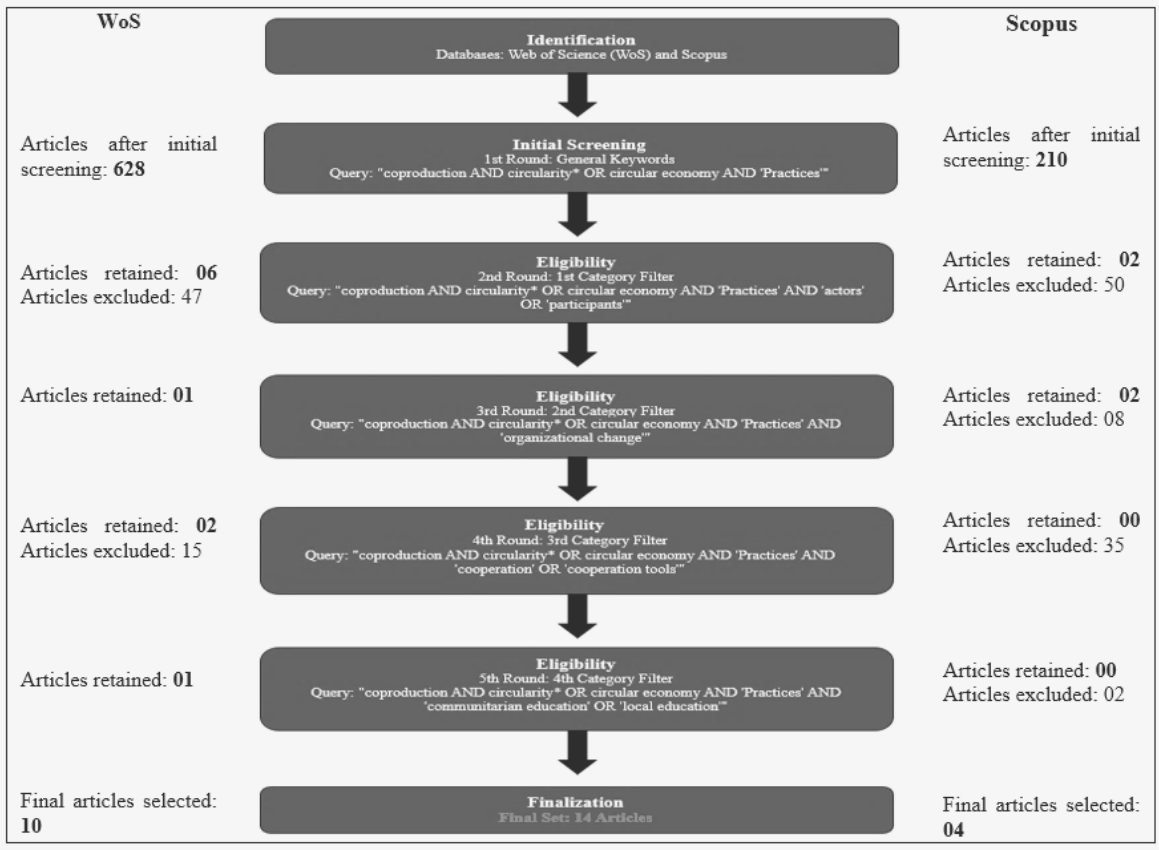
Graph 3 – Number of Publications by Thematic Area



Source: WoS and SCOPUS

The bibliometric analysis provided a quantitative overview of the growth and thematic distribution of publications related to co-production and circularity. This approach enabled the exploration of the interactions between co-production and circularity through the dimensions of actor diversity, organizational change, cooperation mechanisms, and community education, which structure the present study. In each database, four additional search rounds were conducted using the structures outlined in Table 1, generating the results contained in the PRISMA flowchart in Figure 2.

Figure 2 - Prism flowchart



Source: Prepared by the authors (2024).

The process of article selection in both databases involved reading abstracts, keywords, and publication titles, organizing the information to identify selected studies and applying compartmentalized filter rounds by category, as per the queries (Table 1) and the Prism flowchart (Figure 1). In the second round of article searches, the filter related to the first category was applied. Of the 53 and 52 articles found in the WoS and Scopus databases, respectively, a preliminary verification was conducted to align with publication type (journal/article), title, and abstract. From this process, 8 articles were selected, focusing on those aligned with the study theme and the "diversity of actors" category. Duplicate articles across databases and those that did not directly explore co-production or circular practices with active involvement of actors or participants were excluded.

In the third round, the filter for the previous category was removed, and the filter for the "organizational change" category was applied. This resulted in 1 and 17 articles found in the WoS and Scopus databases, respectively, of which only 3 articles were selected. The selection and exclusion criteria were similar to the second round, focusing on articles that explored organizational transformations associated with the circular economy (CE). Articles addressing themes such as digitalization or internal efficiency, which were not relevant to the research focus, were excluded.

In the fourth round, the same method of exclusion for the previous category was followed, and a new category, "cooperation mechanisms," was included. Of the 17 and 35 articles selected in the WoS and Scopus databases, articles that did not address collaborative practices or cooperation tools related to CE were excluded. Only 2 articles were retained, as they aligned with the theme and the new filter category.

The final round followed the same method of replacing the previous filter with the "community education" category. Articles limited to corporate or specific school contexts, without connections to collaborative or circular community practices, were discarded. Only 1 article was retained, as it demonstrated alignment between the theme and this category.

Upon completing the search and selection criteria, a total of 14 articles were identified for this review, as illustrated in Figure 2. This rigorous process ensured that only articles aligned with the analytical categories were retained, guaranteeing methodological consistency and a focus on identifying emerging co-production practices within the context of the circular economy.

Results & Discussions

The results obtained from the search and selection process for articles addressing productivity and circularity are presented in Table 2, which includes the authors, article title, publication journal, year, objectives, and the database.

Table 2 - Key Information from Selected Articles

No.	Author/Year	Article Title	Study Location	Journal	Objective	Database
01	Hjaltadóttir, R. E., & Hild, P. (2021)	Circular Economy in the Building Industry: European Policy and Local Practices	Luxembourg and Sweden (Gothenburg)	European Planning Studies	Investigate how companies in the construction industry in Luxembourg and Gothenburg, Sweden, understand and develop Circular Economy (CE) practices, especially regarding actor cooperation.	Web of Science
02	Quirk, S., Gibson, C., & Cook, N. (2024)	More-than-transactional Circular Economies: The Café-Urban Farm Nexus and Emergent Regional Food Waste Circuits	Australia (Wollongong)	Local Environment	Investigate Circular Economy practices for food waste reuse in an Australian local community, highlighting community connections and environmental values.	Web of Science
03	Ferronato, N., Pasinetti, R., Vargas, D. V., Mendoza, I. J. C., Lizarazu, E. G. G., Portillo, M. A. G., & Torretta, V. (2022)	Circular Economy, International Cooperation, and Solid Waste Management: A Development Project in La Paz (Bolivia)	Bolivia (La Paz)	Sustainability	Improve the solid waste management (SWM) system in La Paz, Bolivia, by introducing a circular economy model through the 'LaPazRecicla' project, fostering cooperation.	Web of Science
04	Beamer, K., Tuma, A., Thorenz, A., Boldoczki, S., Kotubetey, K., Kukea-Shultz, K., & Elkington, K. (2021)	Reflections on Sustainability Concepts: Aloha ʻĀina and the Circular Economy	USA (Hawaii)	Sustainability	Explore the intersection between the circular economy and the Hawaiian indigenous philosophy of aloha ʻāina, emphasizing its potential collaboration to address climate change and promote sustainable development.	Web of Science
05	Nujen, B. B., Kvadsheim, N. P., Mwesiumo,	Knowledge Obstacles When Transitioning	Norway	International Journal	Address knowledge obstacles hindering the transition to a circular economy within	Web of Science

	D., Reke, E., & Powell, D. (2023)	Towards Circular Economy: An Industrial Intra-Organizational Perspective		of Production Research	organizations, particularly focusing on intra-organizational aspects.	
06	Ferronato, N., Mertenat, A., Zurbrügg, C., & Torretta, V. (2024)	Can Tourism Support Resource Circularity in Small Islands? On-Field Analysis and Intervention Proposals in Madagascar	Madagascar	Waste Management & Research	Explore how tourism can foster solid waste recovery and recycling on the island of Nosy Be, Madagascar, proposing circular models supported by international cooperation and active local partner participation.	Web of Science
07	Kooter, E., van Uden, M., van Marrewijk, A., Wamelink, H., van Bueren, E., & Heurkens, E. (2021)	Sustainability Transition through Dynamics of Circular Construction Projects	Netherlands	Sustainability	Understand how inter-organizational circular construction projects drive the transition to a circular economy, identifying factors and dynamics facilitating circular practices in construction.	Web of Science
08	Palafox-Alcantar, P. G., Hunt, D. V. L., & Rogers, C. D. F. (2021)	Current and Future Professional Insights on Cooperation Towards Circular Economy Adoption	United Kingdom (Birmingham)	Sustainability	Analyze the characteristics of stakeholder cooperation in adopting circular economy principles for municipal solid waste management in Birmingham, United Kingdom.	Web of Science
09	Negesa, D., Geme, T., Nijman-Ross, E., & Ntawuhiganayo, E. B. (2023)	Eco-Industrial Transformation in Uganda: Performance Evaluation of Industrial Parks Using the International EIP Framework	Uganda	Frontiers in Sustainability	Investigate the transformation of traditional industrial parks into eco-industrial parks in Uganda, evaluating alignment with global standards and highlighting stakeholder cooperation and challenges.	Web of Science
10	Cocciolo, E. (2024)	The Role of Energy Communities for Thermal Networks: An EU Legal Perspective	European Union	Review of European Comparative & International Environmental Law	Demonstrate the transformative potential of energy communities (ECs) in promoting community empowerment and sustainable energy practices, particularly through fourth- and fifth-generation DHC systems.	Web of Science
11	Heikkilä, T. (2023)	The Heart and Soil of Value-Based Business: Emerging Circular Business Network and Vernacular Accountings	Finland	Accounting Forum	Explore the creation of value-based business networks and vernacular accounting in a circular economy context.	CAPES CAFe - Scopus
12	Wiarda, M., Coenen, T. B. J., & Doorn,	Operationalizing Contested Problem-Solution	Netherlands	Environmental Innovatio	Analyze how problematic spaces and their solutions are operationalized in Dutch	CAPES CAFe - Scopus

	N. (2023)	Spaces: The Case of Dutch Circular Construction		n and Societal Transitions	circular construction.	
13	Taddei, E., Sassanelli, C., Rosa, P., & Terzi, S. (2024)	Circular Supply Chains: Theoretical Gaps and Practical Barriers: A Model to Support Approaching Firms in the Era of Industry 4.0	Italy	Computers and Industrial Engineering	Develop and propose a model to support companies transitioning to circular supply chains, addressing practical barriers and theoretical gaps in the Industry 4.0 context.	CAPES CAFe - Scopus
14	Haleem, A., Singh, R. P., Suman, R., & Khan, S. (2023)	Management 4.0: Concept, Applications and Advancements	India	Sustainable Operations and Computers	Explore the concept of Management 4.0, its technologies, and applications for efficient management systems, focusing on reducing human error, increasing efficiency, and transitioning to advanced technologies in organizational contexts.	CAPES CAFe - Scopu

Source: Prepared by the authors (2024).

Based on the categories defined in the framework, an integrative and critical interpretation of the authors' approaches was sought. Each section discusses a category, constructing a debate among authors, identifying their contributions and ideas, and comparing these with the studied category, with the aim of ultimately validating the results against the study's objectives.

Diversity of Actors

The transition to a circular economy (CE) relies on emerging practices shaped by a broad diversity of actors, each playing interdependent roles. Governments, businesses, NGOs, local communities, and intermediaries contribute to these initiatives, yet their interactions are often marked by tensions, collaborations, and inequalities that influence the success of implemented practices. The eight articles analyzed in this category provide a critical and contrasting overview of how these practices emerge in different contexts—ranging from resource-limited island communities to technologically advanced urban systems in Europe.

In Nosy Be, a tourist island in Madagascar, coproduction was crucial for implementing wood briquettes and biodigesters as circular solutions for solid waste management. NGOs and community associations led the cultural adaptation of technologies, while tourism operators financed the initiatives. However, the lack of basic infrastructure and cultural resistance hindered the large-scale expansion of these practices, limiting their impact (Ferronato, Mertenat, & Zurbrügg, 2023). This example contrasts with Luxembourg and Gothenburg, where emerging practices were structured through robust public policies and advanced infrastructures. In Luxembourg, the use of digital material passports facilitated resource traceability but encountered challenges due to sectoral fragmentation. Gothenburg, on the other hand, stood out by connecting various construction projects through material banks, promoting waste reuse and a more integrated approach (Hjaltadóttir & Hild, 2021). These cases reveal that emerging practices can vary widely in technical sophistication, but in both contexts, the diversity of actors plays a decisive role, requiring tailored strategies to mediate interests and overcome barriers.

The cases of Wollongong, Australia, and the Netherlands showcase opposing approaches to emerging practices in the circular economy, exposing tensions and lessons that transcend their specificities. In

Wollongong, initiatives relied on local networks and direct collaboration between cafés and an urban farm to create closed food waste loops. The absence of a formal structure was offset by the alignment of community interests and operational simplicity, enabling practical implementation and noticeable environmental benefits (Quirk et al., 2024). However, this practice faces challenges related to scalability and long-term sustainability, as it relies exclusively on local actors and limited resources.

n the Netherlands, on the other hand, the circular construction sector is characterized by highly institutionalized structures, where diverse interests have led to conflicts over priorities, such as modularity in design versus resource efficiency. The use of Q-methodology highlighted these divergences, demonstrating that even in technically advanced systems, the lack of consensus among stakeholders can delay the implementation of collaborative practices (Wiarda et al., 2023). Although methodological mediation enabled some alignment, the process revealed that advancements in complex systems require more than technical capacity; they demand robust mechanisms to integrate divergent perspectives.

Comparing the two cases raises fundamental questions for the circular economy and coproduction. On the one hand, Wollongong demonstrates that community-driven solutions can effectively respond to local needs but remain vulnerable to a lack of institutional support and resources for scaling up. On the other hand, the Dutch experience underscores that even with advanced infrastructure and technology, emerging practices face intrinsic limitations due to fragmented interests and reliance on formal mediation tools. This tension brings forth a central question: can local practices truly scale without institutional support? Or will complex systems, no matter how advanced, always struggle to align multiple stakeholders?

Some of these questions can be addressed through the cases themselves. In Wollongong, scalability could be achieved by establishing partnerships that expand the reach of community-driven initiatives without compromising their local essence. Integrating external actors, such as NGOs or social investors, could provide the necessary resources to scale practices without overburdening local agents. In the Netherlands, the difficulty in aligning diverse interests highlights the importance of investing in participatory mechanisms that go beyond reflective methodologies, enabling greater dialogue among technical experts, policymakers, and end-users. Thus, while local practices require institutional reinforcement to achieve greater impact, advanced systems need to become more agile and inclusive to transform conflicts into collaboration.

These two contexts, though opposite in many respects, are complementary in understanding the challenges of the circular economy. Wollongong exemplifies the strength of simplicity and direct engagement, while the Netherlands reveals the necessity of mediating processes to turn conflicts into learning opportunities. Both suggest that for emerging practices to thrive, they must balance operational simplicity with systemic integration, adapting to the cultural and structural specificities of each context.

The intersection of cultural values and technological solutions is particularly evident in studies from Hawaii and Finland, which offer contrasting approaches to the circular economy. In Hawaii, the concept of *Aloha ʻĀina* goes beyond technical logic and proposes a circularity rooted in ethical and spiritual values, prioritizing social justice and care for the land. This perspective challenges the dominant view that operational efficiency alone can address the challenges of the circular economy, suggesting that solutions failing to incorporate local cultural values may be perceived as disconnected or even inadequate for certain communities (Beamer et al., 2021). Meanwhile, in Finland, the approach adopted by CiComp demonstrates that pragmatic strategies, such as integrating industrial and agricultural flows through informal networks and vernacular accounting, can be highly effective in

industrial contexts, overcoming logistical and cultural barriers with a strong technical-operational focus (Heikkilä, 2023).

The comparison between these approaches raises a crucial question: what is more relevant for the success of a circular practice—its technological efficiency or its ability to align with the cultural values of its context? A possible answer lies in horizontal integration and capacity-building for local actors. While international funding can catalyze change, its effectiveness depends on creating structures that empower local communities and ensure the continuity of initiatives after external support ends.

The study conducted in La Paz, Bolivia, offers a complementary perspective by exploring how international cooperation can enable emerging practices in low-income contexts. The emerging practice, centered on the formalization of waste pickers and the establishment of recycling plants, was facilitated through external funding and technical expertise. However, political instability and the lack of regulations limited the initiative's sustainability (Ferronato et al., 2022). This case underscores that while external actors can drive solutions, their effectiveness depends on solid integration with local actors, as also evidenced in Nosy Be.

Finally, the study of European industrial sectors reveals the intra-organizational challenges that arise even in highly developed infrastructure contexts. The emerging practice here involved using organizational learning frameworks to address internal fragmentation and the loss of tacit expertise. Strategies such as interfunctional learning and organizational "unlearning" were proposed to align departments and foster the transition to circular practices (Nujen et al., 2023). This contrast between internal organizational dynamics and the intersectoral collaborations observed in community contexts highlights that, regardless of scale, the diversity of actors necessitates tailored strategies to mediate interests and overcome barriers.

The integrated analysis reveals that the diversity of actors is both a driving force and a source of complexity for circular practices. Cases like Nosy Be and La Paz demonstrate that initiatives rooted in local agents depend on external mediators to overcome structural barriers but struggle without continuous institutional support. In Luxembourg, the implementation of digital material passports exemplifies how public policies can integrate different stakeholders into a robust circular system (Hjaltadóttir and Hild, 2021). However, sectoral fragmentation emphasizes the importance of governance mechanisms that promote alignment and active participation among actors. Finally, approaches such as *Aloha ʻĀina* in Hawaii and CiComp in Finland suggest that sustainable circular practices must balance technical efficiency with human values, adapting to the cultural, structural, and organizational realities of each context.

In contrast to international experiences, which demonstrate varying degrees of institutionalization of circularity, Brazil still faces structural barriers that hinder the consolidation of collaborative arrangements and co-produced practices. Launched in 2007, the Cataforte program marked a milestone in the development of networks of waste pickers' cooperatives by combining public funding, technical training, and the strengthening of solidarity-based logistics. In its first three phases (2007–2014), the program promoted the formation of networks, supported the acquisition of equipment, and expanded the participation of waste pickers in the recycling market. However, following a period of institutional stagnation, its activities were discontinued and only recently resumed in 2024. This lack of continuity compromised previously achieved progress, interrupting co-production processes between the state and social organizations that were being consolidated. Such discontinuity reveals how the diversity of actors in Brazil remains vulnerable to political instability, undermining the consolidation of long-term collaborative arrangements (Secretaria-Geral da Presidência da República, 2024).

This diagnosis deepens when observing the case of the Ekatina Association, formed by Indigenous waste pickers from the Baré and Tukano ethnic groups in São Gabriel da Cachoeira (Amazonas). Although legally constituted, the association operates under extremely precarious conditions, located near the municipal dumpsite and lacking adequate infrastructure. A recent study on recyclable waste management in the municipality emphasizes the actions of the local government but overlooks the active participation of waste pickers, revealing a disconnect between institutional discourse and co-produced practice (Silva & Brito, 2025). These findings demonstrate that actor plurality continues to be neglected, and that participatory initiatives are often discontinued or instrumentalized without the effective inclusion of the collective subjects involved.

Such evidence reinforces that while the diversity of actors is indispensable for the success of emerging practices, it demands continuous strategies for mediation and integration. The inclusion of diverse perspectives enhances the legitimacy and impact of initiatives but also highlights power inequalities that limit equitable participation. Thus, the transition to circularity requires not only the involvement of multiple actors but also the creation of collaborative structures that foster dialogue, collective learning, and alignment among global and local stakeholders. Only through such articulation can the diversity of actors be transformed into a true catalyst for more inclusive and effective circular practices.

Organizational Change

Organizational change within the scope of the circular economy (CE) not only suggests profound transformations in society but also demands that organizations reconfigure their structures, cultures, and interaction dynamics. This transition, far from being linear, requires a break from traditional models and the development of innovative capabilities to support circularity. The three articles analyzed in this category offer significant contributions, addressing topics ranging from the implementation of advanced technologies to the cultural and operational challenges shaping emerging practices.

In the study by Taddei et al. (2024), Industry 4.0 enabling technologies, such as big data and the Internet of Things (IoT), are identified as central tools for enabling circular supply chains (CSCs). These technologies facilitate material traceability and resource optimization, creating conditions for more efficient closed loops and contributing to waste reduction. However, the authors note that organizational resistance to change and a lack of fiscal incentives limit the potential of these practices. This scenario contrasts with the dynamics analyzed by Kooter et al. (2021), which explore interorganizational challenges in circular construction projects. While CSCs require technological transformation within organizations, construction projects highlight that collaboration between different organizations is essential, yet often hindered by power conflicts and cultural differences.

This contrast underscores a critical tension: practices reliant on advanced technologies, as described by Taddei et al. (2024), frequently encounter internal barriers, while collaborative practices, as examined by Kooter et al. (2021), face challenges stemming from external barriers. Despite these differences, both studies converge on the need for profound organizational changes that connect internal and external processes, align strategic objectives, and promote collective learning. Integrating stakeholders to overcome cultural and operational barriers emerges as a shared requirement, although the methods to achieve this differ significantly.

Haleem et al. (2024), on the other hand, expand this discussion by introducing the concept of Management 4.0, which combines advanced technologies such as IoT and artificial intelligence with continuous learning frameworks. These practices offer transformative potential, allowing organizations to monitor and adapt their processes in real time. However, the authors caution that their effectiveness depends on organizational changes that empower employees and integrate internal processes into a

circular logic. Here, a direct connection is evident with the challenges highlighted by Taddei et al. (2024): while enabling technologies are crucial, their practical applicability is limited by the absence of strategic integration and workforce training.

The dialogue between these three articles highlights that emerging practices are not isolated solutions but elements dependent on an adaptable and collaborative organizational ecosystem. The material traceability and operational efficiency discussed by Taddei et al. (2024) can only be fully realized in organizational environments that prioritize continuous capacity-building, as emphasized by Haleem et al. (2024). Similarly, the interorganizational collaborations analyzed by Kooter et al. (2021) demonstrate that technologies will only be effective if stakeholders can align objectives and overcome cultural and political tensions.

Among the few structured experiences within Brazilian territory, the case of Florianópolis stands out. Through a municipal decree, the city set the goal of becoming a zero-waste municipality by 2030, committing to recover 90% of organic waste and 60% of dry recyclables (Jornal Nacional, 2025). This initiative was accompanied by the implementation of the Home Composting Program, which distributes worm composting kits to urban residents and organizes door-to-door collection of organic waste through volunteers, fostering community engagement and systemic benefits. According to estimates by ABRELPE, such initiatives can generate savings of over R$ 40 million per year, in addition to contributing to the mitigation of carbon emissions associated with landfilling and transportation (Associação Brasileira de Empresas de Limpeza Pública e Resíduos Especiais, 2015). Despite this local success, data from the Ministry of the Environment indicates that only 54% of Brazilian municipalities have an Integrated Municipal Solid Waste Management Plan, highlighting an ongoing structural challenge in urban governance regarding the circular transition (Ministério do Meio Ambiente, 2017).

By integrating the contributions of these studies, it becomes evident that emerging practices, such as circular supply chains, interorganizational projects, and Management 4.0, influence the circular economy by enhancing resource efficiency, reducing waste, and fostering more strategic collaborations between organizations. These practices create the necessary conditions for transforming linear systems into circular models. However, their effectiveness directly depends on organizations' ability to overcome internal resistance, align objectives, and adopt a systemic approach. Thus, the circular economy is not merely a technological goal but an organizational challenge requiring structural, cultural, and strategic transformation.

Cooperation Mechanisms

The circular economy (CE) requires not only the participation of multiple actors but also the creation of mechanisms that promote effective collaboration. In this sense, cooperation mechanisms play a structuring role, allowing different stakeholders to align their interests and work together to overcome economic, social, and cultural barriers. The two articles analyzed in this category highlight practices that illustrate cooperation in sustainable circular practices, both in advanced urban contexts and in developing economies.

In the study by Palafox-Alcantar et al. (2021), the focus is on cooperation among different stakeholders to facilitate the adoption of circular economy principles in municipal solid waste management in Birmingham, United Kingdom. The emerging practice identified was the creation of local forums that connect the public and private sectors with local communities, seeking to promote the alignment of interests around circularity. These forums exemplify coproduction by enabling multiple actors to contribute knowledge and resources to develop joint solutions. However, the authors emphasize significant challenges, such as the lack of practical alignment between the interests of the parties involved. For example, while private companies prioritize economic efficiency, community groups

often emphasize social and environmental benefits. These conflicts demonstrate that cooperation and coproduction can only reach their potential when accompanied by mediation tools and clear governance structures.

On the other hand, Negesa et al. (2023) explore the transformation of traditional industrial parks into eco-industrial parks in Uganda, where international cooperation plays a central role. The emerging practice here involves partnerships among local organizations, international agencies, and governments to implement global standards for eco-industrialization. In this context, coproduction manifests in the integration of local communities into industrial initiatives, ensuring that economic and social benefits are widely distributed. The article highlights that while international cooperation is powerful in overcoming structural barriers, it depends on a high degree of coordination to align expectations and overcome operational challenges, such as inadequate infrastructure and limited resources.

Comparing the two cases reveals complementary and contrasting dynamics. In Birmingham, cooperation and coproduction are driven by local actors and seek to reconcile diverse interests within a complex urban environment. In Uganda, the reliance on external actors reveals both the potential and the limitations of coproduction mediated by international cooperation. While Birmingham faces difficulties aligning conflicting priorities among stakeholders, Uganda grapples with structural fragility that could compromise the long-term sustainability of its initiatives.

Despite these differences, both studies converge in highlighting that cooperation mechanisms are indispensable mediators for coproduction practices in the circular economy. The creation of participatory forums in Birmingham demonstrates how cooperation can generate solutions tailored to local realities, while the international partnerships in Uganda illustrate the power of external resources to overcome structural barriers. However, in both cases, the effectiveness of coproduction depends on the creation of structures that promote transparency, flexibility, and mutual learning, ensuring that the benefits generated are distributed equitably.

In Brazil, such structures remain incipient. Agreements like the one signed in 2020 between the Federal Court of Accounts, the Ministry of the Environment, and the UN Global Compact signal an effort toward convergence but lack normative force and budgetary support (Brasil, 2020). Federative fragmentation, administrative discontinuity, and the low prioritization of environmental issues hinder the consolidation of permanent intersectoral structures. As a result, isolated initiatives tend to lose momentum without generating structural impact — in contrast to the international cases analyzed, where cooperation mechanisms are embedded in state policies and regulatory frameworks.

This integrated analysis reinforces that cooperation is more than just a facilitator; it is the foundation upon which the coproduction of circular solutions is built. By aligning expectations, connecting actors, and integrating resources, cooperation mechanisms become indispensable for the circular economy to achieve its objectives. In this context, cooperation mechanisms not only facilitate the articulation among actors but also represent the practical manifestation of coproduction in complex systems. By promoting the sharing of resources, responsibilities, and benefits, these mechanisms reflect the transformative potential of cooperation in enabling circularity across diverse contexts.

Community Education

The study by Cocciolo (2024) explores the role of thermal energy communities as transformative agents in the energy transition and in promoting the circular economy (CE). Fourth- and fifth-generation thermal networks, integrated with renewable sources and residual heat, represent an emerging practice with the potential to decarbonize energy systems and foster circularity at the local level. This approach reinforces the importance of community education as a catalyst for the adoption of these technologies, empowering citizens to actively participate in energy management and decision-making.

The implementation of these networks relies on a robust regulatory framework, such as the European Union's "Fit-for-55" package, which sets decarbonization targets and encourages community participation through subsidies and incentive policies. However, the author highlights critical challenges, including the initial resistance of communities to adopting new habits and the technical complexity of the systems. These factors underscore the need for education that is not only technical but also addresses cultural and social aspects, fostering broad and lasting engagement.

The emerging practice of thermal networks goes beyond technological installation, creating a collaborative environment where local communities develop a sense of energy citizenship. Through workshops and awareness programs, citizens learn to manage energy resources efficiently and sustainably, aligning their actions with circular economy goals. However, Cocciolo (2024) warns that, for these initiatives to have a significant impact, it is necessary to overcome institutional barriers, such as the lack of integration between public policies and sustainable financing, as well as to ensure continuous technical support for the communities involved.

In this context, local practices in Brazil, such as the Mesa Brasil-SESC Program, can serve as illustrative additions to strengthen the global debate on community education and the circular economy. This program, focused on food waste management, promotes collective learning and social engagement, empowering communities to redistribute surplus food and raise environmental awareness. Similar to the thermal networks analyzed by Cocciolo, Mesa Brasil demonstrates how community education can align local practices with global sustainability goals (Rodrigues, Freu, & Moretto Neto, 2022). Although operating in different contexts, both examples emphasize that community education is essential for internalizing circular habits and creating collaborative networks that support the transition to circularity.

Therefore, Cocciolo's (2024) analysis reinforces that community education is an indispensable element for the success of the circular economy. It not only disseminates technical knowledge but also transforms behaviors, promotes collective engagement, and strengthens environmental citizenship. In the context of European community thermal networks, education plays a crucial role by empowering citizens to actively participate in resource management, contributing to decarbonization and local sustainability.

However, the study also highlights the challenges that must be addressed, such as the initial resistance of communities and the lack of integration between public policies and funding. These obstacles demonstrate that without continuous investment in education and awareness, traditional practices and environmental neglect will persist, undermining efforts to build resilient and inclusive circular systems.

The example of the Mesa Brasil-SESC Program in Brazil complements this reflection by showing how community education can mobilize local populations for circular practices in contexts with limited infrastructure. Both cases demonstrate that the transformation to the circular economy will only be possible if individuals are empowered to rethink their relationships with natural resources, abandoning linear practices in favor of innovative and collaborative solutions.

It becomes evident that investing in community education is not just a strategy but an urgent necessity to ensure that the emerging practices of the circular economy are internalized, expanded, and sustained over time. Without this educational foundation, cultural and behavioral barriers will continue to limit the reach of circular initiatives, preventing the achievement of a truly sustainable future.

To consolidate the results of this analysis, **Table 3** was structured to organize and synthesize the categories identified in the reviewed articles. This presentation provides a clear visualization of the emerging practices, the actors involved, and the innovations underpinning the circular economy. Thus, the table serves as a summary of the main trends observed, highlighting the specific contributions of

each study and facilitating the identification of patterns that can guide future research and practical actions.

Table 3 - Synthesized Summary of the Analyzed Articles.

Category	Article Title	Authors	Identified Emerging Practices
Diversity of Actors	Circular Economy in the building industry	Hjaltadóttir, R.E.; Hild, P.	Digital material passports for traceability.
	More-than-transactional circular economies	Quirk, S.; Gibson, C.; Cook, N.	Creation of closed food waste loops.
	Circular Economy, International Cooperation, and Solid Waste Management	Ferronato, N.; Pasinetti, R.; Vargas, D.V.; et al.	Formalization of waste pickers and establishment of recycling plants.
	Reflections on Sustainability Concepts	Beamer, K.; Tuma, A.; Thorenz, A.; et al.	Integration of cultural values into the circular economy (*Aloha ʻĀina*).
	Knowledge obstacles when transitioning towards circular economy	Nujen, B.B.; Kvadsheim, N.P.; Mwesiumo, D.; et al.	Frameworks to overcome intra-organizational barriers.
	Can tourism support resource circularity in small islands?	Ferronato, N.; Mertenat, A.; Zurbrügg, C.; Torretta, V.	Implementation of biodigesters and wood briquettes.
	Sustainability Transition through Dynamics of Circular Construction Projects	Kooter, E.; van Uden, M.; van Marrewijk, A.; et al.	Interorganizational projects with collaborative learning.
	Operationalizing contested problem-solution spaces	Wiarda, M.; Coenen, T.B.J.; Doorn, N.	Conflict resolution in circular construction projects.
Organizational Change	Circular supply chains: theoretical gaps and practical barriers	Taddei, E.; Sassanelli, C.; Rosa, P.; et al.	Integration of Industry 4.0 technologies into circular supply chains.
	Management 4.0: Concept, applications and advancements	Haleem, A.; Singh, R.P.; Suman, R.; Khan, S.	Use of Management 4.0 with artificial intelligence and IoT.
	Sustainability Transition through Dynamics of Circular Construction Projects	Kooter, E.; van Uden, M.; van Marrewijk, A.; et al.	Temporary structures for collaborative innovation.
Cooperation Mechanisms	Current and Future Professional Insights on Cooperation	Palafox-Alcantar, P.G.; Hunt, D.V.L.; Rogers, C.D.F.	Local forums for waste management in Birmingham.
	Eco-industrial transformation in Uganda	Negesa, D.; Geme, T.; Nijman-Ross, E.; Ntawuhiganayo, E.B.	Transformation of industrial parks into eco-industrial parks.
Community Education	The role of energy communities for thermal networks	Cocciolo, E.	Creation of community thermal networks and technical training.

Source: Prepared by the Authors, 2024.

Final Considerations

Co-production and circularity emerge as indispensable responses to global sustainability challenges in a world still dominated by linear models. Currently, more than 400 million tons of plastic are produced annually, yet less than 10% is recycled (UNEP, 2023). In light of this scenario, this study sought to answer the central question: which international co-production practices are emerging within the scope of the circular economy?

Through a systematic-integrative review of 14 articles from the Web of Science and Scopus databases (2019–2024), innovative practices were identified and classified into four analytical categories derived from the theory of polycentricity (Ostrom, 1996): actor diversity, organizational change, cooperation mechanisms, and community education. The analysis revealed that co-production, when applied contextually, strengthens circular processes by integrating multiple types of knowledge, fostering collaborative networks, stimulating collective learning, and ensuring greater social legitimacy for public policies.

Cases such as material digital passports in Luxembourg, resource banks in Gothenburg, and interorganizational networks in the Netherlands demonstrate how coordination among diverse actors can enable more resilient circular structures (Hjaltadóttir & Hild, 2021; Wiarda et al., 2023; Quirk et al., 2024). Meanwhile, experiences such as *Aloha ʻĀina* in Hawaii and local food circuits in Wollongong (Australia) illustrate the power of culturally rooted practices and community engagement. These examples show that circular co-production takes multiple forms—technical, social, cultural, and institutional—adapting to distinct governance arrangements and degrees of organizational maturity.

Organizational change emerged as a cross-cutting axis and a necessary condition for consolidating the circular economy. Technologies such as Industry 4.0 and Management 4.0, as discussed by Taddei et al. (2024) and Haleem et al. (2023), offer important tools, but their effectiveness depends on the transformation of routines, internal capacity-building, and the overcoming of cultural barriers. At the same time, cooperation mechanisms—such as local forums, international agreements, and institutional networks—proved essential to align divergent interests, overcome power asymmetries, and promote the continuity of initiatives.

The analysis also revealed significant gaps in developing countries, especially in Brazil. The discontinuity of policies such as the *Cataforte* Program, the limited integration of waste pickers into institutional arrangements, and the fragility of intersectoral cooperation mechanisms, as illustrated by the case of the Ekatina Association, indicate that actor diversity and the potential for co-production remain underutilized. Only 4% of solid waste is recycled in the country (SNIS, 2018), and just over half of municipalities have an integrated solid waste management plan (MMA, 2017), suggesting that isolated practices lack ongoing institutional support and strategic structuring.

Community education, in turn, has proven to be a catalyst for lasting cultural change. Initiatives such as *Mesa Brasil-SESC* and European energy citizenship networks show that co-production is strengthened when citizens move beyond passive users to become co-authors of transformation. Yet challenges such as digital exclusion, territorial inequalities, and the weak institutionalization of social participation persist, especially in peripheral contexts.

In light of this evidence, this study proposes the Integrated Framework of Circular Co-production, which articulates the four identified dimensions as complementary and interdependent pillars of the circular transition. This framework underscores that there is no transformation without active diversity, organizational change, structured cooperation, and community engagement. Rather than a normative model, it serves as a theoretical and practical reference for guiding public policies, institutional projects,

and research networks aiming to build circular solutions grounded in collaboration, innovation, and environmental justice.

The scientific contribution of this article lies in the construction of a conceptual framework applicable to diverse contexts, with emphasis on emerging economies. Future studies are encouraged to further investigate co-production in environmental public policies, develop indicators to measure the effects of this approach on circular effectiveness, and examine the role of social and digital technologies in fostering multisectoral engagement. It is also recommended to explore how hybrid forms of governance can connect local knowledge and technical instruments into more inclusive circular strategies tailored to territorial realities.

Achieving circularity entails, above all, an organizational, cultural, and political transformation. By mapping international co-production experiences and analyzing them through the lens of theory and practice, this article reaffirms that circularity will not be achieved through isolated actions but through the collective construction of new social pacts around the responsible use of resources, equity, and shared responsibility among the state, the market, and society.

References

Associação Brasileira de Empresas de Limpeza Pública e Resíduos Especiais. (2015). *Panorama dos resíduos sólidos no Brasil 2015*. São Paulo: Abrelpe.

Agamuthu, P., & Mehran, S. B. (2019). Economia circular: perspectiva global. In *Economia circular na Malásia* (pp. 241–268). https://doi.org/10.1016/j.resconrec.2021.106023

Associação Brasileira de Empresas de Limpeza Pública e Resíduos Especiais. (2022). *Panorama dos resíduos sólidos no Brasil 2022*. São Paulo: Abrelpe. Disponível em: https://abespb.com.br/wp-content/uploads/2023/12/Panorama_Abrelpe_2022.pdf. Acesso em: 20 de outubro de 2024.

Bandola-Gill, J., Mather, C., & Williams, D. (2023). Knowledge democracy and co-production in public policy. *Policy and Society*, 42(1), 45–58.

Beamer, K., Kim, K., Akutagawa, M., & Rodenhurst, B. (2021). Reflections on sustainability concepts: Aloha ʻĀina and the circular economy. *Sustainability*, 13(5), 2984. https://doi.org/10.3390/su13052984.Acesso em: 4 de novembro de 2024.

Belle, S., & Zhao, L. (2022). Systematic literature review in software engineering: A new perspective on quality assessment. *Journal of Systems and Software, 178*, 110988. https://doi.org/10.1016/j.jss.2021.110988. Acesso em: 31 out. 2024.

Bochko, O., Bochko, O., & Kulczycka, J. (2023). *The primary levels of Ukraine's transition to a circular economy*. Mineral and Energy Economy Research Institute of the Polish Academy of Sciences. Acesso em: 31 out. 2024.

Botelho, L. L. R., Cunha, C. C. de A., & Macedo, M. (2011). O método da revisão integrativa nos estudos organizacionais. *Gestão e Sociedade, 5*(11), 121–136. Acesso em: 31 out. 2024.

Brasil. Ministério do Meio Ambiente. (2017). *54% dos municípios brasileiros têm plano de resíduos sólidos*. Brasília: MMA. Acesso em: 31 out. 2024

Brasil. Tribunal de Contas da União. (2020). *TCU, Pacto Global da ONU e Ministério do Meio Ambiente firmam acordo para fortalecer a sustentabilidade nas políticas públicas*. Brasília: TCU. Disponível em: https://www.tcu.gov.br/Acesso em: 20 de julho de 2025.

Brasil. Tribunal de Contas da União. (2020). *TCU, Pacto Global da ONU e Ministério do Meio Ambiente firmam acordo para fortalecer a sustentabilidade nas políticas públicas*. Brasília: Autor. Disponível em: https://www.tcu.gov.br/

Acesso em: 20 de julho de 2025.

Brennan, G., Curley, M., & Ruiz-Peralta, R. (2019). Community-led innovation for sustainable cities: Co-production in Amsterdam. *Journal of Urban Planning and Development*, 145(2), 1–10.

Budgen, D., Brereton, O. P., & Kitchenham, B. (2020). Synthesizing evidence in software engineering: A systematic literature review of systematic literature reviews. *Journal of Systems and Software*, 163, 110496. https://doi.org/10.1016/j.jss.2019.110496 Acesso em: 31 de outubro de 2024.
Cardoso, L. F., & Teixeira, A. (2023). Sustainable procurement and the transition to a circular economy: Challenges and opportunities. *Sustainability*, 15(1), 123–145. https://doi.org/10.3390/su150100123 Acesso em: 22 de outubro de 2024.
Chambers, J., Wyborn, C., Ryan, M. E., Serban, A., & Klenk, N. (2021). Six modes of co-production for sustainability. *Nature Sustainability*. https://doi.org/10.1038/S41893-021-00755-X
Chan, H. S. (2022). Rethinking circular economy: Toward a holistic approach. *Sustainability Science*, 17(4), 1111–1125. https://doi.org/10.1007/s11625-022-01029-x. Acesso em: 22 de outubro de 2024.
Cocciolo, E. (2024). The role of energy communities for thermal networks: An EU legal perspective. *Review of European, Comparative & International Environmental Law*, 33(3), 494–506. https://doi.org/10.1111/reel.12558. Acesso em: 15 de novembro de 2024.
Corvellec, H., & Ståhl, A. (2021). Circular economy: An analysis of the socio-technical conditions for implementation. *Sustainable Production and Consumption*, 27, 127–141. https://doi.org/10.1016/j.spc.2020.10.013. Acesso em: 22 de outubro de 2024.
Cuomo, F. (2022). Urban Living Labs: Co-production for sustainable urban development. *Sustainability Science*, 15(4), 450–462. Acesso em: 22 de outubro de 2024.
Dufour, F., & Huber, M. (2020). Coproduction in urban waste management: Best practices from Europe. *Journal of Environmental Management*, *260*, 109813. https://doi.org/10.1016/j.jenvman.2019.109813. Acesso em: 6 de novembro de 2024.
Ellen MacArthur Foundation. (2016). *The new plastics economy: Rethinking the future of plastics*. https://www.ellenmacarthurfoundation.org/publications. Acesso em: 20 de outubro de 2024.
Ezeudu, I. J., & Adekola, A. (2021). The role of coproduction in circular economy: Evidence from waste management. *Waste Management*, *122*, 177–184. https://doi.org/10.1016/j.wasman.2021.10.007. Acesso em: 22 de outubro de 2024.
Ferreira, C. dos S., Vieira, A. C. C., Silva, L. G. da, & Costa, L. S. (2022). Mapping organizational culture in the context of a circular economy: A case study for a Brazilian company. *Revista Gestão da Produção, Operações e Sistemas – GEPROS*, *17*(1), 18. https://doi.org/10.15675/gepros.v17i1.2763.. Acesso em: 22 de outubro de 2024.
Ferronato, N., Mertenat, A., Zurbrügg, C., & Torretta, V. (2024). Can tourism support resource circularity in small communities? *Waste Management & Research*, *42*(5), 406–417. https://doi.org/10.1177/0734242X231187561. Acesso em: 20 de novembro de 2024.
Ferronato, N., Pasinetti, R., Vargas, D. V., & Zanetti, M. C. (2022). Circular economy, international cooperation, and solid waste management: A development project in La Paz (Bolivia). *Sustainability*, *14*(3), 1412. https://doi.org/10.3390/su14031412. Acesso em: 20 de novembro de 2024.
Fugini, M. G., Bracci, E., & Sicilia, M. (2015). Co-production in the public sector: Experiences and challenges. *Public Management Review*, *17*(3), 423–441.
Goulart, P., & Falanga, R. (2022). Co-production and voice in policymaking: Participatory processes in the European periphery. *The European Journal of Development Research*, *34*(3), 564–582. https://doi.org/10.1057/s41287-022-00551-z. Acesso em: 28 de outubro de 2024.
Grupo Ânima Educação. (2014). *Manual: Revisão bibliográfica sistemática integrativa – a pesquisa baseada em evidências*. https://biblioteca.cofen.gov.br/wpcontent/uploads/2019/06/manual_revisao_bibliografica-sistematica-integrativa.pdf Acesso em: 28 out. 2024.
Haleem, A., Javaid, M., Singh, R. P., et al. (2023). Management 4.0: Concept, applications and advancements. *Sustainable Operations and Computers,* *4*, 10–21. https://doi.org/10.1016/j.susoc.2022.10.002
Acesso em: 13 nov. 2024.

Hedestig, U., Väänänen-Vainio-Mattila, K., & Iivari, N. (2018). Digital tools for enhancing co-production: A study of IoT applications in urban governance. *Smart Cities Journal, 14*(3), 210–225.
Heikkilä, T. (2023). The heart and soil of value-based business: Emerging circular business network and vernacular accountings. *Accounting Forum, 47*(4), 614–645. https://doi.org/10.1080/01559982.2023.2185851
Acesso em: 4 nov. 2024.
Hjaltadóttir, R. E., & Hild, P. (2021). Circular economy in the building industry: European policy and local practices. *European Planning Studies, 29*(12), 2226–2251. https://doi.org/10.1080/09654313.2021.1904838. *Acesso em: 10 out. 2024.*
International Solid Waste Association. (2024). *Global waste management outlook 2024*.*Acesso em: 5 nov. 2024.*
Jornal Nacional. (2025, 10 jan.). *Florianópolis é a única cidade lixo zero do Brasil*. Rio de Janeiro: TV Globo.
Kooter, E., Van Uden, M., Van Marrewijk, A., & Weijts, W. (2024). Sustainability transition through dynamics of circular construction projects: Collaborative learning and co-creation. *Journal of Cleaner Production, 299*, 126976. https://doi.org/10.1016/j.jclepro.2024.126976. *Acesso em: 4 nov. 2024.*
Kudo, T. (2024). Historical perspectives on citizen engagement in public service provision. *Journal of Public Administration, 35*(2), 112–130.
Li, Y., & Ma, C. (2014). Economia circular de um parque de fabricação de papel na China: Um estudo de caso. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2014.12.098. *Acesso em: 3 out. 2024.*
McDonough, W., & Braungart, M. (2002). *Cradle to cradle: Remaking the way we make things*. North Point Press. https://mcdonough.com/writings/cradle-cradle-remaking-way-make-things/ *Acesso em: 3 out. 2024.*
Morrison, T. H., Bodin, Ö., Cumming, G. S., Lubell, M., Seppelt, R., Seppelt, T., & Weible, C. M. (2023). Building blocks of polycentric governance. *Policy Studies Journal.* https://doi.org/10.1111/psj.12492
Murray, A., Skene, K., & Haynes, K. (2017). The circular economy: An interdisciplinary exploration of the concept and application in a global context. *Journal of Business Ethics, 140*(3), 369–380. https://doi.org/10.1007/s10551-015-2693-2.*Acesso em: 5 nov. 2024.*
Negesa, D., Geme, T., Nijman-Ross, E., & Ntawuhiganayo, E. B. (2023). Eco-industrial transformation in Uganda: Performance evaluation of industrial parks using the international EIP framework. *Frontiers in Sustainability, 4*, 1286611. https://doi.org/10.3389/frsus.2023.1286611. *Acesso em: 4 nov. 2024.*
Nujen, B. B., Kvadsheim, N. P., Mwesiumo, D., et al. (2023). Knowledge obstacles when transitioning towards circular economy: An industrial intra-organisational perspective. *International Journal of Production Research, 61*(24), 8618–8633. https://doi.org/10.1080/00207543.2022.2158243. *Acesso em: 3 nov. 2024.*
Ogunmakinde, T., et al. (2022). Contributions of the circular economy to the UN Sustainable Development Goals through sustainable construction. *Resources, Conservation and Recycling.* https://doi.org/10.1016/j.resconrec.2021.106023. *Acesso em: 3 nov. 2024.*
Organização Mundial da Saúde. (2020). *Água, saneamento e higiene para todos: Relatório global 2020*. Genebra: OMS. Disponível em: https://www.who.int/water_sanitation_health/en/. *Acesso em: 20 out. 2024.*
Organização Mundial da Saúde. (2020). *Poluição do ar*. Genebra: OMS. Disponível em: https://www.who.int/health-topics/air-pollution
Acesso em: 20 out. 2024.
Ostrom, E. (1996). Governance of common-pool resources: Design principles and the sustainability of irrigation systems. In *Proceedings of the International Workshop on Common-Pool Resources* (pp. 1–19).
Palafox-Alcantar, P. G., Hunt, D. V. L., & Rogers, C. D. F. (2021). Current and future professional insights on cooperation towards circular economy adoption. *Sustainability, 13*, 10436. https://doi.org/10.3390/su131810436
Acesso em: 14 nov. 2024.

Paul, J., & Criado, A. R. (2020). The art of writing literature review: What do we know and what do we need to know? *International Business Review, 29*(4), 1–7.
Quirk, S., Gibson, C., & Cook, N. (2024). More-than-transactional circular economies: The café-urban farm nexus and emergent regional food waste circuits. *Local Environment, 29*(6), 750–765. https://doi.org/10.1080/13549839.2024.2330399. *Acesso em: 4 nov. 2024.*
Rodrigues, P. O., Freu, K., & Moretto Neto, L. (2022). O Programa Mesa Brasil-SESC sob à luz da coprodução e da economia circular: Um estudo multicasos. *REUNIR: Revista de Administração, Contabilidade e Sustentabilidade, 12*(4), 29–43. https://doi.org/10.18696/reunir.v12i4.1348 *Acesso em: 25 out. 2024.*
Rosano-Ortega, G., Negrete-Cardoso, et al. (2022). Circular economy strategy and waste management: A bibliometric analysis in its contribution to sustainable development, toward a post-COVID-19 era. *Environmental Science and Pollution Research, 29*(41), 61729–61746. https://doi.org/10.1007/s11356-022-18703-3. *Acesso em: 4 nov. 2024.*
Secretaria-Geral da Presidência da República. (2024). *Cataforte – Programa de Inclusão Socioeconômica de Catadoras e Catadores*. Coordenação Interministerial para Inclusão Social e Econômica de Catadores (CIISC). Disponível em: https://www.gov.br/secretariageral/pt-br/ciisc/cataforte *Acesso em: 9 jul. 2025.*
Silva, K. L. da, & Brito, L. D. de. (2025). Recicláveis em São Gabriel da Cachoeira: Possibilidades de maior desenvolvimento socioambiental no Alto Rio Negro. *Revista Ambiente & Sociedade, 26*. http://dx.doi.org/10.1590/1809-4422asoc01641vu28L1TD
Sistema Nacional de Informações sobre Saneamento. (2018). *Diagnóstico dos resíduos sólidos urbanos*. Disponível em: https://www.snis.gov.br. *Acesso em: 10 out. 2024.*
Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039. *Acesso em: 31 out. 2024.*
Taddei, E., Sassanelli, C., Rosa, P., et al. (2024). Circular supply chains: Theoretical gaps and practical barriers: A model to support approaching firms in the era of Industry 4.0. *Computers & Industrial Engineering, 190*, 110049. https://doi.org/10.1016/j.cie.2024.110049. *Acesso em: 1 out. 2024.*
United Nations Children's Fund. (2021). *Child labour and electronic waste*. https://www.unicef.org. *Acesso em: 2 out. 2024.*
United Nations Environment Programme. (2023). *Global plastic pollution report*. https://www.unep.org. *Acesso em: 15 out. 2024.*
Winans, K., Kendall, A., & Deng, H. (2017). The history and current applications of the circular economy concept. *Renewable and Sustainable Energy Reviews, 68*, 825–833. https://doi.org/10.1016/j.rser.2016.09.123. *Acesso em 4 out. 2024.*
World Bank. (2022). *What a waste 2.0: A global snapshot of solid waste management to 2050*. Washington, DC: World Bank. https://www.worldbank.org. *Acesso em: 3 out. 2024.*
World Wildlife Fund. (2019). *Brazil is the 4th largest producer of plastic waste in the world*. https://www.wwf.org.br. *Acesso em: 1 out. 2024.*