

## **EXPLORANDO O ECOSISTEMA CIRCULAR: UMA REVISÃO SISTEMÁTICA ABRANGENTE DA LITERATURA**

### *EXPLORING THE CIRCULAR ECOSYSTEM: A COMPREHENSIVE SYSTEMATIC LITERATURE REVIEW*

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### **Objetivo do estudo**

Este estudo teve como objetivo compreender de forma abrangente a evolução dos estudos acadêmicos e práticos relacionados à economia circular e ao ecossistema, com foco na identificação de tendências-chave, metodologias e desafios neste campo em rápido desenvolvimento nos últimos anos.

### **Relevância/originalidade**

Este estudo é altamente relevante, pois fornece uma revisão sistemática da literatura para relacionar a economia circular e o ecossistema, além de apresentar um framework da hélice quártupla do ecossistema circular, baseado na revisão sistemática da literatura (SLR) realizada.

### **Metodologia/abordagem**

O protocolo de pesquisa obteve uma amostra de 103 artigos da Web of Science. Utilizando VOS Viewer e R Studio, foi realizada uma análise bibliométrica e de conteúdo, identificando tendências, clusters e apresentando os resultados na forma de tabelas e figuras condensadas.

### **Principais resultados**

O estudo demonstrou que o desenvolvimento do ecossistema circular depende de tecnologia, uso consciente dos recursos naturais e integração dos esforços. Nesse sentido, a colaboração entre os atores e a busca por inovação constante são obrigatórias.

### **Contribuições teóricas/metodológicas**

Esta RSL avança a compreensão do ecossistema circular ao analisar 103 artigos para identificar tendências, clusters e lacunas. Utilizando o modelo da hélice quártupla, destaca tecnologia, gestão de recursos e inovação, sendo referência fundamental para exploração acadêmica e desenvolvimento de teorias.

### **Contribuições sociais/para a gestão**

Este estudo destaca a necessidade de colaboração entre governos, empresas e sociedade para a transição para um ecossistema circular. Ao enfatizar tecnologia, uso de recursos e esforço coletivo, fornece insights práticos para formuladores de políticas e partes interessadas, promovendo o desenvolvimento sustentável.

**Palavras-chave:** Economia Circular, Ecossistema, Empreendedorismo, Modelo de Negócio Circular, Inovação

## *EXPLORING THE CIRCULAR ECOSYSTEM: A COMPREHENSIVE SYSTEMATIC LITERATURE REVIEW*

### **Study purpose**

This study aimed to comprehensively understand the evolution of academic and practical studies related to the circular economy and the ecosystem, focusing on identifying key trends, methodologies, and challenges in this rapidly developing field over recent years.

### **Relevance / originality**

This study is highly relevant since it provides a systematic literature review to relate the circular economy and the ecosystem and it brings a framework of the circular ecosystem quintuple helix, based on the systematic literature review (SLR) conducted.

### **Methodology / approach**

The SLR protocol obtained a sample of 103 articles from the Web of Science. Using VOS Viewer and R Studio, a bibliometric and content analysis was conducted, identifying trends, clusters, and presenting results in the form of condensed tables and figures.

### **Main results**

SLR demonstrated that the development of the circular ecosystem depends on technology, conscious use of natural resources and integration of efforts. In that matter, collaboration between the actors and the search for constant innovation is mandatory.

### **Theoretical / methodological contributions**

This SLR advances the understanding of the circular ecosystem by analyzing 103 articles to identify trends, clusters, and gaps. Utilizing the quintuple helix model, it highlights technology, resource management, and innovation, serving as a key reference for academic exploration and theory development.

### **Social / management contributions**

This study highlights the need for collaboration among governments, companies, and society to transition to a circular ecosystem. By emphasizing technology, resource use, and collective effort, it provides actionable insights for policymakers and stakeholders to promote sustainable development and greater societal participation.

**Keywords:** Circular economy, Ecosystem, Entrepreneurial, Circular Business Model, Innovation

## **EXPLORING THE CIRCULAR ECOSYSTEM: A COMPREHENSIVE SYSTEMATIC LITERATURE REVIEW**

### **1 Introduction**

Global society is facing many challenges such as climate change and human population growth. Climate change may be considered a consequence of our difficulty to manage conflicts and contradictions. The circular economy (CE) has gained elevated relevance in the post-COVID-19 pandemic recovery (Agrawal *et al.*, 2022; Girard, 2020; Nandi *et al.*, 2021). It emerged as an alternative to the linear paradigm, which implies producing, using, and disposing of goods, as it fosters sustainable development and has been calling up attention as a meaningful way toward a regenerative, low carbon, and resource-efficient society. To ensure a successful transition toward the CE, as the history of previous radical transformations shows, the understanding of the institutional features of industrial transformations is necessary (Suchek *et al.*, 2022; Bravo *et al.*, 2021; Henrysson & Nuur, 2021).

CE is an economic system designed to regenerate on its own (Donia *et al.*, 2018). Management and natural science literature have the CE as one of the prominent topics over the last few decades as it is gaining increasing attention among businesses, policymakers and academia (Alhawari *et al.*, 2021). Mhatre *et al.* (2021) points out the need to develop the redesign and rethink of the manufacturing process, usage and disposal pattern of products and services in an economy based on the CE paradigm. The CE transition produces a range of new challenges for designers and requires specific knowledge, strategies, and methods. The design of the products has to preserve functionality, material properties and economic value for as long as possible (Dokter *et al.*, 2021; Joustra *et al.*, 2021).

The United Nations (UN) 2030 agenda presents the urge to address the sustainable development goals and the CE plays an important role in that, contributing to a resilient environment and human well-being. The Paris Agreement target on archiving net-zero emissions by 2050 (D'amato *et al.*, 2019). According to Fioramonti *et al.* (2019), the focus on wellbeing rather than material output is already emerging in the Anthropocene, related to the new post gross domestic product (GDP) economy, due to the convergence of policy reforms and economic shifts. Because of the increasing alterations in the climate and ecosystems, the concept of the circular economy has brought relevant contributions to a sustainable economic development, where economic growth should be compatible with the environment goals (Martinho & Mourao, 2020).

The transition to CE increasingly points to the need for a change in corporate culture, namely toward sustainability, creating favourable environmental conditions as well as ensuring a higher local community resilience, well-being and quality of life (Salvioni & Almici, 2020; Gamidullaeva *et al.*, 2022). That is related to decreased resource inputs and waste and emission outputs of the economy and its organizational subsystems, according to Kanda *et al.* (2021). Tapaninaho & Heikkinen (2022) say that the companies need to rethink their value creation as well as their stakeholder's relationships.

New digital technologies represent one possible way to support the CE principles to be incorporated into businesses, allowing the development of new business models and generating the conditions to the redesign of products and value chain. The waste culture is damaging our planet and ecosystems in a way that may be irreversible. Circularity focus on closing and narrowing the resource loops, making the waste obsolete, by improving the materials and products lifespan. (Bressanelli *et al.*, 2022; George *et al.*, 2022; Gerding *et al.*, 2021).

Governments can play an important role in promulgating laws and regulations that encourage CE within procurement (Al-sinan & Bubshait, 2022). To target energy efficiency and clean energy alone will not be enough to reduce the greenhouse gas emissions trajectories

in the next decades. There is also the need to substantially reduce the non-energy-related CO<sub>2</sub> emissions in order to archive net-zero emissions in 2050 (Nikas *et al.*, 2022; Khalifa *et al.*, 2022).

Howard *et al.* (2022), points that the resilience of a circular economy system resides at the intersection of business, societal and ecosystem value and so a place based coordination and cross institutional organization matter. According to Kanda *et al.* (2021), the circular ecosystem concept points to be more suitable to describe the high level of coordination between different stakeholders in order to accomplish a circular system.

The presented paper refers to a systematic literature review (SLR) that tries to comprehend the evolution of the studies related to the circular economy and the ecosystem. The article written by Suchek *et al.* (2022) points out the circular ecosystem as a gap, among others, to be filled in order to understand the evolution of the literature concerning the circular economy. Therefore, this study was designed to respond to the subsequent research questions:

RQ1 – How the literature developed to address the circular economy and ecosystem?

RQ2 - What is in the agenda for future studies concerning the circular economy and ecosystem?

To answer the research questions, this study conducts a bibliometric analysis and content analysis of the articles identified. Sehnem *et al.* (2022) affirm that to guarantee the circularity of resources there is the need to develop efficient transition systems. The understanding of the circular economy and the ecosystem is relevant in that sense, as a transdisciplinary scientific agenda that involves representatives from policy, managerial, civil society and industries is necessary to establish goals and objectives to be undertaken in order to achieve the path towards a circular, net zero economy (Nikas *et al.*, 2022) . This study is highly relevant since it is the first systematic literature review to ever relate the circular economy and the ecosystem and it brings a framework of the circular ecosystem approach, based on the systematic literature review (SLR) conducted. That framework intend to demonstrate the inter relation among the many actors and their role in the circular ecosystem chain.

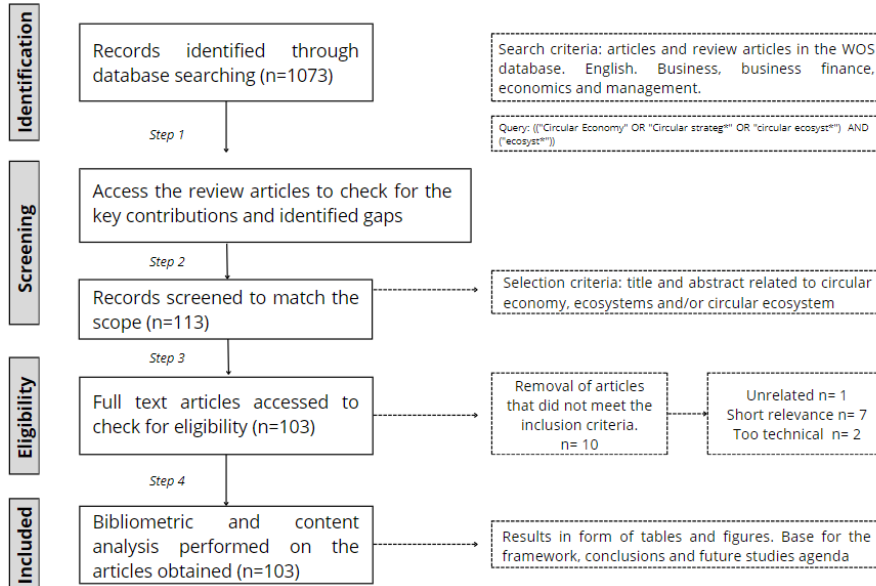
Therefore, this article brings five more sections. The second session presents the methodology adopted to the development of the SLR. The third section presents the main findings and discussions around the circular economy and ecosystems. The identified clusters are shown separately and the main information obtained in the sample is also presented. The fourth section introduces the circular ecosystem framework developed upon the SLR. After the framework the article brings the main conclusions and proposal of future studies. In the final section, the references are presented followed by the appendix.

## 2 Method

In order to bring forth a broad understanding of the most recent findings related to the circular economy and the ecosystem, this article carried out a critical and systematic literature review. The research protocol was conceived following previous studies (Gomes, *et al.* 2018; Ikpaahindi, 1985; Ceipek *et al.* 2019) that conducted reliable and replicable systematic literature reviews.

The articles incorporated in this SLR derived from the Web of Science (WoS) database. A search for articles by topic was conducted based on the criteria established using the query “(("Circular Economy" OR "Circular strateg\*" OR "circular ecosyst\*") AND (“ecosyst\*))”. It was conducted in February 2024 and brought 1074 records prior to filtering. The aim was to identify investigations surrounding the fields of circular economy and ecosystems considering

the categories “Management, Business, Economics and Business Finance”. Articles (including early access) and review articles in the English language with no time restriction were additional filters adopted in the search. The outcome generated a total of 113 articles that were submitted to the protocol described below in figure 1, to be properly analysed in this study.



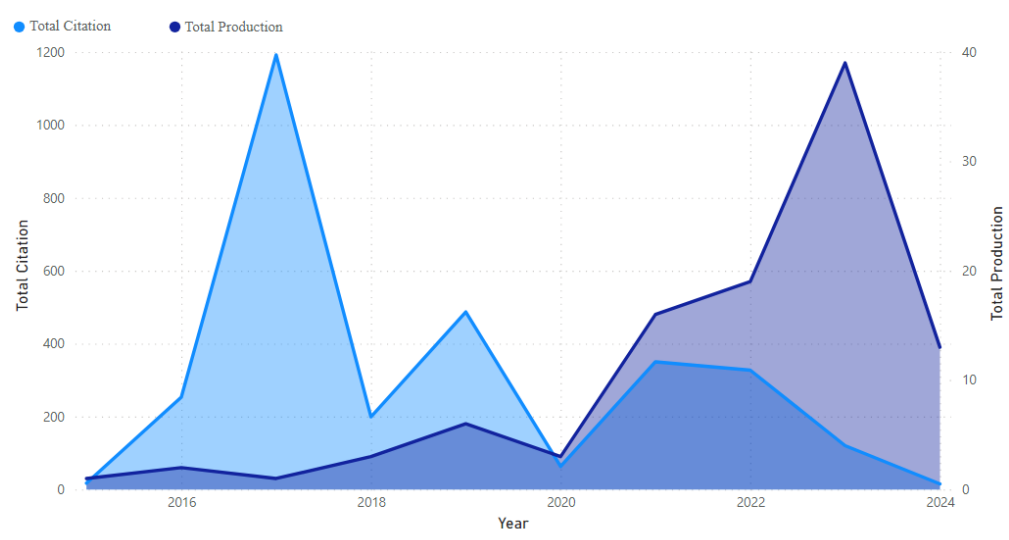
**Figure 1** - Representation of the methodological approach

The first analysis performed was over the previous SLR articles related to the theme. After identifying the main findings and gaps from those studies the remaining articles were screened to match the scope, i.e. relation to circular economy and ecosystems or circular ecosystem. The titles and abstracts were read and those articles that did not match the scope at first glance were fully read to find compatibility. In the end the study was conducted with a sample of 103 articles. This research used the software Vos Viewer and R Studio to conduct a bibliometric analysis of the articles obtained. Then, the procedure combined the bibliometric to a content analysis of the articles to find trends, identifying clusters and presenting the results of condensed information in the form of tables and figures. Those results were the base to the proposal of a framework and to foster the conclusions and future studies agenda.

### 3 Main findings and discussion

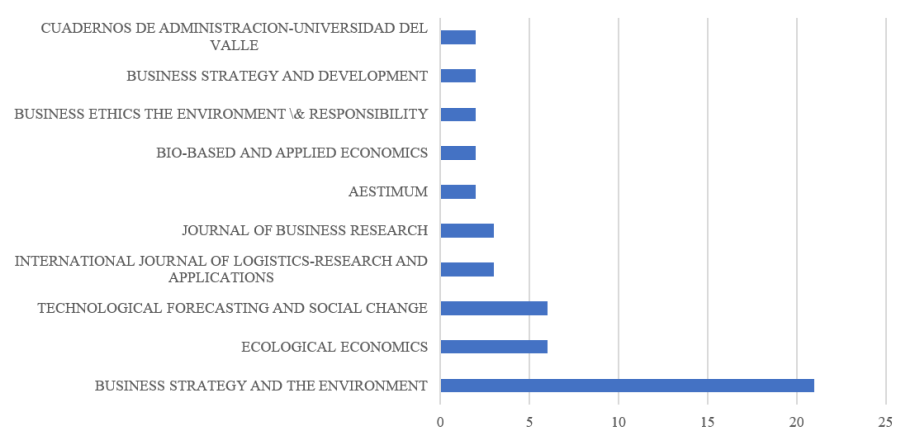
#### 3.1 Research profile

The circular economy and ecosystem have been object of study combined since 2015. The search developed in this study could only find articles written between 2015 and 2024. Figure 2 demonstrates that the relation of the total of publications and citations in the same period of time. The total production higher value was obtained in 2023 with 39 publications. The total citations per year demonstrated that the article of Murray *et al.* (2017), the only published in that year among the sample, accounts for 1092 citations so far.



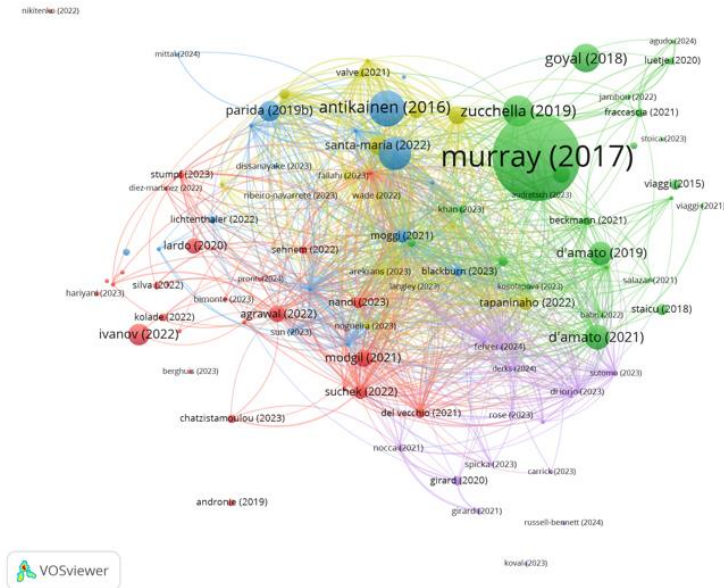
**Figure 2.** Annual scientific production and citations

The records included in this SLR came from total 60 sources listed in the WoS database. Figure 3 indicates Business Strategy and the Environment as the journal that stands out as the major contributor in this field of study with 21 published articles. The second and third more prolific journal are Ecological Economics and Technological Forecasting and Social Change with 6 publications each.



**Figure 3.** Most relevant sources

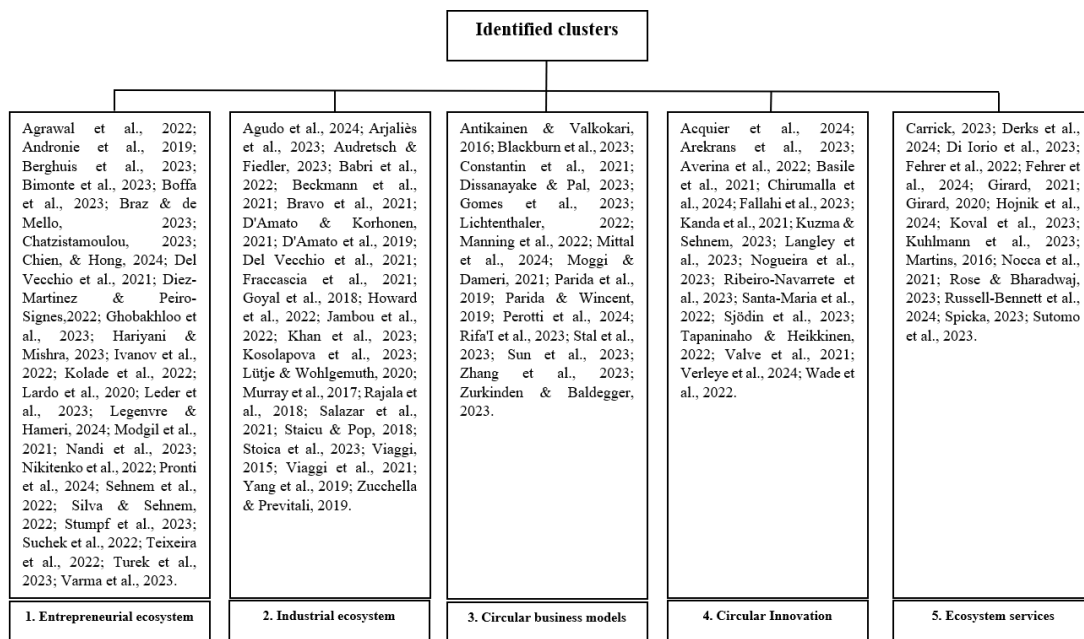
The sample analysed in this study was checked using the VOS Viewer software in order to allow bibliometric coupling analysis. Figure 5 presents the bibliographic coupling of the documents obtained and Murray (2017) followed by Antikainen et al. (2016) and Parida et al. (2019) are the authors of the most cited documents.



**Figure 5.** Bibliographic coupling analysis based on the documents

### 3.2 Identified clusters

The bibliometric analysis showed how the articles interacted and allowed the clusters identification, as shown on Figure 4. It provides a glance of the most cited articles in each cluster. Sections 3.2.1 thru 3.2.5 bring main features of the records in the clusters.



**Figure 4.** Circular economy and ecosystem articles identified in each clusters

#### 3.2.1 Entrepreneurial ecosystem

The cluster highlights the pivotal role of entrepreneurial ecosystems in driving the transition to a circular economy (CE) by fostering innovation, collaboration, and sustainability. They underscore the importance of manufacturing redesign in reducing environmental impacts and address challenges in measuring corporate social responsibility (Agrawal et al., 2022; Andronie et al., 2019). Berghuis et al. (2023) advocate for entrepreneurial government policies



that encourage ecosystem participation and circular purchasing, while Bimonte et al. (2023) emphasize the need for new production models to enhance recycling activities.

Furthermore, the results discuss the role of digital competitiveness and integrated frameworks in driving circular economy transitions (Chatzistamoulou, 2023; Chien & Hong, 2024). Del Vecchio et al. (2021) propose a multidimensional framework for entrepreneurs transitioning to CE models, and Ghobakhloo et al. (2023) explore how blockchain enhances supply chain traceability and transparency. Leder et al. (2023) investigate the influence of collaborative relationships on circular business models' maturation, while Suchek et al. (2022) emphasize the importance of understanding circular economy opportunities and management practices for entrepreneurs.

In addition, Sehnem et al. (2022) and Silva & Sehnem (2022) discuss the adoption of circular economy principles among startups, particularly in the food segment, highlighting the growing interest in sustainable business models. Nikitenko et al. (2022) explore the "blue economy" as a sustainable direction for agricultural production, shedding light on innovative approaches to resource utilization. Stumpf et al. (2023) analyse meta-rules shaping effective plastic packaging management, addressing critical considerations for promoting circularity in packaging materials.

### ***3.2.2 Industrial ecosystem***

This cluster explores the intricate dynamics of industrial ecosystems within the context of the circular economy paradigm. Agudo et al. (2024) elucidate that within a balanced industrial ecosystem, the outputs of one entity are efficiently utilized as inputs by another, thereby optimizing material and energy consumption while minimizing waste generation. There is a focus on how mature stages of Industrial Symbiosis (IS) implementation can lead to collaborative transformations within industrial parks, thereby fostering future industrial ecosystems. IS refers to a collaborative approach to associate the asset supply and request of different industries in arrange to optimize the asset utilization through trade of materials, water, energy and human assets over distinctive companies, whereas creating environmental, specialized, social and financial benefits for firms and society. Although there was no clear, straight arrange in which the organizations involved created advantageous connections, the choices related to industrial symbiosis are formed by a comparative set of factors. (Agudo et al., 2024; Fraccascia et al., 2021). However, there's a recognition of the risk of circular economy initiatives becoming mere symbolic gestures without substantive change (Arjaliès et al., 2023).

Audretsch & Fiedler (2023) highlight the importance of knowledge spillovers between circular start-ups and incumbents in enhancing motivation towards circularity, emphasizing the role of entrepreneurial ecosystems. Meanwhile, Babri et al. (2022) illustrate the evolutive nature of material affordances as organizations shift towards circular business models. Other studies underscore the significance of specific sectors in circular transitions. Beckmann et al. (2021) emphasize the forestry sector's potential for efficiency improvements and resource substitution, while Bravo et al. (2021) shed light on the complex dynamics within PET circular economies.

D'Amato & Korhonen (2021) advocate for collaborative narratives encompassing green, circular, and bioeconomy perspectives, envisioning a society and economy based on renewable processes. Del Vecchio et al. (2021) discuss digital platforms like the Italian Circular Economy Stakeholder Platform, highlighting their role in fostering innovation ecosystems focused on circularity. The findings also stress the importance of systemic perspectives. Fraccascia et al. (2021) present decision-making indicators for industrial symbiosis networks, while Goyal et al. (2018) emphasize the need for product and service designs that address multiple societal and environmental needs. Furthermore, the cluster touches upon challenges such as interfirm cooperation and the need for institutional redesign as Zucchella & Previtali (2019) highlight the necessity of redesigning institutional frameworks to support circular business models.

### **3.2.3 Circular business models**

This cluster delves into the transformative potential of circular business models (CBMs) in reshaping economic and environmental paradigms. Antikainen & Valkokari (2016) underscore the centrality of value creation for stakeholders in understanding the impact of circular economy models and sustainability. Building upon this notion, Blackburn et al. (2023) highlight how CBMs introduce a new systemic logic, challenging traditional economic perspectives and calling for a holistic approach to value creation. Constantin et al. (2021) envision 'agro-urban' ecosystems as a replicable solution facilitating the transition to a cleaner, greener circular economy by addressing resource limitations and environmental challenges specific to urbanization.

Dissanayake & Pal (2023) emphasize the importance of downstream waste reduction and product stewardship in promoting environmental and economic performance, while Gomes et al. (2023) suggest that strategic orientations play a pivotal role in shaping circular ecosystems' performance. Additionally, Lichtenthaler (2022) highlights the interdependent components of sustainability architecture that enable firms to achieve more value and do less harm. Mittal et al. (2024) address the feasibility of consumption scenarios, particularly in logistics-intensive industries like footwear. Moggi & Dameri (2021) stress the importance of trust and knowledge-sharing among stakeholders in fostering circular ecosystems.

Parida et al. (2019) and Parida & Wincent (2019) explore the role of ecosystem orchestrators in facilitating the transition toward circular economies through readiness assessment and transformation. Perotti *et al.* (2024) advocate for collaborative approaches like circular supply chains to intensify open innovation mechanisms. Rifa'i *et al.* (2023) highlight the relevance of the business ecosystem concept, particularly for individuals facing access barriers. Stal et al. (2023) identify blind spots in sustainability-focused business model research, while Sun et al. (2023) emphasize the role of translation in promoting symbiotic strategies in e-waste recycling ecosystems. Zhang et al. (2023) provide a holistic view of business model innovation research, identifying new research gaps and perspectives to address emerging challenges.

### **3.2.4 Circular innovation**

The studies in this cluster encompasses a range of studies that investigate the intricacies of implementing circular economy principles through innovative business models and ecosystem interactions. Through the lens of systemic coherence, Acquier et al. (2024) emphasize the need for alignment across organizational activities to effectively operationalize circular business models. Arekrans et al. (2023) highlight the ongoing ambiguity surrounding the operationalization of circular economy concepts within firms, underscoring the importance of exploring new avenues for innovation and opportunity exploitation. Averina et al. (2022) identify key dimensions such as capability assessment and ecosystem alignment as pivotal factors in evaluating sustainability opportunities before embarking on circular business model development. Basile et al. (2021) contribute a multicriteria decision-making analysis framework for evaluating decommissioning options, emphasizing the importance of considering various environmental and socioeconomic factors.

Chirumalla et al. (2024) provide visual representations of collaborative interactions within electric vehicle battery ecosystems, illustrating the implementation of circular business models. Fallahi et al. (2023) discuss managerial implications and financing potentials for circular business models, while also advocating for the utilization of AI to mitigate transitional challenges. Kanda et al. (2021) argue for the adoption of circular ecosystems as a more suitable concept for describing the coordinated efforts required to implement circular systems effectively. Kuzma & Sehnem (2023) highlight the demands and synergies associated with Circular Economy Business Models (CEBMs) in the pet industry. Langley et al. (2023) propose

a collaborative and incremental implementation approach for digital product passports to enable circularity in the EU market. Nogueira et al. (2023) examine the entanglement of waste valorisation initiatives within existing waste management systems, emphasizing the need for innovation beyond market mechanisms.

Ribeiro-Navarrete et al. (2023) explore the role of digitalization and cooperatives in driving circularity and sustainability, while Santa-Maria et al. (2022) outline relevant practices for circular business model innovation processes, including sustainability-oriented strategies and stakeholder engagement. Sjödin et al. (2023) offer insights into how AI can facilitate circularity and sustainable innovation in industrial digital servitisation, while Tapaninaho & Heikkinen (2022) emphasize the importance of stakeholder relationships in advancing circular economy business value creation. Valve et al. (2021) discuss variations in business models concerning resource recovery, and Verleye et al. (2024) highlight the significance of motivation, opportunity, and ability-related practices in promoting circular economy engagement. Wade et al. (2022) underscore the role of capabilities in reconceptualizing waste as a resource through innovation and stakeholder connections.

### **3.2.5 Ecosystem services**

Within the context of service ecosystems, the articles in this cluster delve into the multifaceted dynamics influencing the transition towards a circular economy. Carrick (2023) underscores the intricate interplay of competing interests within entrepreneurial ecosystems, emphasizing the need for nuanced approaches to address the tensions between the economy, environment, and society. Furthermore, Derks et al. (2024) advocate for an ecosystem perspective to understand how institutional voids impact entrepreneurial activities, particularly in low- and middle-income countries grappling with environmental challenges such as circular e-waste management.

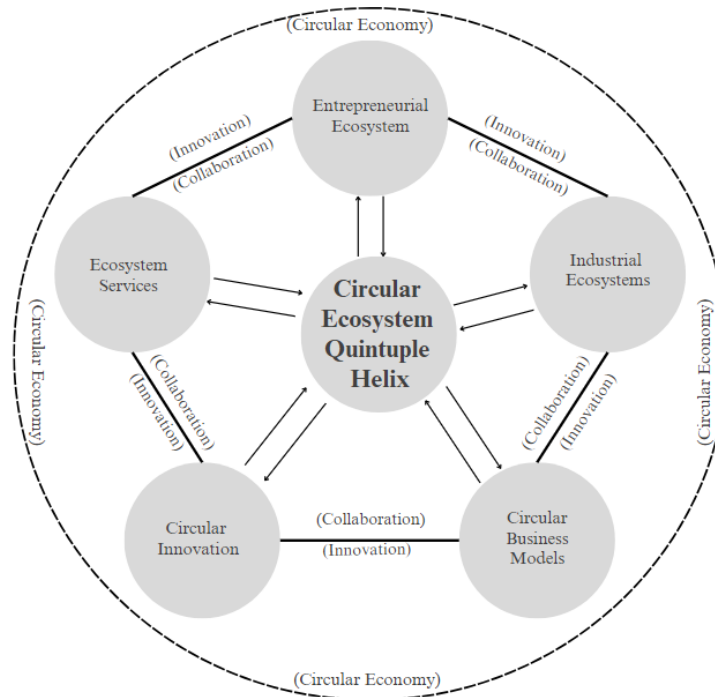
The circular economy is reshaping traditional consumption patterns, providing consumers with opportunities to preserve the ecosystem throughout the product lifecycle. This shift necessitates reconfiguration of institutional arrangements to address wicked problems and drive social change within nested service ecosystems (Di Iorio et al., 2023; Fehrer et al., 2022). Fehrer et al. (2024) articulate the transformative potential of the circular economy, envisioning economies operating akin to natural ecosystems—restorative and waste-free. This necessitates collaborative efforts among stakeholders along value chains, despite the considerable challenges involved (Kuhlmann et al., 2023).

Girard (2020, 2021) emphasizes the critical role of ecosystems in the circular economy, highlighting the need to conserve ecosystem health amidst climate change-induced challenges. Moreover, the establishment of the circular economy fosters sustainable consumption habits and promotes innovations aligned with ecological principles (Koval et al., 2023). Russell-Bennett et al. (2024) stress the importance of services in reducing production through the sharing economy and offer responsible consumption choices, thereby minimizing negative environmental impacts. Lastly, Spicka (2023) discusses the specific relationship between clusters and ecosystems within the context of innovation ecosystems, highlighting the role of collaboration and interaction among organizations in facilitating circular transitions.

## **4 Framework, limitations and future studies agenda**

The systematic literature review that was developed gave rise to the Circular Ecosystem Quintuple Helix framework presented in Figure 5. It demonstrates that for a circular ecosystem to develop, synergy among the various actors involved is necessary. From the supply chain to consumers, government policies, and other stakeholders, all must be committed to closed loops in favor of resource circularity. Circular economy, therefore, permeates the entire five-loop

helix of the circular ecosystem and connects entrepreneurial and industrial ecosystems, along with ecosystem services, circular business models and circular innovation. Among all elements of the chain, collaboration is essential, involving the exchange of people, experiences, knowledge, resources, and constant pursuit of innovation at all stages of production or service development. In this context, the circular ecosystem becomes the most suitable concept to describe the high level of coordination among the different stakeholders required for the implementation of the circular ecosystem (Kanda *et al.*, 2021).



**Figure 5.** Circular ecosystem quintuple helix

This study has limitations which opens avenue for future studies. This SLR involve the use of a single database (WoS). Future research could reach a longer range by considering additional sources of information. The study considered only articles in the English language, what is another limitation as well as the restriction of considering only articles and review articles published until February 2024 in the sample, not taken consideration for conference papers or other publications that could contribute to the development of it and that might be included in a future research. Additional proposal of future studies is presented in Table 1, as the SLR pointed to a variety of lines that need to be explored.

**Table 1.** Future studies agenda related to the clusters

Clusters	Lines of study	Research questions
Entrepreneurial Ecosystem	Technological Solutions for Sustainable Practices	How can information and communication technology (ICT) be leveraged to streamline sustainable practices within entrepreneurial ecosystems? What role can remote computerized recycling management systems play in establishing standardized and environmentally friendly waste disposal processes in entrepreneurial ecosystems?
	Sustainability Integration and Circular	How do top management behaviours influence the adoption and implementation of circular economy objectives within entrepreneurial ecosystems?

	Economy Practices	What are the organizational capabilities required to maximize social benefits in circular economy supply network (CESN) contexts within entrepreneurial ecosystems?
Industrial Ecosystem	Collective Symbiotic Readiness	How can collective symbiotic readiness be measured and evaluated within industrial ecosystems? What factors influence the readiness of a potential exchange network involving multiple companies in industrial ecosystems?
	Socio-Political Perspectives on Circular Economy (CE) Limitations	What are the socio-political implications and consequences of CE initiatives on marginalized communities? How do political issues influence the adoption or prevention of circular economy practices within industrial ecosystems?
	Frameworks for Business Model Innovation	What are the key components of effective frameworks for supporting business model innovation in companies adopting circular business models? What are the challenges and barriers faced by companies in implementing business model innovation frameworks in the context of circular economy adoption?
Circular Business Model	Comparative Analysis of Platform Circular Business Models	How do various types of platform CBMs (e.g., servitisation, P2P sharing) impact resource utilization and circularity within different industries? What factors influence the choice of a specific type of platform CBM by companies operating in a circular economy context?
	Managing Collaboration for Innovation	What are the effective strategies and mechanisms for managing collaboration among large incumbents to foster both exploitation and exploration in the context of circular innovation? How do collaborative practices among incumbents influence the speed and effectiveness of innovation in circular business models?
Circular Innovation	Early Practices for Circular Transformation	What early-stage practices and activities within large incumbent firms contribute most significantly to laying the groundwork for circular transformation? How do organizational culture and leadership influence the adoption and success of early circular innovation practices in large firms?
	Effectiveness of Collaborative Mechanisms in Ecosystem Services (ES)	How do collaborative mechanisms in ES management foster dialogue among stakeholders, and what factors contribute to their effectiveness? What role do power relationships play in collaborative spaces within ES contexts, and how do they shape decision-making processes?
Ecosystem Services	Addressing Institutional Voids in ES Management	How do actors in low- and middle-income countries (LMICs) with institutional voids prioritize economic, environmental, and social values in ES management, and what factors influence their decisions? What approaches can effectively address institutional voids and promote sustainable ES management in LMICs?

## 5 Final considerations

This study intended to understand the evolution of studies related to the CE and the ecosystem. To address that objective a SLR was conducted considering articles and review articles from the Web of Science database. The records obtained were submitted to a research

protocol and the 103 articles sample was therefore analysed using VOS Viewer and R studio software for a bibliometric analysis followed by a content analysis.

The study demonstrates that the literature point to the integration of efforts towards CE and the circular ecosystem encapsulate a range of aspects necessary to facilitate the transition. Cluster 1 demonstrates that the circular ecosystems serve as exemplars in the shift towards a circular economy, offering inspiration and encouragement to fellow entrepreneurs, potentially catalysing transformative change during the transition. Ecosystems exhibit dynamism and evolution, embodying fluidity rather than static structures. Entrepreneurship plays a pivotal role in seizing emerging opportunities within the circular economy landscape (Berghuis et al., 2023; Suchek et al., 2022).

Cluster 2 explores the intricate relationships between circular economy principles and industrial ecosystems. It delves into how companies, industries, and stakeholders interact within these ecosystems to promote circularity, sustainability, and resilience (Beckmann et al., 2021). Cluster 3 identifies relevant practices for circular business model innovation processes, including adopting a lifecycle perspective, employing sustainability-oriented instruments, and engaging stakeholders in the business ecosystem. Additionally, shed light on the ongoing ambiguity surrounding the operationalization of circular economy concepts within firms, highlighting the critical importance of effectively leveraging innovation and exploring new opportunities (Santa-Maria et al., 2022; Arekrans et al., 2023).

Cluster 4 is focused on circular innovation practices and propose to challenge conventional economic approaches and advocate for a broader perspective on value creation. It emphasizes the importance of sharing resources and trust among stakeholders in fostering circular ecosystems and for collaborative approaches like circular supply chains to intensify open innovation mechanisms (Blackburn et al., 2023; Moggi & Dameri, 2021; Perotti et al., 2024). In cluster 5 the ecosystem services are the central aspect and the intricate relationship between ecosystem services and the transition towards a circular economy is explored. The findings shed light on the necessity of reconfiguring institutional arrangements within nested service ecosystems to address wicked problems and drive social change (Fehrer et al., 2022; Fehrer et al., 2024). Additionally, the cluster introduces the regenerative service economy framework as a tool for sustainable resource management (Russell-Bennett *et al.*, 2024).

The implementation of a circular ecosystem depends on the joint efforts of global actors, from governments to companies, stakeholders of the supply chain and depending on society's adherence to changing habits. SLR demonstrated that the development of the circular ecosystem also depends on technology, conscious use of natural resources and integration of efforts. In that matter, clear collaboration and constant search for innovative alternatives towards circularity is mandatory.

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