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Circular economy: A review of review articles

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Abstract

The circular economy (CE) has emerged as a focal point in discussions surrounding sustainable development, industrial production, and resource efficiency. While it has garnered attention as a ground-breaking paradigm with the potential to harmonize economic, societal, and environmental dynamics, divergent perspectives and critical inquiries have surfaced. This paper delves into the interdisciplinary literature on CE, exploring the interpretative flexibility inherent in its conceptualization. Acknowledging the diverse range of strategies associated with the CE, the study contends with the potential risks of its misappropriation, emphasizing the importance of understanding its systemic socio-ecological implications. With an umbrella review approach, rarely applied in social sciences, the study navigates through 167 review articles, unveiling thematic trends and identifying gaps within the existing literature. By scrutinizing the techno-managerial dominance within CE discussions, the paper calls attention to the overshadowing of numerous critical issues. It highlights the importance of systematic attention to CE's social aspects, essential to provide insights into how policies, strategies, and actions affect the society, as well as the emerging discussion on the alternative social transformative paradigm. The paper concludes with a three-stage study design: a meticulous review of 167 articles, a thematic analysis revealing trends, and a reflective exploration of potential research avenues. This review serves as a comprehensive guide for scholars and practitioners for a holistic understanding of CE and encouraging contributions to address identified gaps and fostering the evolution of CE literature.

KEYWORDS

bibliometrics analysis, circular economy, content analysis, literature review, sustainable development, umbrella review

1 | INTRODUCTION

The circular economy (CE) has recently ascended to the forefront of discussions in both discourse and political economy, particularly in the realms of industrial production, resource efficiency, and sustainable development. Advocates view the CE as a ground-breaking paradigm capable of harmonizing the intricate dynamics between the economy, society, and nature. This paradigm seeks to supersede the prevailing linear economic model with an intentional and designed approach that is inherently restorative and regenerative (Ellen MacArthur

Abbreviations: CE, Circular economy; CBM, Circular business model; CBMI, Circular business model innovation; CLSC, Closed loop supply chains; CSCM, Circular supply chain management; EEE, Electrical and electronic equipment; EGD, European Green Deal; EU, European Union; IO, Input-Output; IoT, Internet of Things (IoT); LCA, Life cycle assessment; MFA, Material flow analysis; PET, Hydrolyze polyethylene terephthalate; PSS, Product-service systems; SBMI, Sustainable business model innovation; WEEE, Waste Electrical and Electronic Equipment; WoS, Web of Science.

Foundation, 2017). At its essence, the fundamental concept advocates for the reconsideration of products, components, and materials that might otherwise be discarded and instead encourages their potential for reuse or recycling. The CE aims to prevent and reduce waste and promote a paradigm shift toward the continuous re-engagement of products in a cascade of subsequent or feedback uses (Kirchherr et al., 2023). Although the theoretical underpinnings of the CE concept have been subjects of debate across various academic disciplines for some time, it is only recently that this discourse has gained prominence in the public sphere. Media outlets have begun to allocate growing attention to the topic. Concurrently, there has been a surge in efforts by national governments and international economic policy entities to formulate strategies for integrating CE practices at micro, meso, and macro levels (Mhatre et al., 2021; Murray et al., 2017). Notably, the European Commission has taken a significant step forward with the adoption of a "Circular Economy Action Plan," as a pivotal component of the broader European Green Deal (EGD) (Pinyol Alberich & Hartley, 2023). Similar initiatives are in place in China and the USA (Zhu et al., 2019). These policy initiatives are implemented as part of a broader strategy for climate change adaptation, viewing the CE as a pivotal instrument to revitalize stagnant economies while simultaneously advancing environmental sustainability (Ellen MacArthur Foundation, 2021).

This array of policy actions finds support in a growing body of interdisciplinary literature, ranging from industrial ecology to a diverse spectrum of social sciences. Perhaps no other topic has received such a growing interest from scholars and practitioners of different backgrounds. A study has, for example, found 221 definitions of CE used in various disciplines (Kirchherr et al., 2023). Within this extensive literature, an abundance of uncritical celebratory studies touting its potential to usher in a prosperous and sustainable society are prevalent. However, a recent shift has witnessed both skepticism and criticism emerging from various quarters. For instance, Giampietro and Funtowicz (2020) point out that scholars in Ecological Economics critique the CE paradigm for allegedly conflicting with fundamental physical laws such as the second law of thermodynamics, while others express doubts about its capacity for substantial social transformation.

Despite a growing body of literature on CE principles, the translation of these concepts into tangible economic initiatives yields diverse outcomes, shaped by competing ideological perspectives (Korhonen et al., 2018). This article's principal contribution lies in offering a navigational guide through the *interpretative flexibility* inherent in the literature on the CE. To achieve this, we utilize the method of *umbrella reviews*, a well-established approach in various natural sciences but often overlooked in the realm of social sciences (Grant & Booth, 2009). The aim is to facilitate a holistic understanding of CE, transcending disparate manifestations and bringing them together cohesively. The intention is to explore the topic comprehensively through multiple avenues, discerning commonalities, and identifying trends that characterize CE studies. This involves not only delineating areas of consensus but also highlighting voids among existing reviews. Additionally, the study aims to compare the outcomes of various review articles, shedding light on nuanced insights that inform specific research questions. Furthermore, the research endeavors pinpoint areas that have not been adequately addressed or undergone systematic review.

Our study unfolds in three distinct stages. The initial stage involves the careful selection and analysis of 167 review articles on the CE spanning various disciplines. First, we perform bibliometric analysis. Second, we proceed to a thematic analysis to illuminate the predominant trends discerned from these reviews. Finally, we engage in a reflective examination to pinpoint potential future research avenues, inviting scholars to contribute to CE literature.

2 | METHODS: AN UMBRELLA REVIEW APPROACH

We adopted an umbrella review approach also known as a "review of reviews," a "synthesis of reviews," or an "overview of reviews" (Aromataris et al., 2015). The search was conducted in the first week of 2023 covering the review articles until the end of 2022. Figure 1 shows the process and steps of the article search and selection. The review articles were collected from the Web of Science (WoS), considered the most comprehensive database for scholarly work. We used "circular

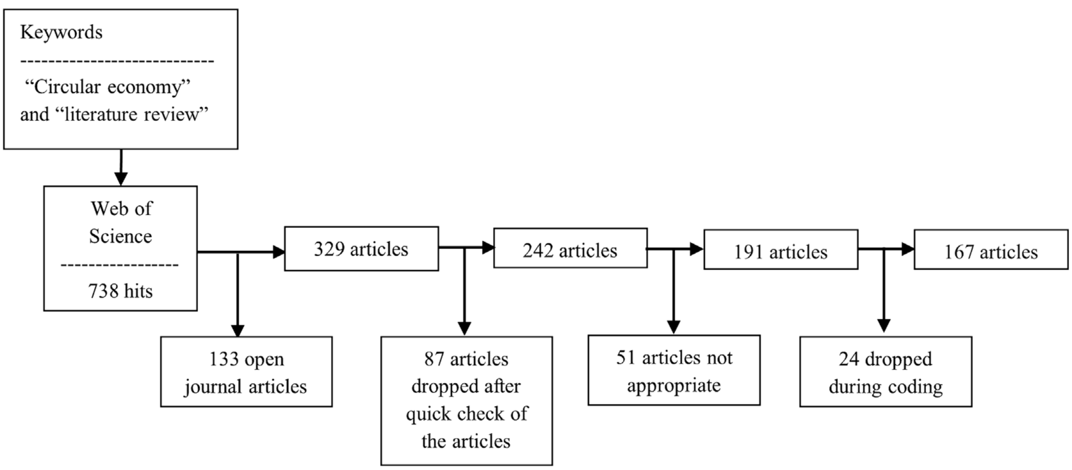

FIGURE 1 Article searching step and process.

economy" and "literature review" as keywords for the searching purpose. Our search was limited to "Web of Science Core Collection" as it is a commonly used practice for reviews (Dahlander & Gann, 2010). The first attempt resulted in 738 hits. Next, we removed 133 articles that appeared in fully open-access journals. Thus, we reduced it to 329 articles in the review category. We quickly checked each article to verify if the articles focused on CE. This process allowed us to find 242 articles. We checked the list of titles, keywords, and abstracts to see if the articles mentioned "circular economy" in these three places. Thus, we have 191 articles for the next step. Such a high number of reviews on a single topic is very uncommon, especially in the management field. Then, we analyzed the texts to extract key information including publication year, authors, main findings, sectors, future research directions included in each article, review approach, journals, and country of the authors. During this exercise, we realized that out of 191 articles, 24 articles do not really focus on CE. Finally, we ended up with 167 review articles.

2.1 | Bibliometric analysis

We applied VOSViewer (van Eck & Waltman, 2010) and Bibliometrix R-package (Aria & Cuccurullo, 2017) software to conduct bibliographic analysis and science mapping. With a descriptive analysis, we evaluated the performance of the research field by analyzing trends of publications and citations, main journals and authors, geophysical location of authors, and collaborations. We applied bibliographic coupling, which consists of using the number of references shared by two documents to measure their similarity (Zupic & Čater, 2015). Therefore, since our study constitutes an umbrella review that analyzes reviews in CE scope, with bibliographic coupling, it becomes possible to identify theoretically derived clusters that integrate articles under related themes. Bibliographic methods enabled to analyze the structure and dynamics of the research field, adding quantitative rigor to the subjective evaluation of the literature (Zupic & Čater, 2015). Therefore, bibliographic coupling was the initial step toward organizing the literature under the CE umbrella.

2.2 | Content analysis approach

We conducted a content analysis by categorizing articles according to their research objectives. It is important to note that the content analysis drew upon, but was not confined to, the results obtained through bibliographic coupling. Subsequently, two authors independently scrutinized each article within the identified groups, extracting meaningful insights and documenting them in bullet points and concise statements. We then engaged in a comparative analysis of our findings, fostering a shared understanding of the articles' outcomes. Two additional authors have refined the content analysis.

3 | RESULTS

3.1 | Descriptive analysis

The 167 articles included in the sample were published between 2013 and 2022, as illustrated in Figure 2. We observed that the number of CE reviews started to grow mainly in 2018, when 16 reviews were published. Until then, only 11 reviews were published between 2013 and 2017. The number of review articles continued to grow, peaking at 44 in 2022 alone. Thus, we may expect a similar result for 2023 since five reviews had already been counted for the year even though our search period was up to the end of 2022, but these five reviews were published ahead of time. The citation trends, as well as publications, demonstrate a high interest in the topic. In 2022, over 6000 articles cited reviews on CE.

As illustrated in Figure 3, the Journal of Cleaner Production is the leading outlet for CE review articles, with 57% (95) review articles. Sustainable Production and Consumption (22) is next in line, followed by Resources, Conservation and Recycling (18 reviews), Journal of Environmental Management (8), Business Strategy and the Environment (8), and Renewable & Sustainable Energy Reviews (6).

Regarding the main authors of reviews on CE, Pigosso stands out with seven reviews; McAloone, Rosa, and Ulgiati with four reviews each; and Bocken, Geissdoerfer, Ghisellini, Sassanelli, Tavares, Terzi, and Vermulen with three reviews each. The authors' production over time is presented in Figure 4. In the figure, the node size represents the number of publications, and the node color represents the citations, whereas darker-colored nodes represent a higher number of citations.

We have also analyzed the scientific production of countries and collaboration links (Figure 5). The red lines represent collaborative

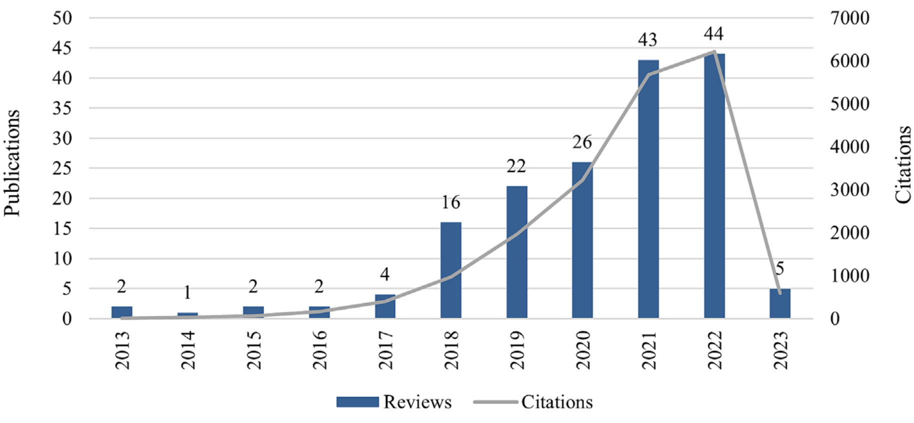

FIGURE 2 Publication and citation trends.

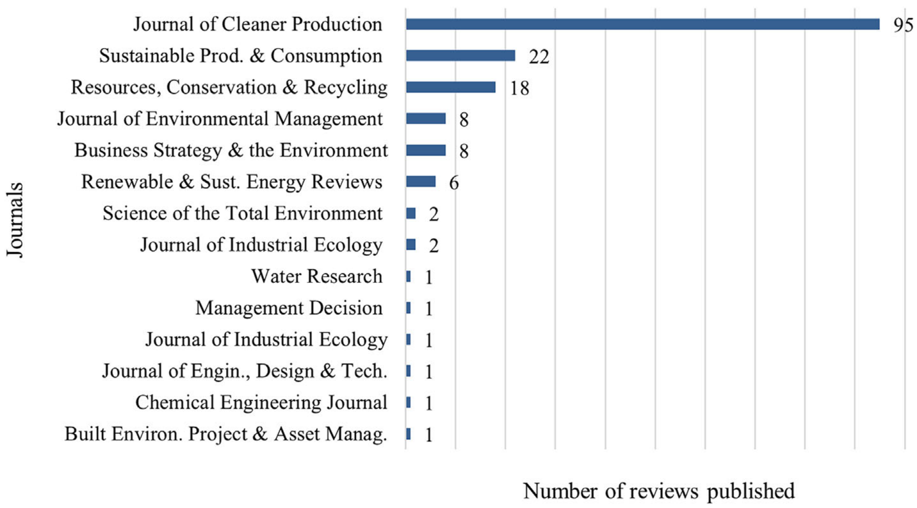

FIGURE 3 Journals publishing CE reviews.

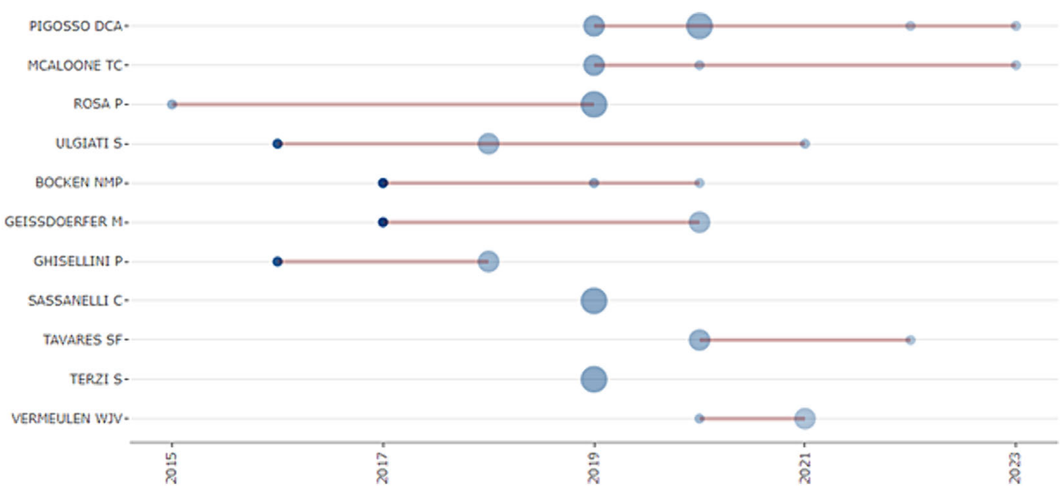

FIGURE 4 Main authors' production over time.

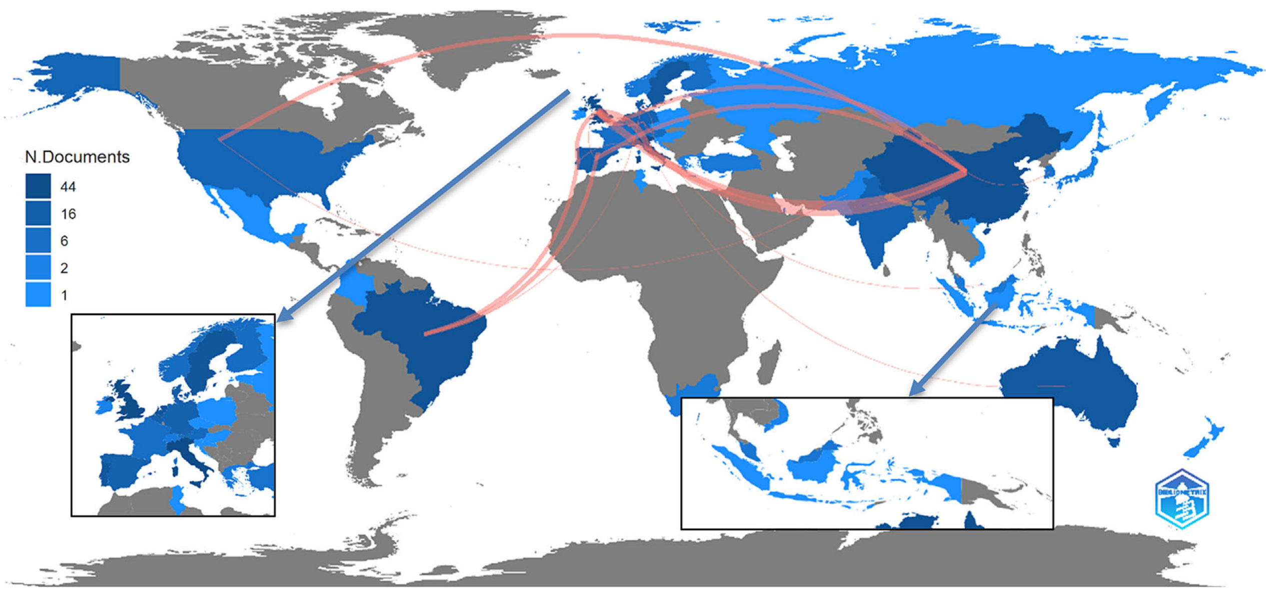

FIGURE 5 Country-wise production and collaboration.

links between countries, while the tone of blue indicates the volume of published reviews, whereas the darkest shades indicate a higher number of publications. Countries such as Italy (44), the United Kingdom (42), Australia (35), China (33), and Brazil (30) are highlighted on the map. We also note stronger collaboration (red) links between China and European countries, China and the United States, and European countries and Brazil.

3.2 | Bibliographic coupling

The bibliographic coupling resulted in seven clusters, as illustrated in Figure 6. In general terms, Cluster 1 ($n = 36$) focuses on circular business models and product-service systems (PSS). Cluster 2 ($n = 27$) deals with the technical cycle of CE, focusing on packaging, plastics, e-waste, and metals. Cluster 3 ($n = 26$) concerns the biological cycle, waste management, circular cities, and education for CE. Cluster 4 ($n = 24$) focuses on the construction and minerals industry. Cluster 5 ($n = 21$) integrates reviews that analyze CE-related concepts and implementations that have policy implications, and Cluster 6 ($n = 19$) mainly focuses on CE assessment and monitoring. Finally, Cluster 7 ($n = 14$) has articles that mainly focus on Industry 4.0, circular procurement, and the textile sector. These clusters are prominent in the literature, providing a comprehensive understanding of CE literature. The "CE Concept" cluster highlights various concepts prevalent in CE studies. The current status of CE implementation and policy is outlined in the subsequent cluster. This is followed by the "CE Assessment and Monitoring" cluster, which demonstrates the range of assessment and monitoring activities in place for CE. Additionally, there is a cluster focusing on the presence of business and management in CE. Several clusters address different industries extensively discussed in the literature, such as Textile and Apparel, Electronic and Electrical Equipment, the Built Environment, Agribusiness and Bioeconomy, and Waste Management. Moreover, we also discuss some less explored industries in the "Other Industries" category.

In the map of Figure 7, node size indicates citations whereas year of publication is represented in the node colors. Highly cited review articles (around 1000–2000 citations) such as Ghisellini et al. (2016), Geissdoerfer et al. (2017), Kirchherr et al. (2017), and Lieder and Rashid (2016) are mainly situated in Cluster 5 regarding CE concept and implementation. Therefore, it is verified that Cluster 5 includes the older and seminal articles of the field. Another work is Tukker's (2015) review paper regarding PSS integrated into Cluster 1.

3.3 | Content analysis

We identified categories of review articles based on content analysis: CE concept, CE implementation and policy, CE assessment and monitoring, and CE in business and management. In addition, we organize the studies according to specific sectors: textile and apparel, electrical and electronic equipment (EEE), built environment, agri-food and bioeconomy, and waste management. Some identified groups also address minerals, metals, plastics, automotive, pharmaceutical, cooling

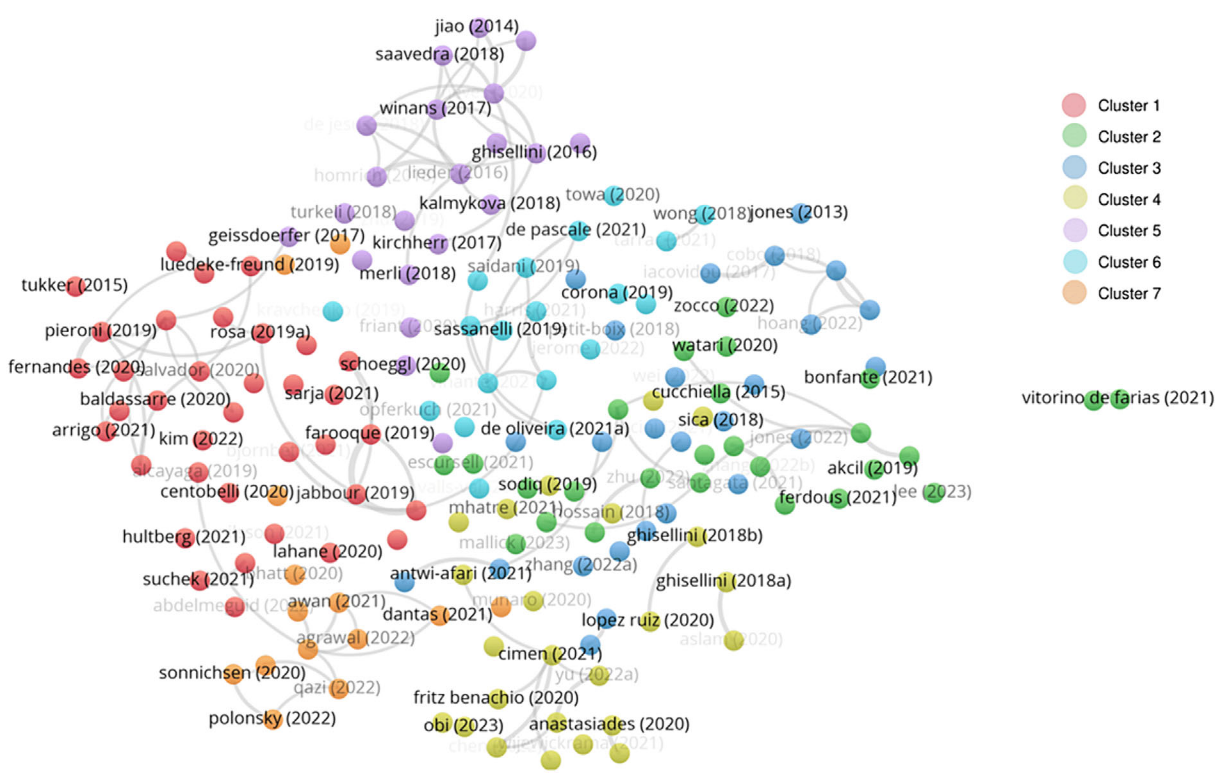

FIGURE 6 Bibliographic coupling network.

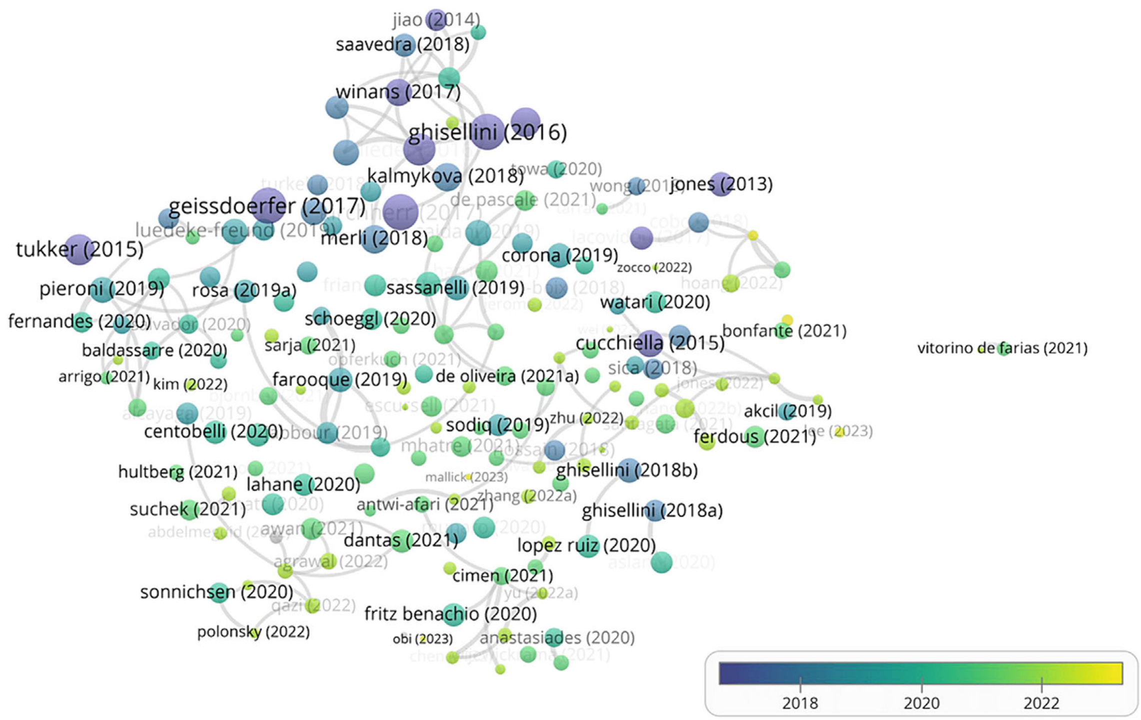

FIGURE 7 Bibliographic coupling network, publication year, and citation analysis.

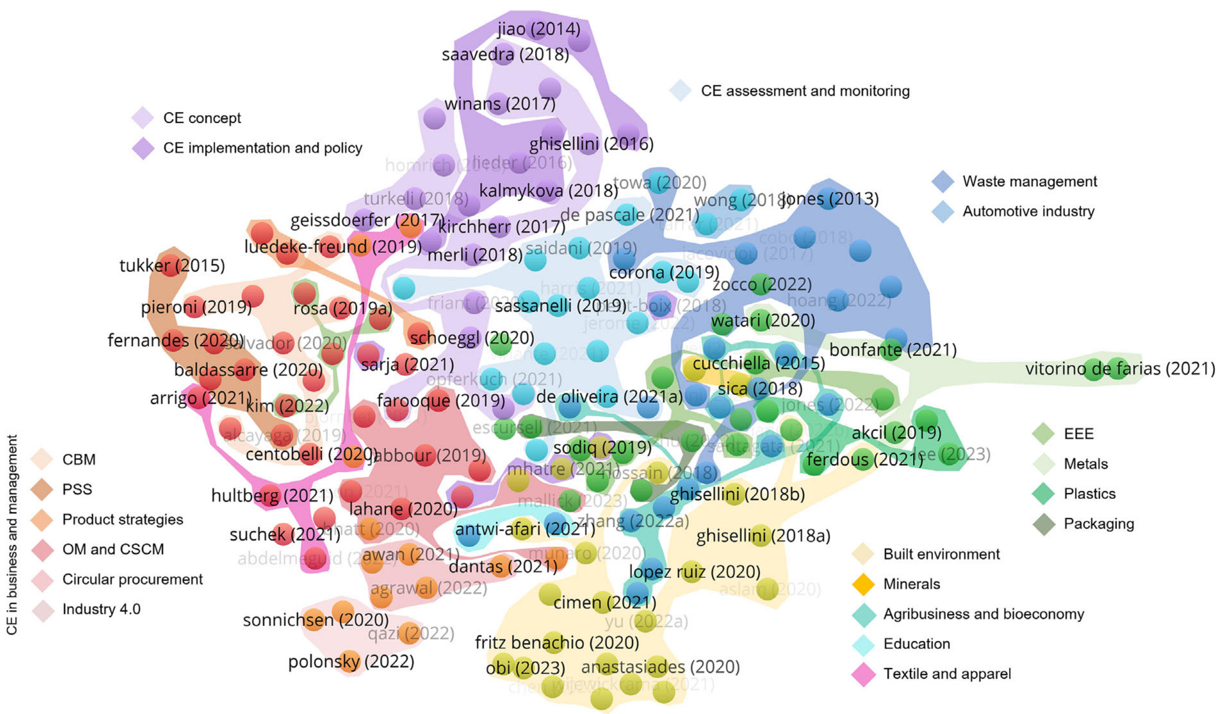

FIGURE 8 Groups of reviews from the content analysis.

and education sectors, and value chain. The coverage of these categories is depicted in Figure 8. We outline the main points addressed within the identified categories of review articles as follows. The list of studies included in each category is presented in Table A1.

3.3.1 | CE concept

Studies in this group comprehensively review the literature related to the conceptual foundations of CE. The CE literature shows the interdisciplinary nature of CE spanning various fields, including economics, finance, and politics (Türkeli et al., 2018) positioning CE as an "umbrella" concept (Merli et al., 2018), which is rooted in ecological economics and industrial ecology (Ghisellini et al., 2016). While some papers provide CE definitions (Homrich et al., 2018; Kirchherr et al., 2023) and analyze relations between the concepts of CE and sustainability (Geissdoerfer et al., 2017) and eco-innovation (de Jesus et al., 2018), other studies evaluate history and current application of the concept (Winans et al., 2017), narratives (Schöggl et al., 2020), and discourses about CE (Friant et al., 2020), as well as the approach taken by scholars (Merli et al., 2018) and the scientific knowledge generated (Türkeli et al., 2018). The literature reflects a multitude of CE definitions, emphasizing a set of core principles (reduce, reuse, recycle, and recover), waste hierarchy, and systems perspective (micro, meso, and macro systems) (Kirchherr et al., 2017). Even though CE and sustainability are closely related concepts, the commonalities and differences between these concepts are still unclear. However, Geissdoerfer et al. (2017) pointed out 12 points of similarities and spotted eight different relationship types between these concepts. The overlap between eco-innovation and CE may be beneficial in filling the gaps that remain in the CE definition (de Jesus et al., 2018).

Efforts are made to organize CE research, with identified clusters focusing on management and technical orientation (Schöggl et al., 2020), focusing on the beginning-of-life or the end-of-life. They also point out that recycling is a widely referred to R-strategy, followed by repair and reuse. R-strategy includes 10 elements, namely, refuse, rethink, reduce, repair, refurbish, remanufacture, repurpose, recycle, and recover. Further typologies are developed to classify CE discourses based on (i) a holistic or segmented approach to economic, social, and environmental aspects and (ii) a skeptical or optimistic view regarding technological innovations and ecological collapse (Friant et al., 2020).

Studies review theories and concepts related to CE, such as industrial symbiosis (Neves et al., 2020) and industrial ecology and its tools (Saavedra et al., 2018) including industrial symbiosis and eco-industrial parks that emerge as instrumental in the transition to CE (Saavedra et al., 2018), contributing to sustainability by transforming industrial waste into raw materials. Most studies on industrial symbiosis are in the context of China and the USA (Neves et al., 2020).

Geographical concentrations and regional variations were highlighted in the CE literature, particularly with high concentration in China and the European Union (EU) (Merli et al., 2018) emphasizing on industrial symbiosis in these regions categorized into two main clusters. One cluster focuses on eco-parks and industrial symbiosis, predominantly in China, and another encompasses supply chains, material closed loops, and business models (Homrich et al., 2018).

Tools and methods such as life cycle assessment (LCA) and material flow analysis (MFA) are evident in decision-making and modeling processes for the CE implementation (Merli et al., 2018), which may result in rebound effects (Metic & Pigosso, 2022) limiting its sustainability prospects. The rebound effect occurs when circular activities do not successfully outpace the consumption pace, increasing production and reducing decoupling benefits. Different definitions, drivers, triggers, mechanisms, and measurement approaches of rebound effects are highlighted in the literature (Metic & Pigosso, 2022).

3.3.2 | CE implementation and policy

In the realm of CE implementation and policy, there has been significant progress over the past decade. The landscape has evolved from a near absence of policy frameworks to a more nuanced and comprehensive understanding of policy processes in diverse countries and regions, such as China and the EU. Around 10 years ago, research pointed out that we lacked a clear policy definition and, instead, focused on policy conceptualization (Jiao & Boons, 2014). The landscape has since shifted, as the CE action plan proposed in 2015 for the EU region has promulgated the practices of CE in various industries due to government policies and regulations (Mhatre et al., 2021). Insights gained from these studies provide insightful guidance to policymakers shedding light on the challenges and opportunities in CE implementation, despite idiosyncrasies among countries.

Several policy-related studies have focused on China, where CE was initially implemented in some pilot cities such as Beijing, Shanghai, and Tianjin. The Chinese government's CE management system is doubted for its complex structure, low accountability of government employees, and corruption (Su et al., 2013). To understand China's efforts for CE, Zhu et al. (2019) found that China's policies for CE have increasingly become more comprehensive over time, reflecting the commitment of government agencies and the expansion of policy instruments. This development has also broadened the scope of recycling opportunities. However, China's policies focus more on the means than the ends relying hugely on financial incentives and direct subsidies. In the same vein, Luo and Leipold (2022) argue that the policy process in China is affected by different stakeholders, such as centralized governance including a portfolio of sub-national, national, and international interactions. Many stakeholders of eco-industrial parks in China are involved in the development and operation with sustained economic momentum to reduce operation costs and sustain economic competitiveness (Hong & Gasparatos, 2020). Learning opportunities from China and the EU have not been universally embraced in other regions, such as Latin America, seemingly repeating implementation mistakes (Morales & Sossa, 2020).

A study presents a framework that integrates both bottom-up and top-down approaches, emphasizing their concurrent application as essential in CE implementation (Lieder & Rashid, 2016). This framework is developed considering three key aspects: resource scarcity, environmental impact, and economic benefits. Technological, market, institutional, and cultural perspectives that hinder the implementation of the CE are identified in the literature (Grafström & Aasma, 2021) arguing that even a tiny barrier can hinder the emergence of CE. Governmental policies and business models are two pivotal elements in transitioning to CE. Command-and-control regulations and the value proposition element of business models are most widely studied interactions related to business models (Wasserbaur et al., 2022).

Various studies have explored implementation tools. Environmental Management System and Eco-design are widely integrated with CE, but the other tools remain "stand-alone" approaches (Marrucci et al., 2019). Additional tools, such as a CE Strategies Database and Implementation Database have been developed to aid CE transition, comprising strategies and case studies (Kalmykova et al., 2018). Some studies extend their focus to the city-level, examining urban infrastructure, social consumption, industries and business, and urban planning (Petit-Boix & Leipold, 2018) as integral components of managing sustainable cities (Sodiq et al., 2019). Beyond policy and implementation, the literature also delves into *education* emphasizing the role of higher education institutions in the CE context (Serrano-Bedia & Perez-Perez, 2022). However, the exploration of CE and bioenergy from an education and communication perspective is in its nascent stages (Romero-Luis et al., 2021). These diverse themes collectively contribute to a more holistic understanding of the multifaced landscape of CE.

3.3.3 | CE assessment and monitoring

An important body of reviews focuses on assessment and monitoring tools. A great deal of these techniques come from LCA literature. In particular, our analysis identified an abundance of reviews focused on indicators, classification of metrics, and assessment tools. Most of the studies focus on the firm-level and span from the already cited LCA to data envelopment analysis, input–output, life cycle inventory, life cycle sustainability assessment, multi-criteria decision methods, fuzzy methods, *emergy*, exergy approach, simulation, discrete event simulation, material cost analysis, and MFA (Sassanelli et al., 2019).

The review of Saidani et al. (2019), for instance, proposes a taxonomy featuring 10 categories of circularity derived from 55 sets of indicators. These categories are differentiated based on criteria related to the implementation level, CE loops, performance, circularity perspective, and transversality. In the same vein, de Pascale et al. (2021) found 61 indicators to measure the sustainability of CE in three levels: three spatial dimensions of sustainability and 3R core CE principles. Vinante et al. (2021) classified 365 metrics at the firm level into 23 broad categories based on a circular value chain framework arguing that most of these enable the assessment, regardless of firm size, geographic location, industry, and selling strategy. Similarly, at the nano-level, de Oliveira, Dantas, and Soares (2021) identified 52 indicators, comprising 38 nano-level, 14 micro-level, and six applicable to both levels. Additionally, indicators for the use phase of materials and lifetime extension strategies are notably absent (Jerome et al., 2022). In the manufacturing sector, Kravchenko et al. (2019) found 270 performance indicators that help companies evaluate the potential impact of their strategies before implementation.

Our analysis also identified reviews that explored critically the limitations and outreach of circularity assessment tool. Camana et al. (2021), for example, analyzed 609 scientific papers on waste management in Italy reaching the conclusion that, despite the sophistication of the assessment tools deployed to measure circularity, most of the effort were nullified by rebound effects. Panchal et al. (2021) analyzed 196 papers to conclude that life cycle indicators are predominantly used to evaluate the CE performance whereas the indicators on the quality aspects are neglected. Similarly, Walker et al. (2021) contend that the social dimension is the least evaluated and integrated in sustainability assessments. Harris et al. (2021) analyze 135 papers concluding that only a few studies propose a combination between firm-level life cycle indicators and meso/macro levels. In other words, there is a scarcity of studies that connect companies' performance with macro dynamics such as countries' and regions' socio-metabolism. In a similar vein, Nika et al. (2020) conclude that assessment tools in the water sector inadequately address the systemic nature of water management neglecting the integration of existing tools (i.e., hydro-biogeochemical models) and methods (i.e., MFA-based and LCA). Finally, only the review of Opferkuch et al. (2021) focuses on qualitative assessment reviewing corporate sustainability reporting arguing that circularity rarely appears in corporate sustainability assessment. Our analysis also suggests that there is a lack of standardized measuring CE as argued by Kristensen and Mosgaard (2020).

More interconnections between various performance assessment methods are needed to assess the consistency of outcomes and the importance of life cycle thinking (Camana et al., 2021). Life cycle indicators predominate over material flow indicators (Panchal et al., 2021). To explore assessment methods for environmental performance, and considering systems at product, industry, and national levels, few studies explored the circularity indicators juxtaposing with environmental performance and society levels (Harris et al., 2021). However, they argue that adequate tools are available for each level, for example, LCA at the micro-level and multi-regional input–output analysis at the macro-level; at the industry level, the use of industrial symbiosis is growing. At the interfirm-level, Walker et al. (2021) point out that the multi-criteria decision-making methods combined with life cycle-based methodologies and indicator frameworks are claimed to be the most common ex-post approaches. They also contend that the social dimension is the least evaluated and integrated in sustainability assessments. Furthermore, there are no established common practices across companies for measuring and assessing circularity performance. Generally, there seems to be no common acceptance of measuring CE (Kristensen & Mosgaard, 2020; Valls-Val et al., 2022).

3.3.4 | CE in business and management

A circular business model (CBM) is a business model designed inherently to support a regenerative system. Its goal is to maximize resource value retention for an extended period and minimize or mitigate resource waste by closing, narrowing, or slowing down resource loops. Research and interest in CBMs have accelerated since 2015, with the Business Model Canvas emerging as a commonly utilized framework (Rosa et al., 2019b). The relation between CBM and CBM innovation (CBMI) is established in the literature, clarifying key conceptual elements. There are 92 approaches identified that encompass conceptual models, methods, and tools significant for business model innovation, including the contention that these approaches, while addressing individual stages, do not fully capture the continuous activities necessary to map the dynamic shifts in CE and sustainability orientation (Pieroni et al., 2019). Several studies include frameworks for CBMI, such as the development of a framework illustrating the CBMI process, which highlights the drivers and barriers as precursors to CBMI within the context of dynamic capabilities (Santa-Maria et al., 2021). Additionally, a framework has been proposed that outlines the effects of policy and institutional responsibilities on CBM dimensions, managerial practices for value creation and capture, emphasizing digital technologies, and managerial commitment as cross-dimensional managerial practices (Centobelli et al., 2020).

Concerns with CBM implementation, including capacity building, organizational culture, rebound effects, and integration with sustainable business model innovation (SBMI), are proposed to address gaps in the literature. The main concerns with implementing the CBM include factors like capacity building, company size, customer consideration, organizational culture, rebound effects, resource flow management, surplus system orientation, and system design (Salvador et al., 2020). It has been observed that not all CE-oriented business model innovation approaches accommodate sustainable principles and vice versa, although they are often considered under the umbrella of sustainable business models (Pieroni et al., 2019). Gaps in CBMI literature, such as sustainability strategy, top management's role, organizational culture, and ambidexterity, can be partially filled by integrating aspects of SBMI (Santa-Maria et al., 2021). The use of the value framework is exemplified in Lüdeke-Freund et al. (2019), which established a link with closed loop supply chains (CLSC) and analyzed 26 CBMs to define major dimensions and patterns of business models. They identified six major CBM patterns promising to support the closing of resource flows, such as repair and maintenance, reuse and redistribution, refurbishment and remanufacturing, recycling, cascading and repurposing, and organic feedstock business model patterns. On the other hand, Galvão et al. (2020) exceeded the organizational boundaries by positioning the CBM in the business ecosystem and identifying the main value streams.

PSS, heralded as a key instrument for resource-efficient CE, integrates into various disciplines, including business management, design, ICT, and manufacturing (Tukker, 2015). PSS-oriented CBMs are widely recognized archetypes (Rosa et al., 2019b). For instance, four broad sustainable designs in business practice have been identified: collaborative ecosystem design, eco-design, PSS design, and sustainable business model design (Baldassarre et al., 2020). Recent studies have focused on how companies have implemented PSS and the key success factors involved (Tukker, 2015). However, challenges like accessibility and tangibility of PSS compared with competing products are noted, as PSS generally does not provide consumers with the same level of behavioral freedom, with business model development being a prominent approach to address these issues (da Fernandes et al., 2020). Barriers to access-based consumption are explored, emphasizing the need for a better understanding of experiences, system changes, regulation, and risk-sharing (Arekrans et al., 2022). PSS is crucial for used products, and strategic orientations in the after-use products' customer experience, such as confidence, convenience, delight orientation, and price, are noted (Schallehn et al., 2019). In the context of smart-circular (product-service) systems, the interrelationship between the Internet of Things (IoT), CE, and PSS has been added to the literature (Alcayaga et al., 2019). Some reviews focused especially on *product strategies* and their implications for CE in business. The relevance of CE in new product development is emphasized, focusing on barriers, drivers, and stakeholders in product design (Pinheiro et al., 2019). Product longevity is a crucial element of CE. In the context of PSS, a product's middle-of-life phase has an increasingly important and promising potential of upgradability as a product lifetime extension strategy. Multiple barriers are prevalent to product longevity under the following three categories: business barriers, product development barriers, and usage barriers (Jensen et al., 2021). However, studies on upgradable PSS are mostly theoretical in nature (Khan et al., 2018). In this sense, ecolabels can be a strategy to establish customer trust and used as a communication tool (Meis-Harris et al., 2021).

The implementation of the CE is further explored from the operations management and manufacturing perspectives, examining the impacts of CBM implementation on operations management, circular supply chain management (CSCM), and reverse logistics. The impacts of CBM implementation on operations management, particularly in product design, production planning and control, and logistics/supply chains, have been examined, which highlights new demands on capabilities, work procedures, relationships, and technologies; the need for changes to support CBMs; and guidelines to develop necessary skills (Jabbour et al., 2019). CSCM has garnered special attention, with research developing a unifying definition of CSCM and classifying various terminologies (Farooque et al., 2019). A content analysis of CSCM literature according to methodological and theoretical dimensions examined the state-of-the-art and future research lines (Lahane et al., 2020). Collaboration, strategic orientation, and cultural and political factors are identified as significant aspects in this context (Nilsson & Göransson, 2021), and reverse logistics are found to be critical for driving CSCMs (Mallick et al., 2023).

Zero-waste manufacturing emphasizes the need for an integrated approach to address economic, social, and environmental aspects. Exploring zero-waste manufacturing in Singapore, Kerdlap et al. (2019) highlight how technologies can connect stakeholders and aid in achieving zero-waste goals. The sustainability impact of CE is predominantly environmental, with social and economic aspects being less explored, as noted by Bjørnbet et al. (2021). Consequently, CE's contribution to sustainability in the manufacturing sector does not fully address the key pillars of sustainability. An integrated approach is thus essential for maximizing sustainable outcomes. Studies in the manufacturing sector often focus on certain aspects, such as lean and green practices, while neglecting the complexity of sustainability. Performance indicators and assessments are crucial in understanding CE's contribution to the manufacturing sector (Bhatt et al., 2020). The importance of streamlining various research streams to comprehend CE's sustainable contribution to the manufacturing sector, considering technologies, evaluation methods, and models, has been emphasized in the literature, and studies clarify various circular manufacturing strategies found in the literature, aiming to diminish confusion (Acerbi & Taisch, 2020).

Circular procurement management has been investigated, revealing drivers and barriers in different clusters, including the identification of 55 such factors (Qazi & Appolloni, 2022) emphasizing the necessity of efforts from 360-degree stakeholders for revamping sourcing strategy and procurement operations. In a similar vein, drivers and barriers of public sector procurement for recycled material or recovered content have been identified and categorized under five themes: organizational factors, procurement function-related factors, financial factors, supplier-related factors, and government-related social factors (Polonsky et al., 2022). The importance of understanding three organizational aspects, individual behavior, operational tools in circular public procurement, and the need for awareness of relevant attributes, is highlighted (Sönnichsen & Clement, 2020). Additionally, research has revealed antecedents, practices, and outcomes for CE (Xu et al., 2022).

Industry 4.0's role in CE management has recently emerged as a new discourse, particularly focusing on the application of the IoT. A review highlighted that while most empirical studies broadly present the Industry 4.0 system with an emphasis on IoT applications, there is a notable absence of comprehensive analysis of IoT from the CE perspective, underlining the complexity of stakeholder interests in CE (Awan et al., 2021). Four dominant themes have been identified in the IoT literature: IoT-related technologies, enablers of IoT, barriers to IoT adoption, and the impacts of IoT on sustainability (Rejeb et al., 2022). Delving into promising digital technologies such as IoT, big data, artificial intelligence, and blockchain as enablers for CE in the context of Industry 4.0, Rusch et al. (2023) observed that these technologies mainly yield incremental improvements and that ethical concerns are often overlooked. The focus of Industry 4.0 in CE on manufacturing redesign aims to reduce environmental impact, yet the literature does not extensively address ethical concerns including financial, social, gender, generational, religious, and racial equality (Agrawal et al., 2022). The integration of CE and Industry 4.0 is considered instrumental in achieving Sustainable Development Goals, directly benefiting goals such as affordable and clean energy; decent work and economic growth; industry, innovation, and infrastructure; sustainable cities and communities; responsible consumption and production; and climate action (Dantas et al., 2021).

Various drivers, obstacles, and ambivalent factors affecting CE management have been widely discussed, highlighting the complex dynamics in this field (Sarja et al., 2021). Recent evidence has focused on the intersection of CE with innovation and entrepreneurship, underlining the evolving nature of this area (Suchek et al., 2021). Business model innovation is particularly emphasized as a crucial element for creating value in CE, with the transition to CBM leading to significant changes in firms, including cleaner production, product-service logic, reverse logistics, pollution controls, and waste management (Suchek et al., 2021). Additionally, the literature on the intersection of CE and entrepreneurship has brought to the fore aspects like circular small- and medium-sized firms, born circular firms, social entrepreneurship with a CE mindset, and ecosystems supporting circular entrepreneurship (Suchek et al., 2022).

3.3.5 | Textile and apparel

The adoption of CE in the textile and apparel sector is rapidly growing. A conceptual framework proposed to guide management in implementing CE identifies drivers, barriers, practices, and sustainable performance indicators as key aspects for CE application in the industry (Jia et al., 2020). The challenges of applying CE principles in the fashion industry encompass hard features, such as business model innovation, regulatory compliance, and financial and stakeholder pressures, as well as soft features like green intellectual capital and consumer-related issues, offering guidance for management during CE implementation (Abdelmeguid et al., 2022). In the fashion industry, reuse is environmentally superior to recycling, providing a better alternative to incineration and landfilling (Sandin & Peters, 2018). However, recycling, despite its value, faces obstacles such as economic viability, complexity of textile composition, limited availability of recyclable materials, technological constraints, and underdeveloped markets (Leal Filho et al., 2019). It is also important to note that the benefits of recycling and reuse may be compromised in scenarios of low substitution rates, fossil energy-based recycling processes, or extensive transport distances (Arrigo, 2021; Sandin & Peters, 2018).

Collaborative consumption in the fashion industry promotes product and resource reuse, taking shape in six modes: fashion sharing/hand-me-downs, fashion rental, fashion subscription services, commercial fashion sharing platforms, swapping, and second-hand resale. The main barriers include health concerns, hygiene, consumption habits, lack of ownership, quality risk, and social risk, while opportunities are categorized into utilitarian, hedonistic, and sustainable factors (Arrigo, 2021). A framework for business model scalability within the CE for the fashion retail value chain has been developed, focusing on efficiency and adaptability strategies like dividing labor, absorbing external ideas and opportunities, and collaborative creation. This framework is based on insights synthesized from 57 articles, outlining four strategic approaches to scale up CE business models in the fashion industry (Hultberg & Pal, 2021).

3.3.6 | Electronic and electrical equipment

The EEE sector is pivotal in the CE, and researchers identified some key themes in this domain. Ten key topics have been identified, reflecting the sector's diverse challenges and opportunities (Pan et al., 2022). Similarly, the e-waste literature has been explored in four aspects: geography and approach, objectives and methodology, actors and life cycle phases, and the CE 4R scheme comprising reduce, reuse, remanufacture, and recycling strategies (Bressanelli et al., 2020).

Extensively studied categories within waste EEE (WEEE) include computers, mobile phones, refrigerators, and televisions (Anandh et al., 2021). Special attention has been given to the end-of-life of LED lamps and photovoltaic panels, with studies demonstrating ways to monetize e-waste (Rahman et al., 2021; Sica et al., 2018). In Kuwait, for example, specific strategies for monetizing e-waste have been showcased (Al-Salem et al., 2022). However, capitalizing on these opportunities often requires the adoption of new business models, with frameworks like circular design and CBMI being employed for strategic structuring (de Kwant et al., 2021; Rosa et al., 2019a).

Various e-waste streams have been the subject of study, revealing significant insights into their management and processing. Rosa et al. (2019a) developed a relationship between PSS-based CBM and circular benefits in the WEEE sector. In the contexts of Singapore and South Korea, Kim et al. (2022) developed a CBM morphology. They found that result-oriented CBMs in Singapore actively engage the local community and government, while in South Korea, strategies such as leasing, renting with membership systems, and customized home visiting with digital capabilities are commonly employed.

Research in the WEEE sector extends to examining consumer behaviors, disposal practices, and the under-researched areas of reuse and repair behaviors, shedding light on various aspects of consumer engagement with WEEE (Islam et al., 2021). Extended Producer Responsibility is recognized as a key policy principle that has been incorporated into the total product life cycle. However, its effectiveness in the upstream stages is limited due to the insufficient allocation of individual responsibility to the original producers, highlighting a gap in the implementation of this principle (Compagnoni, 2022).

The recovery of critical materials and precious metals is crucial for achieving CE in the EEE sector. A comprehensive overview of the current state of e-plastic management, including existing measures, legislations, recycling activities, and major research topics, has been provided, highlighting the progress and challenges in this area (Barouta et al., 2022). Additionally, key research areas across the life cycle of polymer resins, encompassing resources, production, use, recycling, waste, and system analysis, have been identified, offering valuable insights into the holistic management of polymer resins (King & Locock, 2022). The literature on this subject has been organized into categories such as design, production, use, end-of-life, and value chain, providing a structured understanding of the sector (Johansen et al., 2022). Furthermore, the biotechnological upcycling of plastics, particularly through the discovery of plastic-eating species and enzymes that can hydrolyze polyethylene terephthalate (PET), represents a significant advancement in plastic waste management, opening new avenues for sustainable practices (Lee et al., 2023).

There are gaps in understanding certain critical metals, particularly with minimal attention to the spatial divergence in the supply chain, which underscores the need for more targeted research in this area (Watari et al., 2020). The critical metal indium, though abundant in e-waste, is rare as a primary resource, underscoring the importance of recycling in e-waste management (Akcil et al., 2019). For cerium recovery, adsorption and biosorption techniques are vital, known for their low cost, simplicity, and high efficiency, and thus offer practical solutions for material recovery (de Farias et al., 2021). Additionally, adsorption shows potential for recovering rare earth metals from NdFeB magnet scrap, highlighting its broad applicability in resource recovery (de Brião et al., 2022). In the context of rare earth magnet production, studies have emphasized the need to consider economic, social, and environmental aspects in conjunction with CE principles to ensure a comprehensive approach to sustainability (Bonfante et al., 2021).

3.3.7 | Built environment

In the construction sector, there exists a consensus regarding the pivotal shift toward circularity; however, practitioners grapple with challenges during the implementation phase (Benachio et al., 2020). The transition to circular practices is significantly influenced by macroeconomic factors, including gross domestic product, population dynamics, urbanization trends, and regulatory measures (Aslam et al., 2020). Notably, political and governmental support plays a critical role, particularly in well-established CE initiatives in regions like China and Europe (Munaro et al., 2020).

Within the EU, a waste hierarchy directive has been introduced, specifically addressing construction and demolition waste management (Zhang, Zhang, et al., 2022). Conversely, in regions such as Africa, the CE concept may encounter novelty or resistance (Mhlanga et al., 2022). Effective implementation of CE relies on government support, subsidies, and tax incentives, with economic instruments prioritizing recovery strategies proving essential (Ghisellini et al., 2018a; López Ruiz et al., 2020; Munaro et al., 2020). Nevertheless, legislative and economic challenges pose obstacles to cleaner production in the construction and demolition waste sector (Ghisellini et al., 2018b), and there is a noticeable absence of integrated frameworks for CE in construction projects from a policy-making perspective (Yu et al., 2022a).

To streamline the implementation of CE in the built environment, standardization becomes imperative (Anastasiades et al., 2020). Notably, ISO 20887 stands out as the first standard addressing the reuse of building components (Anastasiades et al., 2021). LCA is widely employed in the construction and demolition sector to study CE (Chen et al., 2022), yet environmental perspectives in standards are lacking (Ghisellini et al., 2018a; Hossain & Ng, 2018; López Ruiz et al., 2020).

Critical to envisioning deconstruction are design strategies, especially those emphasizing adaptability and disassembly (Munaro et al., 2022). However, the design stage, particularly in the preconstruction phases, requires further exploration (Çimen, 2021; López Ruiz et al., 2020). While off-site construction, including modular integrated construction, is tangentially related to CE, it remains an area not extensively explored (Antwi-Afari et al., 2021; Obi et al., 2023). Concerning material recovery, on-site recycling generally prevails over off-site methods, with both being preferable to landfilling. In the built environment sector, recycling is more extensively investigated than reuse and reduction, facing barriers such as a lack of knowledge regarding waste composition and characteristics, as well as limited awareness of the costs and environmental values associated with waste recovery (Ghisellini et al., 2018a). Despite the utilization of materials like crumb rubbers and glass sands in construction, global recycling rates remain disappointingly low (Ferdous et al., 2021).

Information brokers are instrumental in transitioning the built environment sector to a circular model by connecting construction and operation stages and bridging reverse and forward supply chains (Wijewickrama et al., 2021). In the construction sector, the prevalence of digital technologies is notable, including building information modeling, geographic information systems, RFID, big data analytics, IoT, blockchain, modeling, and simulation (Yu et al., 2022b). Monitoring the implementation of CE in this sector requires the cataloging of micro and nano-level indicators, emphasizing the need for detailed and granular data (Khadim et al., 2022). Additionally, other industries related to the built environment, such as those involved in cementitious materials cycles and mining and minerals processing, have also been subject to research, demonstrating the interconnectedness of various sectors in the transition to circularity (Pamenter & Myers, 2021; Segura-Salazar et al., 2019).

3.3.8 | Agribusiness and bioeconomy

Studies on CE in agribusiness cover various aspects, including agriculture, the food industry, agri-food industrial parks, and bioeconomy. In agriculture, key waste generation stages include field preparation, mulching, pruning, and training (Velasco-Muñoz et al., 2022). Sustainability themes in food operations and supply chains encompass LCA, waste and recycling, logistics, drivers, barriers, sustainability incentives, and partnerships (Adams et al., 2021). Emerging themes in the sustainable food supply chain literature include waste management, decision support, operation management, food quality and safety, SBM, and social sustainability (Kumar et al., 2022). Dominant themes in this cluster are food waste management, food packaging, resource nexus, legislation, and CE's performance (Zhang, Dhir, & Kaur, 2022). While CE practices are largely explored at an organizational level, there is limited exploration at the eco-industrial park level and in considering social value (Atanasovska et al., 2022). Challenges in the circular bioeconomy include financial and technological resource scarcity, inadequate regulation, logistics difficulties, and awareness gaps. Practitioners focus more on bioenergy, feed, and food CE solutions, while researchers show interest in new products derived from wood (Salvador et al., 2022). The bioeconomy's development to some extent follows the "Logistic S-curve" (Wei et al., 2022).

Other studies investigate food loss and waste and its recovery. Definitions, solutions, examples, and quantification are emphasizing innovative solutions to reduce food loss and waste including composting, reuse for feed animals, energy recovery, generation of biofuels, and production of biomaterials (de Oliveira, Lago, & Dal'Magro, 2021). An alternative technology for food loss and waste recovery is anaerobic digestion, where factors such as feedstock composition, fugitive emissions, energy conversion efficiency, utilization of energy produced, digestate management, and methodological choices significantly influence biogas and energy yields, as well as the overall environmental impact (Ingrao et al., 2018). In parallel, research delves into biorefining processes as additional avenues for addressing food loss and waste (Jones et al., 2022). It is crucial to recognize that recovery strategies need to align with local characteristics, as there is no universal, one-size-fits-all solution (Santagata et al., 2021). The comprehensive exploration of these dimensions in food recovery studies contributes to a nuanced understanding of the multifaceted challenges and diverse solutions in this critical domain.

3.3.9 | Waste management

This collection of studies explores diverse aspects of waste management, covering various compositions and scopes such as municipal solid waste, organic solid waste, and household organic solid waste, along with different approaches and technologies (Celestino et al., 2022; Chen et al., 2023; Cobo et al., 2018; Dastjerdi et al., 2021; de Almeida & Borsato, 2019; Hoang et al., 2022; Jones et al., 2013; Mancini & Raggi, 2021; Paes et al., 2019; Sanjaya & Abbas, 2023). The treatment of municipal solid waste involves both direct methods, like incineration for heat recovery, and indirect methods such as thermochemical and biochemical processes, though selecting the optimal approach is challenging due to varied assessment criteria (Hoang et al., 2022). Waste prevention policy and the consideration of circular Integrated Waste Management Systems emerge as valuable strategies for municipal solid waste management (Cobo et al., 2018). In the realm of organic waste management, challenges include logistic costs, lack of technical standards and regulations, seasonality, and lack of homogenization (Paes et al., 2019). Psychological factors, particularly education and convenience, are crucial in household organic waste management (Celestino et al., 2022).

Various strategies, processes, end-of-life technologies, and terminologies in waste management are scrutinized, with efforts to refine definitions and concepts for improved management (de Almeida & Borsato, 2019). For waste management in landfills, resource recovery has been limitedly explored. Waste-to-energy technologies, such as anaerobic digestion and biochar application, gain attention, while enhanced landfill mining is proposed as a transformative approach with stringent social and ecological criteria (Chen et al., 2023; Jones et al., 2013; Mancini & Raggi, 2021). Plasma gasification is highlighted as an environmentally superior waste-to-energy technology.

The studies also deal with metrics and classifications in waste management and decision-making processes (Iacovidou et al., 2017; Towa et al., 2020; Winterstetter et al., 2021; Zocco et al., 2022). Standard assessment methods for resource recovery are critiqued for providing limited insights to policymakers and neglecting system complexity (Iacovidou et al., 2017). The integration of industrial ecology and advanced computer vision offers insights into material measurement systems that enhance cost reduction and waste management efficiency (Zocco et al., 2022). Anthropogenic resource recovery is underscored in key areas like knowledge management, research and development, policy support, feasibility studies, and marketing (Winterstetter et al., 2021). Resource classification is pivotal for improving value chain communication and assessing anthropogenic resources. The input–output (IO) model, commonly employed in waste management, is classified into four categories, with the observation that the waste IO model is more widely applied than others, while the physical IO model sees the least application (Towa et al., 2020).

3.3.10 | Other industries

In the automotive industry, the focus is on the end-of-life of vehicles in areas such as plastics, batteries, investment and ownership structures, workforce, and the potential use of end-of-life vehicle waste in construction being highlighted as promising (Tarrar et al., 2021; Wong et al., 2018). In the cooling industry, three energy-intensive cases, namely, cold chains, commercial refrigeration, and air conditioning in buildings, are emphasized and suggested interventions including measures to reduce the need for active cooling, appliance recycling, and raising user awareness (Palafox-Alcantar et al., 2022). In the pharmaceutical manufacturing industry, the research mainly focuses on alternative chemistry, emphasizing production design and planning, but less so on waste treatment processes (Ang et al., 2021). In the packaging industry, both industrial and e-commerce packaging are receiving attention. Research in industrial packaging identified four categories: supply chain efficiency, environmental impact minimization, enhancement of the packaging development process, and regulatory compliance (Silva & Pålsson, 2022). Zhu et al. (2022) argue that packaging design is a crucial step toward CE, highlighting aspects such as material selection, design strategies, and tools and indicators for circularity. In e-commerce, issues like overpackaging, the need for renewable materials, and making packaging distribution more efficient are recognized (Escursell et al., 2021).

4 | DISCUSSIONS AND FUTURE RESEARCH AVENUES

4.1 | Discussions

The field of CE has gained attention from numerous scholars in recent years. This umbrella review of 167 articles alleviates readers' understanding of the topic consisting of large volumes of evidence on a topic (Cant et al., 2022). It compiles high-level evidence from multiple reviews into a single overarching document (Fusar-Poli & Radua, 2018; Grant & Booth, 2009). Descriptive analysis has revealed an increase in publications over the past few years, particularly from 2018, peaking in 2021 and 2022. Notably, only a few journals—Journal of Cleaner Production—leading with over 50% of publications—are focusing on this topic. Several authors have published multiple reviews, and there is significant country-wise collaboration across various regions. Figure 9 shows the main themes, research areas, and future research avenues.

Network and content analyses indicate a substantial expansion in the field. This growth seems significantly influenced by policy initiatives, especially in China and the EU. There is a strong correlation between CE concepts and national-level implementation and policy-making studies, emphasizing a practical perspective for development and dissemination. However, the impact of CE in the Global South remains underexplored. Addressing this requires engaging businesses and policymakers in catalyzing a broader shift toward CE. Understanding local operational environments is critical for integrating and shaping locally relevant CE models. CE spans multiple disciplines, focusing on business and management and waste management. In business and management, theoretical approaches like business models, PSS, operations management, and Industry 4.0 are explored. Industry 4.0 is a recently emerged hot topic in CE and other disciplines (Bag et al., 2020, 2021). The interconnected research in waste management covers agri-foods/bioeconomy, packaging, plastics, e-waste, metals, minerals, and construction industries. Five key industries for the circular transition are identified: textile and apparel, EEE, the built environment, agri-food and bioeconomy, and waste management. Yet, sectors like transportation, energy, chemicals, retail, logistics, and distribution need more comprehensive reviews. Monitoring and assessment lack standardized measures across sectors. The textile and apparel sector is closely related to business models and policies, and EEE is highly relevant for policy implementation. Therefore, it is critical to understand the collective efforts and collaboration between multiple disciplines as well as to find cross-industry implications to achieve a successful transition toward CE.

Across these industries, inadequate legislation and lack of political and governmental support are major barriers to successful circularity transitions. Consumer behavior, awareness, and education are consistently crucial. Some sectors emphasize specific aspects, such as digital technologies in EEE and CBM integration in textiles. The EEE sector has garnered significant attention but lacks depth in user habit and behavioral aspect across different phases and product categories. The construction sector, responsible for substantial material waste, needs frameworks, design strategies, and operational manuals for CE implementation. Although high food waste and loss are evident, this issue is under-studied. Different waste streams are needed be considered holistically to achieve CE.

Our review confirms a general lack of systematic attention to CE's social dimensions, but this is changing. Noteworthy aspects include the connection between CE and social equity; the incorporation of social metrics in CE assessment; ethical considerations across dimensions such as generational, religious, and racial equity; and the examination of social factors in CE measurement in industries like textile and apparel. Social aspects provide crucial insights into how policies, strategies, and actions affect or benefit society and contribute to more effective monitoring of CE initiatives, covering employment, health and safety, poverty, and gender equity. Finally, critical perspectives on CE, including calls for alternative social transformative paradigms like degrowth or post-growth, are emerging. More recently, indeed, the CE concept has faced scrutiny and reframing from

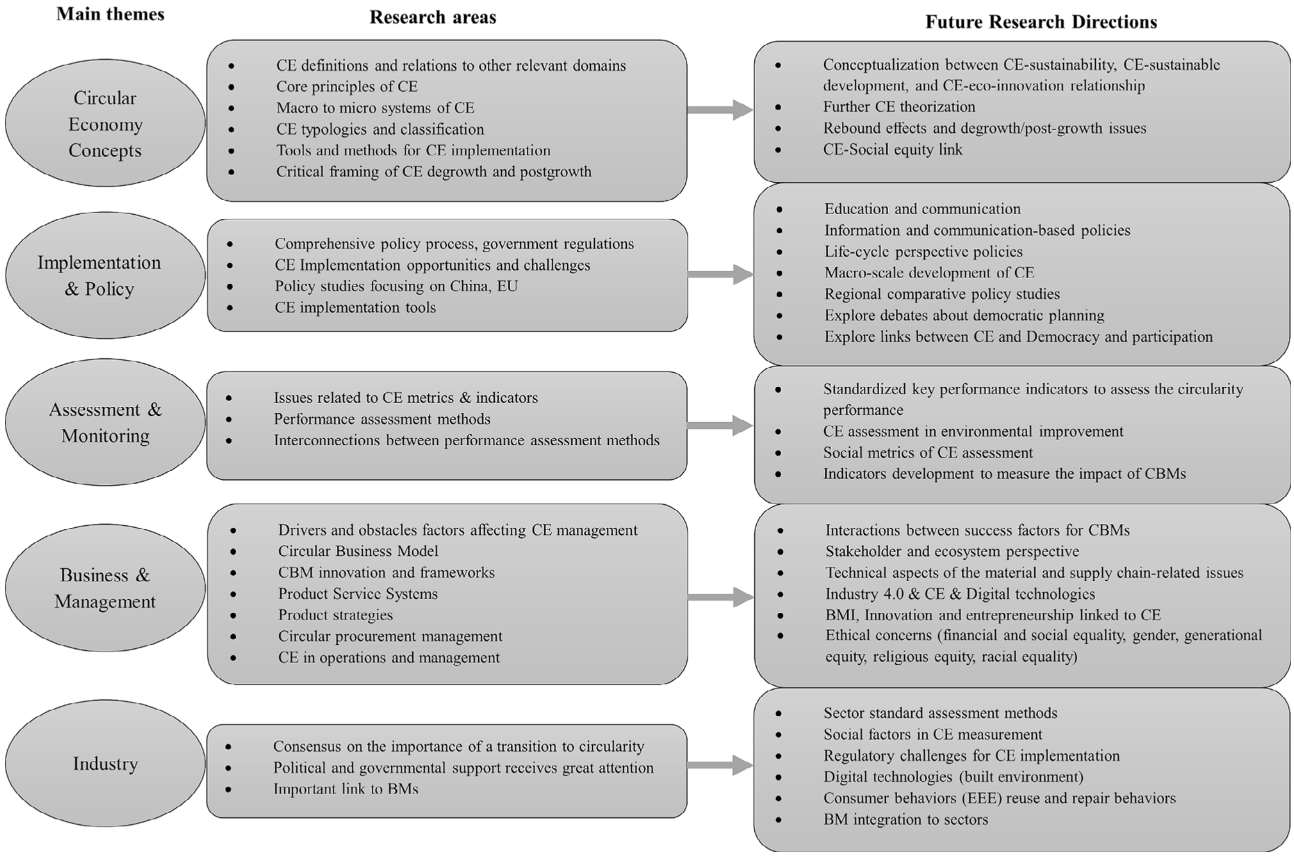

FIGURE 9 Overview of main themes, results areas, and future research directions.

heterodox scholars across disciplines such as ecological economics and political ecology. Conversations about post-growth circularity challenge traditional growth-oriented approaches, emphasizing the necessity for a paradigm shift in economic thinking (Giampietro & Funtowicz, 2020). Notably, Bauwens (2021) initiates a dialogue on post-growth circularity, positing that a sustainable CE is incompatible with economic systems designed to pursue endless economic growth. A growing cohort of scholars in ecological economics is championing a CE integrated into a degrowth scenario, advocating for a democratic downsizing of industrialized economies to levels harmonious with ecosystem preservation (Nesterova & Buch-Hansen, 2023).

4.2 | Future research avenues

Based on our analysis, we propose a potential list of future research avenues (Figure 9). First, there is a need for a more rigorous conceptualization of CE that is solidly grounded in sustainability studies. This includes systematic engagement with contributions from Political Ecology and Ecological Economics, as well as critical emerging paradigms like degrowth and post-growth.

Second, to mainstream the CE concept, it is crucial to evaluate the development of various CE-related projects and legislations and to create awareness at different levels, such as cities, regions, and nations. Emphasizing the role of individuals and their behavioral change is key to implementing CE, highlighting the importance of education and communication. Additionally, given that the characteristics of industries influence appropriate CE strategies, an in-depth analysis of specific value chains and industries is essential. We observe a lack of macro-scale conceptualizations of CE and a need for breaking silos in policy approaches, which vary across different regions and countries.

Third, although CE is often seen as a solution for sustainability, there is a significant gap in standardized and synchronized circularity performance indicators and assessment methods. These methods vary across industries and sectors, with a notable deficiency in the social sector. Attention is increasingly being focused on the social impacts during the shift toward a CE (Padilla-Rivera et al., 2020). The primary focus has been on environmental contributions, creating a knowledge gap regarding its impact on diverse sectors and societal aspects. There is a particular lack of synchronized performance indicators and assessment methods to comprehensively evaluate these contributions as most indicators fail to capture strategies for mass reduction.

Fourth, while business and management should play pivotal roles in the CE, they have garnered relatively less attention from scholars. It is imperative for management scholars to recognize CE as a significant research topic within their domains, prompting business schools to establish agendas for delving into this transformative field. Notably, Critical Management and Planning scholars have only recently redirected their focus toward CE, as exemplified by Savini (2021). Valuable insights from critical management perspectives—including democratic planning (Adaman & Devine, 2017) and alternative organizations (Parker & Parker, 2017)—that not only focus on *how to produce* but also on *why to produce and who produces* are poised to play a central role in guiding the transition toward circularity.

Finally, a holistic approach to CE principles requires addressing cross-industry implications, which includes various key elements such as business models, supply chain collaboration, resource and waste sharing, consumer education and awareness, cross-sector initiatives/alliances, and other issues such as digital technologies, product development, PSS, and Industry 4.0. This strategy recognizes the interconnectedness of industries and underscores the importance of integrating these diverse components to foster a more effective and sustainable implementation of CE principles across sectors.

The study's primary limitations arise from its bibliographic and content analysis approaches, which may entail potential researcher bias in the categorization and interpretation of information. To mitigate this, two authors closely collaborated to check the analysis results, aiming to maintain balanced perspectives and additional two authors refined the results. Furthermore, the study's reliance on articles from the WoS database excludes grey literature, potentially limiting the scope by not considering other valuable contributions (Geissdoerfer et al., 2017). The abundance of review articles also presents a challenge, as it complicates the process of conducting an in-depth analysis. This has led to the selective citation of representative examples within the text. Additionally, by including only articles that specifically meet CE criteria in the selection process, there is a possibility of overlooking relevant publications. However, this approach was chosen to provide a focused overview of current discussions and debates surrounding CE.

5 | CONCLUSIONS

Our study conducted an umbrella review of 167 studies, unveiling key insights across various themes. The academic literature on the CE concept has seen a surge, focusing on core principles, definitions, and tools for practical implementation. More efforts are needed to elucidate the connections between CE and broader concepts like sustainability and social equity. The Implementation & Policy theme underscores comprehensive policy processes and government regulations, identifying opportunities and challenges in global CE implementation. However, most policy initiatives, particularly in the EU, have been largely incremental, potentially overlooking the radical changes needed in economic systems to effectively address environmental challenges like climate change. The study also reveals considerable focus on CE metrics and indicators, emphasizing the need for standardized performance assessment methods and key performance indicators. Despite recognizing the state's leading role, we found no systematic engagement with debates on democratic planning including the role of citizens and communities in the decision-making about transition toward circularity.

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APPENDIX A

TABLE A1 The list of 167 review articles on CE that are included in this study.

Categories	Included articles		
CE concept ($n = 14$)	Friant et al., 2020	Kirchherr et al., 2017	Saavedra et al., 2018
	Geissdoerfer et al., 2017	Kirchherr, 2022	Schöggl et al., 2020
	Ghisellini et al., 2016	Merli et al., 2018	Türkeli et al., 2018
	Homrich et al., 2018	Metic & Pigosso, 2022	Winans et al., 2017
	de Jesus et al., 2018	Neves et al., 2020	
CE implementation and policy ($n = 15$)	Grafström & Aasma, 2021	Marrucci et al., 2019	Serrano-Bedia & Perez-Perez, 2022
	Hong & Gasparatos, 2020	Mhatre et al., 2021	Sodiq et al., 2019
	Jiao & Boons, 2014	Morales & Sossa, 2020	Su et al., 2013
	Kalmykova et al., 2018	Petit-Boix & Leipold, 2018	Wasserbaur et al., 2022
	Luo & Leipold, 2022	Romero-Luis et al., 2021	Zhu et al., 2019
CE assessment and monitoring ($n = 16$)	Camana et al., 2021	Kravchenko et al., 2019	Sassanelli et al., 2019
	Corona et al., 2019	Kristensen & Mosgaard, 2020	Valls-Val et al., 2022
	de Oliveira, Dantas, & Soares, 2021	Nika et al., 2020	Vinante et al., 2021
	de Pascale et al., 2021	Opferkuch et al., 2021	Walker et al., 2021
	Harris et al., 2021	Panchal et al., 2021	
	Jerome et al., 2022	Saidani et al., 2019	
CE in business and management ($n = 40$)	Acerbi & Taisch, 2020	Jabbour et al., 2019	Rusch et al., 2022
	Agrawal et al., 2022	Jensen et al., 2021	Salvador et al., 2020
	Alcayaga et al., 2019	Kerdlap et al., 2019	Santa-Maria et al., 2021
	Arekrans et al., 2022	Khan et al., 2018	Sarja et al., 2021
	Awan et al., 2021	Lahane et al., 2020	Schallehn et al., 2019
	Baldassarre et al., 2020	Lieder & Rashid, 2016	Sönnichsen & Clement, 2020
	Bhatt et al., 2020	Lüdeke-Freund et al., 2019	Suchek et al., 2021
	Bjørnbet et al., 2021	Mallick et al., 2023	Suchek et al., 2022
	Centobelli et al., 2020	Meis-Harris et al., 2021	Tukker, 2015
	Dantas et al., 2021	Nilsson & Göransson, 2021	Xu et al., 2022
	Farooque et al., 2019	Pieroni et al., 2019	Rejeb et al., 2022
	da Fernandes et al., 2020	Pinheiro et al., 2019	Rosa et al., 2019b
	Galvão et al., 2020	Polonsky et al., 2022	
	Geissdoerfer et al., 2020	Qazi & Appolloni, 2022	
Textiles & apparel ($n = 7$)	Abdelmeguid et al., 2022	Hultberg & Pal, 2021	Leal Filho et al., 2019
	Arrigo, 2021	Jia et al., 2020	Sandin & Peters, 2018
Electronic & electrical equipment ($n = 21$)	Cucchiella et al., 2015	Brião et al.	King & Locock, 2022
	Akcil et al., 2019	Compagnoni, 2022	Lee et al., 2023
	Al-Salem et al., 2022	de Farias et al., 2021	Pan et al., 2022
	Anandh et al., 2021	de Kwant et al., 2021	Rahman et al., 2021
	Barouta et al., 2022	Islam et al., 2021	Rosa et al., 2019a
	Bonfante et al., 2021	Johansen et al., 2022	Sica et al., 2018
	Bressanelli et al., 2020	Kim et al., 2022	Watari et al., 2020
Built environment ($n = 23$)	Anastasiades et al., 2020	Ghisellini et al., 2018a	Obi et al., 2023
	Anastasiades et al., 2021	Ghisellini et al., 2018b	Pamenter & Myers, 2021
	Antwi-Afari et al., 2021	Hossain & Ng, 2018	Segura-Salazar et al., 2019
	Aslam et al., 2020	Khadim et al., 2022	Wijewickrama et al., 2021
	Benachio et al., 2020	López Ruiz et al., 2020	Yu et al., 2022a
	Chen et al., 2022	Mhlanga et al., 2022	Yu et al., 2022b
	Çimen, 2021	Munaro et al., 2020	Zhang, Hu, et al., 2022
	Ferdous et al., 2021	Munaro et al., 2022	

TABLE A1 (Continued)

Categories	Included articles		
Agrifood & bioeconomy ($n = 11$)	Adams et al., 2021	Jones et al., 2022	Velasco-Muñoz et al., 2022
	Atanasovska et al., 2022	Kumar et al., 2022	Wei et al., 2022
	de Oliveira, Lago, & Dal'Magro, 2021	Salvador et al., 2022	Zhang, Dhir, & Kaur, 2022
	Ingrao et al., 2018	Santagata et al., 2021	
Waste management ($n = 14$)	Celestino et al., 2022	Hoang et al., 2022	Sanjaya & Abbas, 2023
	Chen et al., 2023	Iacovidou et al., 2017	Towa et al., 2020
	Cobo et al., 2018	Jones et al., 2013	Winterstetter et al., 2021
	Dastjerdi et al., 2021	Mancini & Raggi, 2021	Zocco et al., 2022
	de Almeida & Borsato, 2019	Paes et al., 2019	
Other industries ($n = 7$)	Palafox-Alcantar et al., 2022	Silva & Pålsson, 2022	Zhu et al., 2022
	Ang et al., 2021	Tarrar et al., 2021	
	Escursell et al., 2021	Wong et al., 2018	