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Circular economy practices: A systematic review with a textometric analysis

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Abstract
Circular economy (CE) practices aim to extend the lifespan of materials and products while reducing waste and dependence on virgin resources. This study conducts a Systematic Literature Review (SLR), following PRISMA guidelines, to identify CE practices adopted by public and private entities between 1st January 2012 and 31st December 2024 and to assess their outcomes. From 782 retrieved articles, 164 were selected for textometric and thematic analysis, revealing four principal classes: analytical methods, organizational capabilities and performance, circular practices, and waste management and material recovery. The review shows that circularity has been advanced through regulatory frameworks, standards, and green procurement in the public sector, while private organizations relied on dynamic capabilities, collaboration, and technological adoption to enhance CE performance. Key policy drivers include Extended Producer Responsibility, the EU Circular Economy Action Plans, and the 2024 Right to Repair Directive. Evidence also highlights the growing relevance of emotional durability and affective design in extending product lifespan, provided these elements are compatible with principles of technical circularity.
Keywords: circular economy, circular product development, product design, innovation barriers, recycling.

creative commons

Introduction

The Circular Economy (CE) has emerged as a prominent framework for sustainable development, promoting resource efficiency, waste reduction, and the regeneration of natural systems through the closure of material loops and the extension of product lifecycles (Alhawari et al., 2021; Hoffmann et al., 2025; Rocha et al., 2023; Sabale et al., 2025; Verma, 2024). Although research on CE has expanded considerably across sectors and regions, significant conceptual, operational, and implementation challenges remain (Alhawari et al., 2021; Lamey et al., 2024; Purushothaman et al., 2025; Sabale et al., 2025; Shaharudin et al., 2024; Upadhayay et al., 2024; Zavos et al., 2024).

The literature identifies three interrelated dimensions of CE implementation: circular resource and product management, the transformation of business models and supply chains, and supportive governance and policy frameworks (Arsawan et al., 2024; Corrêa & Corrêa, 2021; Maleki, 2025; Pisitsankkhakarn & Vassanadumrongdee, 2020; Purushothaman et al., 2025; Safhi et al., 2024). Emerging technologies, such as the Internet of Things, artificial intelligence, and blockchain, further facilitate circularity through enhanced traceability and resource optimization, yet their adoption remains constrained by financial, technological, and organizational limitations, particularly among SMEs (Barón et al., 2020; Chowdhury et al., 2022; Hong et al., 2024; Khoja et al., 2024; Ronaghi, 2023; Sun & Wang, 2022).

Despite the documented environmental and economic benefits of CE, its social dimension remains underexplored, particularly regarding equity, decent work, civic participation, and responsible consumption (Zavos et al., 2024). Additional barriers, including organizational resistance, insufficient standardization of circularity metrics, inadequate reverse logistics infrastructure, and uneven adoption across sectors and regions, continue to hinder CE advancement (Sabale et al., 2025; Shaharudin et al., 2024).

To address the question of which circular practices have been adopted by public and private organizations between January 1, 2012, and December 31, 2024, and what outcomes they generate, this study advances the literature through three contributions. First, it develops an integrative taxonomy of CE practices based on textometric analysis, linking operational activities, organizational capabilities, technological enablers, and governance mechanisms. Second, it highlights the role of adaptability, collaboration, and innovation capabilities in shaping sustainability outcomes. Third, it extends current CE discussions by incorporating emotional durability and anthropomorphic product design as emerging mechanisms for product life extension that complement traditional principles of technical circularity.

Theoretical background

The concept of CE, as defined by Hong et al. (2024), is a production and consumption paradigm that aims to maximize resource value, reduce costs, and improve environmental sustainability by promoting the recycling of energy and materials. Furthermore, Zavos et al. (2024) note that CE has gained increasing prominence over the past two decades.

Although the momentum toward a CE continues to grow and its ecological, economic, and social benefits are widely recognized, progress in CE initiatives

and their adoption remains limited and less substantial than expected (Upadhayay et al., 2024).

Conceptual framework

Building on the literature reviewed and the identified research gaps, this study proposes a conceptual framework (Figure 1) that explains how CE practices translate into sustainability performance outcomes. The framework integrates three core dimensions: organizational capabilities, circular economy practices, and sustainability performance.

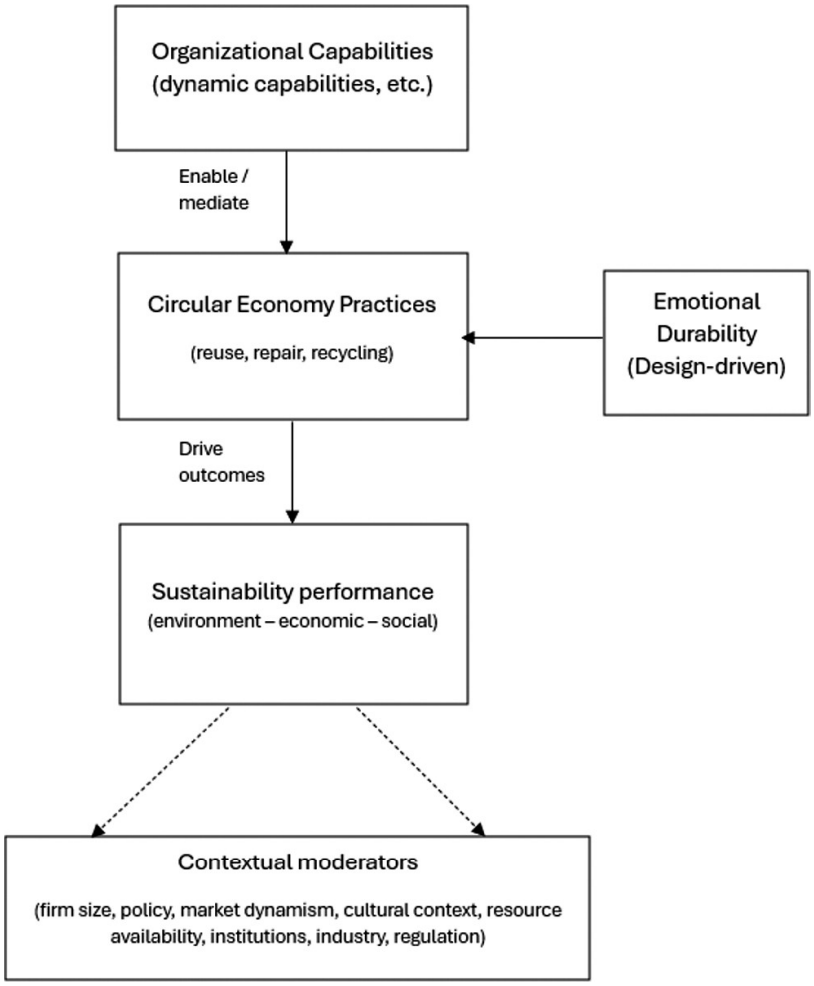


Figure 1: *Conceptual framework of the capability–practice–performance relationship in the circular economy.*

Organizational capabilities—such as collaboration, technological adoption, and supply chain integration—enable and mediate the implementation of circular practices. These practices, including reuse, repair, remanufacturing, and recycling, constitute the operational mechanisms that drive circularity.

The model further posits that contextual moderators, including firm size, the institutional environment, and policy frameworks, influence the relationship between practices and performance. Additionally, the framework incorporates emotional durability as a complementary dimension to technical circularity, highlighting the role of design and consumer–product relationships in extending product lifespans.

Method

A comprehensive review of the literature on CE applications in business contexts was conducted using the PRISMA methodology (Page et al., 2021; Pallavicini et al., 2018). Following the three prescribed stages —identification, screening, and inclusion— the identification phase employed three major scientific databases (Scopus, Web of Science, and ScienceDirect) to locate peer-reviewed journal articles, explicitly focused on CE implementation in enterprises. Search strings were constructed using Boolean operators (AND, OR), quotation marks, and parentheses, with targeted keyword selection.

The final search query, defined as TITLE-ABS-KEY (“Circular economy practices”) AND PUBYEAR >= 2012 AND PUBYEAR <= 2024 AND (LIMIT-TO (SRCTYPE , “j”)) AND (LIMIT-TO (DOCTYPE , “ar”)) AND (LIMIT-TO (LANGUAGE , “English”) OR LIMIT-TO (LANGUAGE , “Spanish”)) AND (EXCLUDE (EXACTSRCTITLE , “ACS Agricultural Science and Technology”)), further incorporated restrictions related to source type (journals), document type (articles), language (English or Spanish), and the exclusion of specific journal titles. The selected temporal range (2012–2024) ensured coverage of contemporary CE developments. The application of this search strategy yielded 782 manuscripts, which are summarized in Table 1.

Database	Search string	Total of identified works
Scopus	TITLE-ABS-KEY (“Circular economy practices”) AND PUBYEAR >= 2012 AND PUBYEAR <= 2024 AND (LIMIT-TO (SRCTYPE, “j”)) AND (LIMIT-TO (DOCTYPE, “ar”)) AND (LIMIT-TO (LANGUAGE, “English”) OR LIMIT-TO (LANGUAGE, “Spanish”)) AND (EXCLUDE (EXACTSRCTITLE, “ACS Agricultural Science and Technology”))	481
Web of Science	Refine results for AB= (“circular economy practices”) and English or Spanish (Languages) and Article (Document Types) and Mdpi (Exclude – Publishers) and 2024 or 2023 or 2022 or 2021 or 2020 or 2019 or 2018 or 2017 or 2016 or 2015 or 2014 or 2013 or 2012 (Publication Years)	265
ScienceDirect	Year: 2012-2024. Title, abstract, keywords: “circular economy practices” AND “application” Filtered by: only articles	36

Table 1: *Search strings by database and the total number of identified works.*

Coding of papers

The selected papers were coded according to a data extraction matrix developed by Connolly et al. (2012) and updated by Boyle et al. (2016). Ultimately, the 164 studies that met both the inclusion criteria and the quality threshold were coded considering the following categories: (1) circular economy; (2) circular economy practices (recycling, reuse, repair, ecodesign, reduction, upcycling, and remanufacture); (3) circular economy requirements (waste management procedures, industry-specific strategies, cost reduction, corporate social responsibility, regulatory compliance, and customer demand); and (4) circular economy applicability (SMEs, Supply Chain, product development process). Furthermore, studies related to agricultural practices were excluded from this study. Figure 2 shows the application of the PRISMA methodology.

Inclusion Criteria

Scientific literature published between January 1, 2012, and December 31, 2024, was considered, with inclusion restricted to peer-reviewed journal articles written in English or Spanish. Furthermore, selected studies had to be directly related to CE practices, organizational implementation, and empirical or theoretical frameworks.

Exclusion Criteria

The study applied the following exclusion criteria: (1) document types other than journal articles (e.g., book chapters, conference papers, and conference abstracts); (2) grey literature; (3) duplicates; (4) inaccessible full-text; and (5) unrelated sustainability studies.

Screening process

Two independent reviewers conducted title, abstract, and full-text screening, with any disagreements resolved through discussion and consensus.

The selection process was reported following the PRISMA 2020 statement (Figure 2). Of the 782 records identified (Scopus, n = 481; Web of Science, n = 265; ScienceDirect, n = 36), 41 duplicates and 4 records removed for other reasons were eliminated before screening, leaving 737 records for title and abstract screening evaluation. Of these, 573 records were excluded because they did not meet the inclusion criteria. The remaining 164 reports were sought for retrieval; all were successfully retrieved and assessed in full text for eligibility and quality, with none being excluded at this stage. Consequently, 164 studies, each corresponding to one report, were ultimately included in the review.

Quality assessment of the studies

Following established systematic review protocols, manuscripts were evaluated using a quality-scoring framework adapted from Connolly et al. (2012) and Kitchenham et al. (2009). Studies were assessed across six dimensions—research quality, methodological rigor, thematic alignment, generalizability, clarity, and relevance—yielding scores from −6 to 6 (Crespo-Martinez et al., 2024). Applying a minimum threshold of 3 points to the full-text reports assessed for eligibility, 164 studies were retained for analysis. The quality-assessment instrument and the matrix of the 164 included studies are provided in Appendix A.

To ensure methodological rigor and reproducibility, the selected corpus was analyzed using IRaMuTeQ and TXM, two

complementary textometric tools that enable the systematic examination of large textual datasets by utilizing the hypergeometric law as index. IRaMuTeQ facilitates lexical classification and Downward Hierarchical Clustering, while TXM supports correspondence analysis and vocabulary specificity assessment through corpus linguistics and multivariate statistics (Camargo & Justo, 2013; Heiden, 2010). Together, these tools provide an empirical and replicable framework that supports a systematic and transparent analysis of the textual discourse (Sousa, 2021).

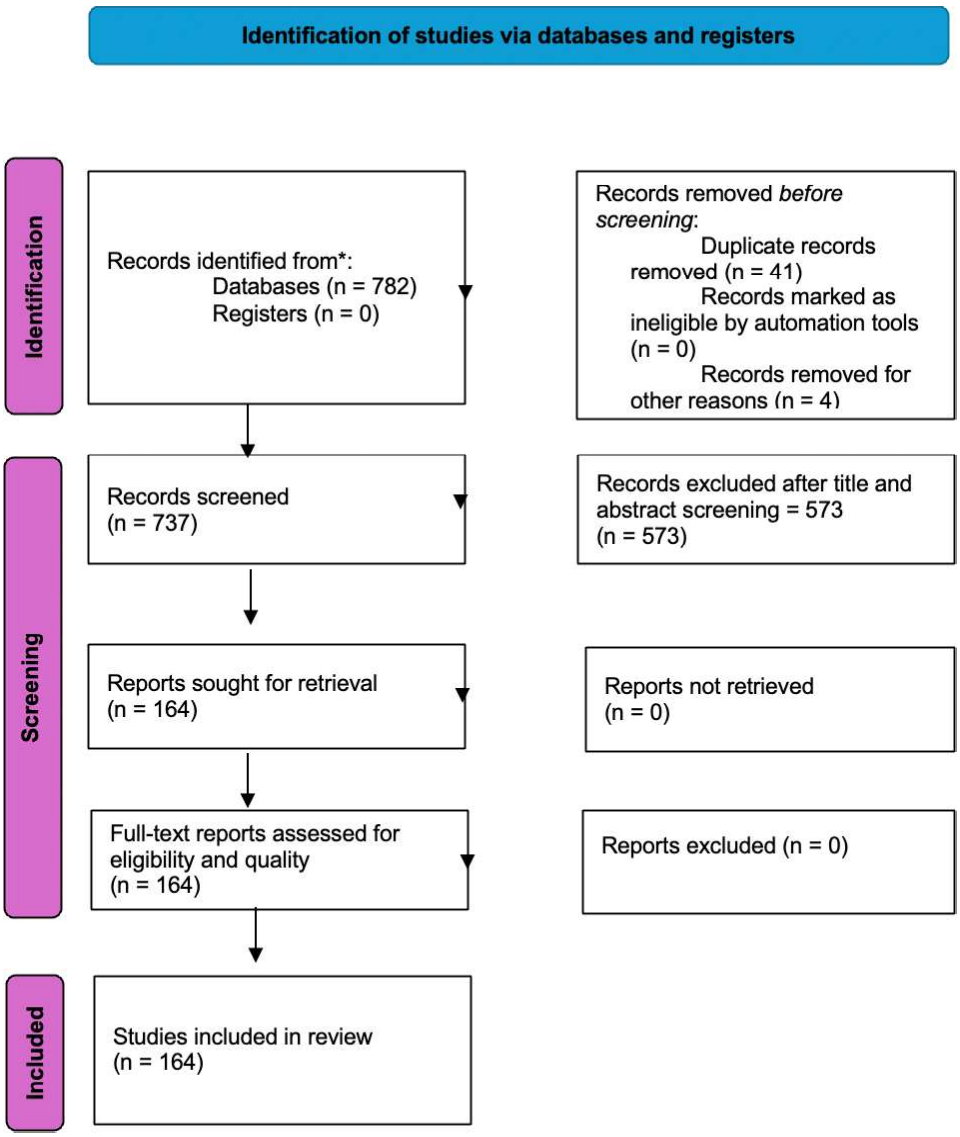


Figure 2: *PRISMA 2020 flow diagram.*

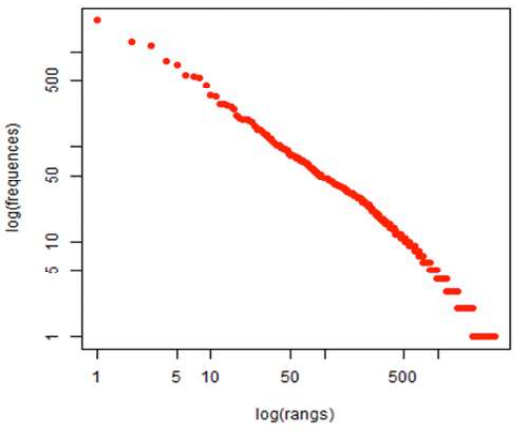
Corpus construction followed a standardized procedure. Bibliographic metadata were organized in a structured database, and, following the PRISMA screening process, only titles, abstracts, and keywords from eligible studies were retained. The resulting corpus was exported as a plain-text file and analyzed in IRaMuTeQ using lexical classification, correspondence analysis, and cluster analysis techniques, thereby ensuring analytical consistency, traceability, and reproducibility throughout the study. Publications published after December 31, 2024, are cited only as methodological or contextual references and are not part of the corpus of 164 studies; the included studies are marked with an asterisk (*) in the reference list.

Results and discussion

The results are organized in primary components: the "Text Analysis" section provides a broad overview of the studies analyzed, while the "Lexicographic Analysis" section presents and discusses the findings in detail.

Text Analysis

The analysis was divided into three sections: (a) lexicographic analysis, (b) cluster analysis using DHC (Reinert method), and (c) similarity analysis. These analyses were performed using IRaMuTeQ software. The statistics of the textometric analysis are presented in Figure 3.



Number of texts: 164

Number of occurrences: 39876

Number of forms: 3510

Hapax number: 1311 (3.29% of occurrences – 37.35% of the forms)

Occurrences per text mean: 244.64

Figure 3: *Statistics of the lexicographic analysis.*

Lexicographic Analysis

Titles, abstracts, and keywords from 164 carefully chosen academic publications were included in this research. The preliminary data for the systematic review was derived from this lexicometric analysis. To obtain these initial findings, a lemmatization procedure was used (Table 2). Through this procedure, each word was substituted with its canonical form (Bueno et al., 2021; Crespo-Martinez et al., 2024).

#	Word	Freq.	#	Word	Freq.	#	Word	Freq.
1	Circular	570	**11**	model	162	**21**	result	104
2	Economy	535	**12**	Ce	160	**22**	strategy	104
3	Practice	436	**13**	management	148	**23**	business	98
4	Study	278	**14**	industry	133	**24**	technology	97
5	Performance	265	**15**	Firm	132	**25**	resource	93
6	Chain	195	**16**	impact	126	**26**	base	91
7	environmental	192	**17**	research	121	**27**	product	84
8	Sustainable	190	**18**	green	120	**28**	production	83
9	Waste	190	**19**	data	114	**29**	recycle	81
10	Supply	183	**20**	sustainability	108	**30**	development	81

Table 2: *The 30 most frequent words.*

Cluster Analysis

The Reinert cluster analysis method, which applied downward hierarchical classification of the active forms, was performed. This method defines four general groups of lexical clusters, as shown in Figure 4.

Additionally, the Factorial Correspondence Analysis (FCA) results shown in Figure 5 illustrate clusters of active words. Cluster 1 constitutes 15.5%, followed by cluster 2 (24.3%), cluster 3 (29.3%), and cluster 4 (31%). The graph's layout, determined by chi-square values, signifies variable significance. This analysis effectively synthesizes and justifies word relationships within the lexicon, revealing particularly close connections between clusters 2 and 3, and between clusters 1 and 4.

Similarity Analysis

The co-occurrence network analysis, weighted using chi-square association values, revealed structured lexical relationships. Edge thickness indicated the strength of associations, while node font size reflected term frequency. The resulting graph (Figure 6) shows three prominent word communities centered on "circular," "economy," and "practices." "Circular" functions as the central lexical construct, with "economy" and "practices" forming its immediate semantic neighborhood, highlighting the cohesive structure of terminology within the corpus.

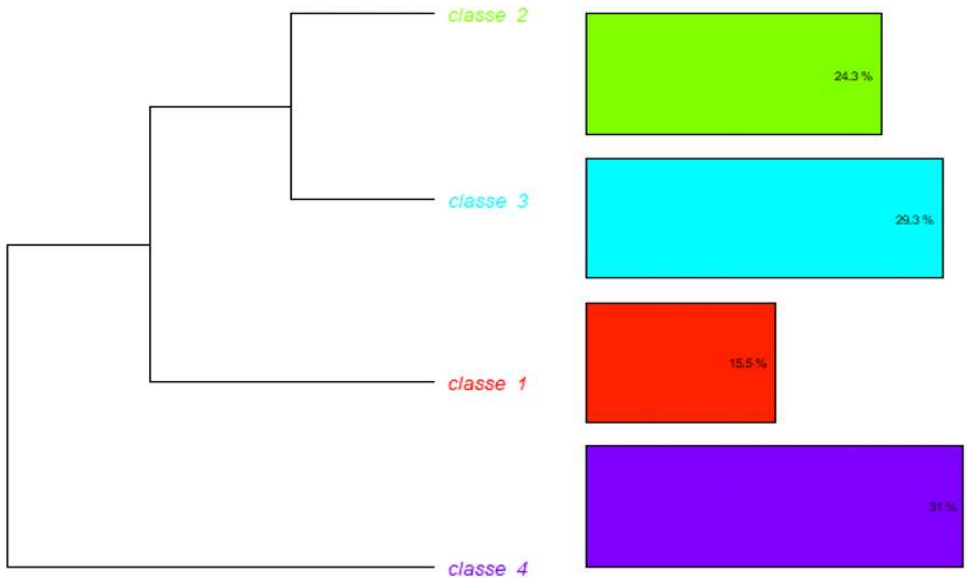


Figure 4: *Dendrogram, including cluster analysis and lexical clusters.*

Detailed analysis of clusters

Research subjects in circular economy practices can be identified through these clusters, which reveal four distinct groupings of papers and scientific materials. Below are the descriptions and interpretations of these groups. Additionally, it has been possible to examine the practices that SMEs have adopted and implemented in accordance with the definition of these four clusters.

CLUSTER 1: Data collection and analysis method

Research on CE practices employs diverse data collection methods, including qualitative approaches—such as interviews (Bais et al., 2025; Corrêa & Corrêa, 2021; Dey et al., 2022; Jia & Lin, 2024; Panori et al., 2024) and observation (Boorsma et al., 2022)—and quantitative tools, such as surveys, structured questionnaires (Alateeg & Alayed, 2025; Batool et al., 2023; Khodaparasti & Garabollagh, 2023; Lamey et al., 2024; Siddik et al., 2023), and firm-level datasets (Xie et al., 2025; Zhang & Zhu, 2024). These methods facilitate the examination of links between CE strategies and organizational performance while capturing environmental, social, and economic dimensions (Geissdoerfer et al., 2017; Vaidyabhushana et al., 2021). Surveys—particularly online formats (Hartwell et al., 2021; Sahoo et al., 2023; Tietz et al., 2024)—remain central to CE research, enabling large-scale assessment of behaviors, perceptions, and barriers to the adoption of circular business models. Structured questionnaires enhance reliability and replicability by aligning standardized items with CE constructs such as product life extension, recycling, and resource efficiency, often validated through pilot testing (Bocken et al., 2016; Chiappetta et al., 2020).

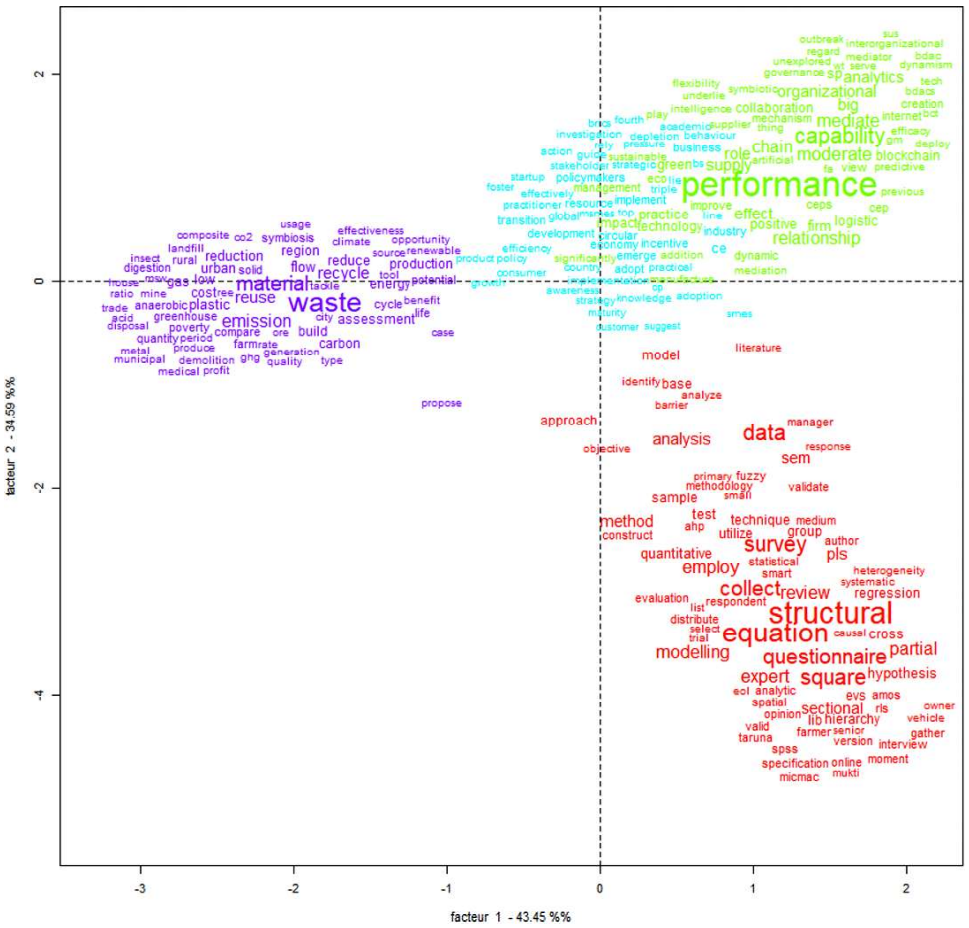


Figure 5: *Factorial correspondence analyses (FCA) of frequently used words.*

Structural Equation Modeling (SEM) is widely used to test complex theoretical relationships among CE-related constructs (Al Rawashdeh et al., 2024; Cheffi et al., 2023; Dubey et al., 2019; Junaid et al., 2024; Mishra et al., 2022; Raza et al., 2022; Riggs et al., 2024; Sellitto et al., 2024). SEM begins with Confirmatory Factor Analysis to validate latent constructs—such as circular orientation or eco-innovation readiness—ensuring robust measurement models (Hair et al., 2021), before estimating structural pathways that reflect dynamic interactions across environmental, social, and economic domains (Dubey et al., 2019). Sampling strategies significantly influence the validity of survey-based CE research, with probability methods enhancing generalizability, whereas non-probability designs remain common for specialized or hard-to-reach CE populations (Sharma et al., 2024). Despite their value, surveys and structured questionnaires can be biased and lack sufficient contextual depth, necessitating complementary methods such as interviews or case studies (Dung Nguyen & Nguyen, 2025).

To address these limitations, CE research increasingly adopts mixed-methods designs, integrating quantitative surveys with qualitative tools to enable triangulation and richer interpretive insights (Dey et al., 2022). Advances in digital survey platforms such as Qualtrics, SurveyMonkey, and Google Forms have further strengthened methodological efficiency by facilitating large-scale data collection, intelligent survey flows, and seamless integration with statistical software (Chen, Jarecka, et al., 2025; Evans, 2021).

CLUSTER 2: Performance and capability

Research consistently demonstrates that the relationship between performance and capability in the CE is mediated by an organization's ability to adapt, innovate, and operationalize circular practices. Circular economy practices (CEPs) enhance sustainable supply chain performance, with supply chain capability and flexibility serving as partial mediators of this relationship (Lartey & Amikiya, 2025). These capabilities—reflecting an organization's adaptive and operational strength—enable more effective implementation of CE principles and thus contribute to improved sustainable outcomes (Alateeg & Alayed, 2025; Chiappetta et al., 2020; Dubey et al., 2019). Moreover, CE capabilities also drive green supply chain and process innovation, which further mediate the link between circular capability and sustainable performance, particularly within manufacturing contexts (Alateeg & Alayed, 2025).

Organizational capabilities, such as collaboration and environmental commitment, strengthen circular supply chain capabilities and enhance CE performance. Empirical findings highlight the importance of firm-level collaboration and commitment for translating circular capabilities into tangible performance improvements (Rijal et al., 2024). Broader systematic reviews confirm a positive relationship between CE practices and sustainability performance, moderated by contextual factors including industry type, institutional environment, and firm size (Ahmadov et al., 2024; Lartey & Amikiya, 2025). Firm size has been shown to moderate both the effect of CEPs on sustainable performance and the influence of stakeholder pressure on CE adoption.

Technological and cultural dimensions further shape the capability–performance nexus. Technology adoption improves environmental performance only indirectly, through sustainability-oriented innovation (SOI) and CE practices, which act as mediators (Koval et al., 2025). Green dynamic capabilities also enhance environmental and social performance by reducing inefficiency and pollution, linking resource-based strategies to sustainable outcomes (Li et al., 2023). Organizational culture plays a key mediating role: CEPs foster green culture within SMEs, thereby increasing environmental performance (Junejo et al., 2024). Additionally, collaborative supply chain practices amplify the impact of circular practices on sustainability performance, underscoring collaboration as a critical driver of CE success (Sudusinghe & Seuring, 2022).

CLUSTER 3: CE Practices

Circular value-retention practices constitute the operational core of CE systems by extending product lifecycles, preserving embedded material value, and reducing dependence on virgin resource extraction.

Across the reviewed literature, these practices operate through interconnected mechanisms involving product-life extension, material recovery, reverse supply-chain coordination, and sustainability-oriented infrastructure systems. Rather than functioning independently, CE practices form integrated value-retention configurations where organizational capabilities, technological readiness, and consumer participation collectively determine circular performance outcomes.

Product life-extension mechanisms

Product life-extension mechanisms represent one of the most effective pathways for retaining material and economic value within CE systems. Unlike downstream recycling processes, which frequently involve energy-intensive transformations and material degradation, life-extension practices preserve product functionality, embodied energy, and manufacturing value through prolonged use, restoration, adaptation, and recirculation (Bakker et al., 2014; Panori et al., 2024).

Reuse extends product lifecycles through resale, redistribution, reconditioning, and secondary-market circulation, thereby reducing waste generation and limiting demand for virgin resources (Anaya et al., 2024; Jia & Lin, 2024; Shcherbak et al., 2024). The literature consistently identifies reuse as a high-priority CE strategy due to its environmental benefits, including greenhouse gas reduction and resource conservation, as well as its economic and social contributions through employment generation and circular market development (Directorate-General for Communication, 2020; Findik et al., 2023). Social acceptance and consumer trust remain central determinants of reuse adoption, while technologies such as blockchain, IoT sensors, and digital product passports increasingly support traceability, quality assurance, and lifecycle transparency (Batool et al., 2023; Berninger et al., 2025; Kuah & Wang, 2020).

Repair further strengthens circular longevity by preserving product integrity and delaying material disposal. Beyond its technical dimension, repair functions as a socio-technical practice that reshapes consumer relationships with products by embedding care, responsibility (Bakker et al., 2014; Colombo et al., 2024; David et al., 2025; Yu, 2022), and prolonged ownership into consumption behavior (Graziano & Trogal, 2017). At the organizational level, repair systems depend on reverse logistics infrastructures, predictive maintenance technologies, and modular product architectures that facilitate disassembly and component replacement (Findik et al., 2023; Junaid et al., 2024). Ecodesign principles—including reparability, modularity, and spare-part accessibility—are therefore critical for enabling scalable repair ecosystems and service-oriented business models such as Product-as-a-Service (Maleki, 2025; Tellez et al., 2024).

Remanufacturing represents a more advanced value-retention strategy by restoring end-of-life products to near-new conditions through standardized industrial processes involving inspection (Mugge et al., 2018; Rahee & Sarker, 2024), component replacement, testing, certification, and warranty assurance (Adu-Amankwa & Ijomah, 2023; Rahee & Sarker, 2024). The literature associates remanufacturing with substantial reductions in lifecycle emissions, resource extraction, and production costs (Adu-Amankwa & Ijomah, 2023; Hartwell et al., 2021; Li, Hamidi, et al., 2024), positioning

it as a central mechanism within closed-loop supply chains and industrial sustainability transitions (Boorsma et al., 2022; Russell & Nasr, 2023). However, market expansion depends heavily on consumer trust, perceived product quality, and supportive regulatory frameworks that reduce perceived risks associated with remanufactured goods (Belbağ & Belbağ, 2023; Lee & Kwak, 2020).

Ecodesign and emotional durability

Ecodesign is widely recognized as a foundational enabler of CE implementation because it incorporates circularity principles during the earliest stages of product development (Barón et al., 2020; Khoja et al., 2024; Riesener et al., 2023). By emphasizing durability, reparability, modularity, and recyclability, ecodesign supports product life extension while facilitating repair, remanufacturing, and material recovery processes across supply chains (Khoja et al., 2024; Riesener et al., 2023; Yu et al., 2022). Empirical evidence further indicates that ecodesign capabilities improve environmental performance, innovation capacity, and long-term organizational competitiveness, reinforcing capability-based interpretations of CE transitions (Ho & Lin, 2024; Yu et al., 2022).

Concurrently, recent studies highlight the growing relevance of emotional durability and anthropomorphic product design and marketing in strengthening circular consumption behaviors. By incorporating human-like characteristics, symbolic meaning, facial features, or expressive elements into products and promotional stimuli, firms can foster relational closeness, increase emotional engagement, and induce care-taking motivations. These mechanisms effectively reduce premature replacement and encourage sustainable behaviors such as repair, maintenance, reuse, and waste reduction (Chen, Wu, et al., 2025; Ishigaki et al., 2025, Miesler, 2012). Similarly, anthropomorphic marketing enhances empathy toward recycling and reuse systems, promoting consumer responsibility and participation in circular practices (Sehgal et al., 2023; Shirai, 2023). Emotional durability is therefore emerging as a complementary dimension to technical circularity, particularly in aging societies, where secure attachment can mitigate perceived obsolescence, prolong ownership, and promote behavioral sustainability.

However, tensions may arise because integrating human-like features can conflict with technical circularity requirements such as design for disassembly, modularity, and material purity (Hernández, 2025; Pietroni et al., 2023). To resolve this tension, scholars propose a Hybrid Structure–Interface Design Model, in which internal product structures adhere to strict circular design principles, while emotional and anthropomorphic elements are confined to external or digital interfaces, thereby ensuring emotional attachment without compromising recyclability or repairability (Rahman et al., 2025). Advancing this approach requires integrated assessment frameworks—such as the Hybrid Evaluation Model (HEM)—that measure both emotional durability and technical circularity performance. As ecodesign becomes mandatory, firms will increasingly rely on humanized experiences, material storytelling, and circular business models (e.g., Product-as-a-Service) where emotional durability becomes a key competitive advantage (Haines-Gadd et al., 2018; Palmieri et al., 2025).

Material recovery and optimization

Material recovery and optimization practices complement product-life extension mechanisms by reintegrating post-consumer and industrial waste into production systems while minimizing material losses. Advanced recycling technologies—including chemical depolymerization, solvent-based dissolution, and thermolytic conversion (Clark & Shaver, 2024; Karimian et al., 2025)—enable the recovery of high-quality secondary feedstocks capable of approaching virgin material standards (Clark & Shaver, 2024; Klotz et al., 2024; Li, Theodosopoulos, et al., 2024). Their effectiveness, however, depends on reverse logistics coordination, industrial symbiosis, digital traceability systems, and access to shared technological infrastructures (Caceres et al., 2025; Filho et al., 2025).

Reduction constitutes the highest-priority CE strategy because it prevents waste generation at the source and decouples material throughput from economic growth (Sabale et al., 2025). Circular business models, product-service systems, and resource-efficient production systems contribute to reduction by minimizing virgin material intensity and extending resource productivity across value chains (Ferasso et al., 2020; Geissdoerfer et al., 2017). However, scholars warn that rebound effects may partially offset environmental gains if reductions in material intensity stimulate additional consumption (Castro et al., 2022; Schultz et al., 2024).

Similarly, upcycling transforms waste streams into higher-value products through redesign and creative material reuse, contributing simultaneously to waste reduction, local entrepreneurship, and niche circular markets (Camacho-Otero et al., 2018; Wulf et al., 2024). Nevertheless, scalability remains constrained by material heterogeneity, inconsistent supply chains, and the absence of standardized industrial processes (Cheffi et al., 2023; Hernández, 2025).

System-enabling infrastructures

The effectiveness of CE value-retention mechanisms depends largely on enabling infrastructures that facilitate material circulation, improve energy efficiency, and integrate reverse supply-chain. Reverse logistics systems play a central role in this process by facilitating product collection, redistribution, recovery, remanufacturing, and recycling across closed-loop supply chains (Yun & Han, 2025). These systems support waste minimization, greenhouse gas emissions reduction, and resource recirculation while preserving economic value through coordinated management post-consumer material flows.

The integration of renewable energy further strengthens CE systems by reducing the environmental footprint of manufacturing, logistics, and material recovery activities (Bassi & Dias, 2019; Le et al., 2024), while reducing dependence on fossil fuels (Nikolakis et al., 2024). Beyond decarbonization, renewable energy adoption can enhance supply chain resilience, promote social equity, and support long-term sustainability transitions, particularly in the context of growing energy insecurity and increasing regulatory pressure (Baldassarre, 2025; Yuyang, 2024).

Overall, the findings suggest that circular value retention relies not on isolated technical interventions but on the integration of product life extension strategies, material recovery systems, organizational capabilities, consumer engagement, and

enabling infrastructures. Accordingly, CE transitions should be understood as multidimensional sociotechnical transformations in which operational practices, behavioral dynamics, and governance mechanisms interact to support long-term circular performance.

CLUSTER 4: CE in the enterprise

The literature indicates that adopting CE practices remains particularly challenging for firms operating in developing and emerging economies, especially SMEs, despite the growing policy emphasis on sustainable and resource-efficient business models (Sabale et al., 2025). Furthermore, organizational characteristics, including governance structures, firm size, and ownership patterns, significantly influence the effectiveness of CE implementation (Bertelli et al., 2025).

Across organizations, strategic and operational barriers remain among the most persistent obstacles to circular transitions. Firms frequently face inadequate leadership, limited stakeholder engagement across the value chain, fragmented collaboration, and weak strategic alignment, all of which hinder the shift from linear to circular business models (Ahmadov et al., 2024; Ara et al., 2024; Chowdhury et al., 2022; Elia et al., 2020; Sabale et al., 2025). These challenges are compounded by unclear business cases, divergent managerial perspectives, and a lack of standardized performance indicators, which constrain firms' ability to assess circular outcomes and develop long-term strategies (Boorsma et al., 2022; Mahanth et al., 2023; Van Opstal & Borms, 2023). Organizational cultures that primarily perceive sustainability as a cost further undermine managerial commitment to CE initiatives.

Financial constraints are particularly acute for SMEs and micro-enterprises. Limited access to funding for CE operations, research and development, workforce training, and green technologies, combined with high upfront investment requirements and uncertain returns, discourages the adoption of circular business models (Ahmadov et al., 2024; Ara et al., 2024; Azadnia et al., 2021; Bertelli et al., 2025; Boorsma et al., 2022; Brglez et al., 2025; Chowdhury et al., 2022; Ghisetti & Montresor, 2020; Henao-Hincapié et al., 2024; Hetherington et al., 2024). Weak economic incentives and limited financial support further constrain firms' capacity to implement resource-efficient practices (Mahanth et al., 2023; Mishra et al., 2023; Ormazabal et al., 2018; Sabale et al., 2025; Schmid et al., 2025; Xie et al., 2025).

Institutional and technological barriers also play a critical role. Firms often encounter governance inefficiencies, insufficient technical support, and weak enforcement of CE-related regulations (Azadnia et al., 2021; Bertelli et al., 2025; Brglez et al., 2025; Mahanth et al., 2023; Sabale et al., 2025). At the same time, inadequate information systems, legacy technologies, and restricted access to affordable green technologies hinder material recovery, remanufacturing, and resource circulation (Ara et al., 2024; Bertelli et al., 2025; Brglez et al., 2025; Chowdhury et al., 2022; Hetherington et al., 2024; Mahanth et al., 2023; Mishra et al., 2022; Nandha Gopan & Balaji, 2023; Ormazabal et al., 2018; Sabale et al., 2025; Saha et al., 2025; Van Opstal & Borms, 2023; Verma, 2024; Xie et al., 2025).

Beyond organizational and technological factors, social, cultural, and market barriers highlight the importance of collaboration and behavioral change. Poor coordination among stakeholders, limited

supplier engagement, and insufficient demand for circular products restrict the development of circular value chains (Camacho-Otero et al., 2018; Mahanth et al., 2023). Consumer preferences for new products, skepticism toward remanufactured goods, and a limited willingness to pay premium prices further constrain market expansion. In addition, shortages of skilled personnel, limited expertise CE-related, and supply-chain inefficiencies reduce firms' capacity to operationalize circular solutions effectively (Ahmadov et al., 2024; Henao-Hincapié et al., 2024; Sung, 2015; Van Opstal & Borms, 2023).

Despite these challenges, the literature identifies several factors that support CE adoption. For SMEs, economic benefits such as lower repair costs, procurement efficiencies, reduced investment risks, and increased profitability serve as key drivers (Ormazabal et al., 2018; Yun & Han, 2025). Other incentives include enhanced market value, improved environmental performance, reputational gains, and stronger corporate sustainability (Sonar et al., 2024; Verma, 2024; Xie et al., 2025). For both SMEs and large firms, greater customer acceptance of circular products, improvements across the value chain, and positive environmental outcomes facilitate circular transitions and strengthen the business case for CE implementation (Ormazabal et al., 2018; Shirai, 2023). Overall, successful CE adoption depends on addressing multidimensional barriers while leveraging economic, operational, environmental, and market-related benefits.

Path Analysis

As shown in Figure 6, the terms circularity and economy exhibit a strong relationship. The term circular is also associated with practice. The thickness of the connecting lines represents the strength of the relationship between each pair of terms. These patterns highlight the central role of the circular economy in linking economic activity, resource efficiency, and sustainability. Unlike the linear "take, make, dispose" model, the circular economy emphasizes retaining the value of products, materials, and resources for as long as possible. From an economic perspective, this approach seeks to decouple production and consumption from the extraction of finite resources, thereby reducing costs, mitigating supply risks, and strengthening resilience across global value chains.

Circularity is central to this framework because it involves the continuous circulation of resources through strategies such as reuse, remanufacturing, and recycling. Rather than being discarded after a single use, materials can be reintegrated into production cycles, thereby minimizing waste. This principle has ecological implications and also supports the development of closed-loop systems that retain value, contributing to both environmental protection and economic viability.

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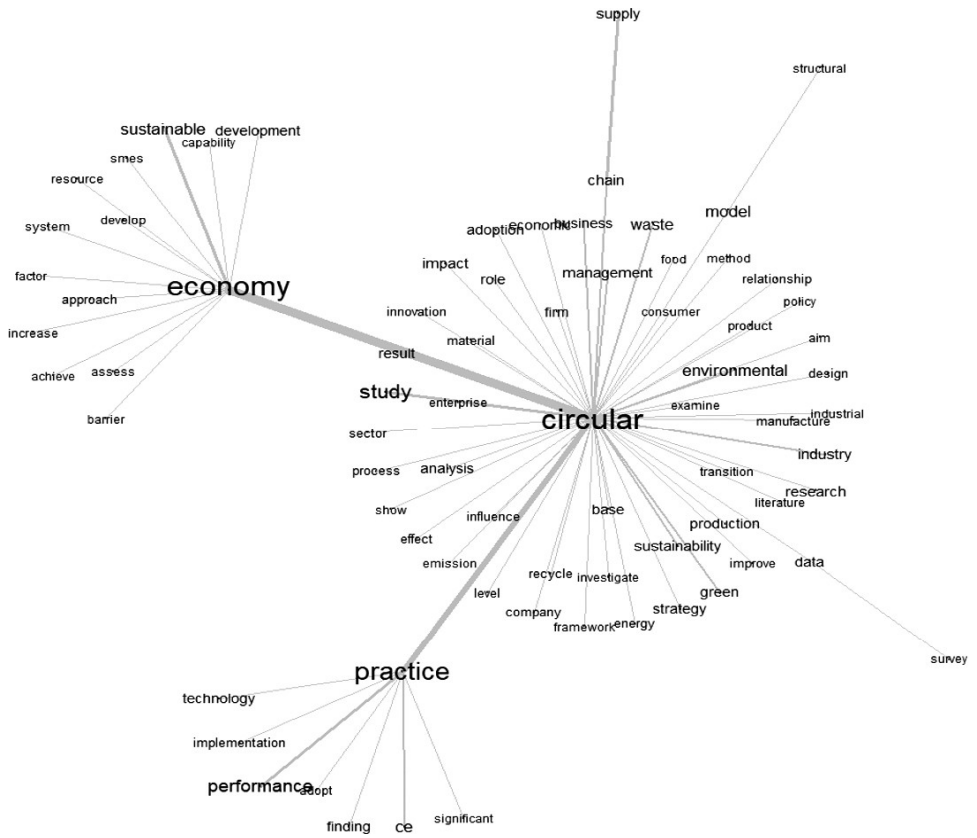


Figure 6: *Path analysis.*

Finally, the practical dimension of the circular economy concerns the translation of theoretical principles into concrete actions by industries, policymakers, and consumers. Practices such as eco-design, product-as-a-service models, and industrial symbiosis demonstrate how circular strategies can be operationalized in real-world contexts. The relationship between economy, circularity, and practice is dialectical: economic objectives drive the adoption of circular principles, circularity provides the conceptual foundation for these efforts, and practical implementation translates these principles into action. Together, these dimensions contribute to shaping a more sustainable socioeconomic model.

Theoretical implications

The findings of this review contribute to the theoretical development of circular economy research by suggesting that circular transitions are driven not only by operational practices but also by the interaction among organizational capabilities, institutional frameworks, technological readiness, and sustainability-oriented business strategies. The results support capability-based interpretations of circular economy implementation, suggesting

that dynamic capabilities, including collaboration, adaptability, innovation orientation, and supply chain flexibility, help explain the relationship between circular practices and sustainability performance.

Additionally, the study contributes to the emerging discussion of emotional durability in circular economy systems. Whereas traditional circular economy research has primarily focused on material recovery, recycling efficiency, and technical product optimization, the findings suggest that anthropomorphic product design and mechanisms of affective attachment may also contribute to extending product lifespans and reducing premature disposal. This perspective expands the existing circular economy literature by integrating behavioral and emotional dimensions into technical discussions of circularity.

Furthermore, the textometric classification developed in this study provides an integrative conceptual framework for organizing circular economy research across interconnected dimensions of operational practices, organizational capabilities, governance mechanisms, and technological systems. This integrative perspective contributes to reducing the fragmentation currently observed across circular economy literature.

Conclusions

This study aimed to identify the CE practices adopted by public and private organizations between 2012 and 2024 and examine the outcomes associated with their implementation. Using a PRISMA-based systematic literature review and textometric analysis of 164 scientific articles, the findings reveal that CE adoption has evolved from isolated waste management initiatives toward integrated organizational, technological, and policy-oriented transition strategies.

The results suggest that CE implementation is shaped by the interplay of organizational capabilities, technological readiness, governance mechanisms, and sustainability-oriented business practices. Across the reviewed literature, practices such as ecodesign, reuse, repair, remanufacturing, reverse logistics, advanced recycling, and renewable energy integration emerged as prominent mechanisms for extending product lifespans, reducing dependence on virgin resources, and improving environmental performance. Organizational capabilities, including collaboration, supply chain flexibility, environmental commitment, and innovation readiness, also emerged as important factors associated with the relationship between CE practices and sustainability performance.

From a theoretical perspective, this study contributes to the CE literature in three main ways. First, it develops an integrative taxonomy of CE practices through textometric classification, bringing together operational practices, organizational capabilities, technological enablers, and policy mechanisms within a unified analytical framework. Second, the findings support capability-based interpretations of CE transitions by highlighting the importance of organizational adaptability and interorganizational coordination alongside technical practices. Third, the study broadens current discussions of CE by incorporating emotional durability and anthropomorphic product design as emerging dimensions that may contribute to extending product lifespans and complementing technical circularity strategies.

The findings also indicate that CE implementation varies according to

organizational size, institutional context, and technological maturity. SMEs face persistent barriers, including financing constraints, inadequate technological infrastructure, regulatory complexity, and limited managerial capabilities. By contrast, large organizations may benefit from more developed governance structures, collaborative networks, and technological capabilities, which can facilitate the implementation of more advanced circular initiatives.

From a managerial perspective, the findings suggest that organizations should approach CE not only as an environmental strategy but also as a process of capability development that requires investment in collaboration, innovation, reverse logistics systems, and circular product design. Policymakers should prioritize coherent regulatory frameworks, financial incentives, legislation supporting repair activities, and industrial symbiosis initiatives to reduce implementation barriers, particularly for SMEs.

This study has several limitations. First, the review was restricted to journal articles indexed in selected scientific databases and published in English or Spanish, potentially excluding relevant research published in other languages or disseminated through grey literature. Second, although textometric analysis facilitates the identification of thematic structures across large bodies of literature, it may capture less contextual nuance than qualitative approaches such as meta-synthesis. Third, the rapid evolution of CE policies and technologies means that emerging practices may not yet be adequately represented in the analyzed corpus. Fourth, the textometric analysis captures lexical co-occurrence patterns in titles, abstracts, and keywords. Consequently, the identified relationships among practices, organizational capabilities, and outcomes should be interpreted as thematic associations rather than causal relationships or empirically validated effects.

Future research should investigate the relationship between emotional durability and technical circularity, particularly how anthropomorphic product design and affective attachment may influence long-term consumption patterns, product retention, and repair practices. Further studies could also examine sector-specific CE transitions, compare implementation patterns across developed and emerging economies, and investigate the roles of artificial intelligence, blockchain, and digital product passports in supporting scalable circular ecosystems.

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[1] *Note.* References marked with an asterisk (*) correspond to studies included in the systematic review corpus.

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Appendix A. Quality-assessment instrument and matrix of included studies

Table A1 presents the quality-assessment instrument applied to the full-text reports, and Table A2 lists the 164 studies included in the review with their scores on each criterion. Each criterion was scored as 1 (fully meets), 0.5 (partially meets), or 0 (does not meet).

Criterion	Description	Scoring
Research design	Clarity and appropriateness of the research design and methodology reported in the study.	0 / 0.5 / 1
Approach	Alignment of the study's focus with CE practices in public or private organizational contexts.	0 / 0.5 / 1
Generalizable findings	Extent to which the findings can be generalized beyond the specific case, sector, or sample.	0 / 0.5 / 1
Research question	Degree to which the study addresses the review question on CE practices adopted and their outcomes.	0 / 0.5 / 1
Impact rating	Impact of the publication source based on journal indicators (e.g., Impact Factor, JCI).	0 / 0.5 / 1

Table A1: *Quality-assessment instrument.*

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
1	Sustainable production: The economic returns of circular economy practices	Antonioli D.; Ghisetti C.; Mazzanti M.; Nicolli F.	0.5	1	0.5	0.5	1
2	An investigation into circular economy practices in the traditional wooden furniture industry	Susanty A.; Tjahjono B.; Sulistyani R.E.	1	1	1	1	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
3	Strategies to implement circular economy practices: A fuzzy DEMATEL approach	Khan S.; Haleem A.	0.5	1	1	0	1
4	Industry 4.0 and circular economy practices: A new era business strategies for environmental sustainability	Khan S.A.R.; Razzaq A.; Yu Z.; Miller S.	1	1	0.5	1	1
5	Digital technology and circular economy practices: future of supply chains	Khan S.A.R.; Piprani A.Z.; Yu Z.	1	1	1	0.5	1
6	Establishing linkages between circular economy practices and sustainable performance: the moderating role of circular economy entrepreneurship	Le T.T.; Behl A.; Pereira V.	1	1	1	1	0
7	Technological Revolution and Circular Economy Practices: A Mechanism of Green Economy	Khan S.A.R.; Umar M.; Asadov A.; Tanveer M.; Yu Z.	1	1	0.5	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
8	Digital technologies, circular economy practices and environmental policies in the era of covid-19	Khan S.A.R.; Ponce P.; Thomas G.; Yu Z.; Al-Ahmadi M.S.; Tanveer M.	1	1	1	1	1
9	Digital technology and circular economy practices: An strategy to improve organizational performance	Khan S.A.R.; Zia-ul-haq H.M.; Umar M.; Yu Z.	1	1	1	1	1
10	On the adoption of circular economy practices by small and medium-size enterprises (SMEs): does "financing-as-usual" still matter?	Ghisetti C.; Montresor S.	0.5	1	1	0	1
11	Evaluating the adoption of circular economy practices in industrial supply chains: An empirical analysis	Elia V.; Gnoni M.G.; Tornese F.	0.5	1	1	0	1
12	Electric vehicles lithium-ion batteries reverse logistics implementation barriers analysis: A TISM-MICMAC approach	Azadnia A.H.; Onofrei G.; Ghadimi P.	0.5	1	1	0	1
13	The use of circular economy practices in SMEs across the EU	Bassi F.; Dias J.G.	1	1	1	1	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
14	Understanding the effect of market orientation on circular economy practices: The mediating role of closed-loop orientation in German SMEs	Schmidt C.V.H.; Kindermann B.; Behlau C.F.; Flatten T.C.	1	1	1	1	1
15	Performance assessment of circular driven sustainable agri-food supply chain towards achieving sustainable consumption and production	Kumar M.; Sharma M.; Raut R.D.; Mangla S.K.; Choubey V.K.	0.5	1	0.5	0	1
16	Towards a circular economy: Implications for emission reduction and environmental sustainability	Hailemariam A.; Erdiaw-Kwasie M.O.	0.5	0	0.5	0	1
17	Organizational enablers for circular economy in the context of sustainable supply chain management	Hussain M.; Malik M.	1	1	0.5	0	1
18	The role of Fintech in circular economy practices to improve sustainability performance: a two-staged SEM-ANN approach	Siddik A.B.; Yong L.; Rahman M.N.	1	1	1	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
19	Technological innovation and circular economy practices: Business strategies to mitigate the effects of COVID-19	Khan S.A.R.; Ponce P.; Tanveer M.; Aguirre-Padilla N.; Mahmood H.; Shah S.A.A.	1	1	0.5	0	1
20	Circular economy and consumer acceptance: An exploratory study in East and Southeast Asia	Kuah A.T.H., Assoc Professor; Wang P., Assoc Professor	0.5	0	1	0	1
21	Adoption of circular economy practices in small and medium-sized enterprises: Evidence from Europe	Dey P.K.; Malesios C.; Chowdhury S.; Saha K.; Budhwar P.; De D.	1	1	1	1	1
22	Startups and circular economy strategies: Profile differences, barriers and enablers	Van Opstal W.; Borms L.	1	1	1	0.5	1
23	Supply chain management in the era of circular economy: the moderating effect of big data	Del Giudice M.; Chierici R.; Mazzucchelli A.; Fiano F.	1	1	1	1	1
24	Enhancing purchase intention in circular economy: An empirical evidence of remanufactured automotive product in Thailand	Pisitsankkhakarn R.; Vassanadumrongdee S.	1	0	1	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
25	The role of block chain technology in circular economy practices to improve organisational performance	Rehman Khan S.A.; Yu Z.; Sarwat S.; Godil D.I.; Amin S.; Shujaat S.	1	1	0.5	0.5	1
26	Investigation of circular economy practices in the context of emerging economies: a CoCoSo approach	Khan S.; Haleem A.	0.5	1	0.5	0	1
27	Unveiling the Role of Green Logistics Management in Improving SMEs' Sustainability Performance: Do Circular Economy Practices and Supply Chain Traceability Matter?	Zhou B.; Siddik A.B.; Zheng G.-W.; Masukujjaman M.	1	1	1	0.5	1
28	A SEM-ANN analysis to examine sustainable performance in SMEs: The moderating role of transformational leadership	Hidayat-ur-Rehman I.; Alsolamy M.	1	1	1	0.5	1
29	Do circular economy practices matter for financial growth? An empirical study in China	Yu Y.; Xu J.; Zhang J.Z.; Wu Y.; Liao Z.	0.5	1	1	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
30	Do circular economy practices moderate the wine tourism–green performance relationship? A structural analysis applied to the Spanish wine industry	Martínez-Falcó J.; Marco-Lajara B.; Zaragoza-Sáez P.C.; Millan-Tudela L.A.	0.5	1	1	1	1
31	The role of interorganizational collaboration and digital technologies in the implementation of circular economy practices—Empirical evidence from manufacturing firms	Schöggl J.-P.; Stumpf L.; Baumgartner R.J.	1	1	0.5	0	1
32	Ethical leadership, management control systems and circular economy in SMEs in an emerging economy, the UAE	Cheffi W.; Kaleem Zahir-ul-Hassan M.; Omer Farooq M.; Baqrain A.; Mohamed Habib Mansour M.	0.5	1	1	0	1
33	Do circular economy practices accelerate CSR participation of SMEs in a stakeholder-pressured era? A network theory perspective	Baah C.; Agyabeng-Mensah Y.; Afum E.; Kumi C.A.	0.5	1	1	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
34	An integrated measurement of the efficiency of China's industrial circular economy and associated influencing factors	Lu C.; Zhang Y.; Li H.; Zhang Z.; Cheng W.; Jin S.; Liu W.	0	0	0	0	1
35	Sustaining circular economy practices in supply chains during a global disruption	Dwivedi A.; Chowdhury P.; Paul S.K.; Agrawal D.	0.5	1	1	0	1
36	Impact of circular economy practices on supply chain capability, flexibility and sustainable supply chain performance	Malhotra G.	0.5	1	1	0.5	1
37	Circular economy practices among industrial emasregistered SMEs in Spain	Barón A.; de Castro R.; Giménez G.	0.5	1	0.5	0.5	1
38	The influence of artificial intelligence adoption on circular economy practices in manufacturing industries	Ronaghi M.H.	0.5	1	0.5	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
39	Beyond lean manufacturing and sustainable performance: are the circular economy practices worth pursuing?	Maldonado-Guzmán G.; Garza-Reyes J.A.	1	1	1	0.5	1
40	Adoption of Circular Economy by Construction Industry SMEs: Organisational Growth Transition Study	John I.B.; Adekunle S.A.; Aigbavboa C.O.	1	1	0.5	0	1
41	Risk assessment of circular economy practices in construction industry of Pakistan	Hassan M.S.; Ali Y.; Petrillo A.; De Felice F.	1	0	0.5	0	1
42	Are the Small- and Medium-Sized Enterprises in Developing Countries Ready to Implement Circular Economy Practices? An Empirical Quest for Key Readiness Factors	Ghosh S.; Raut R.D.; Mandal M.C.; Ray A.	0.5	1	1	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
43	Modeling and Analyzing the Impact of the Internet of Things-Based Industry 4.0 on Circular Economy Practices for Sustainable Development: Evidence From the Food Processing Industry of China	Sun X.; Wang X.	0.5	1	1	0	1
44	Circular economy practices in innovative and conservative stages of a firm's evolution	Kalar B.; Primc K.; Erker R.S.; Dominko M.; Ogorevc M.	0.5	1	1	0.5	1
45	Effects of circular economy practices on sustainable firm performance of green garments	Amin M.B.; Asaduzzaman M.; Debnath G.C.; Rahaman M.A.; Oláh J.	0.5	0	0.5	0.5	0
46	Indian automotive supply chains: barriers to circular economy for sustainable development	Nandha Gopan S.; Balaji M.	0.5	1	0.5	0	1
47	A multicriteria approach for assessing the maturity of supply chains regarding the implementation of circular economy practices in Brazil	Tietz Cazeri G.; Sigahi T.F.A.C.; Rampasso I.S.; de Moraes G.H.S.M.; Zanon L.G.; de Oliveira Gavira M.; Paulino Pires Eustachio J.H.; Leal Filho W.; Anholon R.	0.5	0	0.5	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
48	Economic and Environmental Efficiencies of Organizations: Role of Technological Advancements and Circular Economy Practices	Chishty S.K.	0.5	1	0.5	0	1
49	Modelling the Barriers to Circular Economy Practices in the Indian State of Tamil Nadu in Managing E-Wastes to Achieve Green Environment	Mahanth T.; Suryasekaran C.R.; Ponnambalam S.G.; Sankaranarayanan B.; Karuppiah K.; Nielsen I.E.	0.5	1	0.5	0	1
50	Circular economy and inclusion as effective tools to prevent ecological threats in rural areas during military operations	Shcherbak V.G.; Danko Y.I.; Tereshchenko S.; Nifatova O.; Dehtiar N.; Stepanova O.; Yatsenko V.	0	0	1	0	1
51	Energy Transition and Poverty Alleviation in Light of Environmental and Economic Challenges: A Comparative Study in China and the European Union Region	Derouez F.; Ifa A.; Al Shammre A.	0.5	0	0.5	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
52	Circular economy practices using the ReSOLVE framework: An assessment by sector and scale in the Brazilian planted tree industry	Sell L.G.; Tedesco M.; Simioni F.J.; Sehnem S.; Soares J.F.; Coelho Junior L.M.	1	1	0.5	0	0
53	An Analysis of the Circular Economy Practices of Pesticide Container Waste in Pakistan	Raza A.; Naqvi S.A.A.; Mehdi M.A.; Usman M.; Ali S.; Shah A.A.; Hussain B.	0.5	0	0.5	0	1
54	Developing an environmental assessment framework for an insect farm operating in circular economy: The case study of a Montréal (Canada) mealworm farm	Paris N.; Fortin A.; Hotte N.; Rasooli Zadeh A.; Jain S.; Hénault-Ethier L.	0.5	1	0.5	0.5	1
55	Eco-control systems and firm performance: Understanding the mediating role of circular economy practices and the moderating role of environmental uncertainty	Laguir I.; Stekelorum R.; Beysül A.; Mouadili O.; Segbotangni E.A.	1	1	1	1	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
56	Fintech Adoption and Banks' Non-Financial Performance: Do Circular Economy Practices Matter?	Lamey Y.M.; Tawfik O.I.; Durrah O.; Elmaasrawy H.E.	1	0	0.5	0	0
57	Assessing consumer knowledge, attitudes, and adoption of circular economy practices in Colombia	Henao-Hincapié L.J.; Leyes M.; Loeber-Vizcaíno G.E.; Cruz-Pérez A.; Romero-Perdomo F.; González-Curbelo M.Á.	0.5	0	0.5	0	1
58	Circular Economy Concept at the Micro-Level: A Case Study of Taruna Mukti Farmer Group, Bandung Regency, West Java, Indonesia	Latif A.; Cahyandito M.F.; Utama G.L.	0.5	0	0.5	0.5	1
59	Green-resilient model for smartphone closed-loop supply chain network design: A novel four-valued refined neutrosophic optimization	Saeed A.; Jian M.; Imran M.; Freen G.; ur Rehman Majid A.	0.5	1	0.5	0.5	1
60	Developing a plastic cycle toward circular economy practice	Nguyen T.T.A.; Ta Y.T.; Dey P.K.	0.5	1	0.5	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
61	The Covid-19 Pandemic—Opportunities for Circular Economy Practices Among Sewing Professionals in the City of Curitiba-Brazil	Corrêa H.L.; Corrêa D.G.	0.5	0	0.5	0.5	0
62	Getting to the bottom of food waste: identifying obstacles to effective circular economy practices in a Thai semi-urban context	Rado I.	0.5	0	0.5	0.5	1
63	DEVELOPMENT OF GUIDANCE FOR THE ADOPTION OF CIRCULAR ECONOMY IN CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT	Salleh H.; Ying C.K.; Hanid M.; Samad Z.A.; Sabli N.A.M.; Khuzzan S.M.S.	0.5	1	0.5	0	0

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
64	STUDYING THE RELATIONSHIP BETWEEN BLOCK CHAIN TECHNOLOGY AND CIRCULAR ECONOMY DIMENSIONS FROM PRODUCTION ASPECT AND ITS ASSOCIATION WITH ORGANIZATIONAL PERFORMANCE: A CASE STUDY OF PAKISTANI FIRMS	Batool H.; Ye X.; Wang T.	1	1	0.5	0	1
65	The impact of public procurement on the adoption of circular economy practices	Sun S.; Li W.; Sun X.; Lin X.	1	1	1	0.5	1
66	From linear to circular economy: The role of BS 8001:2017 for green transition in small business in developing economies	Pacheco D.A.D.J.; Rampasso I.S.; Michels G.S.; Ali S.M.; Hunt J.D.	0.5	1	1	0	1
67	Evaluation of relationship between nonmetallic mineral resources production and sustainable development	Wei X.; Su W.; Du C.	0.5	0	0.5	0	0

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
68	Enhancing the circular economy business model towards sustainable business performance: Moderating the role of environmental dynamism	Arsawan I.W.E.; Suhartanto D.; Koval V.; Tralo I.; Demenko V.; Azizah A.	0.5	1	1	0.5	1
69	Who Drives Circularity?—The Role of Construction Company Employees in Achieving High Circular Economy Efficiency	Dräger P.; Letmathe P.	0.5	1	0.5	0	1
70	From Waste to Wealth: Identifying the Economic Impact of the Recycling Sector in Malaysia	Utit C.; Rosland A.; Saari M.Y.; Rahman M.D.A.	0.5	0	0.5	0	1
71	Information systems capabilities value creation through circular economy practices in uncertain environments: A conditional mediation model	Riggs R.; Felipe C.M.; Roldán J.L.; Real J.C.	1	1	1	0	1
72	Digital transformation, incentives, and pro-environmental behaviour: Assessing the uptake of sustainability in companies' transition towards circular economy	Toșa C.; Paneru C.P.; Joudavi A.; Tarigan A.K.M.	1	1	0.5	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
73	EXAMINING CIRCULAR ECONOMY PRACTICES AND SUSTAINABILITY PERFORMANCE IN KNOWLEDGE-BASED COMPANIES IN IRAN	Khodaparasti R.B.; Garabollagh H.B.	0.5	1	1	0	0
74	The transition to a circular economy: different paths for international and non-international micro-manufacturing firms	Ahmadov T.; Foli S.; Durst S.; Gerstlberger W.	1	1	0.5	0.5	1
75	Circular economy and social life cycle assessment: The role of corporate renewable energy strategies, environmental justice, and environmental impacts	Le T.T.; Tran P.Q.; Dhar B.K.	1	1	0.5	1	1
76	Natural resource efficiency and the road to a green economy: From scarcity to availability	Yuyang L.	0.5	0	0.5	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
77	Demystifying circular economy and inclusive green growth for promoting energy transition and carbon neutrality in Europe	Shobande O.A.; Tiwari A.K.; Ogbeifun L.; Trabelsi N.	1	0	0.5	0.5	1
78	Exploring symbiotic supply chains dynamics	Fussone R.; Cannella S.; Dominguez R.; Framinan J.M.	1	1	0.5	0.5	1
79	A forest companies typology regarding their contribution to circular economy: a sustainability reporting-based analysis	Panori D.; Papaspyropoulos K.G.; Nikolaou I.E.	0.5	0	0.5	0	1
80	Potential of Lauryl Gallate as Stability and Recyclability Improver of Poly (Butylene succinate-co-adipate)	Rossi D.; Cappello M.; Filippi S.; Cinelli P.; Seggiani M.	0.5	0	0	0	1
81	Circular economy practices and corporate social responsibility performance: the role of sense-giving	Hong T.; Ou J.; Jia F.; Chen L.; Yang Y.	0.5	1	0.5	1	1
82	Impact of Bioplastic Design on Biodigestion Treatment	Oliver I.; Martínez-Pérez N.; Fullana A.; Conesa J.A.	0.5	0	0.5	0	1
83	Green marketing horizon: Industry sustainability through marketing and innovation	Chen G.; Sabir A.; Rasheed M.F.; Belascu L.; Su C.-W.	1	0.5	0.5	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
84	Synergistic Impact of Internet of Things and Big-Da-ta-Driven Supply Chain on Sustainable Firm Perfor-mance	Zhang Q.; Ullah A.; Ashraf S.; Abdullah M.	1	1	0.5	0.5	1
85	Green Logis-tics Practices Toward a Circular Economy: A Way to Sustainable Develop-ment	Verma A.	0.5	1	1	0.5	1
86	Consumer intentions to purchase remanu-factured products: a behavioral reasoning theory approach	Güngördü Belbağ A.; Belbağ S.	1	0	0.5	1	1
87	Circular Economy Practices for Net Zero: Analysis of Barriers in Indian Small and Medium Enterprises Context	Sabale D.B.; Kaswan M.S.; Rathi R.; Garza-Reyes J.A.; Yadav V.	0.5	1	1	0	0
88	Towards circularity in supply chains: The case of agtechs	Provensi T.; Sehnem S.; Lopes de Sousa Jab-bour A.B.	0.5	1	1	0	1
89	Precursors of circular economy practices	Agyapong D.; Ag-yapong G.; Frimpong S.E.	0.5	1	1	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
90	Circular Economy Practices and Sustainable Performance of the Textile and Apparel Industry: The Roles of Corporate Environmental Ethics and Green Self-efficacy	Alam S.S.; Masukujjaman M.; Ahsan M.N.; Kokash H.A.	1	1	1	1	0
91	EU-Focused Circular Economy Modelling of Rare Earth Element Waste in Mobile Phone Touch Screens by a System Dynamics Approach	Konyalıoğlu A.K.; Zhang N.; Bereketli I.	0.5	0	0.5	0	0
92	Assessing the peer effects of college students' engagement in the circular economy: Survey evidence from textbook reuse and recycling in China	Jia H.; Lin B.	0.5	0	0.5	0	1
93	Examining the Factors Influencing the Level of Circular Economy Adoption in Agriculture: Insights from Vietnam	Nguyen T.K.; Khue N.T.M.; Tran Q.P.; Anh N.T.Q.; Cuong L.K.; Du N.C.; Cuong C.V.; Thuong V.T.; Anh D.H.; Vu N.A.	1	1	1	1	0

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
94	Green supply chain management in the Southern Brazilian rice industry: A survey and structural analysis	Sellitto M.A.; Herrmann F.F.; Dias M.F.P.; Rodrigues G.S.; Butturi M.A.	1	1	1	0.5	1
95	Optimal ordering for Product-as-a-Service models with circular economy practices	Vishkaei B.M.	0.5	1	1	0.5	1
96	Competitive strategy and circular economy practice implementation toward corporate sustainability performance	Osei V.; Bai C.; Asante-Darko D.; Kwarteng A.	1	1	1	0.5	1
97	Impact of Organisational Factors on the Circular Economy Practices and Sustainable Performance of Small and Medium-sized Enterprises in Vietnam	Chowdhury S.; Dey P.K.; Rodríguez-Espíndola O.; Parkes G.; Tuyet N.T.A.; Long D.D.; Ha T.P.	1	1	1	0	1
98	Circular economy practices in SMEs: aligning model of green economic incentives and environmental commitment	Arsawan I.W.E.; Koval V.; Suhartanto D.; Hariyanti N.K.D.; Polishchuk N.; Bondar V.	1	1	1	0.5	0

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
99	Industry 4.0 technology and circular economy practices: business management strategies for environmental sustainability	Tang, YM; Chau, KY; Fatima, A; Waqas, M	1	1	1	1	0.5
100	Exploring environmental benefits of reuse and recycle practices: A circular economy case study of a modular building	Minunno, R; O'Grady, T; Morrison, GM; Gruner, RL	1	0	0.5	0.5	1
101	Eco-benefits assessment on urban industrial symbiosis based on material flows analysis and emergy evaluation approach: A case of Liuzhou city, China	Sun, L; Li, H; Dong, L; Fang, K; Ren, JZ; Geng, Y; Fujii, M; Zhang, W; Zhang, N; Liu, Z	1	1	1	1	1
102	Circular economy practices and industry 4.0 technologies: A strategic move of automobile industry	Yu, Z; Khan, SAR; Umar, M	0.5	1	1	1	1
103	Carbon footprints of urban transition: Tracking circular economy promotions in Guiyang, China	Fang, K; Dong, L; Ren, JZ; Zhang, QF; Han, L; Fu, HZ	0.5	0	1	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
104	Organisational identity and circular economy: Are inter and intra organisational learning, lean management and zero waste practices worth pursuing?	Agyabeng-Mensah, Y; Tang, L; Afum, E; Baah, C; Dacosta, E	0.5	1	0.5	0.5	1
105	Barriers to the adoption of circular economy practices in Micro, Small and Medium Enterprises: Instrument development, measurement and validation	Mishra, R; Singh, RK; Govindan, K	1	1	1	0.5	1
106	Impact of industry 4.0 technologies on sustainable supply chain performance: The mediating role of green supply chain management practices and circular economy	Karmaker, CL; Al Aziz, R; Ahmed, T; Misbauddin, SM; Moktadir, MA	0.5	1	0.5	0.5	1
107	What lies about circular economy practices and performance? Fresh insights from China	Chen, PY; Dagestani, A	0.5	1	1	1	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
108	Circular economy practices and environmental performance: Analysing the role of big data analytics capability and responsible research and innovation	Sahoo, S; Upadhyay, A; Kumar, A	1	1	0.5	0.5	1
109	Waste valorization of iron ore tailings in Brazil: Assessment metrics from a circular economy perspective	Vilaca, ASI; Simao, L; Montedo, ORK; De Oliveira, APN; Raupp-Pereira, F	0.5	1	1	0.5	1
110	Responsible governance mechanisms and the role of suppliers' ambidexterity and big data predictive analytics capabilities in circular economy practices improvements	Stekelorum, R; Laguir, I; Lai, KH; Gupta, S; Kumar, A	1	1	1	0.5	1
111	Green growth & sustainability transition through information. Are the greener better informed? Evidence from European SMEs	Chatzistamoulou, N; Tzylianakis, E	1	1	1	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
112	Industry 4.0 as an enabler of circular economy practices: Evidence from European SMEs	Findik, D; Tirgil, A; Özbugday, FC	1	1	0.5	1	1
113	Opening the black box of big data sustainable value creation: the mediating role of supply chain management capabilities and circular economy practices	Riggs, R; Roldan, JL; Real, JC; Felipe, CM	1	1	1	1	1
114	The contribution of circular economy practices on the resilience of production systems: Eco-innovation and cleaner production's mediation role for sustainable development	Le, TT; Ferraris, A; Dhar, BK	0.5	1	1	0.5	1
115	Circular economy practices as a tool for sustainable development in the context of renewable energy: What are the opportunities for the EU?	Jakubelskas, U; Skvarciany, V	1	0	1	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
116	Investigating the effects of the outbreak of COVID-19 on perishable food supply chains: an empirical study using PLS-SEM	Khan, SAR; Ponce, P	0.5	1	0.5	0	1
117	Pricing strategies in a dual-channel green closed-loop supply chain considering incentivized recycling and circular economy	Khorshidvand, B; Guitouni, A; Govindan, K; Soleimani, H	0.5	1	1	0.5	1
118	Data-driven insights for circular and sustainable food supply chains: An empirical exploration of big data and predictive analytics in enhancing social sustainability performance	Bag, S; Srivastava, G; Cherrafi, A; Ali, A; Singh, RK	1	1	1	0.5	1
119	Circularity measurement of external resource flows in companies: The circular flow tool	Barros, MV; Salvador, R; Gallego-Schmid, A; Piekarski, CM	0.5	0	1	0.5	1
120	Creating a sustainable future through Industry 4.0 technologies: Untying the role of circular economy practices and supply chain visibility	Junaid, M; Du, JG; Mubarik, MS; Shahzad, F	1	1	1	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
121	Industry 4.0 technologies and sustainable performance: do green supply chain collaboration, circular economy practices, technological readiness and environmental dynamism matter?	Shahzad, MF; Liu, HZ; Zahid, H	0.5	1	0.5	0.5	1
122	A methodology to assess circular economy strategies for sustainable manufacturing using process eco-efficiency	Nikolakis, N; Catti, P; Chaloulos, A; Kamp, WV; Coy, MP; Alexopoulos, K	0.5	1	1	0.5	1
123	Copper recovery from treatment of simulated copper-iron wastewater using fluidized-bed homogeneous crystallization technology	Jeremias, JS; Dalida, ML; Lu, MC	0.5	1	1	0.5	1
124	E-waste challenges of generative artificial intelligence	Wang, P; Zhang, LY; Tzachor, A; Chen, WQ	0.5	0	0.5	0.5	1
125	Additive manufacturing for sustainability, circularity and zero-waste: 3DP products from waste plastic bottles	Al Rashid, A; Koç, M	0.5	0	1	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
126	Enhancing sustainability in phosphate ore processing: Performance of frying oil as alternative flotation collector for carbonate removal	El-bahi, A; Taha, Y; Ait-Khouia, Y; Elghali, A; Benzaazoua, M	1	0	1	0	1
127	Sustainable green circular economic model with controllable waste and emission in healthcare system	Suthagar, KS; Mishra, U	0.5	0	0.5	0.5	1
128	Implications of circular strategies on energy, water, and GHG emissions in housing of the Global North and Global South	Keena, N; Rondinel-Oviedo, DR; De-los-Ríos, AA; Sarmiento-Pastor, J; Lira-Chirif, A; Raugei, M; Dyson, A	0.5	0	1	0.5	1
129	Processability predictions for mechanically recycled blends of linear polymers	van Gisbergen, J; den Doelder, J	0.5	0	1	0	1
130	Demystifying circular economy and inclusive green growth for promoting energy transition and carbon neutrality in Europe	Shobande, OA; Tiwari, AK; Ogbeifun, L; Trabelsi, N	1	0	1	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
131	Sustainable biosynthesis of squalene from waste cooking oil by the yeast Yarrowia lipolytica	Wang, SH; Sun, X; Han, YQ; Li, Z; Lu, XC; Shi, HR; Zhang, CY; Wong, A; Yu, AQ	0.5	0	0.5	0	1
132	Deepening big data sustainable value creation: insights using IPMA, NCA, and cIPMA	Riggs, R; Felipe, CM; Roldán, JL; Real, JC	N/A	N/A	N/A	N/A	1
133	Strategic pathways to achieve Sustainable Development Goal 12 through Industry 4.0: Moderating role of institutional pressure	Sharma, M; Singh, P; Tsagarakis, K	1	1	1	0.5	1
134	Dredged materials in Morocco: Current practices, policies, and roadmap for sustainable management	Safhi, AE; Mejjad, N; El FadilI, H; Bortali, M	1	0	0	0	1
135	Determinants of the transition towards circular economy in SMEs: a sustainable supply chain management perspective	Tan, H; Yan, Y; Wu, ZZ	1	1	1	1	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
136	Exploring the impact of goals and motivation on young consumers' sustainable plastic management behavior using the Theory of Reasoned Goal Pursuit	Islam, MH; Anam, MZ; Islam, MT; Sabbir, MM	1	0	0.5	0	–
137	Circular economy implementation and sustainability performance of the textile industry in an emerging economy	Ho, YH; Lin, CY	1	1	0.5	1	1
138	Developing an environmental assessment framework for an insect farm operating in circular economy: The case study of a Montreal al (Canada) mealworm farm	Paris, N; Fortin, A; Hotte, N; Zadeh, AR; Jain, S; Hénault-Ethier, L	1	1	0.5	0.5	1
139	Towards sustainable manufacturing: A comprehensive analysis of circular economy key performance indicators in the manufacturing industry	Aljamal, D; Salem, A; Khanna, N; Hegab, H	1	1	0.5	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
140	Unveiling the power of social value: Catalyzing circular economy in emerging market SMEs	Ayaz, O; Tatoglu, E	1	1	1	0.5	1
141	Integrating urban building information modeling and circular economy framework for green sustainability	Andriyani, N; Suprobo, P; Adi, TJW; Aspar, WAN; Jatmiko, AD; Santoso, AD	0.5	0	1	0.5	1
142	Key drivers for the adoption of circular economy practices in the tourist accommodation sector	Santos, MC; Veiga, C; Dantas, SS; Aguas, P; Santos, JAC	1	1	1	1	1
143	Unlocking sustainable performance through circular economy principles	Pillai, SG; Arasli, F; Haldorai, K; Rahman, I	1	1	0.5	0.5	1
144	Modeling the circular economy in food production: insights from a dynamic stochastic general equilibrium analysis	Moustabchir, A; Ouakil, H; EL Ouazzani, H	0.5	1	1	0.5	1
145	Analyzing the role of environmental policy innovations and natural resource management in driving circular economy forward: Evidence from BRICS economies	Wang, YB; Zhen, JQ; Wang, BC	1	0	1	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
146	Improving Soil Resilience and Crop Productivity Through Recycling of Spent Mushroom Substrate: A Transition Towards Circular Economy in Hill Agriculture	Annepu, SK; Pushpanathan, R; Karuppasamy, R; Palanisamy, S; Kurathalvar, K; Vanitha, SM; Barh, A; Shirur, M; Khatri, P	0.5	0	1	0.5	1
147	Barriers and influencing factors in the implementation of circular economy in Slovenian road transport	Brglez, K; Cucek, M; Kober, AA; Lukman, RK	1	1	0.5	0.5	1
148	Enhanced Nanocellulose Production from Cotton and Textile Waste Using Binary and Ternary Natural Deep Eutectic Solvents	Karimian, D; Anzuoni, V; Smania, Z; Orian, L; Gross, S; Carraro, M	0.5	0	1	0.5	1
149	Solvolysis and oxidative liquefaction of the end-of-life composite wastes as an element of the circular economy assumptions	Muzyka, R; Mumtaz, H; Sobek, S; Werle, S; Adamek, J; Semitekolos, D; Charitidis, CA; Tiriakidou, T; Sajdak, M	0.5	0	1	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
150	Biopolymer cryogels for enhanced adsorption of valuable metals from multi-metal waste after flocculation and precipitation	Braga, VHA; Fuentes, DP; Oliveira, P; Petri, DFS	0.5	0	1	0.5	1
151	Reused green glass for the production of low-density ceramic proppants	Anaya, R; Hernández, MF; Mocciaro, A; Richard, D; Rendtorff, NM	0.5	0	1	0	1
152	Methane production from the energy valorization of biomass and agro-industrial waste: an experimental approach for the bioenergy development in Rio Grande do Sul, Brazil	Nadaleti, WC; dos Santos, M; Gomes, J; de Souza, E; Missio, A; Delucis, R; Przybyla, G	0.5	1	1	0.5	1
153	Are university students really hungry for sustainability? A choice experiment on new food products from circular economy	di Santo, N; Califano, G; Sisto, R; Caracciolo, F; Pilone, V	1	0	0.5	0	1
154	The impact of TOURISM and seasonality on different types of municipal solid waste (MSW) generation: The case of Ibiza	Arbulú, I; Rey-Maquieira, J; Sastre, F	0.5	0	0.5	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
155	Linking methodologies to assess climate impacts and circular economy strategies along supply chains	Lahcen, B; Eyckmans, J; Brusselaers, J	1	0	1	0.5	1
156	Developing an extended producer responsibility system for solid waste management in Jordan using multi-criteria decision-making approach	Abu-Qdais, H; Al-Saleh, M	0.5	0	1	0.5	1
157	Multicriteria analysis as a supporting decision tool for expanding the use of the 3T method for waste-to-energy technologies and biorefineries	Isigonis, P; Moustakas, K; Vakalis, S	1	0	1	0.5	1
158	Reduction of Hexavalent Chromium to Trivalent Chromium using Sludge from Acetylene Gas Production	Zainuddin, NAM; Sarwani, NM; Puasa, SW; Ismail, KN	0.5	0	1	0	1
159	Industry 4.0 and cleaner production: A comprehensive review of sustainable and intelligent manufacturing for energy-intensive manufacturing industries	Shuaiyin Ma, Wei Ding, Yang Liu, Yingfeng Zhang, Shan Ren, Xianguang Kong, Jiewu Leng	0.5	0	0.5	0	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
160	Life cycle assessment applications to reuse, recycling and circular practices for textiles	Samuele Abagnato, Lucia Rigamonti, Mario Grosso	0.5	0	0.5	0	1
161	Possibilities for applying the circular economy in the aerospace industry: Practices, opportunities and challenges	Veruska Mazza Rodrigues Dias, Daniel Jugend, Paula de Camargo Fiorini, Carlos do Amaral Razzino, Marco Antonio Paula Pinheiro	0.5	1	0.5	0.5	1
162	Circular product design maturity matrix: A guideline to evaluate new product development in light of the circular economy transition	Marina Fernandes Aguiar, Daniel Jugend	0.5	1	1	0.5	1
163	Automating building element detection for deconstruction planning and material reuse: A case study	Matthew Gordon, Anna Batallé, Catherine De Wolf, Aldo Sollazzo, Alexandre Dubor, Tong Wang	0.5	0	1	0.5	1

No.	Title	Authors	Research design	Approach	Generalizable findings	Research question	Impact rating
164	Buildings and the circular economy: Estimating urban mining, recovery and reuse potential of building components	Mohit Arora, Felix Raspall, Lynette Cheah, Arlindo Silva	1	0	0.5	0	1

Table A2: *Matrix of the 164 included studies and quality-assessment scores.*