Mapping the Landscape: A Literature Review on Circular Economy Adoption

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The circular economy (CE) has emerged as a strategic framework to decouple economic growth from environmental degradation through resource efficiency, waste reduction, and closed-loop systems. The current study uniquely integrates the PRISMA protocol with the 5W1H analytical framework and bibliometric triangulation to bridge conceptual, behavioural, and policy perspectives within CE research. This study conducts a systematic literature review of 332 peer-reviewed articles from Scopus and Web of Science, applying the PRISMA methodology and the 5W1H analytical framework. Bibliometric and thematic analyses reveal five core research themes: technological innovation, circular business models, policy mechanisms, behavioural insights, and supply chain optimisation. While the United Kingdom and India lead in scholarly and policy contributions, the CE research landscape remains fragmented. Key gaps persist in digital nudging, behavioural adoption, and sector-specific applications. The study emphasises the need for interdisciplinary approaches and model-driven frameworks to foster systemic CE transitions. By mapping conceptual trends, theoretical linkages, and regional participation, this study provides a novel integrative synthesis and actionable implications for policymakers, researchers, and practitioners seeking to accelerate CE adoption.

Keywords: circular economy, CE adoption, CE practices, sustainable development, literature review
JEL *Classifications:* Q01, Q56, Q53, O44, M14

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Introduction

The foundations of circular economy (CE) can be traced back to the work of ecological theorists and environmental economists who emphasised closed-loop systems and resource regeneration, and the concept has garnered significant attention as a vital paradigm for sustainable develop-

ment and addressing global environmental challenges (Boulding 1966; Pearce and Turner 1990). CE builds on the concept of Industrial Ecology (IE) by addressing both the technological (such as industrial symbiosis) and cultural (such as stakeholder engagement) components essential for effective implementation. According to Beaurain et al. (2023), integrating cultural considerations with environmental efficiency is crucial for achieving national transition goals and widespread acceptance of CE.

This revolutionary approach to economic growth seeks to minimise waste, optimise resource use, and build long-term ecological resilience (Ellen MacArthur 2013; Stahel 2013). By shifting away from traditional linear production methods towards a regenerative economic system, CE aims to meet the needs of present and future generations while preserving environmental integrity (Stahel 2013).

The latest report on circularity (Circle Economy Foundation 2024) identifies a pressing need for circular economy adoption due to a substantial decrease in global circularity from 9.1% in 2018 to 7.2% by 2023. This downward trend, against a backdrop of escalating discourse on circular economy, underscores escalating material consumption levels and necessitates comprehensive systemic transformations through legislative amendments, financial realignment, and vocational enhancement. These findings underscore the imperative for collective, immediate action to advance circular practices and curb material extraction, thereby underscoring the topicality and relevance of this report's primary focus – leveraging circular economy as a viable pathway to sustainable development. However, achieving the full potential of CE requires stakeholders from all sectors to collaborate, remove barriers, and advance the transition to circularity through innovative solutions.

Despite the growing popularity of the CE model across various industries, numerous challenges remain, particularly for small and medium-sized enterprises (SMEs) that face resource constraints and ambiguous definitions of CE (Rittershaus et al. 2023). The lack of consensus on how to implement CE approaches in supply chains further complicates the effective adoption of CE practices (Elia et al. 2020). Recent behavioural shifts and technological advancements have significantly enhanced CE procedures, with companies increasingly embracing circularity to meet sustainability objectives (Ghisellini et al. 2018). However, successful CE implementation requires cooperative efforts across supply chains, regulatory support, and adaptive leadership (Soni et al. 2022; de Vass et al. 2023).

The promising potential of CE principles to drive sustainable growth is often hindered by several barriers, especially in economies with entrenched linear production systems (Ellen MacArthur 2013; Ghisellini et al. 2018). Overcoming these obstacles necessitates multi-stakeholder support and technological innovation (Chikwava et al. 2022; Jamwal et al. 2022). In particular, the adoption of standardised reporting frameworks like the Global Reporting Initiative (GRI) Standards and the integration of Industry 4.0 technologies can enhance transparency and foster broader CE adoption (Lei et al. 2023; Massari and Giannoccaro 2023).

Geographical variations in CE adoption are evident in the literature, with developed nations leading the way in circular business models and emerging economies navigating unique socioeconomic and environmental challenges (World Economic Forum 2014; Moorhouse and Moorhouse 2017). Consumer behaviour, particularly in waste-intensive sectors such as the textile industry, plays a significant role in the adoption of CE practices (Rajala et al. 2016; Hopkinson et al. 2018). Technological advancements in supply chain management, including digital supply chains and textile-to-textile recycling, underscore the importance of traceability and transparency in achieving CE goals (Sandvik and Stubbs 2019; Dwivedi and Paul 2022).

A thorough examination of the CE's widespread adoption across diverse sectors, geographical locations, and stakeholder groups reveals persisting knowledge gaps. Substantial groundwork for the CE has been laid theoretically by prior research, which highlights the importance of closed-loop systems, resource regeneration, and industrial symbiosis (Boulding 1966; Pearce and Turner 1990; Ellen MacArthur 2013). However, implementation remains hindered in practice, notably for SMEs, due to limitations in available resources, ambiguous definitions, and inadequate policy frameworks (Rittershaus et al. 2023; Kumar et al. 2022). The literature further indicates that although various Industry 4.0 technologies, supply chain innovations, and behavioural shifts have enhanced CE practices (Lei et al. 2023; Soni et al. 2022; Jain et al. 2022), disparities in adoption persist across developed and emerging economies, with existing models insufficiently integrating cultural, institutional, and behavioural dimensions (Beaurain et al. 2023; Chikwava et al. 2022). Recent 2022–2024 evidence shows that digital technologies such as IoT, AI, and blockchain are essential enablers of CE, but their effectiveness depends on complementary behavioural interventions related to trust, awareness, perceived risk, and incentives (Awana et al. 2024; Sonar et al. 2024; Jain et

al. 2022). Policy emphasis must therefore address both digital infrastructure and socio-cultural change to support firm-level and consumer-level circular practices. Furthermore, fragmented insights on consumer knowledge, prosumerism, and stakeholder engagement highlight the need for a holistic understanding of behavioural influences on CE uptake (Rajala et al. 2016; Hopkinson et al. 2018). These gaps underscore the necessity for a structured and evidence-based synthesis of the diverse CE adoption literature. To address this, the present study conducts a Systematic Literature Review (SLR) guided by the 5W1H framework – examining the who, what, where, when, why, and how of CE adoption – and employs the PRISMA protocol to ensure methodological transparency and replicability. This approach enables a comprehensive and contextualised analysis of CE adoption, bridging theoretical, practical, and regional gaps while offering actionable insights for policymakers, practitioners, and researchers working to accelerate circular transitions.

A Systematic Literature Review (SLR) approach is particularly well-suited for this study because it ensures transparency, replicability, and methodological rigour in synthesising the rapidly expanding body of CE research (Agnusdei et al. 2022; Johri et al. 2024; Varma et al. 2023). Unlike narrative reviews, which may introduce subjectivity, SLR employs a structured, evidence-driven process for identifying, screening, and evaluating pertinent studies (Page et al. 2021). This process minimises researcher bias and offers robust insights into key themes, trends, and research gaps within the CE field (Geissdoerfer et al. 2017; Ghisellini et al. 2016). Moreover, adopting the 5W1H framework – recognised for enhancing clarity, comprehensive coverage, and systematic organisation in literature reviews (Jia and Yu 2013; Siju and Shivdas 2024) – facilitates an in-depth mapping of CE adoption by systematically exploring what has been investigated, the significance of these studies, application contexts in terms of location and time, the primary stakeholders involved, and the approaches to implementation across diverse settings (Beaurain et al. 2023; Soni et al. 2022).

Despite the exponential growth of circular economy literature, existing reviews remain fragmented, either focusing solely on bibliometrics or on narrow industry perspectives. None combines the 5W1H analytical lens with PRISMA-based systematic synthesis to map the who, what, where, when, why, and how of CE adoption. This study contributes originality by integrating quantitative bibliometric evidence with qualitative thematic interpretation, revealing under-explored behavioural, institutional, and

digital-transition dimensions that influence CE adoption. Following are the set of objectives that this research is intended to achieve.

1. To identify dominant research themes, key authors, and regional trends in CE adoption.
2. To explain how 5W1H dimensions structure the CE adoption discourse.
3. To bridge bibliometric and thematic insights through a synthesised conceptual model.
4. To derive policy and managerial implications for accelerating circular transition.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature through multiple perspectives, while Section 3 outlines the research methodology. Section 4 presents the results and discussion, and Sections 5 and 6 conclude with the study's implications and future research directions.

LITERATURE REVIEW

This section synthesises existing scholarship on the CE, tracing its conceptual evolution, practical advancements, and global adoption pathways. It integrates foundational definitions, technological and behavioural insights, and implementation challenges across regional contexts.

OVERVIEW AND DEFINITION OF THE CIRCULAR ECONOMY

The CE concept originates from ecological and environmental economics, emphasising closed-loop systems and resource regeneration (Boulding 1966; Pearce and Turner 1990). Positioned as a response to rising environmental pressures, CE promotes sustainability through efficient resource use and waste minimisation. Building on industrial ecology, CE integrates cultural and technical dimensions – such as stakeholder collaboration and industrial symbiosis – to enable system-wide transitio£n (Beaurain et al. 2023).

Despite its growing prominence, CE adoption remains uneven. SMEs face definitional ambiguity, resource limitations, and capability constraints (Rittershaus et al. 2023). In manufacturing, CE principles support sustainable production, yet supply-chain integration remains a major bottleneck (Elia et al. 2020). Overall, the literature stresses the need for clear frameworks and coordinated adoption strategies.

ADVANCEMENTS IN CIRCULAR ECONOMY PRACTICES

Technological progress and evolving business behaviour continue to strengthen CE implementation (Ellen MacArthur 2013; Ghisellini et al. 2018). Firms increasingly adopt waste reduction, lifecycle management, and resource optimisation practices. Leadership and distributed decision-making also enhance CE adoption in SMEs, particularly in developing regions (Soni et al. 2022).

Empirical studies highlight the importance of supportive governance structures, as seen in the Brazilian brewing sector, where policy gaps impede adoption (Sehnem et al. 2021). Across wood manufacturing, CE uptake is shaped by leadership commitment and supply-chain collaboration (de Vass et al. 2023). Integration of Industry 4.0 technologies – such as IoT, AI, and automation – further enhances CE efficiency and transparency (Lei et al. 2023). Transparency standards, including GRI 301 and GRI 302, are increasingly applied to strengthen reporting and drive CE adoption in SMEs (Massari and Giannoccaro 2023).

POSSIBILITIES AND IMPLEMENTATION CHALLENGES

While CE offers a viable pathway to sustainable growth, economies rooted in linear production face barriers such as regulatory gaps, organisational inertia, and infrastructural limitations (Ellen MacArthur 2013; Ghisellini et al. 2018). Studies emphasise the need for multi-stakeholder coordination and technological innovation to overcome these constraints.

Logistical and financial barriers hinder organic waste recovery systems, underscoring the need for improved infrastructure (Chikwava et al. 2022). In manufacturing, blockchain-enabled systems help resolve sustainability challenges across resources, waste, and quality (Jamwal et al. 2022).

Institutional, organisational, and cultural barriers remain prominent, especially where stakeholder engagement and socio-cultural norms shape CE adoption (Beaurain et al. 2023). Studies integrating Industry 4.0 technologies demonstrate improved circular logistics and reverse-flow management (Agnusdei et al. 2022). Policy gaps, insufficient incentives, and low awareness also impede CE implementation in food and agricultural supply chains (Kumar et al. 2022; Sonar et al. 2024).

Consumer acceptance plays a key role. For instance, performance expectancy, attitudes, and contamination-risk concerns influence adoption

of blockchain-enabled e-commerce platforms for second-hand clothing in India (Jain et al. 2022). Scientometric evidence shows a shift from early CE research topics toward logistics, Industry 4.0, and food supply chains (Varma et al. 2023).

REGIONAL PLANS AND WORLDWIDE PERSPECTIVES

Early CE scholarship often highlighted China due to its pioneering national strategies and large-scale industrial initiatives; however, the bibliometric evidence from this review shows a more globally distributed research landscape. In particular, the United Kingdom and India now emerge as leading contributors in terms of publication output and collaborative activity. Therefore, this study adopts a global perspective recognising that CE transitions increasingly draw on diverse regional experiences.

Industrialised regions, especially the EU and the UK, continue to advance circular business models and policy frameworks, supported by strong regulatory alignment and innovation-driven agendas (World Economic Forum 2014; Moorhouse and Moorhouse 2017). At the same time, emerging economies such as India adapt CE principles to their specific socio-economic and environmental contexts, reflecting different institutional capacities and implementation pathways. Together, these regional variations underscore that CE development is shaped by both global policy momentum and localised conditions influencing adoption.

CUSTOMER KNOWLEDGE AND CONDUCT IN THE ADOPTION OF THE CIRCULAR ECONOMY

The adoption of CE techniques is heavily influenced by consumer behaviour, especially in industries like textiles where fast fashion generates a lot of waste (Rajala et al. 2016; Hopkinson et al. 2018). Prosumerism emphasises the necessity for consumer knowledge and engagement while erasing the distinction between producers and consumers. It also signals societal moves towards circularity.

COORDINATION OF THE SUPPLY CHAIN AND TECHNOLOGICAL ADVANCEMENTS

Supply-chain transparency, traceability, and technological integration are critical enablers of CE. Closed-loop systems such as textile-to-textile recycling demonstrate the need for improved collection, sorting, and reporting mechanisms (Sandvik and Stubbs 2019).

Industry 4.0 technologies – including 3D printing, digital supply chains, and IoT – transform CE implementation by enhancing operational efficiency, governance, and sustainability (Marić et al. 2023; Dwivedi and Paul 2022). Combined frameworks of Industry 4.0 and CE help address SSCM (Sustainable Supply Chain Management) barriers and support sustainable logistics (Yadav et al. 2020). Green technology adoption also strengthens organisational performance, moderated by environmental dynamism and innovation capabilities (Chaudhuri et al. 2023).

Existing CE studies converge on resource efficiency and industrial ecology but diverge in behavioural and institutional coverage. The limited integration of cultural and policy variables constrains theory development. Hence, this paper's integrative 5W1H-PRISMA design systematically unites these strands to overcome the conceptual fragmentation observed above.

TABLE 1 Evolution and Comparison of CE Definitions and Frameworks

Definition / How CE is Framed in the Paper	Framework Components	Relevance to Present Study	Author(s)
'Earth as a closed economy of matter' – finite resources must be cyclically used.	Foundational ecological framing of closed material loops.	Historical basis for sustainability logic in CE.	Boulding (1966)
Waste from one process becomes input for another; economic internalisation of externalities.	Economic interpretation of circular material flow.	Economic anchor for CE efficiency models.	Pearce and Turner (1990)
'An industrial system that is restorative or regenerative by design.'	Three principles: design out waste; keep materials in use; regenerate natural systems.	Widely adopted operational model for CE.	Ellen MacArthur (2013)
CE as organisational transformation maintaining product value and minimising waste across lifecycles.	Skills, roles, and design for CE.	Anchors behavioural/ capability dimensions.	De los Rios and Charnley (2017)
CE aims to radically improve resource efficiency by eliminating 'waste' and closing technocycles and biocycles.	Technology-driven circularity (3D printing).	Links technology to 'how' in 5W1H.	Despeisse et al. (2017)
CE/GSCM integration enhances firm performance through closed-loop supply chains.	Supply-chain and operations perspective.	Supports 'where/how' of CE adoption.	Geng et al. (2017)

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TABLE 1 *Continued from the previous page*

Definition / How CE is Framed in the Paper	Framework Components	Relevance to Present Study	Author(s)
'An economic system that replaces the 'end-of-life' concept with reducing, reusing, recycling, and recovering materials.'	Integrates 3Rs and systemic change.	Definitional anchor for bibliometric keywords.	Kirchherr et al. (2017)
'A regenerative system minimising resource input, waste, emissions and energy leakage by slowing, closing and narrowing loops.'	Three strategic loops: slowing, closing, and narrowing.	Supports 'how/why' analytical dimensions.	Geissdoerfer et al. (2017)
CE supply chains are restorative systems with infinite reuse/ remanufacture loops.	Circular supply-chain barriers/enablers.	Highlights developing-country context.	Mangla et al. (2018)
CE adoption depends on leadership, HR skills, and behavioural change.	Human/behavioural side of CE.	Supports behavioural cluster.	Chiappetta Jabbour et al. (2019)
Defines CE transition in cities as 'a systemic change to urban metabolism that retains resources in closed loops.'	Urban and policy dimension.	Extends CE to urban systems – new 'where'.	Sanches and Bento (2020)
CE capability development shaped by institutional pressures and resources; digital technologies mediate adoption.	Institutional and RBV integration.	Provides theoretical linkage.	Bag et al. (2021a)
CE transitions in SMEs rely on adoption of Industry 4.0 technologies and ethical governance.	SME focus, digital enablement.	Practical 'who/how' linkage.	Kumar et al. (2021)
'The CE is an alternative to the linear 'take–make–waste' model; it regenerates, keeps materials in use, and reduces pollution.'	Digitalisation and CE integration.	Adds 'digital circularity' framing for 2022.	Chauhan et al. (2022)
CE business models (PSS, sharing, remanufacturing) face specific drivers and barriers.	Business-model perspective.	Informs 'what' and policy implications.	Hina et al. (2023)
'CE has emerged as a viable way to achieve sustainable development through circular start-ups.'	Entrepreneurial and HR barriers to CE.	Extends CE discourse to start-ups and employment ecosystems.	Awana et al. (2024)

NOTE Chronological comparison of major CE definitions and frameworks demonstrating the evolution of the concept from early ecological systems thinking to digitally-enabled, policy-integrated models.

SOURCE Compiled by authors from seminal and recent CE publications

Table 1 shows the chronological evolution of CE definitions from early ecological framings (1966) to contemporary digitally enabled and entrepreneurial perspectives (2022–2024). Over time, CE conceptualisation has expanded from closed-loop resource logic to systemic, behavioural, technological, and supply-chain dimensions. This progression demonstrates a broadening of CE theory and directly informs this study's integrative 5W1H-PRISMA approach by linking historical foundations with modern digital and institutional developments.

Methodology and Search Strategy

Scholarly interest in sustainability practices has increased manifold, which has prompted a multifaceted examination of CE and its adoption (Geissdoerfer et al. 2017; Kirchherr et al. 2017; Korhonen et al. 2018). This diversity of perspectives makes it more difficult to assess the successes of the subject and comprehend its current status, which poses a barrier to upcoming scholars looking for direction and insight into new research. Thus, Systematic Literature Reviews (SLR) and Bibliometric Analysis (BA) studies are intended to bridge the knowledge gap left by the wide-ranging literature. SLR is referred to as a qualitative methodology and BA is considered a quantitative methodology and thus brings a holistic approach to the literature review. To address the knowledge gap the research objectives are designed on the questions using the 5W1H pattern, which is an abbreviation for Who, What, Where, When, Why, and How (Callahan 2014). This framework helps to organise our systematic literature review on the adoption of circular economy by defining the questions and identifying the suitable approaches to achieve it (Table 2).

The research paper used PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to have a systematic process which involves identification, screening, eligibility testing, and inclusion of literature for bibliometric analysis and systematic literature reviews (Johri et al. 2024).

To ensure comprehensive coverage and logical structuring of the literature, this review adopts the 5W1H analytical framework (Who, What, Where, When, Why. and How) for synthesising findings. The 5W1H framework was preferred over alternative review approaches such as TCCM (Theory-Context-Characteristics-Method) (Paul and Criado 2020) and bibliometric coupling (Zupic and Čater 2014), as it offers a question-driven and integrative mapping pattern. Prior research has

TABLE 2 5W1H Research Framework for Circular Economy Adoption Study

Dimension	Refined Research Question (RQ)	Approach Used to Achieve It
Who	RQ1.Who are the most active researchers and institutions contributing to circular economy adoption?	Performed bibliometric analysis and country co-occurrence analysis using VOSviewer.
Why	RQ2. Why is adoption of circular economy practices emphasised in business and management research?	Thematic synthesis of literature (abstracts, conclusions) to uncover motivations, gaps, and objectives.
What	RQ3. What are the major constructs and themes studied in relation to circular economy adoption?	Conducted keyword co-occurrence and cluster analysis to identify dominant research themes.
Where	RQ4. Where is the research most concentrated in terms of geography and publication venues?	Bibliometric analysis used to track publication countries and source journals from the datasets.
When	RQ5. When did the interest in circular economy adoption rise, and what are the publishing trends?	Analysed publication year metadata to identify growth trends and research evolution over time.
How	RQ6. How are research concepts interlinked, and what models or frameworks are being proposed?	Examined inter-theme relationships and framework discussions via full-text review and citation mapping.

demonstrated that 5W1H facilitates systematic exploration of emerging domains by linking descriptive bibliometric data with interpretive thematic analysis (Jia et al. 2016; Jia and Yu 2013). Given the circular economy's multi-dimensional and interdisciplinary nature (Korhonen et al. 2018), employing this framework strengthens conceptual clarity, enhances cross-theme triangulation, and improves the interpretive depth of the synthesis. The review methodology involved three major steps: (1) completing a thorough search and preliminary review, (2) conducting a bibliometric analysis, and (3) performing a thematic synthesis.

DATA GATHERING AND KEYWORD SELECTION

In line with PRISMA guidelines, the search was conducted using Scopus and Web of Science (WoS) to ensure comprehensive coverage of high-quality, peer-reviewed literature. The keywords 'circular economy' and 'adoption' were used for conceptual precision; however, the multi-stage PRISMA screening process enabled the inclusion of studies that

addressed CE adoption implicitly through related themes such as business models, technology, supply chains, behaviour, and policy. To ensure objectivity, all records retrieved from WoS and Scopus were screened using predefined inclusion and exclusion criteria based on relevance, peer-review status, and conceptual alignment with CE adoption. The final dataset, therefore, reflects transparent PRISMA-based selection rather than author preference, and its size is consistent with comparable CE systematic reviews.

Beyond the quantitative clustering, a qualitative thematic content analysis of the abstracts and conclusions of all 332 articles was conducted to extract behavioural, institutional, and policy-related insights that complement the bibliometric patterns.

SEARCH STRATEGY AND RESULTS

The terms 'adoption' and 'circular economy' were combined to create a methodical search approach that was intended to find pertinent research records. Although the primary keywords used were 'circular economy' and 'adoption', the PRISMA screening process allowed the inclusion of studies where CE adoption themes appeared implicitly in the title, abstract, keywords, or full text. This ensured that relevant work on business models, technology, institutional drivers, behaviour, and supply chains was captured despite the focused initial search terms. The data was sourced from 2010 to 2024 to provide rich data sets for conducting an intensive study. For analysis we used the operators 'TITLE-ABS-KEY' and 'TS =' on SCOPUS and Web of Science databases, respectively, to guarantee inclusivity. The filters applied were: document type = article; language = English; subject area = Business, Management & Accounting; publication year = 2010–2024.

RESULTS REFINEMENT AND DATA EXTRACTION

In order to further refine the search results, inclusion criteria were used. Publications specifically pertaining to the fields of Accounting, Management, and Business were included. Furthermore, a language filter (English) and a document type filter (articles only) were used. Through the use of keywords and publishing stage, the results were further refined. Web of Science provided a total of 212 refined articles, while Scopus produced 299 articles following the comparable refining procedures. A further 93 reports were excluded after each article was screened to determine its applicability to the research topic based on its title, keywords,

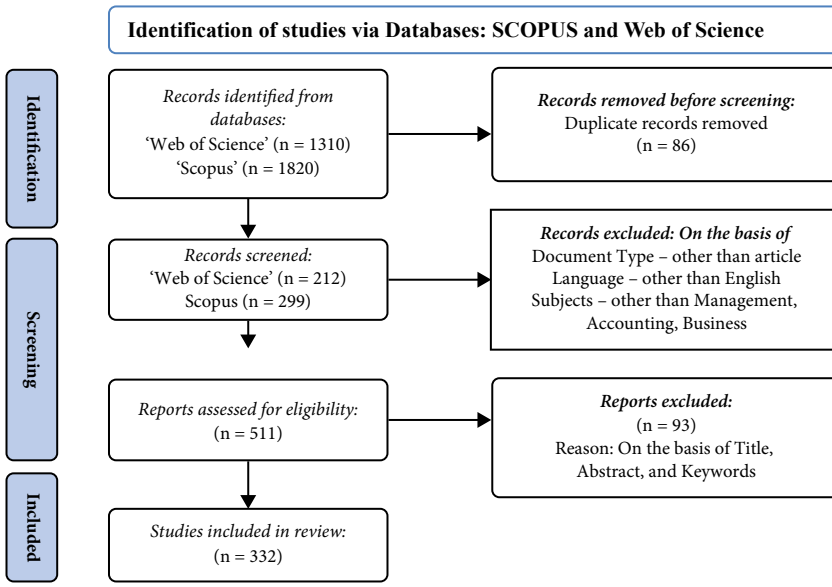

FIGURE 1 PRISMA Flow Diagram for Bibliometric Analysis

NOTE PRISMA flow diagram depicting the screening and selection process of articles from Scopus and Web of Science (2010–2024). The diagram illustrates removal of duplicates, exclusion, and final inclusion (n = 332), confirming transparency and reproducibility of the review protocol.

and abstract, resulting in 332 unique articles to conduct the BA. From the chosen articles, pertinent data – such as abstract, findings, conclusions and bibliographic details – were extracted for further examination. As per Page et al. (2021), we followed the PRISMA 2020 (fig. 1) standards for conducting this systematic literature review to guarantee thorough and lucid documenting.

Results and Discussion

RQ1 'WHO' – MOST ACTIVE RESEARCHERS AND INSTITUTIONAL CONTRIBUTIONS TO CE ADOPTION

Distinguished authors with the highest number of publications and citations are identified.

- Anil Kumar leads with the most publications at 8, followed by Sunil Luthra with 7.
- Six articles by Sergio Ulgiati and Patrizia Ghisellini attest to their notable contributions.

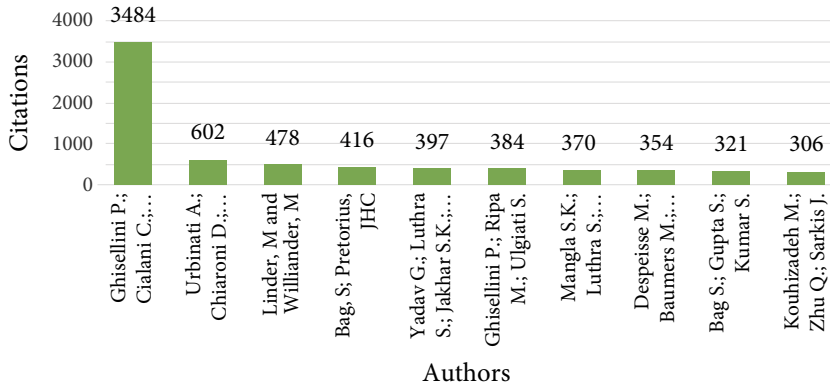

FIGURE 2 Distinguished Authors with the Highest Citations

- Additionally, a strong group of active researchers is indicated by the five publications each of Sachin Kumar Mangla, Surajit Bag, Jose Arturo Garza-Reyes, Soumyadeb Chowdhury, Ana Beatriz Lopes de Sousa Jabbour, and Simone Sehnem. According to the data, these authors are productive and influential and their significant output highlights the field's collaborative and ongoing engagement and points to avenues for future research collaborations and breakthroughs.

Leading researchers in the subject have notable differences in their citation counts, as seen by the chart (fig. 2) displaying the authors with the most citations. With 3,484 citations, Patrizia Ghisellini, Catia Cialani and Sergio Ulgiati, for their paper titled, 'A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems', substantially outperform other authors. This demonstrates their significant impact and the academic community's broad acknowledgement of their contributions. Andrea Urbinati, Davide Chiaroni and Vittorio Chiesa, with 602 citations for the paper titled 'Towards a new taxonomy of circular economy business models', and Marcus Linder and Mats Williander, with 478 citations for their paper titled 'Circular business model innovation: Inherent uncertainties', are the third most referenced authors, showing a strong but relatively lesser influence.

There are several other authors with citation counts ranging from 306 to 416. This distribution implies that the area has a number of writers whose work has received only moderate attention, in addition to a small number of extremely significant academics. The fact that several authors

have more than 300 citations suggests a good mix of influential research contributions, but the notable difference between the most cited authors and the others highlights the extraordinary importance of Ghisellini, Cialani and Ulgiati's efforts. Below is a significant collection of research outputs from a select few leading institutions, highlighting the data on papers based on affiliations and emphasising their prominence in the field:

- With 15 documents, Politecnico di Milano leads among the contributors.
- The University of Derby and London Metropolitan University acquire second and third place, respectively, with 13 and 12 documents each.
- EM Normandie Business School, O.P. Jindal Global University, the National Institute of Technology, and Graphic Era (Deemed to be University) are among the other noteworthy institutions, with each contributing between 10 and 11 documents.
- Mid-level contributors with 8–9 documents each include Aston Business School, University of Plymouth, Parthenope University of Naples, Universidade Estadual de Campinas, and others.

This pattern highlights the focused yet varied activities of top universities in different nations, demonstrating a cooperative and globally engaged research landscape. According to the data, these universities are actively participating in CE research, which highlights their important contribution to the field's advancement.

RQ2 'WHY' – WHY CE ADOPTION PRACTICES ARE EMPHASISED IN BUSINESS AND MANAGEMENT RESEARCH.

The adoption practices of the CE are a focus of business and management research because of their potential to improve resource efficiency, spur sustainable innovation, and revolutionise conventional business models. Through the review, a number of significant precursor elements impacting CE's acceptance were found and are shown in Table 3. A conceptual understanding of CE is provided by foundational frameworks and thorough reviews, such as Ghisellini et al. (2016). Linder and Williander (2017) and Mangla et al. (2018) highlight the practical difficulties in managing circular supply chains and putting circular business models into practice, particularly in developing economies. According to Yadav et al. (2020) and Despeisse et al. (2017), the incorporation of

TABLE 3 Preceding Factors and Resulting Factors Identified Through Literature

Authors (Year)	Preceding Factors (Themes)	Resulting Factors (Constructs studied)
Acerbi et al. (2022)	Environmental Innovations, Circular Economy Adoption, EU Firms	Circular Economy Adoption, Indian SMEs, Change Management
Bag et al. (2021b)	Resources for Industry 4.0 adoption and its effect on circular economy	Circular Economy Adoption, Sustainability Performance
Bag et al. (2021c)	Adoption of big data analytics-powered AI in manufacturing	Digital Manufacturing, Circular Economy Adoption, Barriers
Bag et al. (2021d)	Data Management, Circular Manufacturing, Reference Model	Integration of Digital Technologies in Circular Economy Practices
Bag et al. (2021)	Impact of Industry 4.0 on sustainable development and circular economy	Circular Economy Adoption, Indian SMEs, Change Management
Cainelli et al. (2020)	Resource-efficient eco-innovations in circular economy	Circular Economy Adoption, Indian SMEs, Change Management
Despeisse (2017)	Integration of 3D printing into circular economy	Integration of Digital Technologies in Circular Economy Practices
Dey et al. (2020)	Circular economy practices in SMEs	Circular Economy Adoption, Indian SMEs, Change Management
Dey et al. (2022)	Circular Economy Adoption, Sustainability Performance	Circular Economy Adoption, Indian SMEs, Change Management
Ghisellini et al. (2016)	Review on circular economy	Enhances resource efficiency, emphasises waste reduction, separates environmental impact from economic growth, advances renewable technologies, and fosters stakeholder collaboration
Ghisellini et al. (2018)	Using a circular economy in the building and demolition industries	Circular Economy Engagement, Circular Business Models (CBMs), and Motivation, Possibility, Ability, Signalling, Persuasion, Matching, Validating, Encouraging, and Empowering
Ghisellini and Ulgiati (2020)	Circular economy transition in Italy	Awareness and Psychological Barriers to Circular Economy Adoption
Guldmann and Huulgaard (2020)	Barriers to circular business model innovation	Circular Economy Adoption, Indian SMEs, Change Management

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TABLE 3 *Continued from previous page*

Authors (Year)	Preceding Factors (Themes)	Resulting Factors (Constructs studied)
Gupta et al. (2019)	Role of big data analytics in circular economy	Digital Manufacturing, Circular Economy Adoption, Barriers
Kouhizadeh et al. (2020)	Blockchain technology and circular economy	Circular Economy Adoption, Indian SMEs, Change Management
Kumar et al. (2021)	Barriers to Industry 4.0 and circular economy adoption in agriculture supply chain	Industry 4.0 Technologies, Circular Economy, Sustainable Development Goals
Linder and Williander (2017)	Challenges preventing the implementation of circular business models	Enablers, Rural Areas, Agri-Food Sector, Political Support, Institutional Environment, Stakeholder Collaboration, and Circular Business Models
Lopes de Sousa Jabbour et al. (2019)	Operations management in circular economy	Digital Manufacturing, Circular Economy Adoption, Barriers
Mangla et al. (2018)	Barriers to circular supply chain management in developing countries	Awareness and Psychological Obstacles to the Adoption of the Circular Economy
Park et al. (2010)	Integration of sustainable supply chain management in China's circular economy policy	Industry 4.0 Technologies, Circular Economy, Sustainable Development Goals
Patwa et al. (2021)	Adoption of circular economy in emerging economies	Circular Economy Adoption, Psychological Barriers, Awareness, Behavioural Choice Theory, Social Influence, Decision-making, Regenerative Economy
Prideaux et al. (2020)	Transformation of tourism industry towards circular economy	Circular Economy Adoption, Psychological Barriers, Awareness, Behavioural Choice Theory, Social Influence, Decision-making, Regenerative Economy
Ranta et al. (2018)	Business models in circular economy	Circular Economy Adoption, Indian SMEs, Change Management
Urbinati et al. (2017)	Taxonomy of circular economy business models	Circular Business Models, Enablers, Rural Areas, Agri-food Sector, Political Support, Institutional Environment, Stakeholder Collaboration
Yadav et al. (2020)	Industry 4.0 and CE as a framework for sustainable supply chain management	Digital Manufacturing, Circular Economy Adoption, Barriers
Jaeger and Upadhyay (2020)	Barriers to circular economy in manufacturing	Digital Manufacturing, Circular Economy Adoption, Barriers
Zucchella and Previtali (2019)	Circular business models for sustainable development	Circular Economy Adoption, Indian SMEs, Change Management

cutting-edge technology, such as Industry 4.0 and digital solutions like 3D printing, is crucial for CE adoption. Additionally, this shift is made possible by institutional settings, stakeholder cooperation, and political backing (Urbinati et al. 2017; Linder and Williander 2017). However, as Gupta et al. (2019) and Kouhizadeh et al. (2020) explain, psychological obstacles and a lack of understanding among stakeholders continue to be major challenges. Its importance in business and management study is further supported by the outcomes of implementing CE practices. The transformative potential of CE is demonstrated by the creation of fresh circular business models (Ghisellini et al. 2018; Urbinati et al. 2017), enhanced sustainability and resource efficiency (Bag et al. 2021b; Dey et al. 2022), and contributions to regenerative economies and sustainable development goals (Ranta et al. 2018; Park et al. 2010).

Additionally, CE techniques have sped up the adoption of big data analytics and digital manufacturing (Lopes de Sousa Jabbour et al. 2019; Bag et al. 2021b) and improved supply chain management (Jaeger and Upadhyay 2020; Yadav et al. 2020). This thorough research shows that adopting CE is not merely a response to environmental concerns but also a strategic necessity for businesses looking to remain innovative, competitive, and resilient over the long term in a world with limited resources.

RQ 3 'WHAT' – WHAT ARE THE MAJOR CONSTRUCTS AND THEMES STUDIED IN THE CONTEXT OF CE ADOPTION?

We have conducted keyword co-occurrences, cluster analysis, to identify the dominant research themes. BA has been conducted on the basis of co-occurrences of the keywords, co-occurrences of the countries, and co-citation analysis with the help of VOSviewer 1.6.19. For seeking the answers to further questions, a detailed review of the literature has been undertaken to identify studied constructs, themes, preceding factors and future outlook of the studies. Figure 3 shows a network visualisation of keyword co-occurrence which indicates the number of times a keyword is used by the researchers. It has been produced with the commonly used bibliometric software, VOSviewer 1.6.19 to process the combined databases. The analysis of the keyword co-occurrences was done through the full counting method and taking the minimum number of occurrences of a keyword as 15. Out of 1,237 keywords, 25 meet the threshold. The keywords are categorised into four clusters.

TABLE 4 Thematic Clusters from Keyword Co-occurrence and Their Conceptual Linkages

Cluster 1	Cluster 2	Cluster 3	Cluster 4
Barriers	Adoptions	Business Models	Industry
Economy	Circular Economy	Challenges	
Framework	Drivers	Industry 4.0	
implementation	Eco-innovation	Strategies	
Innovation	Impact	Supply chain management	
Model	Performance	Sustainable development	
SMEs	Technology		
Sustainability			

Table 4 integrates VOSviewer keyword clusters with theoretical and practical interpretations. The clusters reveal that CE adoption research has evolved from firm-level technological frameworks (cluster 1) and institutional drivers (cluster 2) toward business-model innovation (cluster 3) and digital-industrial applications (cluster 4). These align respectively with innovation diffusion, institutional, and socio-technical transition theories – demonstrating that CE scholarship increasingly connects abstract conceptual models with applied industrial practices.

The four clusters generated by VOSviewer (fig. 3; table 4) represent distinct yet interconnected theoretical streams within CE adoption. The first cluster corresponds to technological and innovation-oriented literature, drawing on the resource-based and diffusion-of-innovation perspectives. The second cluster reflects institutional and policy drivers

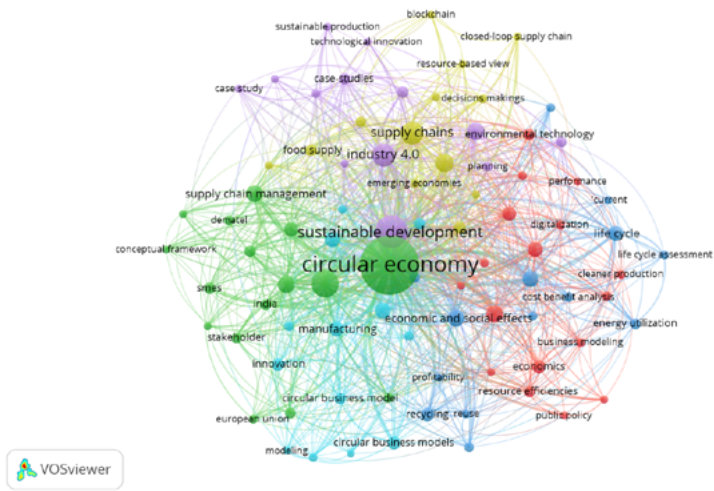

FIGURE 3 Network Visualisation of Co-occurrences of Keywords

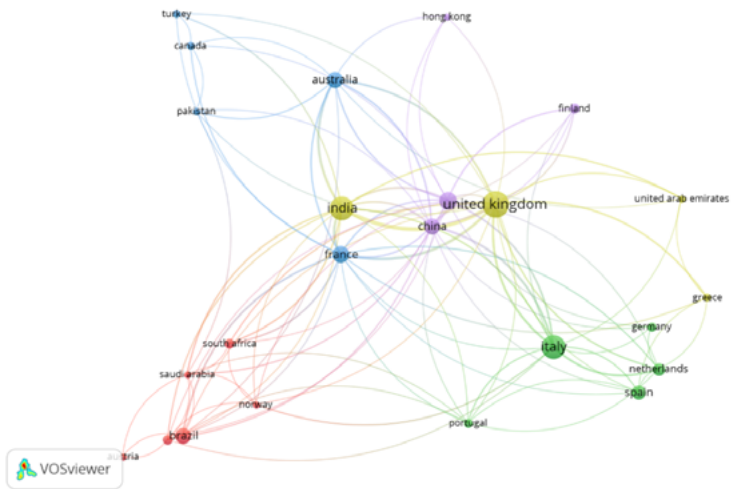

FIGURE 4 Network Visualisation of Co-occurrences of Countries

that legitimise CE practices. The third cluster emphasises business-model and supply-chain redesign, aligning with systems theory, while the fourth cluster represents the socio-technical transitions that integrate Industry 4.0 and industrial symbiosis. Together, these clusters illustrate a progressive evolution from conceptual models to actionable strategies – bridging theory with practice in the circular-economy discourse. The prominence of 'circular economy' and 'sustainable development' reflects conceptual centrality. These central keywords underscore the primary focus on sustainable practices and economic models that prioritise resource efficiency and environmental stewardship. Surrounding these core themes are several key clusters that represent different areas of emphasis within the field. For instance, the green cluster, with keywords like 'manufacturing', 'stakeholders', and 'circular business models', indicates a strong focus on practical implementations and strategic frameworks for achieving circular economy goals in manufacturing and stakeholder engagement contexts.

Other significant clusters include the yellow cluster, which focuses on 'supply chains', 'food supply', and 'Industry 4.0', suggesting an emphasis on integrating advanced technologies and innovations in supply chain management to support sustainability. The purple cluster, with keywords like 'sustainable production and 'closed-loop supply chain', emphasises creating closed-loop systems and enhancing sustainability in production processes. Additionally, the red cluster, featuring 'life cycle assessment'

TABLE 5 Three Clusters with Relatively Strong Network of Relation

Cluster 1	Cluster 2	Cluster 3
Austria	Turkey	Portugal
Brazil	Pakistan	Spain
South Africa	Australia	Italy
Norway	Canada	Netherlands
Saudi-Arabia	France	Germany

and 'cleaner production', highlights the evaluation of environmental and economic impacts throughout product life cycles. Finally, the blue cluster, which includes 'resource efficiency', 'policy', and 'public policy', indicates a strong interest in the economic and policy dimensions of sustainability and the circular economy. The dense interconnections among these keywords suggest a highly integrated research landscape, where advancements in one area can significantly influence progress in others, highlighting the need for collaborative and cross-disciplinary efforts to achieve sustainable development and circular economy goals.

Countries with larger partnerships and contributions to the field of circular economy are emphasised in figure 4, which displays the network visualisation of nation co-occurrences, showing collaborations between countries based on their publications, with the UK, India, Italy, and China forming central hubs of CE knowledge exchange. Five clusters have been identified, out of which three have a relatively strong network of relation. The clusters are categorised as in Table 5.

The complex global web of collaborative research partnerships is illustrated by the network visualisation of co-occurrences of countries. The emphasis on central hubs like the UK and India highlights their crucial involvement in global research initiatives. Their several international connections – for example, Australia and China for India, and China, Italy, France, and the United Kingdom for the United Kingdom – highlight their important role and active involvement in promoting cross-national research collaborations. Due to their prominent placement, these nations are likely major forces in the world of research, contributing significantly to joint projects and co-authored papers.

The visualisation also highlights many regional clusters. For example, Italy has a dense network of linkages with other European nations, including Germany, Portugal, the Netherlands, and Spain, indicating robust regional cooperation within Europe. South Africa and Saudi Arabia are only two of the Middle Eastern and South American nations with

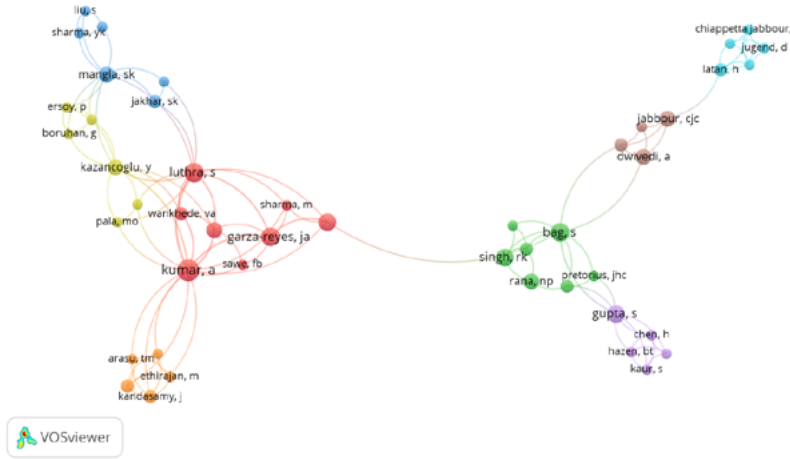

FIGURE 5 Co-authorship Analysis

which Brazil actively engages. Even if they are fewer, peripheral links connecting nations like Hong Kong, Finland, Canada, Pakistan, and Turkey nevertheless help to connect various regional clusters. These collaborative clusters are further highlighted by the colour-coded groups, which emphasise the dynamics of both regional and transcontinental research. This interconnected network is a reflection of the worldwide integrated research scene, and by comprehending these relationships, one can plan more inclusive research programmes and find possible new collaborations.

The co-authorship analysis (fig. 5) is used to understand the researchers' collaborations among each other and also reveals the research landscape. The current data reveals distinct clusters of researchers with limited inter-cluster collaboration. Notably, Sunil Luthra emerges as a central figure, acting as a bridge across multiple clusters and indicating a high level of collaborative engagement. Other prominent contributors include Rakesh Dattatraya Raut, Anil Kumar, Rohit Agrawal, and Sachin Kumar Mangla, all of whom show significant co-authorship ties within their respective clusters. The network is composed of several well-defined collaboration groups such as those predominated by Nripendra Pratap Rana (green cluster), Bengky Latan and Simone Sehnem (red cluster), and Jose Arturo Garza-Reyes (cyan cluster). However, the overall structure of the network suggests a fragmented research landscape, with relatively few connections between clusters. This fragmentation highlights

a need for greater interdisciplinary and cross-institutional collaboration to consolidate efforts in this research domain and foster more integrated scientific progress.

The identified clusters align with multiple theoretical foundations: Institutional Theory (Bag et al. 2021c), Resource-Based View (Yadav et al. 2020), and Behavioural Theory (Patwa et al. 2021). This triangulation clarifies how technological capabilities, institutional pressures, and individual attitudes jointly determine CE adoption.

RQ4 'WHERE' – WHERE IS RESEARCH MOST CONCENTRATED IN TERMS OF GEOGRAPHY AND PUBLICATIONS?

We undertook BA to track countries' publications and journals. In Table 6, we have identified the top 10 prestigious journals with the most citations, showcasing the best works in business, production, and sustainability study.

With 17,872 papers and 313,186 citations, the *Journal of Cleaner Production* is the most prominent publication, demonstrating its vital importance in environmental management research. Additional noteworthy

TABLE 6 Top 10 Distinguished Journals Based on Citations

Journals	Documents	Citations	CiteScore*	SJR**
Journal of Cleaner Production	17,872	313,186	17.5	2.058
Journal of Business Research	3,183	63,168	20.3	3.128
Technological Forecasting and Social Change	2,735	59,300	21.7	3.118
Business Strategy and the Environment	1,076	22,621	21.0	3.666
International Journal of Production Economics	1,070	18,064	16.9	3.074
Production Planning and Control	336	6,133	19.3	2.02
Research Policy	639	7,614	11.9	3.29
Journal of Enterprise Information Management	242	3,328	13.8	1.648
Tourism Geographies	209	1,869	8.9	2.617
Sustainability Accounting, Management and Policy Journal	190	1,642	8.6	1.197

*CiteScore measures average citations received per document published in the serial (as on 5 August,2024).
**SCImago Journal Rank measures weighted citations received by the serial. Citation weighting depends on subject field and prestige (SJR) of the citing serial.

NOTE Table 6 highlights the journals with highest impact in CE adoption research, showing dominance of sustainability, production, and business strategy outlets. The prominence of *Journal of Cleaner Production* and *Technological Forecasting and Social Change* reflects strong interdisciplinary anchoring of CE scholarship.

journals that have a substantial impact on corporate strategy and technological innovation include *Business Strategy and the Environment* and *Technological Forecasting and Social Change*. Both have a high number of citations and CiteScores of 21 and higher. With significant citation counts and high CiteScores, *Production Planning and Control* and the *International Journal of Production Economics* also demonstrate a considerable impact, highlighting their significance in the advancement of knowledge and research in production and economics.

With 3,183 documents and 63,168 citations, the *Journal of Business Research* stands out and is crucial to the field of business studies. Despite producing fewer papers, journals with notable citation counts and CiteScores that highlight their specialised impact in policy, tourism, in-

TABLE 7 Top Distinguished Documents with Highest Citations

Title of Paper	Author(s)	Citation Count*
A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems	Ghisellini et al. (2016)	3,484
Towards a new taxonomy of circular economy business models	Urbinati et al. (2017)	602
Circular business model innovation: Inherent uncertainties	Linder and Williander (2017)	478
Role of institutional pressures and resources in the adoption of big data analytics powered artificial intelligence, sustainable manufacturing practices, and circular economy capabilities	Bag et al. (2021c)	416
A framework to overcome sustainable supply chain challenges through solution measures of Industry 4.0 and circular economy: An automotive case	Yadav et al. (2020)	397
Exploring environmental and economic costs and benefits of a circular economy approach to the construction and demolition sector. A literature review	Ghisellini et al. (2018)	384
Barriers to effective circular supply chain management in a developing country context	Mangla et al. (2018)	370
Unlocking value for a circular economy through 3D printing: A research agenda	Despeisse et al. (2017)	354
Industry 4.0 adoption and 10R advance manufacturing capabilities for sustainable development	Bag et al. (2021)	321

NOTE * Citation count as on April, 2024.

Table 7 lists the most influential CE adoption papers, revealing strong foundational work in business models, technological enablers, and policy-driven CE transitions. These highly cited studies shape the conceptual and methodological direction of CE research.

formation management, and sustainability accounting, such as *Research Policy*, *Tourism Geographies*, *Journal of Enterprise Information Management*, and *Sustainability Accounting, Management and Policy Journal*, also significantly contribute. All things considered, these journals show a great deal of influence across a wide range of disciplines, furthering knowledge and study in their respective sectors.

The citation analysis in Table 7 highlights the most influential works shaping circular economy research. 'A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems' remains the field's most cited contribution, with 3,484 citations. This is followed by 'Towards a new taxonomy of circular economy business models' with 602 citations and 'Circular business model innovation: Inherent uncertainties' with 478 citations, reflecting strong scholarly interest in business-model perspectives. Technological and institutional themes are represented by 'Role of institutional pressures and resources in the adoption of big data analytics powered artificial intelligence, sustainable manufacturing practices, and circular economy capabilities' with 416 citations.

Additional contributions include research on applying Industry 4.0 to sustainable supply chain challenges, the economic and environmental effects of circular construction methods, obstacles to circular supply chain management in developing nations, value creation via 3D printing, and the implementation of Industry 4.0 for sustainable development. These studies have received between 321 and 397 citations. Together, these publications demonstrate the widespread interest in and continuous research

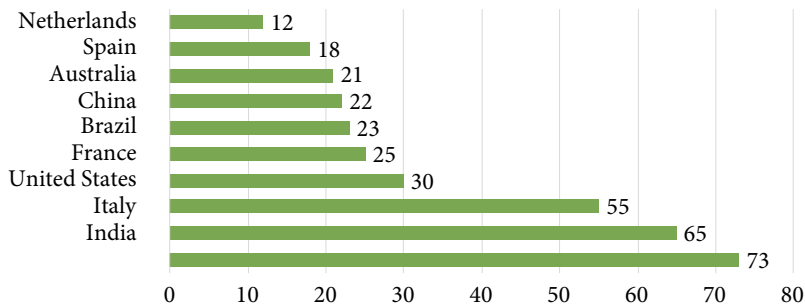

FIGURE 6 Top 10 Distinguished Countries with Highest Published Documents

NOTE Figure 6 maps global CE research output, showing the UK, India, and Italy as leading contributors, indicating strong institutional and policy engagement. The geographic spread highlights opportunities for cross-country collaboration and diffusion of CE practices.

into the advancement of circular economy practices and ideas across a variety of industries.

The bibliometric mapping (fig. 6) reveals that the UK and India lead CE scholarship, indicating potential for North–South policy collaboration. Shared research agendas on digital circular supply chains and SME behavioural adoption could foster global CE diffusion. The United Kingdom is the top contributor with around 70 publications, closely followed by Italy and India, each with about 60 publications. This is seen in the list of the top 10 nations with the most published documents (fig. 6). With over 50 documents, the United States is also notably present. The Netherlands, Brazil, China, Australia, Spain, and France each contribute 20 to 30 documents. This distribution highlights these nations' large research output and their important place in the global research environment. The dominance of the UK, India, and Italy in the particular field indicates that these nations are leading the way in intellectual activities, encouraging global cooperation and the diffusion of information. The research has attracted interest and investment from around the world, as evidenced by the broad geographical representation.

RQ 5 'WHEN' – WHEN DID THE INTEREST IN CE ADOPTION RISE AND WHAT ARE THE PUBLICATION TRENDS?

We have analysed publication data and studied evolution of research over time. The pattern of publications from 2010 to 2024 (fig. 7) shows that the field's research activity has been steadily and significantly increasing.

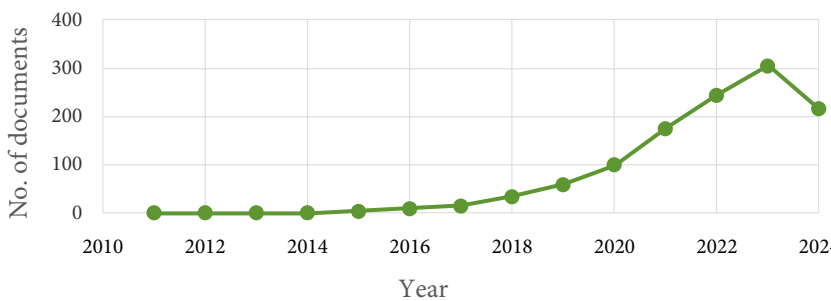

FIGURE 7 Trend of Publication of the Documents

NOTE Figure 7 shows the annual publication trend - a steady increase in circular-economy adoption studies, with pronounced growth after 2017, reflecting global policy attention and the diffusion of CE discourse across disciplines.

There is a visible upward tendency that appears to have peaked around 2014, indicating rising interest and higher levels of research output. From 2020 to 2024, this growing trend becomes more noticeable and is indicated by a rapid increase of publications. This acceleration is probably the result of international policy frameworks, societal pressures, and technical breakthroughs, bringing sustainability and circular economy challenges more attention globally. All things considered, the pattern points to a dynamic and quickly developing field of study, and as more scholars and organisations work with these important concerns, it is anticipated that the conversation around sustainability and the circular economy will continue to grow. The spike in publications suggests that the value of circular economy strategies in tackling global issues, including resource depletion, waste management, and environmental degradation is becoming increasingly apparent. Moreover, additional study endeavours are anticipated to yield inventive resolutions, refined techniques, and superior approaches for executing circular economy tenets. This growing trend in scholarly engagement highlights the need for cross-sector collaboration in order to promote a more sustainable future. It also signifies a significant shift in the way corporations and politicians approach sustainability.

The consequences of putting CE into practice are complex. One of the main outcomes, according to several studies (e.g. Ghisellini et al. 2018; Urbinati et al. 2017), is the creation of creative circular business models. The works of Bag et al. (2021b) and Dey et al. (2022) emphasise improved resource efficiency and sustainability performance. Ranta et al. (2018) and Park et al. (2010) have both written about the regenerative economy and sustainable development goals as examples of broader economic and social advantages. Jaeger and Upadhyay (2020) and Yadav et al. (2020) both observe that supply chain management has improved as a result of CE practices. Last but not least, applying CE has significantly benefitted digital and technical developments, such as the adoption of digital manufacturing and big data analytics, as highlighted by Lopes de Sousa Jabbour et al. (2019) and Bag et al. (2021b). This thorough analysis highlights how important it is for institutional, technological, and psychological elements to work together to support the shift to a circular economy. The benefits of this shift will be seen in the form of increased supply chain efficiency, sustainability, and economic growth.

We have determined the CE's evolutionary environment within the literature. According to Ghisellini et al. (2016), Urbinati et al. (2017), and Linder and Williander (2017), future research on CE is expected to

TABLE 8 Evolution of the Research on CE Adoption

Evolution Aspect	Description	
Interdisciplinary Approach	Future research will embrace an interdisciplinary approach, integrating insights from economics, environmental science, engineering, and management.	Ghisellini et al. (2016), Urbinati et al. (2017), Linder and Williander (2017)
Advanced Technologies	Emphasis will be placed on integrating emerging technologies like AI, blockchain, IoT, and big data analytics to optimise CE practices.	Bag et al. (2021b), Acerbi et al. (2022)
Quantitative Analysis	Future studies will focus on quantitative analysis and empirical studies to measure environmental, economic, and social impacts of CE initiatives.	Gupta et al. (2019), van Keulen and Kirchherr (2021), Prideaux et al. (2020)
Policy and Governance	Exploration of the role of policy frameworks and governance mechanisms in facilitating CE adoption and assessing the effectiveness of regulatory frameworks.	Park et al. (2010), Kouhizadeh et al. (2020), Malik et al. (2022)
Circular Business Models	Continued exploration of innovative circular business models focusing on design, implementation, and scalability, considering value creation and stakeholder engagement.	Ranta et al. (2018), Zucchella and Previtali (2019)
Supply Chain Optimisation	Research will focus on optimising circular supply chains, reducing waste, improving resource efficiency, and fostering collaboration among supply chain partners.	Mangla et al. (2018), Jaeger and Upadhyay (2020), Massaro et al. (2021)
Behavioural Insights	Understanding consumer behaviour, stakeholder perceptions, and organisational motivations will remain critical, with a focus on strategies to overcome barriers.	Patwa et al. (2021), Gonella et al. (2024), Abou Taleb and Al Farooque (2021),
Global Collaboration	Collaboration among researchers, policymakers, industry stakeholders, and NGOs on a global scale will be essential to accelerate the transition to a circular economy.	Bag et al. (2021b), Van Hoof et al. (2024)

NOTE Table 8 summarises the major future directions in CE adoption research, highlighting increasing interdisciplinarity, technological integration, and policy relevance. The themes reflect how CE research is shifting toward digitalisation, behavioural insights, and global collaboration.

advance through an interdisciplinary approach that integrates insights from economics, environmental science, engineering, and management. Big data analytics, blockchain, IoT, and artificial intelligence (AI) are examples of emerging technologies that will be essential to optimising CE

procedures (Bag et al. 2021b; Acerbi et al. 2022). To quantify the effects of CE initiatives on the environment, economy, and society, a significant focus on quantitative analysis will be placed on the data (Gupta et al. 2019; van Keulen and Kirchherr 2021; Prideaux et al. 2020). There will also be much attention paid to how government and policy may help promote the adoption of CE (Park et al. 2010; Kouhizadeh et al. 2020; Malik et al. 2022).

Innovative circular business models, supply chain optimisation, and behavioural insights will all be the subject of future research to help overcome obstacles (Ranta et al. 2018; Zucchella and Previtali 2019; Mangla et al. 2018; Jaeger and Upadhyay 2020). Lastly, to expedite the shift to a circular economy, international cooperation between scholars, legislators, industry stakeholders, and non-governmental organisations will be crucial (Bag et al. 2021b; Van Hoof et al. 2024).

This all-encompassing, multidisciplinary strategy emphasises how crucial technology innovation and teamwork are to promoting CE for sustainable development. A succinct overview of the development of research on CE adoption is provided in Table 8, with emphasis on significant features and authors. It highlights the significance of interdisciplinary methods, state-of-the-art equipment, quantitative analysis, governance and policy, supply chain optimisation, circular business models, behavioural insights, and global collaboration.

One can gain knowledge of the wide range of research on CE adoption by analysing these tables and visualisations, which highlight important concerns, eminent writers, esteemed journals, and changing research patterns. Numerous subjects and disciplines have researched CE and its adoption, demonstrating the need for an interdisciplinary approach. Researchers need to adopt a broad perspective because the topic has been examined with a variety of purposes. The domains of management, business, and environmental studies are conducive to research endeavours, suggesting a robust inclination among scholars in these topics towards forthcoming publications and cooperative efforts. Thus, there is a significant opportunity for future research and collaborative work in these subjects.

RQ 6 – 'HOW' – HOW ARE RESEARCH CONCEPTS INTERLINKED, AND WHAT MODELS OR FRAMEWORKS ARE BEING PROPOSED?

We examined inter-theme relationships and framework through full text review of the highly cited and seminal papers which are scrutinised

TABLE 9 Description Criteria

Field	Description
Paper Title	Full citation
Cluster	Thematic cluster it belongs to
Authors	Key authors and affiliations
Year	Publication year
Framework/Model	Name of the framework or model, if given
Type	Conceptual / Analytical / Empirical / Policy-based
Components	Key components or elements of the framework
Methodology Used	E.g. case study, simulation, survey
Area of Application	E.g. manufacturing, waste management, SMEs
Contribution	What gap it fills or how it advances the field
Linkages	How it connects to circular economy / sustainability themes

NOTE Table 9 outlines the structured criteria used to examine models and frameworks in leading CE studies, enabling systematic comparison across theories, methods, and applications. This classification supports tracing conceptual evolution and identifying cross-theme linkages.

on the basis of the description criteria that is provided in the Table 9. We have also employed cluster analysis to achieve the objective.

TABLE 10 Interlinkage of Research Concepts

Themes	Interlinked Concepts	Implication
Circular Economy (CE)	Environmental Economics, Industrial Ecology, Urban Waste, Strategic Management	CE is not treated in isolation – it integrates sustainability science with economic and organisational theory.
Business Model Innovation	Customer Value Proposition, Organisational Activities, Revenue Models	Circular business models emphasise value beyond profit, including environmental and social dimensions.
Technology & Industry 4.0	Big Data, AI, Smart Manufacturing, Digital Tools	Data and AI-driven systems are increasingly vital in implementing CE at scale.
Institutional & Strategic Pressures	Regulatory norms, Stakeholder Engagement, Market Orientation	Institutional theory helps explain how external forces shape CE practices.
Supply Chain & Sustainability	SSCM Challenges, Multi-Criteria Decision Making (MCDM), Green Practices	Supply chains are central in operationalising CE, especially through digital and collaborative mechanisms.

NOTES Table 10 demonstrates how CE concepts intersect with business models, technology, institutional theory, and supply chains, indicating strong multidisciplinary integration. These interlinkages reveal how CE transitions rely on both technological enablers and organisational drivers.

Interlinkage of the research concepts and its implications is shown in Table 10, and the proposed models and frameworks in literature in Table 11.

Research on CE illustrates robust multidisciplinary integration, merging ecological, economic, and technological viewpoints to facilitate sustainability transitions (Ghisellini et al. 2016; Ghisellini et al. 2018). The domain demonstrates significant model diversity, encompassing conceptual taxonomies, hypothesis-testing frameworks, and hybrid decision-support systems (Urbinati et al. 2017; Linder and Williander 2017; Yadav et al. 2020). A persistent theme is the use of technology as a connective framework, namely the utilisation of big data, artificial intelligence, and Industry 4.0, which augment circular economy capabilities via digital transformation and automation (Bag et al. 2021b; Bag et al. 2021a). A robust emphasis on decision support is evident through the application of integrated methodologies such as BWM (Best-Worst Method) and ELECTRE (ELimination and Choice Expressing REality method) to address intricate SSCM difficulties (Yadav et al. 2020; Mangla et al. 2018). Numerous research contributes to the development of a theory-practice nexus, providing empirically based frameworks that facilitate the implementation of circular economy (CE) across several sectors, including manufacturing, construction, and 3D printing (Despeisse et al. 2017; Guerra et al. 2021).

TABLE 11 Proposed Models and Frameworks

Study	Model/Framework Name	Type	Core Components
Ghisellini et al. (2016)	Interdisciplinary Multi-level Framework for CE	Conceptual–Review	Evolution of CE across policy, urban/industrial systems
Urbinati et al. (2017)	Taxonomy of CE Business Models	Conceptual–Empirical	Customer value, structure, revenue model
Linder and Williander (2017)	Hypothesis-Testing Framework for CBM	Empirical–Theoretical	Uncertainty factors, remanufacturing models
Bag et al. (2021b)	Institutional Pressures–Resources–Performance Framework	Empirical–Theoretical	Institutional theory, big data analytics
Yadav et al. (2020)	Hybrid BWM–ELECTRE Framework for SSCM	Empirical–Quantitative	SSCM barriers, Industry 4.0 enablers

NOTE Table 11 presents key CE models and frameworks proposed in influential studies, ranging from conceptual taxonomies to hybrid decision-support systems. These frameworks illustrate how CE theory connects with practical applications across industries.

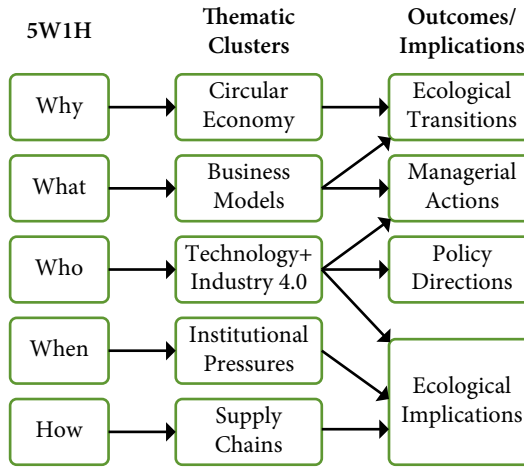

FIGURE 8 Linking Research Questions to CE Clusters and Outcomes

Figure 8 contributes a novel synthesis to CE adoption research by integrating the 5W1H research questions with bibliometric clusters and thematic insights drawn from 332 studies.

Unlike prior reviews that examined themes in isolation, this model demonstrates how each analytical dimension – Who, What, Where, When, Why, and How – maps onto the technological, institutional, behavioural, supply-chain, and business-model clusters revealed through VOSviewer. Although the study includes 'Where' as a research question to analyse the geographical and publication-wise distribution of CE research, this dimension is not represented in the diagram because it did not emerge as a distinct conceptual cluster; instead, it operates as a contextual descriptor that frames the dataset rather than shaping the thematic structure. By visually connecting these components, the model establishes clear triangulation between descriptive patterns, theoretical perspectives, and practical outcomes. This integrated representation advances the field by offering a structured explanation of how CE adoption emerges from the interaction of policy drivers, technological enablers, organisational capabilities, and behavioural factors, thus providing a comprehensive foundation for future empirical and comparative research.

The results from the six research questions collectively provide a clear foundation for policy action. RQ1 and RQ2 highlight the dominance of technological, supply-chain, and behavioural themes, showing that policy interventions must target infrastructure and behaviour simultaneous-

ly. RQ3 and RQ4 identify geographical and institutional differences, suggesting the need for region-specific legislation, capacity-building, and international collaboration models. RQ5 emphasises drivers and barriers, directly informing policies related to incentives, digitalisation support, and SME-focused programmes. Finally, RQ6 shows the growing reliance on digital and hybrid frameworks, reinforcing the need for integrated policy designs that combine regulatory clarity with technological enablement. Together, these insights reveal how empirical patterns from the results section translate into practical, scalable policy recommendations.

Conclusion and Implications of the Study

The comprehensive review of circular economy (CE) literature reveals significant developments across conceptual foundations, technological advancements, and behavioural dynamics that shape CE adoption. The findings underscore the importance of integrating advanced technologies, interdisciplinary perspectives, and supportive legislative frameworks to drive the transition toward a regenerative and resource-efficient economic system. By synthesising insights across 332 studies, the review identifies persistent gaps and emerging opportunities that can guide future research and practical interventions.

The bibliometric finding that the United Kingdom and India lead CE publications carries notable policy and collaboration implications. The UK's strengths in regulatory coherence, CE governance, and university–industry innovation ecosystems complement India's expertise in frugal innovation, digital CE adoption, and scalable SME-oriented circular practices. Strengthening bilateral or triangular collaborations – through joint research programmes, shared CE knowledge platforms, co-funded demonstration projects, and harmonised reporting standards – can accelerate cross-country learning and support the transfer of CE solutions adaptable to diverse socio-economic contexts. Such collaborations also enhance global CE diffusion by bridging institutional, technological, and behavioural capabilities across regions.

The synthesis of CE barriers across technological, institutional, financial, and behavioural dimensions reveals clear policy levers that can support CE implementation. Regulatory fragmentation can be addressed through CE-specific legislation, extended producer responsibility (EPR) schemes, and unified compliance guidelines. Technological and supply-chain constraints may be mitigated through incentives for digital infrastructure, Industry 4.0 adoption, and investments in reverse logis-

tics and waste valorisation systems. Financial constraints, particularly in SMEs, can be eased through targeted subsidies, tax incentives, and green public procurement. Behavioural and cultural barriers require awareness campaigns, eco-labelling reforms, and consumer education initiatives that build trust and shift consumption norms. Together, these instruments offer a coherent policy pathway aligned with the barriers identified in this review.

Building on these insights, the review explicitly links key CE barriers to relevant policy instruments to enhance practical clarity. Regulatory barriers can be addressed through harmonised CE legislation, EPR expansion, and improved monitoring mechanisms; technological barriers require support for digital infrastructure, data governance, and industry–academia innovation partnerships; financial barriers can be mitigated through targeted SME incentives, green financing, and public procurement reforms; and behavioural barriers can be reduced through awareness programmes, trust-building initiatives, and consumer-facing certifications. These targeted instruments align directly with the challenges identified in the literature and provide policymakers with a structured pathway for accelerating CE adoption across sectors and regions.

This study also highlights the critical role of behavioural insights in CE adoption. Consumer trust, perceived risk, environmental identity, social norms, and attitudes toward refurbished or remanufactured products significantly influence participation in circular practices. These behavioural drivers act as hidden constraints even in technologically advanced settings, underscoring the need for interventions that combine psychological, cultural, and informational strategies with technological and policy reforms. Integrating behavioural dimensions into CE initiatives can enhance adoption across households, SMEs, and broader supply networks.

From a managerial perspective, integrating CE principles enables firms to improve resource efficiency, reduce operational costs, and enhance resilience by incorporating reuse, recycling, and remanufacturing into business processes. Circular business models also support innovation, competitiveness, and access to sustainability-focused markets. In supply chains, CE adoption strengthens transparency, traceability, and risk mitigation, especially when supported by digital tools such as IoT, blockchain, and AI. Organisations can accelerate CE uptake by investing in capability-building, life-cycle thinking, and collaborative partnerships across their value chains.

Policymakers can further facilitate CE transitions through holistic policy frameworks that combine regulatory incentives, capacity-building, digital infrastructure development, and public–private collaboration. Investments in education, skill enhancement, and awareness programmes can strengthen institutional capacity and support widespread behavioural change. These strategies collectively advance sustainable consumption and production patterns and align with broader global sustainable development goals. In summary, this review consolidates conceptual, technological, behavioural, and policy-focused CE insights into an integrative understanding of adoption pathways. By identifying dominant themes, emerging gaps, and cross-country opportunities, the study provides a foundation for future empirical work and practical interventions aimed at accelerating the transition to a circular and sustainable economy.

Limitations and Future Research Direction

Although this systematic review is very thorough, there are a few things to be aware of. First, because the study was limited to resources found in particular databases, it is possible that pertinent research not indexed in these sources was missed. This could have led to scope and selection bias, which could have affected the results. It is also possible that prejudice in selection affected the inclusion criteria. Second, the review's geographic focus, which might have contained a lot of research from particular areas, might have limited the findings' applicability to other situations with different socioeconomic and regulatory environments. Third, the review's temporal coverage – which includes works published mostly up until 2024 – might not adequately reflect current developments and developing patterns in CE activities. Fourth, redundancy may have resulted from conceptual overlap in studies addressing numerous themes.

Lastly, as PRISMA ensures transparency, its strict inclusion criteria may under-represent interdisciplinary or grey literature sources. Several scholars have therefore recommended hybrid PRISMA–scoping or bibliometric–systematic approaches to capture emerging themes in sustainability research (Munn et al. 2018; Snyder 2019). Subsequent investigations ought to explore multiple approaches to surmount current constraints and augment the outcomes of this analysis. To obtain a more profound comprehension of the enduring consequences of CE activities and the progression of CE adoption across time, longitudinal research is needed. Furthermore, cross-regional comparisons may offer insightful informa-

tion about the contextual elements influencing the uptake and efficacy of CE methods, allowing for the customisation of these tactics to particular socioeconomic and regulatory contexts. Future research should focus on industry-specific circular economy practices, particularly in construction, healthcare, the automotive industry, and agriculture, through longitudinal and empirical studies that validate the proposed conceptual model. Additionally, using sound quantitative techniques to evaluate the social, economic, and environmental effects of CE programmes will produce empirical data that can be used to inform policy-makers and businesses.

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