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Strategic Pathways for Circular Economy Implementation in Small and Medium Enterprises: A Theoretical Integration Approach

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ABSTRACT

This study **aims** to systematically map the literature on circular economy (CE) applications in small and medium enterprises (SMEs) and to propose a conceptual framework for sustainability strategies. The **method** involved retrieving a dataset of 510 publications from the Scopus database and analyzing it with the Bibliometrix package in RStudio, using bibliometric techniques to assess publication performance, prolific authors, institutional contributions, collaboration patterns, and thematic structures, followed by thematic cluster mapping integrated with strategic management perspectives (environmental scanning, strategy formulation, implementation, and evaluation) underpinned by institutional theory, the technology-organization-environment framework, and dynamic capabilities theory. The **results** reveal a significant increase in CE-related SME research in recent years, with contributions concentrated in specific institutions and research networks, and identify three dominant research directions: digital technologies enabling circular practices, environmental policies driving adoption, and the design of sustainable business models, underscoring the importance of technology-enabled transformation, regulatory alignment, and organizational readiness in SME transitions. The **contributions** of this study lie in providing a strategic roadmap that integrates bibliometric insights with management theory, demonstrating how SMEs can transform challenges such as capital constraints and limited infrastructure into strategic opportunities through capability development and stakeholder collaboration, while offering practical implications for SMEs, policymakers, and academics to design evidence-based sustainability strategies that enhance competitiveness and advance global sustainability goals.

Keywords: circular economy; small and medium enterprises; bibliometric analysis; sustainability transition; strategic management; circular business model; technology-organization-environment framework; institutional theory; dynamic capabilities; sustainable business strategy

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ОРИГИНАЛЬНАЯ СТАТЬЯ

Стратегические пути внедрения экономики замкнутого цикла на малых и средних предприятиях: теоретический интеграционный подход

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АННОТАЦИЯ

Цель данного исследования — систематизировать литературу по применению экономики замкнутого цикла (циркулярной экономики) на малых и средних предприятиях (МСП) и предложить концептуальную

основу для стратегий устойчивого развития. **Методы** включали получение набора данных из 510 публикаций из базы Scopus и его анализ с помощью пакета Bibliometrix в RStudio, использование библиометрических методов для оценки эффективности публикаций, наиболее продуктивных авторов, институционального вклада, моделей сотрудничества и тематических структур. Затем было проведено тематическое кластерное картирование, интегрированное с перспективами стратегического управления (анализ внешней среды, разработка стратегии, ее реализация и оценка), подкрепленное институциональной теорией, концепцией «технология-организация-среда» и теорией динамических возможностей. **Результаты** показывают значительный рост исследований в области циркулярной экономики для малых и средних предприятий в последние годы, при этом вклад сосредоточен в конкретных учреждениях и исследовательских сетях. Авторы выделяют три доминирующих направления исследований: цифровые технологии, способствующие внедрению экономики замкнутого цикла, экологическая политика, стимулирующая ее внедрение, и разработка устойчивых бизнес-моделей. Подчеркивается важность технологически обеспеченной трансформации, соответствия нормативным требованиям и организационной готовности в процессе перехода МСП к устойчивой экономике. **Научный вклад** данного исследования заключается в разработке стратегической дорожной карты, которая интегрирует библиометрические данные с теорией управления, демонстрируя, как МСП могут превратить такие проблемы, как нехватка капитала и ограниченная инфраструктура, в стратегические возможности посредством развития потенциала и сотрудничества с заинтересованными сторонами, а также предлагая практические рекомендации для МСП, политиков и ученых по разработке научно обоснованных стратегий устойчивого развития, повышающих конкурентоспособность и способствующих достижению глобальных целей устойчивого развития.

Ключевые слова: экономики замкнутого цикла (циркулярная экономика); малые и средние предприятия; библиометрический анализ; переход к устойчивому развитию; стратегическое управление; циркулярная бизнес-модель; концепция «технология-организация-окружающая среда»; институциональная теория; динамические возможности; стратегия устойчивого бизнеса

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1. Introduction

The linear economic paradigm that has dominated world production has caused excessive resource use, industrial waste, carbon emissions, and environmental degradation [1]. According to [2], the “take-make-dispose” model is environmentally harmful and pushing a more sustainable economy. The Circular Economy (CE) is a long-term solution that promotes recycling, waste reduction, and sustainable product design to reduce environmental consequences [1, 2]. Small and medium enterprises (SMEs) are essential in this transition, especially in developing countries, significantly contributing to job creation, value-added distribution, and local innovation [3, 4]. The implementation of CE principles in this sector can enhance product longevity and optimize resource utilization while facilitating the emergence of a more environmentally sustainable market [5]. SMEs play a crucial role in advancing Sustainable Development Goals (SDGs), especially SDG 12, which emphasizes responsible consumption and production practices [4].

The transition of SMEs to a CE encounters multiple challenges, including organizational structure,

capital constraints, digital infrastructure, and insufficient technical skills [6, 7]. To address these challenges, SMEs must implement strategies that facilitate their transition to a CE. In this context, it is essential to evaluate the various factors that influence the readiness and ability of SMEs to adapt to a circular business model. An effective method for evaluating readiness involves utilizing the technology-organization-environment (TOE) framework. This framework is essential for assessing the readiness of SMEs through three primary dimensions: technology, organization, and external pressures related to regulations and infrastructure support [6]. Conversely, it is essential to comprehend the impact of external factors and institutional pressures on the adoption of CE. Institutional theory elucidates the influence of coercive pressures (stemming from government policies), mimetic pressures (resulting from interindustry imitation), and normative pressures (derived from industry standards) on the adoption of CE practices in developing nations such as India, China, and Brazil [8].

Internally, the implementation of CE necessitates that SMEs modify their structures and cul-

tivate dynamic capabilities to effectively respond to rapid external and internal changes. Dynamic capabilities theory (DCT) serves as a significant framework for analyzing how SMEs cultivate sensing, seizing, and reconfiguring capabilities to address the challenges associated with implementing CE principles in their operational activities [9]. This change is both operational and strategic, involving alterations in business models, supply chain management, and collaboration among participants within a sustainability-focused industrial ecosystem [10, 11]. The existing literature on CE and SMEs tends to be predominantly descriptive, reliant on case studies, or excessively focused on isolated sectoral issues. Research systematically mapping the relationships among topics, influential actors, and emerging trends in CE is scarce [12, 13]. This deficiency obstructs data-driven decision-making and the formulation of adaptable clean production strategies. However, despite the increasing number of studies on CE in SMEs, limited research has integrated bibliometric mapping with strategic management perspectives to explain how SMEs can systematically formulate and implement CE strategies. Existing studies also tend to examine technological, organizational, or environmental dimensions separately, without offering an integrative conceptual understanding of CE implementation pathways. Therefore, a comprehensive knowledge mapping that combines CE themes with strategic management frameworks remains underexplored.

Therefore, this study aims to systematically map and analyze the development of CE research in the context of SMEs through a bibliometric approach integrated with strategic management perspectives. Specifically, this research seeks to identify major research trends, thematic clusters, influential publications, and conceptual relationships that explain how SMEs formulate, implement, and evaluate CE strategies within dynamic business environments. In addition, this study aims to develop an integrative conceptual framework that connects the TOE framework, institutional theory, and dynamic capabilities theory in explaining CE adoption and strategic transformation in SMEs.

This study contributes to the existing literature in several ways. First, unlike previous studies that primarily focus on isolated technological or environmental aspects, this research integrates bibliometric mapping with strategic manage-

ment analysis to provide a more comprehensive understanding of CE implementation pathways in SMEs. Second, this study contributes theoretically by synthesizing the TOE framework, institutional theory, and dynamic capabilities theory into a unified conceptual perspective for analyzing CE adoption processes. Third, this research extends the bibliometric literature by offering a strategic thematic interpretation of CE studies, thereby enriching the discussion on sustainability-oriented business transformation in SMEs [14].

The significance of this study lies in both its theoretical and practical implications. Theoretically, the findings provide a structured knowledge map that clarifies the evolution and intellectual structure of CE research in SMEs. Practically, the proposed conceptual framework may assist policymakers, SME managers, and practitioners in designing adaptive CE strategies, strengthening sustainability-oriented capabilities, and supporting green industry policies and clean production initiatives [15]. Furthermore, this study provides insights that may support the transition toward more inclusive and sustainable production and consumption systems in developing and emerging economies.

2. Literature review

The implementation of CE principles in SMEs necessitates systematic planning. The strategic management framework proposed by [14] serves as a crucial basis for formulating strategies that incorporate CE principles, emphasizing resource efficiency and long-term sustainability. An effective strategy must encompass market analysis, the identification of external opportunities and challenges, and sufficient internal management to facilitate the implementation of CE principles [16]. Strategic management is crucial for establishing a framework that enables SMEs to develop and evaluate sustainability-oriented strategies [17]. During the initial phase of environmental scanning, SMEs evaluate factors that affect the implementation of the CE. Institutional theory is significant in illustrating the impact of external pressures, including government policies and environmental regulations, on SMEs' decisions to adopt CE practices [18]. Coercive pressures, including government regulations on waste management, frequently serve as a key impetus for SMEs to shift towards a more

sustainable economy [19]. The TOE framework enables SMEs to evaluate their technological and organizational preparedness for the implementation of CE [20].

In the strategy development phase, SMEs design strategies to integrate CE into their existing business models. DCT theory explains that SMEs need to develop flexible capabilities to adapt to technological and market changes [15]. DCT shows that SMEs must be able to change supply chain configurations and redesign products to be more sustainable [11]. Therefore, the strategy needs to consider internal capabilities that support CE and involve collaboration with external parties [10]. Institutional theory ensures that SMEs comply with regulations and industry standards that support sustainability [21]. During the strategy implementation phase, SMEs began integrating CE principles into their operational activities. DCT plays an important role here, as SMEs need to have dynamic capabilities to adapt to the changes that are occurring [10]. The TOE framework is used to assess the readiness of the technology used in operations and environmentally friendly waste management [20]. Institutional theory helps SMEs stay compliant with environmental regulations and current policies [19].

During the evaluation phase, SMEs must assess the effectiveness of CE implementation, focusing on waste reduction and energy savings. At this stage, institutional theory is significant, as it aids SMEs in evaluating their compliance with external demands from government regulations and the industrial sector [1]. The assessment incorporates an analysis of the dynamic capabilities of SMEs in their response to occurring changes [15]. SMEs must participate in organizational learning and offer feedback to modify their strategies, thereby ensuring long-term sustainability [4]. The implementation of CE principles in SMEs necessitates a systematic approach encompassing four stages of strategic management: environmental scanning, strategy formulation, strategy implementation, and evaluation. The strategic management theory by [14] offers a framework for developing sustainable strategies, whereas the TOE framework and DCT assist in evaluating technological and organizational preparedness for CE initiatives. Institutional theory presents external factors that affect decision making and the execution

of CE initiatives. Utilizing these theories enables SMEs to implement CE practices effectively, improve sustainability, and mitigate adverse environmental effects. Ongoing assessment will guarantee that the implementation of CE evolves and delivers sustained advantages for SMEs and society at large [1, 10, 20].

3. Method

3.1. Sources of data and search methodology

This study employs a bibliometric approach to examine the development of scientific literature concerning CE within the context of SMEs. Bibliometric analysis enables the systematic identification of publication trends, collaboration patterns, influential authors, and thematic structures derived from publication metadata [22]. The Scopus database was selected as the primary data source due to its broad coverage of peer-reviewed international publications and its compatibility with bibliometric analysis tools such as Bibliometrix and Biblioshiny.

The data collection process was conducted in May 2025 using the search query TITLE-ABS-KEY (“circular” AND “economy” AND “SMEs”). The query was intentionally designed in a broad and inclusive manner to capture interdisciplinary studies related to CE implementation in SMEs and to minimize the exclusion of relevant publications that may employ varying terminologies. No publication year restriction was applied in order to observe the long-term evolution of research trends in this field.

Several inclusion criteria were applied to improve dataset relevance and consistency. The study included: (1) documents indexed in Scopus, (2) publications written in English, (3) document types limited to journal articles, conference proceedings, and books/book chapters, and (4) publications categorized within the subject areas of Business, Management and Accounting; Environmental Science; Social Sciences; Economics, Econometrics and Finance; and Decision Sciences. Documents outside these criteria, including editorials, notes, errata, and records with incomplete metadata, were excluded from the dataset. The initial search identified 510 documents. After screening and metadata verification, all 510 documents fulfilled the inclusion criteria and were retained for bibliometric analysis.

3.2. Data cleaning and preparation

The data was processed using RStudio and the bibliometrix package. The cleaning stage involved duplicate checking, verification of metadata completeness (including author names, titles, affiliations, abstracts, and keywords), and the standardization of synonymous terms such as “SMEs,” “small and medium enterprises,” and “small business” to improve consistency across the dataset. The data was transformed into a bibliographic format utilizing the `convert2df` function.

3.3. Bibliometric indicators

The performance analysis indicators comprised total publications, average annual citations, active authors, and the journals that predominantly published articles on CE and SMEs [21]. Science mapping indicators are employed to evaluate the conceptual dimension via keyword frequency and density, topic development mapping, and thematic analysis illustrated in thematic maps. This method offers a thorough examination of the literature structure and facilitates the creation of an integrative conceptual framework concerning sustainability in the SME sector [5, 23].

3.4. Data analysis

The analysis employed two primary methodologies: document performance analysis and science mapping. Performance analysis of documents assesses publication productivity through metrics such as annual publications, citation counts, contributing authors, and source of publications. Science mapping analyzes the relationships between concepts using techniques such as co-occurrence, bibliographic coupling, and co-citation. Visualization through Biblioshiny demonstrates the conceptual network and keyword clusters associated with the strategic management framework proposed by [14]. This framework encompasses four stages: environmental scanning, strategy formulation, strategy implementation, and evaluation [14]. The mapping is based on several theories, including institutional theory [18], the TOE framework [20], and DCT [24], which are commonly utilized in CE studies concerning SMEs [6, 7].

3.5. Visualization of methodology

Figure 1 illustrates the research methodology flow, detailing the stages from data retrieval in Scopus to integration into a bibliometric-based strategic

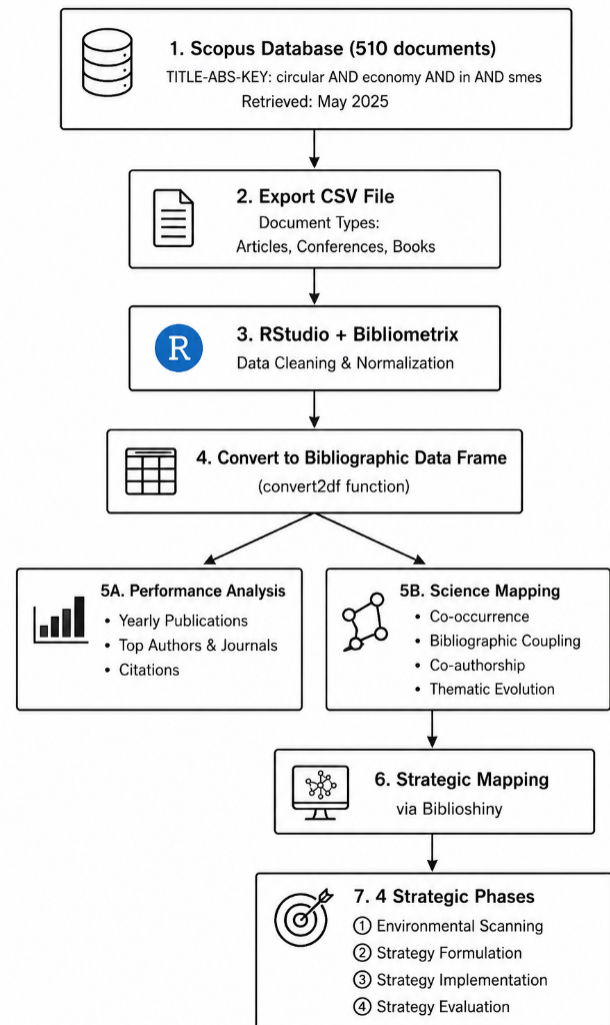


Fig. 1. Workflow of the research methodology

Source: Developed by the authors.

management framework. Each step illustrates a distinct contribution to data-driven analysis, establishing a robust foundation for the sustainable development of CE policies and practices within the SME sector.

4. Results and discussion

4.1. Performance analysis

4.1.1. Overview of literature characteristics

A bibliometric analysis of 510 publications from 2005 to 2025 indicates substantial growth in literature concerning CE in SMEs, with an average annual growth rate of 23.4%. This trend underscores the rising global focus on sustainable transitions within the small business sector [4]. The publications comprise 248 sources, including scientific journals, conference proceedings, books, and book series, reflecting the growth of CE themes in SMEs across diverse academic and practical platforms [25]. A total of 1,459 authors

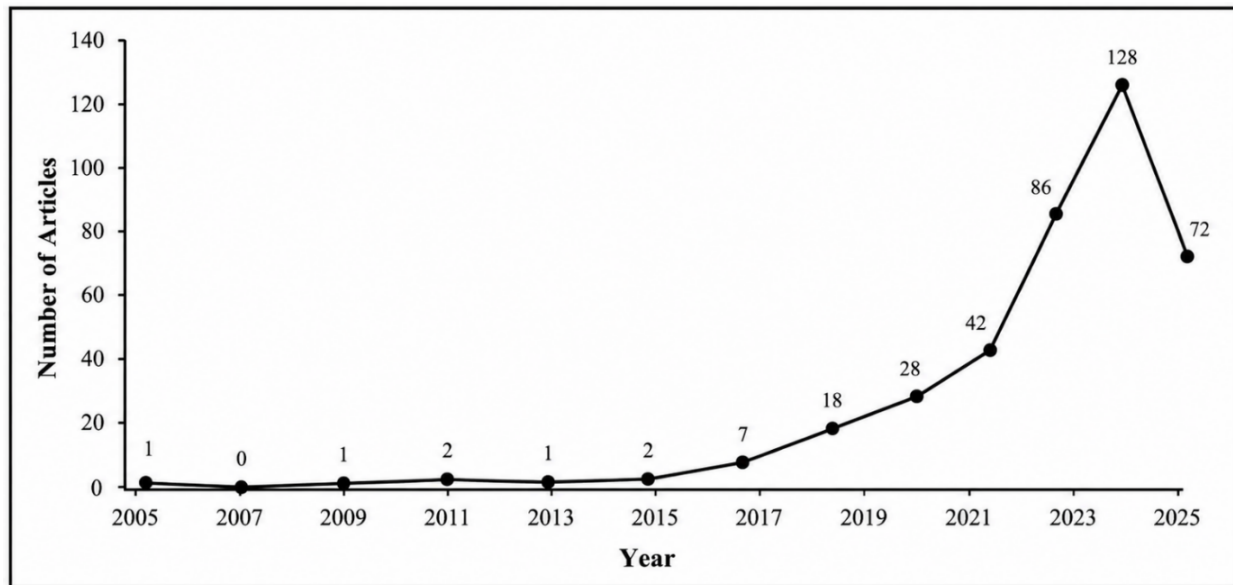


Fig. 2. Annual scientific production on circular economy research in SMEs from 2005–2025

Source: Developed by the authors.

contributed, averaging 3.44 authors per document, which reflects the interdisciplinary and complex nature of the CE-SME issue [13]. International collaboration has reached 34.31%, signifying that CE is increasingly recognized as a global research focus [1].

4.1.2. Productivity and citation impact

The average citations per document, at 25.25, suggest that the literature on CE in SMEs is expanding rapidly in both volume and academic significance. The average document age of 2.53 years indicates that CE in SMEs is a dynamic and increasingly relevant subject [5]. The analysis of 510 documents revealed 1,315 distinct terms, highlighting the variety of approaches and perspectives in CE-SME research. This suggests significant thematic diversity and potential for further research, especially regarding technological innovation, sustainable business models, and environmental policies [21].

4.1.3. Yearly scientific output

The annual trend in scientific production indicates a notable rise in research CE within SMEs from 2005 to 2025 (Fig. 2). From 2005 to 2015, the number of publications remained limited. However, post-2017, a gradual increase was observed, culminating in a significant surge beginning in 2020, with a peak of over 120 publications annually in 2024. This increase correlates with the global demand for sustainability, the advocacy for envi-

ronmentally friendly economic policies, and the heightened industry awareness of climate change. The COVID-19 pandemic accelerated digital and sustainable transformation in SMEs, leading to increased research on CE implementation [4, 25].

The trend illustrated in Fig. 2 corresponds with earlier studies suggesting that over the past five years, CE has emerged as a significant theme across business, environmental studies, industrial engineering, and strategic management [13]. CE has become a strategic priority in both developed and developing nations, particularly through the lens of SMEs. The decrease in publications in 2025 is likely attributable to indexing processes and publication delays, rather than a diminished interest in this topic [5]. The average annual publication growth of 23.4% indicates that CE in SMEs is a rapidly evolving strategic domain, presenting opportunities for further conceptual synthesis and the enhancement of evidence-based policy agendas [21, 26].

4.1.4. Mean citations annually

The analysis of average annual citations indicates notable variations in the academic impact of publications related to CE within the context of SMEs. Figure 3 demonstrates that articles published from 2005 to 2013 garnered minimal citations, attributable to the restricted volume of publications and the nascent status of CE as a significant subject in academic and policy discourse. In 2015, there was a notable rise in citations, averaging nearly 30 citations per article, which suggests the

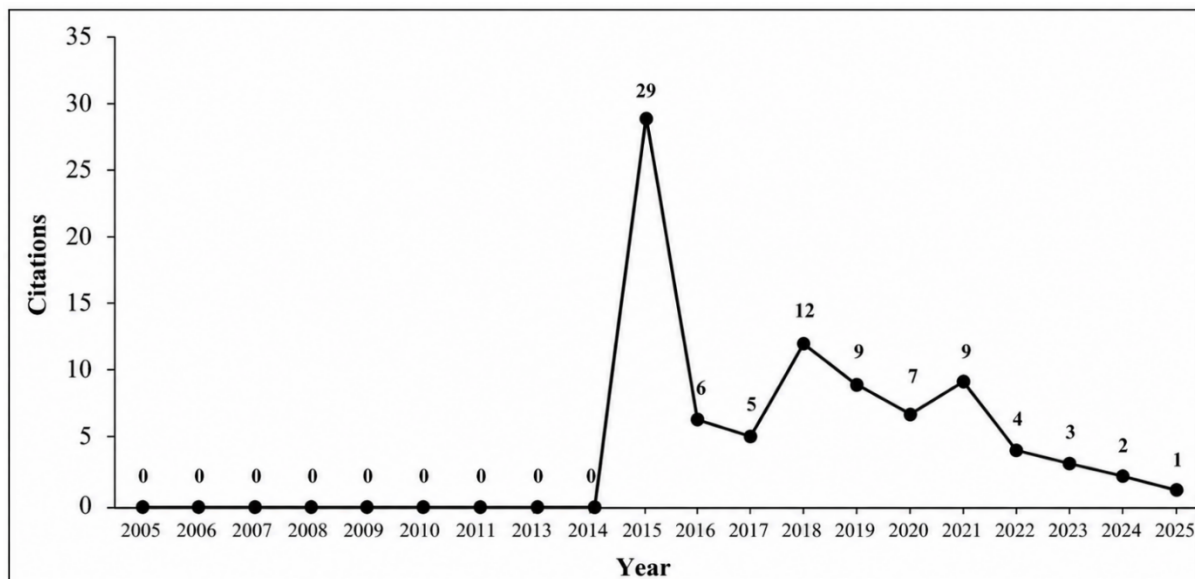


Fig. 3. Mean annual document citations on circular economy research in SMEs

Source: Developed by the authors.

presence of several key articles that were extensively referenced in later research [13]. Following the attainment of this peak, the average citations exhibited a decline ranging from five to 15 citations per article during the period from 2017 to 2023. The observed decline does not indicate a reduction in quality or relevance; rather, it is attributable to the time lag citation effect, wherein newer articles require additional time to garner consistent citations [21]. The rise in publication volume facilitates a more equitable distribution of citations among a greater number of articles.

Figure 3 indicates a decline in citations for 2024 and 2025; however, this trend should be interpreted cautiously, as the data may not be fully indexed or have garnered sufficient academic attention. The average document age is 2.53 years, indicating that most publications remain relatively recent and may garner additional citations in the future [4]. Overall, despite fluctuations in annual citation averages, these results confirm that publications on CE and SMEs make a significant scientific contribution, demonstrating that CE in the context of SMEs is not just a temporary discourse but is becoming a strategic discipline in clean production and the transition towards a sustainable economy [1, 25].

4.1.5. Leading authors and their contributions across time

An analysis of the most active authors over the past two decades identifies several key figures who have consistently contributed to the develop-

ment of CE literature within the context of SMEs. Figure 4 illustrates the ten authors with the highest publication counts and the temporal distribution of their works. Jose Arturo Garza-Reyes is a primary author who has consistently published from 2018 to 2025, concentrating on the integration of lean manufacturing and CE into business processes, alongside the impact of process innovation on enhancing the operational sustainability of SMEs [27]. Consistency demonstrates his strategic role in the CE literature, especially within the small manufacturing sector. Furthermore, researchers including Soumyadeb Chowdhury and Prasanta Kumar Dey have become significant contributors, emphasizing the integration of CE with digitalization, data-driven decision-making, and the preparedness of SMEs to adopt CE models [2, 28]. Both are crucial for linking sustainability theory to practice within the small business sector, particularly in developing countries [4].

Figure 4 illustrates that researchers, including Ebenezer Afum, Yaw Agyabeng-Mensah, and Charles Baah, have conducted empirical studies focusing on organizational factors, environmental leadership, and green innovation in the context of supporting CE in SMEs. The CE-SME literature encompasses not only environmental and production aspects but also governance issues, organizational strategy, and managerial behavior [21, 25]. The contributions of the lead authors reflect a cohesive group of scientists actively engaged in advancing theory and its application. The activ-

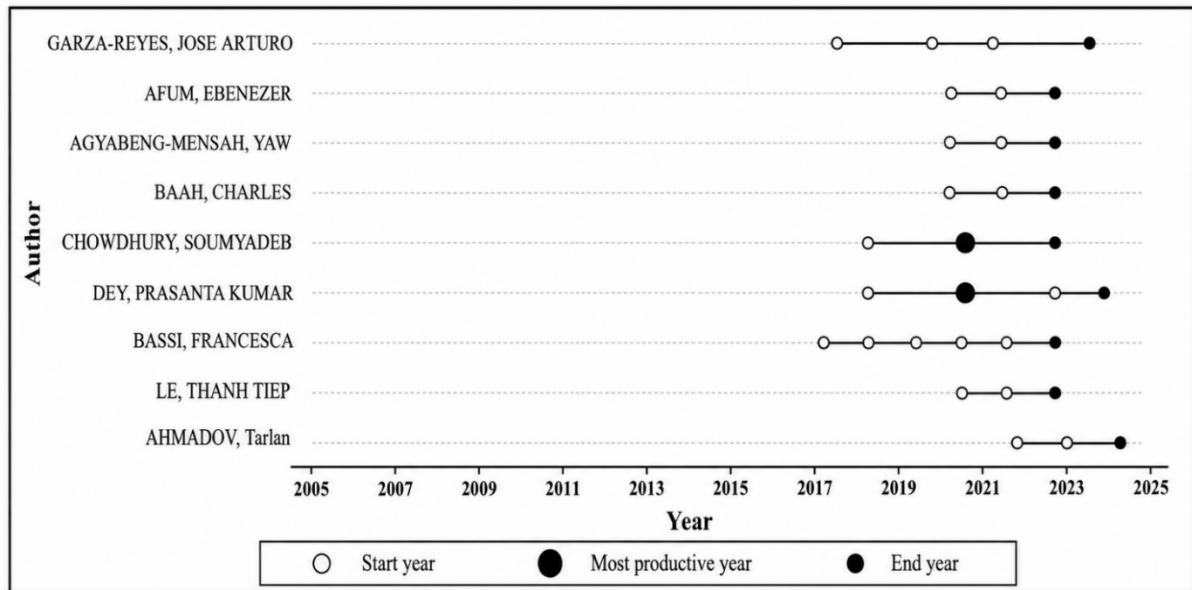


Fig. 4. Top author's production over time on circular economy research in SMEs

Source: Developed by the authors.

ity and productivity of CE in SMEs indicate the establishment of a robust academic community prepared to enhance interdisciplinary and international collaboration [1, 26].

4.1.6. Sources of publication

Figure 5 illustrates the distribution of the research publication's sources across multiple platforms. The journal Sustainability, noted for its significant contributions, exemplifies a commitment to interdisciplinary approaches and global perspectives in the study of sustainability practices, particularly within the SME sector. Despite its extensive scope, this journal encounters challenges related to selectivity and the substantial volume of articles requiring review [13]. The Journal of Cleaner Production is distinguished by its emphasis on technical, policy, and clean production dimensions, rendering it particularly pertinent for evidence-based and applied research.

Figure 5 indicates that Business Strategy and the Environment occupy the third position, emphasizing the relevance of research in business strategy for facilitating the transition to a CE, especially within SMEs. This aligns with the findings of [21], that sustainability strategies centered on business models and value are critical for the implementation of CE practices in SMEs. Additional journals, including the Journal of Business Research (23 documents), Resources, Conservation and Recycling (eight documents), and Circular Economy and Sustainability (10 documents), significantly contribute

to the dissemination of relevant literature. Certain conference proceedings, including Lecture Notes in Networks and Systems and Springer Proceedings in Business and Economics, facilitate the dissemination of CE research, illustrating the connection between academic and industry platforms. The findings indicate that the literature on CE in SMEs has expanded in both volume and scope, influencing significant scientific domains, including sustainability, business management, and technological innovation. Comprehending active publication sources is essential for researchers in strategizing future publications and enhancing the visibility and academic impact of their work [4, 26].

4.2. Science mapping analysis

4.2.1. Knowledge structure and conceptualization

4.2.1.1. Conceptual framework via keyword co-occurrence network

Figure 6 illustrates the conceptual framework of CE literature pertaining to SMEs via a keyword co-occurrence network. This analysis delineates three primary clusters derived from the semantic relationships among concepts in the examined publications. The initial cluster, indicated in red, centers on the term "circular economy," which serves as the primary keyword regarding both frequency and significance. Additional pertinent terms encompass sustainability, supply chain management, resource efficiency, climate change, and environmental economics, suggesting that

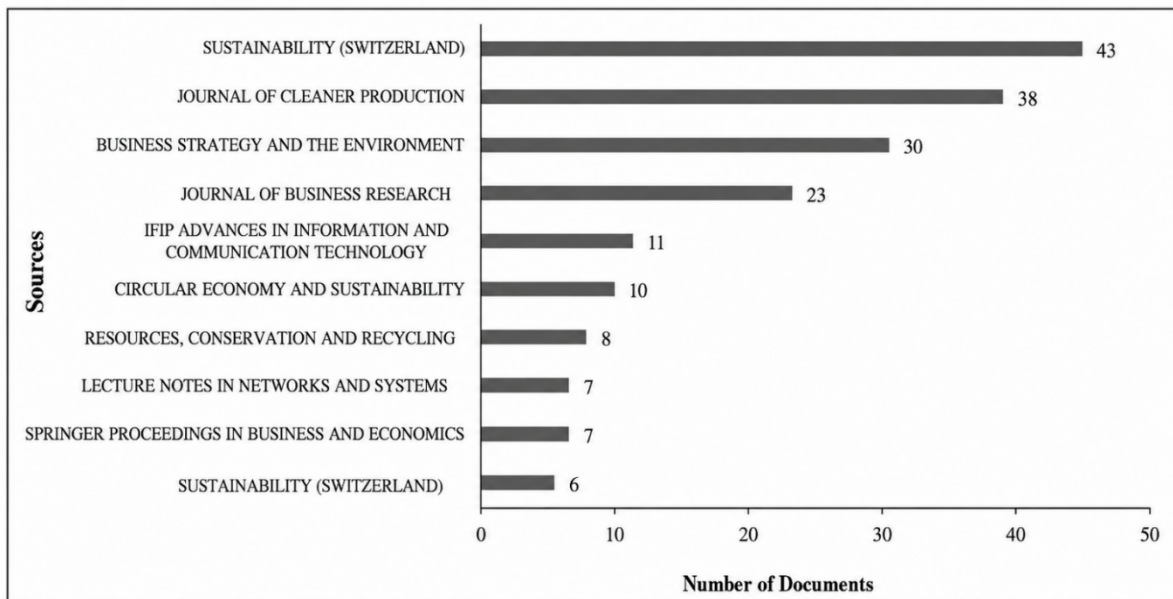


Fig. 5. Top 10 most productive sources on circular economy research in SMEs

Source: Developed by the authors.

the CE approach is extensively examined within the framework of production system sustainability and resource efficiency [1, 21].

The second cluster, represented in blue, centers on the term “SMEs” and encompasses concepts including developing countries, barriers, business models, product design, and Industry 4.0. The implementation of CE in the analyzed SMEs is assessed not only from an environmental standpoint but also through the lenses of technological innovation, process design, and adoption challenges in developing countries [4, 29]. The significant connection between SMEs and sustainable development highlights the crucial role of SMEs in attaining the SDGs, especially Goals 8, 9, and 12. The third cluster, indicated in green, includes terms such as recycling, waste management, environmental sustainability, and economic factors. This cluster presents a technical and economic perspective on CE, emphasizing waste management and recycling processes in relation to operational sustainability [25]. The emergence of the terms “human” and “economic” also indicates a tendency to associate the CE not only with environmental aspects but also with social and economic dimensions. The network structure indicates that the literature on CE in SMEs exhibits a diverse nature, integrating economic, social, environmental, and technological components. The significant co-existence of keywords suggests that the approach to CE in the SME sector is transitioning from technical concerns, such as recycling, to strategic consider-

ations, including business model design, decision-making, and the integration of new technologies [13]. This mapping delineates the existing knowledge structures and presents avenues for investigating more profound cross-disciplinary themes in forthcoming research.

4.2.1.2. Co-occurrence density map of keywords

Figure 7 illustrates the keyword co-occurrence density map, indicating the intensity of topics within CE studies related to the SME sector. Dark red areas represent high concentrations of keywords, indicating the predominant core themes within this literature. In contrast, regions with lighter hues signify subjects that are infrequently addressed yet maintain a thematic relationship.

The density map reveals that terms like CE, sustainability, SMEs, and sustainable development are predominant, highlighting these four concepts as central themes in CE-SME literature, which emphasizes the integration of sustainability into SME activities [1, 25]. Furthermore, concepts including supply chain management, environmental management, resource efficiency, climate change, and ecological innovation are gaining prominence in high-density areas, suggesting that CE-SMEs are progressively addressing more specialized topics, such as sustainable supply chain management [13, 21]. Terms associated with digital technology and Industry 4.0 emerged in areas of low intensity, suggesting that this domain remains in development

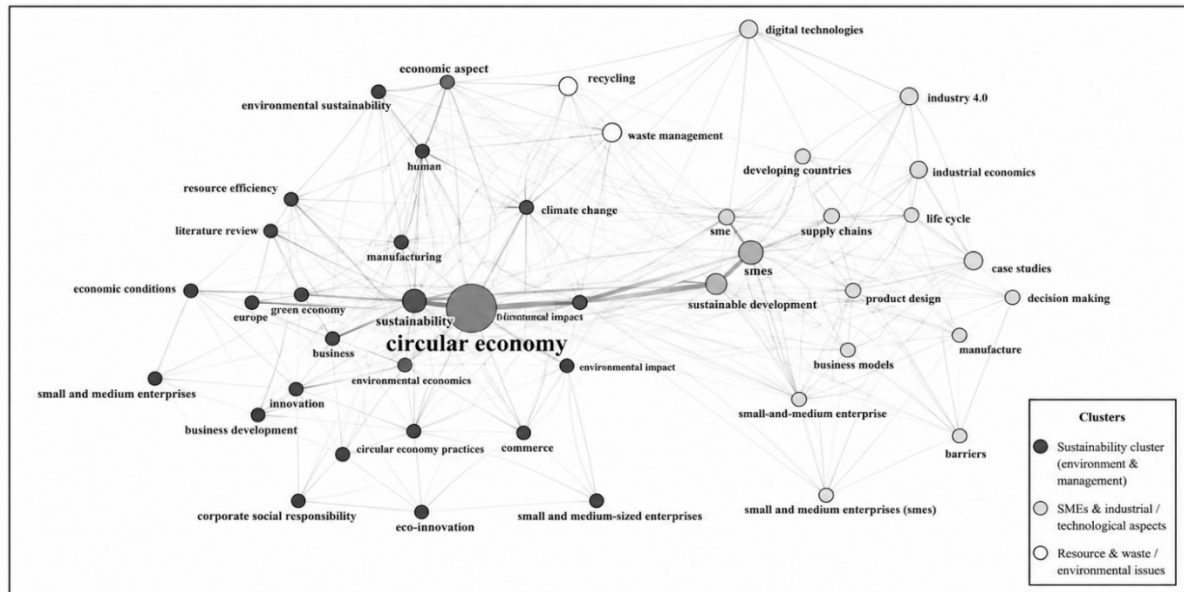


Fig. 6. Keyword co-occurrence network on circular economy research in SMEs

Source: Developed by the authors.

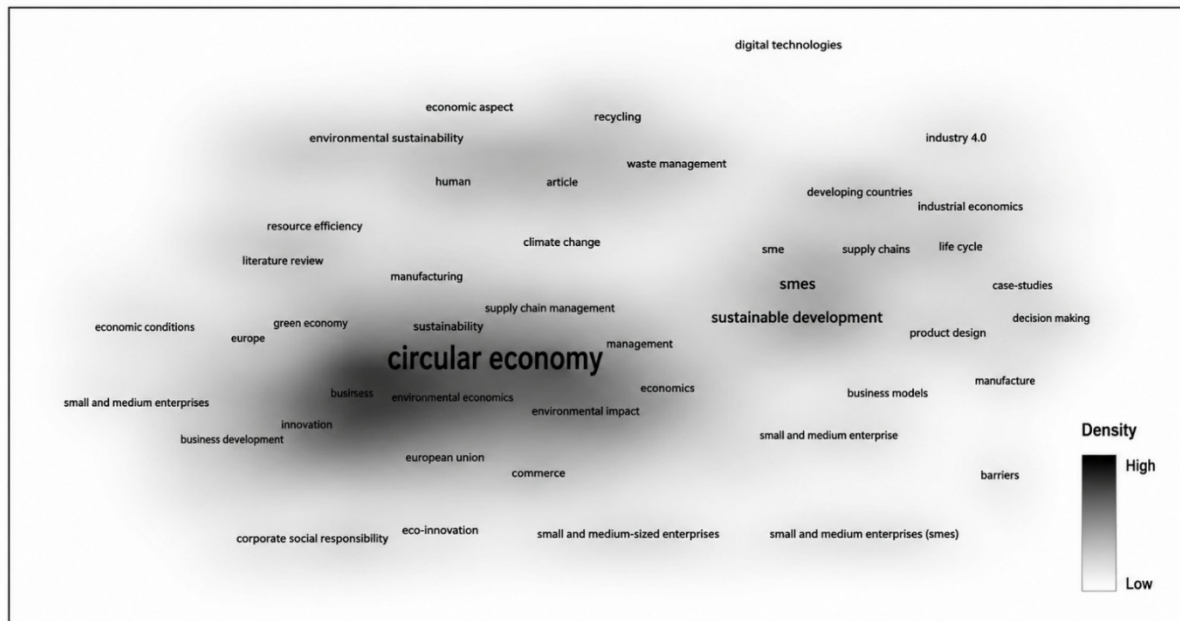


Fig. 7. Key word density visualization of research on circular economy research in SMEs

Source: Developed by the authors.

and holds significant potential to facilitate sustainable practices in the future [4]. The density map supports prior analyses and underscores potential avenues for further investigation, especially regarding the incorporation of digital technologies, innovative business models, and data-driven decision-making in the context of the CE for SMEs [26, 29].

4.2.1.3. Trending topics

Figure 8 illustrates the evolution of topics within CE literature in the SME sector from 2018 to 2025, as derived from the Scopus database. This finding

indicates that key themes such as CE, SMEs, and sustainable development were dominant between 2020 and 2024, reflecting that these fundamental issues remain central to academic discussions related to the sustainability of SMEs [1].

The terms “recycling,” “waste management,” and “environmental management,” which have been prevalent since the onset of the period, began to decline in frequency post-2022, suggesting a transition from conventional environmental concerns to a more strategic and digital focus. Since 2023, emerging topics such as digital transforma-

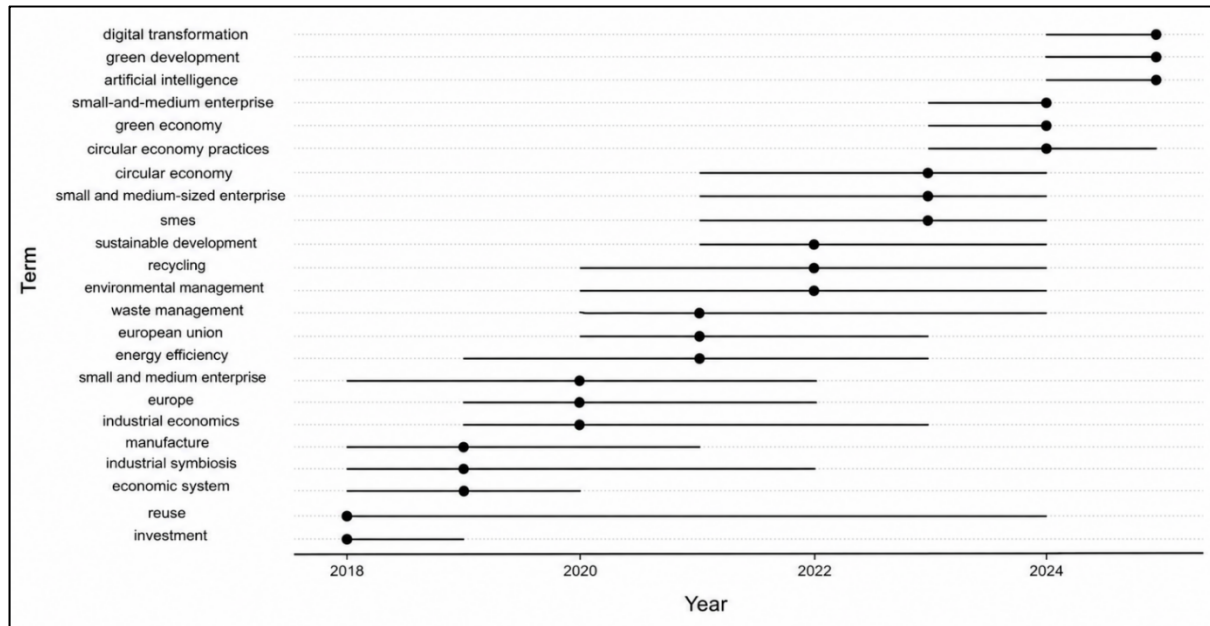


Fig. 8. Timeline of keyword trends on circular economy research in SMEs

Source: Developed by the authors.

tion, green development, and artificial intelligence indicate that technology is becoming a significant driver in the implementation of CE practices in SMEs. Themes such as “circular economy practices” and “green economy” have experienced notable growth, indicating a heightened interest in the practical implementation of CE principles within the framework of green development. This finding is consistent with the research conducted by [21], which indicates that CE practices in SMEs are now transitioning towards the integration of digital and collaborative methods. This analysis of trends in the topic reflects the evolution of concepts within CE-SME literature and identifies strategic directions for future research, such as technology integration, sustainability performance measurement, and eco-friendly business models.

4.2.1.4. Thematic mapping

Figure 9 presents a thematic map that depicts keywords associated with SMEs in the CE study. This map classifies topics into four quadrants according to their relevance and level of development. The upper right quadrant (Motor Themes) prominently features the terms “small and medium-sized enterprises,” “sustainability,” and “innovation,” indicating the primary emphasis of the literature on the implementation of sustainability by SMEs through innovation in business models and technology [1, 25]. While CE policies and societal pressures have promoted green innovation,

the effectiveness of digitalization remains limited due to constraints in human resources and access to technology, necessitating training and capacity development [30]. Advanced technologies, including big data analytics [31] and social media [32], facilitate the CE transition by enhancing transparency and efficiency in the assessment of the triple bottom line (TBL). Digital business models, such as digital platforms and the metaverse, enhance the scope of CE practices in SMEs, facilitating their growth and internationalization [33].

The upper left quadrant (Niche Themes) highlights the topics “barriers,” “digital technology,” and “facilitators.” The evidence suggests that, although barriers to CE implementation continue to be a primary concern, digital technology and digital transformation are emerging as potential enablers to facilitate CE [4]. Issues such as low awareness, limited infrastructure, and a shortage of human resources create a negative cycle in the transition to a CE [34, 35]. Blockchain, Internet of Things (IoT), and big data enhance efficiency and transparency in the CE process [36, 37]. The themes of “circular economy,” “MSMEs,” and “SMEs” in the lower right quadrant (Basic Themes) remain at the foundational concept stage and necessitate further investigation, especially regarding new sectors and business models [21].

The lower left quadrant (Emerging or Declining Themes) signifies that topics like “business models,” “decision-making,” and “product design” remain in

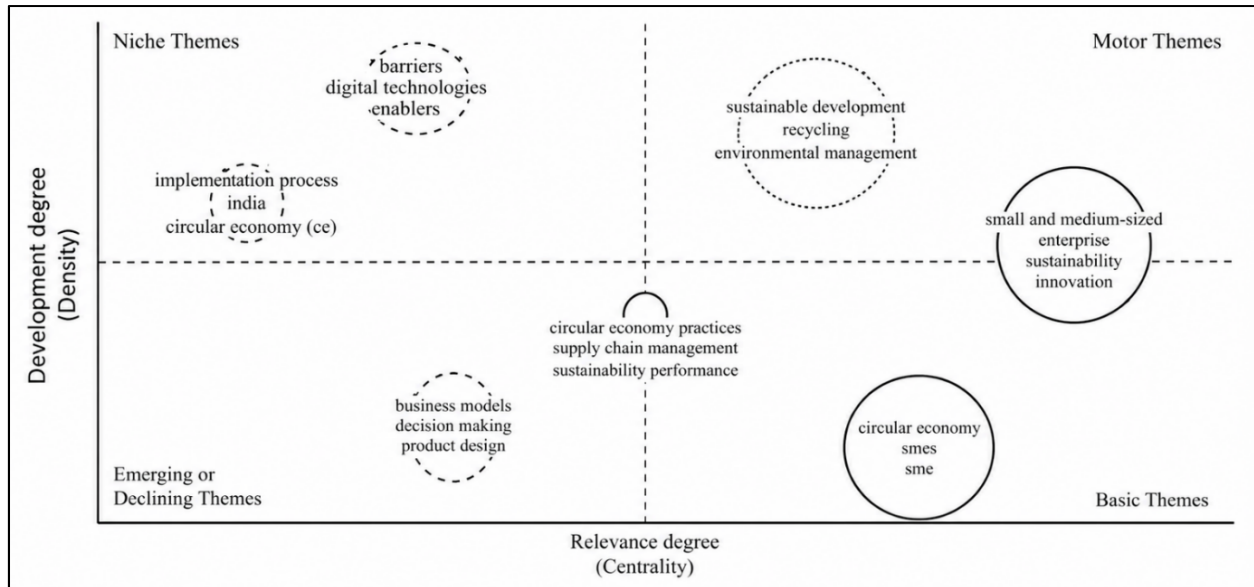


Fig. 9. Thematic quadrant of keywords on circular economy research in SMEs

Source: Developed by the authors.

the conceptual and experimental phases. Several studies have established CE-based business models [38] and ISM-based decision frameworks [39], which demonstrate the importance of multidisciplinary approaches in product design and technology integration to facilitate CE [40]. The central quadrant encompasses themes including CE practices, supply chain management, and sustainability performance. This suggests that the CE in SMEs is progressing from fundamental concerns such as waste management and resource efficiency to a more integrated approach involving digitalization, innovation, and supply chain management [3, 41]. Digital technologies, including blockchain, IoT, and big data, are essential for facilitating CE transformation and enhancing transparency and sustainability performance [42, 43]. A comprehensive strategy that emphasizes cross-sector collaboration and enhances the internal capabilities of SMEs can expedite the transition to a sustainable and competitive CE [44, 45]. This finding suggests that CE in SMEs is progressively advancing from fundamental concepts to the incorporation of more intricate issues, including innovation, digitalization, and supply chain management. This evolution presents opportunities for further research into the advancement of more inclusive and sustainable CE practices.

4.2.2. Thematic integration and theoretical framework

A bibliometric analysis of 510 documents sourced from Scopus revealed seven primary clusters:

barriers, business models, CE, CE practices, implementation processes, SMEs, and sustainable development. The groups represent interrelated conceptual dimensions that can be examined in relation to organizational strategy, as demonstrated in Fig. 10.

This research integrates three primary theories: the TOE framework, DCT, and institutional theory, applied to the strategic management process as outlined in the model [14]. This method facilitates a thorough examination of the CE in SMEs, encompassing external influences and internal competencies, to develop effective sustainability strategies.

4.2.2.1. Environmental scanning: external pressures and contextual readiness for CE implementation in SMEs

During the environmental scanning phase, institutional theory elucidates the influence of coercive, normative, and mimetic pressures on the adoption of CE practices. The significance of public policy and national context is clearly illustrated in the process and policy implementation cluster, as demonstrated by the cases of India and China [8]. The environmental dimension of the TOE framework enhances this study by assessing external readiness, encompassing infrastructure support and logistics systems, which affect SMEs' capacity to transition towards CE [20]. A significant aspect in the literature regarding CE in SMEs is the impact of external factors on organizational readi-

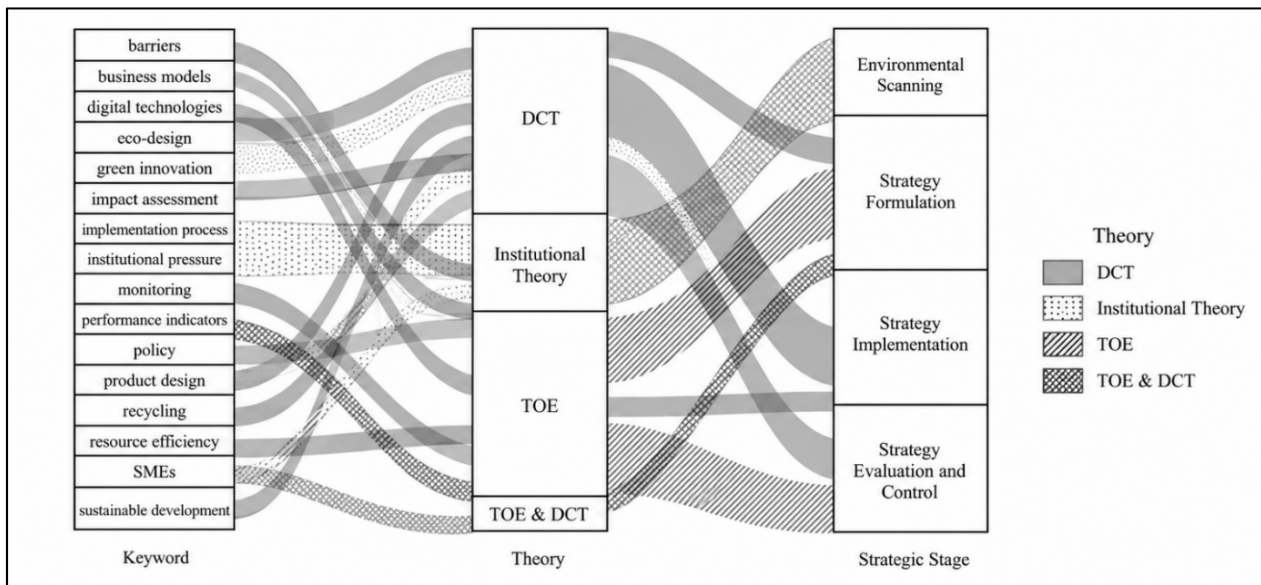


Fig. 10. Thematic integration within the strategic management framework on circular economy research in SMEs

Source: Developed by the authors.

ness for sustainable transition. Keyword clustering reveals that implementation processes and policies are pivotal, exhibiting high frequency and strong centrality values within the bibliometric network. Terms like implementation processes, India, CE, and market conditions are prevalent in numerous documents, underscoring the significance of market and policy dynamics in facilitating CE [4].

Institutional theory posits that organizations encounter three forms of pressure: coercive (regulations and policies), mimetic (adopting successful practices), and normative (industry and professional standards) [18]. [46] highlight the importance of national policies, tax incentives, and waste management regulations in fostering the development of CE practices within SMEs. The implementation is primarily driven by the central government's coercive pressure; however, its continuation is contingent upon the internal capacity of the organization. Nonetheless, a significant challenge for developing nations such as India and Indonesia is the disparity between governmental policies and the constraints of infrastructure readiness and available resources. Study [47] demonstrates that the disparity between macro policies and the micro capacity of SMEs obstructs the effective implementation of CE. The TOE framework indicates that the effective implementation of a CE necessitates backing from infrastructure, regulatory frameworks, and technological collaborations [20].

Market conditions significantly influence the relationship between the intention to adopt CE

practices and their success rate. Study [48] demonstrates that the CE will not progress without a market prepared to accept products derived from remanufacturing, recycling, or upcycling. The focus on normative and mimetic pressures, as articulated by [49] indicates that SMEs in South Asia are adopting CE not solely due to government policies but also in response to pressures from industry communities and trade associations advocating for environmentally sustainable standards. The bibliometric data suggests that the primary emphasis in the CE literature for SMEs is on the implementation process and policies. From a practical perspective, SMEs may operationalize the environmental scanning stage by conducting regulatory assessments, identifying market demand for sustainable products, and evaluating the availability of recycling infrastructure and technology support systems. Stakeholder mapping activities involving suppliers, local governments, industry associations, and consumers may also assist SMEs in identifying institutional expectations and sustainability opportunities [46, 49]. In addition, SMEs can assess external readiness through infrastructure audits and collaboration feasibility analyses to determine the availability of reverse logistics systems, waste management facilities, and technological partnerships required for CE adoption [20, 55]. This practical mechanism enables SMEs to identify external constraints and opportunities before developing CE-oriented strategic initiatives.

4.2.2.2. Strategy formulation: assessing organizational readiness and dynamic capabilities in CE strategy development

The strategy formulation stage in implementing CE in SMEs focuses on how the organization responds to external challenges and designs strategies that align with its capabilities. Based on bibliometric analysis, clusters such as SMEs, business models, and barriers indicate a strong strategic orientation from within the organization. Keywords such as product design, decision making, resource efficiency, and digital technology reflect that CE strategies are highly influenced by technological readiness, business process structures, and an organization's ability to adapt to environmental changes [1, 25]. Within the framework of TOE theory, internal technological readiness and organizational structure are relevant at this stage. TOE emphasizes that the success of innovations like CE depends on internal technological readiness, such as digital devices and production processes, as well as organizational readiness in terms of management and human resource capabilities. This finding is supported by, who showed that SMEs with integrated digital information systems are better prepared to design data-driven circular business models and automate processes.

Additionally, DCT explains the importance of dynamic capabilities in SMEs, such as the ability to reconfigure supply chains and redesign products for greater sustainability [6, 50] emphasize that CE strategies need to focus on product design innovation to extend product lifecycles and achieve efficient disassembly. Decision making is one of the key aspects in formulating CE strategies. In SMEs, strategic decisions tend to be top down but often lack formal structure. [51] emphasize the importance of data-driven decision-making frameworks and technological support to help SMEs formulate more targeted CE strategies based on sustainability performance indicators. However, many SMEs face internal barriers, such as a lack of skilled labour, unwillingness to change, and a short-term orientation in business management. [52] show that sustainability strategies must be integrated with the core business strategies of SMEs for the transition towards a CE to be effective and sustainable. Overall, this analysis confirms that CE strategies are not only linked to overall business strategies but must also be a core component of business models focused on innovation and long-term sustainability [1].

Practically, SMEs may formulate CE strategies by integrating sustainability objectives into their core business models and identifying priority areas for resource efficiency, eco-design, and waste reduction initiatives. Internal capability assessments involving digital readiness, employee competencies, and organizational flexibility may support strategic alignment between CE objectives and operational capacities [7, 20]. Furthermore, SMEs may utilize sustainability indicators and data-driven decision-making systems to support strategic planning processes and evaluate the feasibility of circular business models [51]. Product redesign strategies emphasizing durability, repairability, and efficient disassembly may also strengthen long-term CE competitiveness and support sustainable innovation pathways [6, 50]. These mechanisms allow SMEs to translate environmental pressures and sustainability goals into actionable organizational strategies.

4.2.2.3. Strategy implementation: operational execution and process transformation towards CE

The implementation stage of the strategy for applying CE in SMEs is crucial because it links strategy formulation to the achievement of promised sustainability. Based on bibliometric analysis, groups such as resource efficiency, supply chain, production processes, and green innovation show a strong focus on operational execution. Terms like remanufacturing, reverse logistics, industrial symbiosis, and sustainable production consistently appear, indicating the dynamics of CE implementation at the operational level [1, 25].

Implementing a CE requires planned changes across the entire value chain, from design, production, and distribution to recycling. DCT is highly relevant at this stage because it explains that the successful implementation of a strategy depends on the organization's ability to adapt its processes to sustainability demands [53]. In the study [54], SMEs that successfully integrated CE principles into production were able to increase energy efficiency by up to 30%. However, the implementation of CE faces significant challenges, including building reverse logistics infrastructure and effective waste management systems. The author of [55] showed that the success of CE in SMEs is highly dependent on a local ecosystem that supports recycling. This is where TOE becomes relevant again,

with an emphasis on organizational structure, information systems, and technology partnerships to support sustainable innovation [20].

New technologies and eco-innovation also play a crucial role in supporting CE. Study [56] emphasizes that eco-innovation is not only related to technology replacement but also encompasses changes in business processes. Digital technologies, such as IoT and eco-friendly enterprise resource planning (ERP), are becoming essential tools in the implementation of CE [1]. Although many SMEs understand the concept of CE, challenges such as lack of funding and limited technical training hinder implementation. [57] suggest that incentive policies and support for an eco-friendly entrepreneurial ecosystem are crucial. Industrial symbiosis practices can also accelerate the transition, as exemplified in [58], which noted the successful collaboration between companies in using waste as raw material. Overall, implementing CE in SMEs requires a comprehensive, contextual, and strategic approach that involves collaboration between various stakeholders. From an operational perspective, SMEs may implement CE practices through phased transformation initiatives, beginning with pilot projects focused on waste reduction, recycling systems, green procurement, and resource efficiency improvements. The implementation process may also involve the adoption of reverse logistics systems, industrial symbiosis partnerships, and sustainable production technologies to optimize material circulation across the value chain [1, 25, 58]. Digital technologies such as IoT-based monitoring systems and environmentally integrated ERP platforms can further support operational efficiency, waste tracking, and process transparency [1, 56]. To address financial and technical limitations, SMEs may collaborate with external stakeholders, including suppliers, government agencies, universities, and industry networks, to strengthen technological capabilities and access sustainability incentives [55, 57]. This implementation mechanism reflects the importance of adaptive organizational capabilities and collaborative ecosystems in facilitating CE transition within SMEs.

4.2.2.4. Evaluation and control: impact evaluation and feedback mechanisms in the implementation of CE in SMEs

The evaluation and control stage of the CE strategy implementation in SMEs emphasizes

the importance of continuous performance assessment and feedback mechanisms for strategy adjustments to remain relevant. The evaluation focuses not only on measuring environmental efficiency or waste reduction but also on the economic and social benefits that can be generated by implementing CE in SMEs [1]. Bibliometric analysis identifies new clusters, such as performance assessment, sustainability indicators, impact evaluation, resilience, and circular metrics, highlighting the importance of integrated sustainability measurement systems in SME management [21, 25]. The study [59] developed a multi criteria evaluation framework incorporating life cycle thinking and the TBL, assessing the effects of CE on SMEs by considering environmental, economic, and social aspects.

Limited access to complex evaluation tools is a major challenge for SMEs, necessitating a practical indicator-based approach. Study [1] suggests implementing easily accessible sustainability indicators, such as waste intensity, material reuse ratio, and energy savings, to increase organizational awareness of CE performance. TOE [20] is relevant in assessing an organization's readiness to implement technology-based evaluation systems, such as digital dashboards for monitoring emissions or automated reporting systems, which reflects the maturity of CE in SMEs [53]. DCT also plays an important role in developing learning routines and establishing a sustainable feedback loop [7]. The importance of performance-based incentives supported by government policies to drive strategic evaluation and control is also reflected in subsidy programs that can improve SME compliance with CE indicators [54]. In practical terms, SMEs may evaluate CE performance using measurable sustainability indicators, such as waste intensity, material reuse rates, recycling efficiency, energy savings, and environmentally sustainable product revenues [1].

The implementation of digital monitoring systems and sustainability dashboards may support continuous tracking of operational performance and environmental impacts [20, 53]. In addition, periodic sustainability reviews and stakeholder feedback mechanisms involving customers, suppliers, and employees can help organizations identify implementation gaps and improve CE practices over time. Government-supported incentive sys-

tems and performance-based sustainability programs may further encourage SMEs to strengthen compliance with CE objectives and continuously improve organizational learning processes [54]. These evaluation and feedback mechanisms are essential for ensuring long-term CE effectiveness and strategic adaptability in dynamic business environments.

4.2.2.5. Practical implementation pathway for circular economy transformation in SMEs

Building upon the integration of the TOE framework, Institutional Theory, and DCT, this study proposes a practical implementation pathway to support SMEs in operationalizing CE strategies in a more systematic and adaptive manner. Rather than viewing CE adoption as a single organizational initiative, the findings suggest that SMEs should approach CE transformation as a continuous strategic cycle involving readiness assessment, strategic alignment, operational adaptation, and continuous performance improvement.

The proposed pathway highlights that successful CE implementation in SMEs depends on the interaction between external institutional conditions and internal organizational capabilities. At the early stage of CE transition, SMEs need to establish strategic alignment between sustainability objectives and organizational resources. This alignment requires firms to evaluate the compatibility between existing business processes, technological readiness, financial capacity, and long-term sustainability orientation [20]. Institutional pressures from governments, markets, and industry networks further influence organizational priorities and may accelerate the willingness of SMEs to adopt circular practices [18, 46]. Therefore, CE transition should be positioned not only as an environmental initiative but also as a strategic business transformation process.

The findings also indicate that SMEs require gradual capability development to support CE operationalization. Instead of implementing large-scale transformation immediately, SMEs may adopt incremental transition strategies through pilot-based initiatives, resource efficiency programs, and collaborative sustainability projects. This staged approach is particularly important for SMEs facing resource limitations, technological constraints,

and limited managerial expertise [52, 57]. Consistent with DCT, organizational adaptability and learning capability become essential mechanisms that enable SMEs to continuously reconfigure resources, modify operational routines, and respond to changing environmental demands [53].

Another important implication of the proposed pathway is the role of interorganizational collaboration in strengthening CE implementation effectiveness. The literature demonstrates that SMEs often lack sufficient infrastructure and technological capacity to independently develop circular systems [55]. Consequently, collaboration with suppliers, recycling partners, local governments, universities, and industrial networks becomes a critical mechanism for improving knowledge transfer, technological access, and sustainable innovation capacity [49, 58]. This collaborative ecosystem perspective reinforces the importance of external support structures in facilitating CE scalability and long-term sustainability.

Furthermore, the proposed pathway emphasizes that CE implementation should be integrated into organizational evaluation and strategic learning mechanisms. Continuous monitoring through sustainability indicators, resource efficiency measurements, and operational performance reviews allows SMEs to identify implementation gaps and improve decision-making quality over time [1, 59]. This feedback-based mechanism strengthens organizational resilience and supports the long-term institutionalization of CE practices within SME business models.

Overall, the practical implementation pathway developed in this study contributes by translating bibliometric and theoretical findings into a more actionable strategic framework for SMEs. The pathway demonstrates that effective CE transformation requires not only technological adoption and policy support but also organizational learning, collaborative capability, and continuous strategic adaptation across multiple implementation stages.

4.3. Comparison of research findings with prior studies

The expanding literature on CE has enhanced our comprehension of the adoption and implementation of circular practices in diverse sectors. Recent reviews on CE indicate significant deficiencies in the current research landscape, especially concerning the strategic management of CE in SMEs.

Table shows the comparative analysis that identifies gaps by evaluating three recent review articles and illustrates the positioning and novelty of our proposed research findings.

This study seeks to address significant gaps present in the existing reviews that contribute to the CE discourse. Study [62] presents a macroregional perspective; however, they do not explore firm level strategies or establish a theoretical framework. Their analysis focuses on broader trends in CE research, offering observations about the productivity of authors and institutions; however, it lacks actionable guidance for SMEs or organizations seeking to implement CE. This study, therefore, inadequately addresses the specific challenges and strategic considerations that SMEs encounter when transitioning to a CE, especially in developing economies.

Research [60] offers an extensive theoretical framework for CE strategies; however, they do not include empirical triangulation. The study lacks the inclusion of bibliometric methods and detailed sector specific insights, which could provide more practical guidance for SMEs. The incorporation of various theoretical perspectives, although beneficial, leads to a deficiency in emphasis on practical, firm level dynamics, rendering the implementation of these strategies ambiguous for organizations seeking to adopt circular practices.

Study [61] offers important insights regarding reparability within the electronics sector; however, their limited scope restricts the broader applicability of their conclusions. This study fails to comprehensively address the potential benefits of the CE for SMEs in various industries by excluding other sectors and neglecting their role within the broader CE ecosystem. The emphasis on product design lacks engagement with the strategic and managerial frameworks essential for facilitating broader organizational change towards CE adoption.

Conversely, this study significantly contributes by addressing these gaps. This review integrates bibliometric mapping with strategic management theories, presenting a novel theoretical synthesis that combines the TOE framework, institutional theory, and DCT. This integration facilitates the exploration of CE adoption in SMEs by encompassing both macro level trends and firm level dynamics. In contrast to prior studies, our research evaluates bibliometric data while also connecting these findings to strategic phases including envi-

ronmental scanning, strategy formulation, implementation, and evaluation based on Wheelen and Hunger's four phase strategic management model. This study employs a strategic management perspective to examine the organizational challenges encountered by SMEs in implementing CE practices, offering practical insights for practitioners. This approach connects theoretical frameworks with practical applications, providing a theoretically grounded, evidence-based comprehension of CE evolution in SMEs. This research enhances the understanding of CE by considering the external pressures faced by SMEs, such as regulatory changes and market demands, alongside the internal capabilities required for development, including digital infrastructure, organizational readiness, and skill enhancement.

5. Conclusion

5.1. Research conclusions

This research systematically delineates knowledge domains associated with CE in the context of SMEs through a bibliometric analysis utilizing Scopus data. An analysis of 510 publications indicates a significant increase in academic interest in the topic since 2018, correlating with the global movement towards sustainable production practices and environmentally conscious economic policies. Three primary thematic focuses have been identified: (1) efficiency in resource utilization and environmental management, (2) digitalization alongside circular business models, and (3) the role of institutional interaction and public policy in facilitating the implementation of CE practices in SMEs. This study integrates thematic mapping with the strategic management framework proposed in [14] delineating four essential steps for adopting CE: environmental scanning, strategy formulation, strategy implementation, and strategy evaluation and control. The implementation of CE in SMEs is analyzed through institutional theory, the TOE framework, and DCT. This analysis reveals that both internal factors and external pressures, along with organizational capability dynamics, significantly influence the process.

5.2. Implications

The findings of this study provide several theoretical and practical implications. Theoretically, this research strengthens the integration of strategic management theory, the TOE framework,

Table
Comparative analysis with prior studies

Comparison Aspect	[62]	[60]	[61]	Research Finding
Type of Review	Bibliometric Review	Systematic Literature Review	Narrative Technical Review	Bibliometric Review with Strategic Management Theory Integration
Geographic Focus	Emerging Economies (e.g., Nigeria, South Africa, India)	Global scope	Primarily OECD and EU countries	Global, with emphasis on SMEs
Sectoral Focus	Macro level: National/Regional analysis	General CE implementation across sectors	Electronics and consumer technology sector	Small and Medium Enterprises
Theoretical Perspective	No explicit theoretical lens	Multiple theoretical views: ecological modernization, stakeholder, triple bottom line	Design for repair theory, eco-design frameworks	Strategic Management theories: TOE Framework, Institutional Theory, Dynamic Capabilities Theory
Analytical Approach	Performance metrics and science mapping: co-authorship, co-citation, trend analysis	Thematic clustering and conceptual synthesis	Qualitative analysis of design practices and policy implications	Bibliometric + Thematic Clustering + Strategic Mapping (Wheelen & Hunger's four phase model)
Key Contributions	Provides an overview of CE research trends in developing regions and identifies productivity patterns among authors and institutions	Offers a broad taxonomy of CE strategies, theories, tools, and country level comparisons	Focuses on practical reparability criteria to support CE adoption in product design	Bridges bibliometric evidence with managerial insight to strengthen CE integration in MSMEs

Source: Developed by the authors.

institutional theory, and dynamic capabilities theory in explaining CE implementation within SMEs. The study also expands the CE literature by demonstrating how bibliometric mapping can be utilized to identify strategic patterns, emerging themes, and organizational capabilities related to sustainable business transformation. Practically, the results highlight the importance of digital transformation, innovation capability, institutional support, and sustainable supply chain management in accelerating CE adoption among SMEs. Policymakers and SME practitioners may use these findings to formulate more adaptive sustainability strategies, improve technological readiness, and strengthen collaborative ecosystems that support circular business practices.

5.3. Limitations and future research

This study has several limitations. First, the analysis only utilized the Scopus database, which may exclude relevant publications indexed in other databases. Second, only English-language publications were included, potentially limiting the representation of regional studies. Third, bibliometric analysis primarily emphasizes publication metadata and conceptual relationships without empirically validating CE implementation practices in SMEs.

Future studies may expand database coverage by incorporating Web of Science, Dimensions, or other databases to obtain broader literature representation. Further research is also recommended to empirically validate the proposed conceptual

framework and investigate sector-specific CE implementation in SMEs. In addition, future studies may explore digital readiness, AI integration, and comparative analyses between developed and developing countries to better understand the evolution of CE adoption in diverse SME contexts.

REFERENCES

1. Geissdoerfer M., Savaget P., Bocken N.M.P., Hultink E.J. The circular economy — A new sustainability paradigm? *Journal of Cleaner Production*. 2017;143:757-768. URL: <https://doi.org/10.1016/j.jclepro.2016.12.048>
2. Chowdhury S., Dey P.K., Rodríguez-Espíndola O., Parkes G., Tuyet N.T.A., Long D.D., et al. Impact of organisational factors on the circular economy practices and sustainable performance of small and medium-sized enterprises in Vietnam. *Journal of Business Research*. 2022;147:362-378. URL: <https://doi.org/10.1016/j.jbusres.2022.03.077>
3. Kuhmonen I., Näyhä A., Solaranta M., Keränen J. Can small and medium-sized companies increase the value added from wood-based side streams? *Silva Fennica*. 2024;58(5):23080. URL: <https://doi.org/10.14214/sf.23080>
4. Nguyen K.H. Circular economy practices, green innovation and financial performance: The moderating role of big data analytics. *E&M Economics and Management*. 2025;28(3):1-16. URL: <https://doi.org/10.15240/tul/001/2025-5-014>
5. Raudales-Garcia E.V., Acosta-Tzin J.V., Aguilar-Hernández P.A. Circular economy: A systematic and bibliometric review. *Región Científica*. 2024;3(1):2024192. URL: <https://doi.org/10.58763/rc2024192>
6. Kirchherr J., Reike D., Hekkert M. Conceptualizing the circular economy: an analysis of 114 definitions. *Resources, Conservation and Recycling*. 2017;127:221-232. URL: <https://doi.org/10.1016/j.resconrec.2017.09.005>
7. Zhang M., Liu R., Sun H. Achieving carbon-neutral economies through circular economy, digitalization, energy transition, and eco-friendly trade strategy. *Scientific Reports*. 2025;15(1):97810. URL: <https://doi.org/10.1038/s41598-025-97810-w>
8. Govindan K., Hasanagic M. A systematic review on drivers, barriers, and practices towards circular economy: A supply chain perspective. *International Journal of Production Research*. 2018;56(1-2):278-311. URL: <https://doi.org/10.1080/00207543.2017.1402141>
9. Teece D.J. Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*. 2007;28(13):1319-1350. URL: <https://doi.org/10.1002/smj.640>
10. Teece D.J. The foundations of enterprise performance: dynamic and ordinary capabilities in an (economic) theory of firms. *Academy of Management Perspectives*. 2014;28(4):328-352. URL: <https://doi.org/10.5465/amp.2013.0116>
11. Helfat C.E., Peteraf M.A. Understanding dynamic capabilities: progress along a developmental path. *Strategic Organization*. 2009;7(1):91-102. URL: <https://doi.org/10.1177/14761270081001>
12. Batista-Canino R.M., Sosa-Cabrera S., Medina-Brito P., Santana-Hernández L. Scientific progress on entrepreneurship in the circular economy: a scientometric analysis. *Sustainability*. 2025;17(2):777. URL: <https://doi.org/10.3390/su17020777>
13. Lu F., Du S., Mehmood K., Hakeem M.M. Steering sustainability: The interplay of CEO imprints, organizational performance, and government policies in green innovation. *Sustainability*. 2025;17(3):1234. URL: <https://doi.org/10.3390/su17031234>
14. Wheelen T.L., Hunger J.D. Strategic Management and Business Policy toward global sustainability 13th ed. New Jersey: Pearson; 2012. URL: [https://wcu.edu.az/uploads/files/Strategic%20Management%20and%20Business%20Policy%20\(%20PDFDrive%20\).pdf](https://wcu.edu.az/uploads/files/Strategic%20Management%20and%20Business%20Policy%20(%20PDFDrive%20).pdf)
15. Santa-Maria T., Vermeulen W.J.V., Baumgartner R.J. How do incumbent firms innovate their business models for the circular economy? Identifying micro-foundations of dynamic capabilities. *Business Strategy and the Environment*. 2022;31(4):1308-1333. URL: <https://doi.org/10.1002/bse.2956>
16. Gennari F. The transition towards a circular economy: a framework for SMEs. *Journal of Management and Governance*. 2023;27:1423-1457. URL: <https://doi.org/10.1007/s10997-022-09653-6>
17. Centobelli P., Cerchione R., Chiaroni D., Del Vecchio P., Urbinati A. Designing business models in circular economy: a systematic literature review and research agenda. *Business Strategy and the Environment*. 2020;29(4):1734-1749.

18. Zhu B., Nguyen M., Siri N.S., Malik A. Towards a transformative model of circular economy for SMEs. *Journal of Business Research*. 2022;144:545-555. URL: <https://doi.org/10.1016/j.jbusres.2022.01.093>
19. Bocken N.M.P., de Pauw I., Bakker C., van der Grinten B. Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*. 2016;33(5):308-320. URL: <https://doi.org/10.1080/21681015.2016.1172124>
20. Baker J. The technology-organization-environment framework. In: Dwivedi Y. K., Wade M. R., Schneberger S. L. Information systems theory. New York: *Springer*; 2012:231-245. URL: https://doi.org/10.1007/978-1-4419-6108-2_12
21. Dey P.K., Malesios C., De D., Chowdhury S., Abdelaziz F.B., Venkatraman S. The impact of lean management practices and sustainably-oriented innovation on sustainability performance of small and medium-sized enterprises: empirical evidence from the UK. *British Journal of Management*. 2022;33(1):141-161. URL: <https://doi.org/10.1111/1467-8551.12485>
22. Aria M., Cuccurullo C. bibliometrix: an R-tool for comprehensive science mapping analysis. *Journal of Informetrics*. 2017;11(4):959-975. URL: <https://doi.org/10.1016/j.joi.2017.08.007>
23. Rosário A.T., Lopes P., Rosário F.S.. Sustainability and the circular economy business development. *Sustainability*. 2024;16(14):6092. URL: <https://doi.org/10.3390/su16146092>
24. Teece D.J. Business models and dynamic capabilities. *Long Range Planning*. 2018;51(1):40-49. URL: <https://doi.org/10.1016/j.lrp.2017.06.007>
25. Köhler J., Sönnichsen S.D., Beske-Jansen P. Towards a collaboration framework for circular economy: The role of dynamic capabilities and open innovation. *Business Strategy and the Environment*. 2022;31(6):2700-2713. URL: <https://doi.org/10.1002/bse.3000>
26. Kondala M., Nudurupati S.S., Pappu R.P. The challenges in adoption of circular economy in SMEs—a research agenda and way forward. *Benchmarking: An International Journal*. 2024;31(5):1667-1699. URL: <https://doi.org/10.1108/BIJ-04-2023-0272>
27. Singh A.K., Kumar V.R.P., Dehdasht G., Mohandes S.R., Manu P., Pour Rahimian F. Investigating barriers to blockchain adoption in construction supply chain management: a fuzzy-based MCDM approach. *Technological Forecasting and Social Change*. 2023;197:122849. URL: <https://doi.org/10.1016/j.techfore.2023.122849>
28. Schöggel J.P., Rusch M., Stumpf L., Baumgartner R.J. Implementation of digital technologies for a circular economy and sustainability management in the manufacturing sector. *Sustainable Production and Consumption*. 2023;35:401-420. URL: <https://doi.org/10.1016/j.spc.2022.11.012>
29. Scuotto V., Del Giudice M., Garcia-Perez A., Orlando B., Ciampi F. A spill over effect of entrepreneurial orientation on technological innovativeness: an outlook of universities and research-based spin offs. *The Journal of Technology Transfer*. 2020;45(6):1634-1654. URL: <https://dx.doi.org/10.1007/s10961-019-09760-x>
30. Megawati S., Herdiansyah H., Machmud A., Antriandarti E., Sudirman S. Integrating circular economy, digital economy, and social protection policies to drive green business innovation: insights from Indonesia's culinary SMEs. *Problems and Perspectives in Management*. 2024;22(4):368-381. URL: [https://doi.org/10.21511/ppm.22\(4\).2024.28](https://doi.org/10.21511/ppm.22(4).2024.28)
31. Sangpet P., Ueasangkomsate P. The influence of big data analytics and circular economy on the sustainable performance of SMEs. *Thammasat Review*. 2023;26(1):114-139. URL: <https://doi.org/10.14456/ture-view.2023.5>
32. Bruce E., Keelson S., Amoah J., Bankuoru E.S. Social media integration: an opportunity for SMEs sustainability. *Cogent Business & Management*. 2023;10(1):2173859. URL: <https://doi.org/10.1080/23311975.2023.2173859>
33. Huy P.Q., Phuc V.K. Contribution to accelerated internationalization with digital forensic accounting and metaverse circular business model innovation for Vietnam-based SMEs. *Journal of Innovation and Entrepreneurship*. 2024;13(1):88. URL: <https://doi.org/10.1186/s13731-024-00442-z>
34. Aboalhool T., Alzubi A., Iyiola K. Humane entrepreneurship in the circular economy: the role of green market orientation and green technology turbulence for sustainable corporate performance. *Sustainability*. 2024;16(6):2517. URL: <https://doi.org/10.3390/su16062517>
35. Sklavos G., Theodossiou G., Papanikolaou Z., Karelakis C., Lazarides T. Investing the impact and the challenges of Digital Transformation and Green Entrepreneurship in Greek Food Industry. *Intellectual Economics*. 2024;18(2):360-383. URL: <https://www.cceol.com/search/article-detail?id=1294392>

36. Abdel-Aty T.A., Acerbi F., Brook S., Negri E., McFarlane D., Macchi M. A circular manufacturing framework for SMEs leveraging on low-cost digital technologies. In IET Conference Proceedings CP885. 2024(11):54-60. Stevenage, UK: The Institution of Engineering and Technology. URL: <https://doi.org/10.1049/icp.2024.3485>
37. Stasiuk-Piekarska A., Hordyńska M., Michalska M. The usefulness of cleaner production projects as an element of the initial assessment of the circularity of SMEs in the context of obtaining funds supporting the implementation of the circular economy. *Sustainability*. 2024;16(12):4951. URL: <https://doi.org/10.3390/su16124951>
38. Mahl T., Petry M., Köhler C. Adapting a dashboard-based approach for feasibility analysis to circular PSS business models. *Proceedings of the Design Society*. 2023;3:465-474. URL: <https://doi.org/10.1017/pds.2023.47>
39. Oliveira P.S.P.C., Ferreira F.A.F., Dabić M., Ferreira J.J.M., Ferreira N.C.M.Q.F. Analyzing the causal dynamics of circular-economy drivers in SMEs using interpretive structural modeling. *Energy Economics*. 2024;138:107842. URL: <https://doi.org/10.1016/j.eneco.2024.107842>
40. Franke M., Deng Q., Hribernik K.A., Thoben K.D., Ciaccio G. Towards a Service Marketplace to Empower Circular Economy Transition: An Example Application in the Supply Chain of Textile Industry. *InIFIP International Conference on Advances in Production Management Systems*. 2024:235-249. Cham: Springer Nature Switzerland. URL: https://doi.org/10.1007/978-3-031-71622-5_16
41. Parviziomran E., Elliot V. Barriers to circular economy: insights from a small electric vehicle battery manufacturer. *Journal of Purchasing and Supply Management*. 2024;30(2):100905.
42. Neri A., Negri M., Cagno E., Franzò S., Kumar V., Lampertico T., Bassani C.A. The role of digital technologies in supporting the implementation of circular economy practices by industrial small and medium enterprises. *Business Strategy and the Environment*. 2023;32(7):4693-4718. URL: <https://doi.org/10.1108/MEQ-03-2022-0045>
43. Agyabeng-Mensah Y., Baah C., Afum E. Do the roles of green supply chain learning, green employee creativity, and green organizational citizenship behavior really matter in circular supply chain performance? *Journal of Environmental Planning and Management*. 2024;67(3):609-631. URL: <https://doi.org/10.1002/bse.3388>
44. Madaan G., Singh A., Mittal A., Shahare P. Reduce, reuse, recycle: circular economic principles, sustainability and entrepreneurship in developing ecosystems. *Journal of Small Business and Enterprise Development*. 2024;31(6):1041-1066. URL: <https://doi.org/10.1080/09640568.2022.2130036>
45. Kumar S., Kumar R., Phanden R.K., Rath R. Implementing circular economy practices in Indian SMEs: analysis of challenges with case study. *International Journal of Advanced Operations Management*. 2025;16(1):35-59. URL: <https://doi.org/10.1108/JSBED-01-2023-0009>
46. Marrucci L., Daddi T., Iraldo F. The circular economy, environmental performance and environmental management systems: the role of absorptive capacity. *Journal of Knowledge Management*. 2022;26(8):2107-2132. URL: <https://doi.org/10.1504/IJAOM.2025.145197>
47. Serrano-García J., Bikfalvi A., Llach J., Arbeláez-Toro J.J. Capabilities and organisational dimensions conducive to green product innovation: Evidence from Croatian and Spanish manufacturing firms. *Business Strategy and the Environment*. 2022;31(7):2767-2785. URL: <https://doi.org/10.1108/JKM-06-2021-0437>
48. Basse Mama H., Mandaroux R. Do investors care about carbon emissions under the European Environmental Policy? *Business Strategy and the Environment*. 2022;31(1):268-283. URL: <https://doi.org/10.1002/bse.3014>
49. Witczak J., Kasprzak J., Klos Z., Kurczewski P., Lewandowska A., Lewicki R. Life cycle thinking in small and medium enterprises: the results of research on the implementation of life cycle tools in Polish SMEs — part 2: LCA related aspects. *The International Journal of Life Cycle Assessment*. 2014;19(4):891-900. URL: <https://doi.org/10.1002/bse.2886>
50. Järvenpää A.M., Jussila J., Kunttu I. Barriers and practical challenges for data-driven decision-making in circular economy SMEs. 2023. *Emerald Publishing Limited*. URL: <https://doi.org/10.1007/s11367-013-0687-9>
51. Averina E., Frishammar J., Parida V. Assessing sustainability opportunities for circular business models. *Business Strategy and the Environment*. 2022;31(4):1464-1487. URL: <https://doi.org/10.1108/9781803825519>
52. Eisenhardt K.M., Martin J.A. Dynamic capabilities: what are they? *The SMS Blackwell handbook of organizational capabilities*. 2017:341-363. URL: <https://doi.org/10.1002/bse.2964>
53. Röck M., Passer A., Allacker K. SLiCE: An open building data model for scalable high-definition life cycle engineering, dynamic impact assessment, and systematic hotspot analysis. *Sustainable Production and Consumption*. 2024 Mar 1;45:450-463. URL: <https://doi.org/10.1002/9781405164054.ch21>

54. Olipp N., Schwarz M., Woschank M. Integrating the principles of reverse logistics into circular economy strategies: A mixed-method study of small and medium-sized enterprises. *Sustainability*. 2025 Aug 14;17(16):7361. URL: <https://doi.org/10.1016/j.spc.2024.01.005>
55. Dewiyan L., Marini A., Yarmi G., Atmanto D., Salim S., Safitri D., Irwansyah P., Zahari M., Saputro R.H., Marfu A. Eco-innovation and green entrepreneurship: transforming challenges into opportunities for the environment. *Cleaner Environmental Systems*. 2025:100345. URL: <https://doi.org/10.3390/su17167361>
56. Sobko O., Gavkalova N., Kurbatska L., Boichyk V., Krysovaty I. Green entrepreneurship strategies: integrating Eco-Friendly energy technologies with the digital economy. *Grassroots Journal of Natural Resources*, 2024;7(3):92-114. URL: <https://doi.org/10.1016/j.cesys.2025.100345>
57. Fric U., Levnajić Z., Modic D., Rončević B. Industrial symbiosis networks supporting circularity: Understanding complexity, cyclicity and resilience. *Environmental Technology and Innovation*. 2025;37:104026. URL: <https://doi.org/10.33002/nr2581.6853.0703ukr05>
58. Silva T.H., Sehnem S. Industry 4.0 technologies as a motivator for the circular economy in foodtechs: A stakeholder perspective. *Sustainable Development*. 2024;32(5):4633-4648. URL: <https://doi.org/10.1016/j.eti.2025.104026>
59. Purushothaman R., Alamelu R., Sudha M. Bridging the circular economy knowledge gap in SMEs: A systematic review of adoption barriers, implementation strategies, and theoretical insights. *Circular Economy and Sustainability*. 2025;5(6):5455-5474. URL: <https://doi.org/10.1002/sd.2921>
60. Roskladka N., Bressanelli G., Saccani N., Miragliotta G. Repairable electronic products for the circular economy: a review of design for repair features, practices and measures to contrast obsolescence. *Discover Sustainability*. 2025;6(1):66. URL: <https://doi.org/10.1007/s43615-025-00680-7>
61. Roskladka N., Bressanelli G., Saccani N., Miragliotta G. Repairable electronic products for the circular economy: a review of design for repair features, practices and measures to contrast obsolescence. *Discover Sustainability*. 2025;6(1):66. URL: <https://doi.org/10.1007/s43621-024-00753-x>
62. Uwugbe U., Issah O., Ranti U.O., Zubeiru M., Anaba S., Seidu A.A. Circular economy: a bibliometric review of research in emerging economies (2010-2024). *International Journal of Energy Economics and Policy*. 2025;15(1):77-89. URL: <https://doi.org/10.32479/ijeep.17021>

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