

Bibliometric Insights into Circular Economy Strategy: Mapping Key Research Streams

Timea CISMA*

Politehnica University of Timisoara, Timisoara, Romania

***Corresponding author, timea.cisma@student.upt.ro*

Andrei AGACHE

Politehnica University of Timisoara, Timisoara, Romania

Larisa IVASCU

Politehnica University of Timisoara, Timisoara, Romania

Academy of Romanian Scientists, 3 Ilfov, 050044, Bucharest, Romania

Alexandra COROIAN

Politehnica University of Timisoara, Timisoara, Romania

Abstract. *The circular economy is a modern and captivating subject, even though different areas remain inadequately explored. Creating a circular economy strategy involves transforming the traditional linear model of production and consumption into a system that is more sustainable and regenerative. In order to create a circular economy plan, a comprehensive approach is needed in order to identify connections with relevant areas of interest. This study analyzes in depth existing research on circular economy strategies, offering a detailed perspective on the relationship between various elements. The methodology consists of a bibliometric analysis of Web of Science data from 2016 to 2023. The paper is structured around three main objectives. The main objective is to determine the most widely read articles, significant publications and understand how did the topic evolve. Secondly, a examination of keywords was performed on the top 100 most referenced publications in order to ascertain the main subjects associated with circular economy initiatives. Thirdly, in order to identify the most discussed points when addressing strategies in the circular economy, a key words analysis and a qualitative analysis was conducted on the same most often cited papers. The primary conclusion is that circular economy solutions are a significant and interesting topic, prompting extensive scholarly investigation. Within research, distinct streams are identified: Circular Business model, Framework and Methodology, Key elements and Capabilities, Assessment and Indicator, Barriers and Enablers, Network and Collaboration, Technology and Innovation, Costumer behavior and perspective, and Industry specific.*

Keywords: Circular Economy, Strategy, Bibliometric analysis, Research streams, VosViewer

Introduction

In the recent discussions about sustainable development and managing resources, circular economy solutions have become more popular. In a world faced with environmental problems, lack of resources and growing waste production, it is becoming frequent to use concepts from the circular economy. But we must remember that this idea of "circular" is only an idea. Making it real needs careful planning - shown by making and doing things in strategy plans (strategic initiatives).

Strategies are crucial for organizations in order to guide them towards their goals and manage the challenges of conditions that are always changing. In essence, strategies are very important because they provide clarity, guidance and an organized system for achieving continual success in a fierce yet fluctuating market environment.

The shift towards circular economy is fueled by a global acknowledgement that the traditional linear economy is not suitable for the future, which leads to resource depletion and ecological imbalances. (Kirchherr et al., 2017; Rizos et al., 2017). Due to these concerns, the field of circular economy has gained significant attention in academic, policy-making and business fields. They provide a comprehensive framework that focuses on sustainably replenish and utilize resources. (Morseletto, 2020).

Common basic principles have been identified as common across current methods of the circular economy. These methods include optimizing resource use, improving environmental efficiency and effectiveness and reduce waste. The 4Rs - reducing, reusing, recycling and recovering - were seen as important tactics to achieve CE goals. In contrast, it was observed that these approaches vary in relation to specific parts of the Circular Economy; for example how much they impact a certain area or their level of integration into a value chain could be limited only to one item or cover an entire industry (Kalmykova et al., 2018).

This study proposes to examine in detail the existing literature on circular economy strategies and provides an in depth view of how its various components are correlated to one another. A bibliometric study has been made, specifically looking at Web of Science data from 2016 until 2023. The article's structure is based on three main objectives. Mainly, we want to find out which articles are getting the most readership, what notable publications there are and understand how this topic has changed over time. The top 100 papers that were referred to frequently underwent a citation analysis using VosViewer software in order for us to understand main areas of study. Additionally, we performed a keyword analysis and qualitative study on the works most frequently referenced to determine what topics are mentioned often in relation with strategies for circular economy.

The paper is organized in the following sections. Section 2 offers a literature review, Section 3 explains the methodology, Section 4 presents and discusses results, while Section 5 provides a concise summary of findings.

Literature review

Circular Economy

The process of incorporating circular economy practices into businesses involves three crucial stages of redesign: restructuring services, reconfiguring relationships in the value chain both upstream and downstream, and overhauling the internal organizational structure. The phrase 'circular economy journey' refers to a methodical process of investigating and evaluating the possibilities and difficulties related to circular economy practices via actively reducing, limiting, and eventually eliminating resource flows. This shows how circular economy ideas can be used to many product and service industries. Implementation requires changes to production, retail, and services across the value chain.

Between the first steps, it is important to create a map of the relationships between different parts of a company, including its resources and materials. This map serves as a basis for developing alternative strategies for implementing a circular economy (Jørgensen & Remmen, 2018).

The effective use of circular economy concept rely significantly on the efficient usage of policy instruments and information exchange. When governments set specific goals for policy

processes and continuously evaluate and regulate them in a repetitive manner to accomplish both immediate and long-term objectives. Without a comprehensive assessment methodology or widespread backing from the sector or society, circular economy (CE) programs face challenges in sustaining their environmental viability. Information transfer consistently affects CE efficacy. A detailed review of CE initiatives shows the challenges of long-term circularity. These obstacles mostly arise from imbalances in material flows, either exceeding or falling short of demand. Additionally, there are constraints linked to transportation and infrastructure, especially in the context of energy exchange (Winans et al., 2017).

Additionally, integrating circular ideas requires reviewing the relationship between organizational cultures and product development methods. It is recommended to promote the incorporation of the concepts, especially at the strategic stages of product development and job clarity. During the early phases, there are significant chances to engage stakeholders who have the ability to impact many aspects of a resource strategy. This includes the product ecosystem, revenue model, and lifecycle stakeholders. Circularity as a socio-technical challenge allows collaboration with many design disciplines, especially user-centered design. Decision-making support should actively promote cross-functional discussions at these crucial junctures, including a range of departments and business divisions. Circularity indicators in product evaluation comparison tables are a good way to improve the present decision-making support mechanisms and boost the incorporation of circularity concepts. As the development process moves forward, modifying the design parameters may facilitate cross-functional discussions to assess the sustainability performance (Diaz et al., 2021).

Strategy

The achievement of significant improvements, the transition to a circular economy depends on the creation and application of exact strategic techniques. In a dynamic environment, unique and inventive tactics are produced using the company's talents, knowledge, and creativity. A natural passion inside the firm drives these strategies, creating a tangible goal both internally and externally. Successful methods are not limited by previous constraints, but rather are motivated by future prospects. The utilization of sequential inductive/deductive techniques frequently results in predictable answers, which lack differentiation. Innovative solutions require close collaboration and flexible business-wide communication. (Feurer & Kazem, 1995).

The effectiveness of a business is greatly influenced by its organizational structure and the cultivated habits inside the organization. Managers should carefully analyze these tactics and customize them for their organizations, emphasizing on the necessity for a single direction rather than several directions. Organizations that effectively match their structure and norms with their strategic goals outperform those that fail to achieve such synchronization (Olson et al., 2005).

Methodology

In the ISI Web of Science database, restricted to the topic category encompassing article titles, abstracts, and keywords, a Boolean search targeting articles related to circular economy strategy was conducted. The search included the phrases "circular economy" and "strategy". Following that, the results were improved by considering the time frame (2016-2023), language (English), type of documents (articles), and fields of research (engineering, environmental sciences, ecology, business economics, science technology other topics, operations research management science, social science other topics), resulting in a total of 1458 articles.

All these articles were used to achieve the main aim of the investigation, which is to ascertain the most extensively read articles, noteworthy publications, and comprehend the progression of the topic. For the following goals, only the 100 most often referenced publications were taken into account to determine the primary research directions and essential issues necessary for creating a circular approach. Additionally, in achieving the last objective, even though "China" was one of the main keywords, it has been deliberately excluded from the final graph because it was determined that this keyword lacks relevance to the current study. Furthermore, to conduct the keywords analysis and a comprehensive citation analysis, the VOSviewer software was judiciously utilized.

In adherence to scholarly conventions and with the aim of maintaining conciseness, not every individual publication has been included in the bibliography due to the extensive volume of works involved, which could potentially lead to bibliographic clutter. To avoid this, the PhD thesis, a comprehensive asset with multiple sources, was chosen as a key reference. This eliminates bibliographic overload and gives readers a concentrated location to explore the PhD thesis's extensive works. This aligns to the pursuit of academics that seek clarity and efficiency in source material presentation.

Results and discussions

In this chapter, the results of the study are revealed. The first goal was to determine the articles that were read the most, notable publications, and the development of the topic. In order to provide an understanding among the most current and significant articles in the field of circular economy strategy, this research identifies and displays in Table 1 (Table 1. The 10 most trending articles on “circular economy” and “strategy” (2016-2023)) the ten most cited articles—those that have received the greatest number of citations annually between 2016 and 2023. Regarding the data, the article in first place has roughly three times more citations than that of second place and around 5 to 6 times more citations than the following publications. Furthermore, it is seen that the second paper has nearly double amount of citation as compared with third one. Furthermore, the second paper has almost double the number of citations as the third paper. Contrary, the publications ranked from positions 3 to 10 have around the same amount of citations.

Table 1. The 10 most trending articles on “circular economy” and “strategy” (2016-2023)

Article Title	Authors	Publication	Local cited reference	Total local citations received	Total citations received (all databases)
Circular Economy: The Concept and its Limitations	Korhonen, J; Honkasalo, A; Seppälä, J	Ecological Economics	75	1419	1499
Measuring circular economy strategies through index methods: A critical analysis	Elia, V; Gnoni, MG; Tornese, F	Journal Of Cleaner Production	60	436	446
Exploring institutional drivers and barriers of the circular economy: A cross-regional comparison of China, the US, and Europe	Ranta, V; Aarikka-Stenroos, L; Ritala, P; Mäkinen, SJ	Resources Conservation and Recycling	55	277	283

Article Title	Authors	Publication	Local cited reference	Total local citations received	Total citations received (all databases)
Critical appraisal of the circular economy standard BS 8001:2017 and a dashboard of quantitative system indicators for its implementation in organizations	Pauliuk, S	Resources Conservation and Recycling	129	274	280
A Conceptual Framework for Circular Design	Moreno, M; De los Rios, C; Rowe, Z; Charnley, F	Sustainability	68	258	276
Supply chain management and the circular economy: towards the circular supply chain	De Angelis, R; Howard, M; Miemczyk, J	Production Planning & Control	135	262	266
Circular Economy in Spanish SMEs: Challenges and opportunities	Ormazabal, M; Prieto-Sandoval, V; Puga-Leal, R; Jaca, C	Journal Of Cleaner Production	66	252	264
Industry 4.0 based sustainable circular economy approach for smart waste management system to achieve sustainable development goals: A case study of Indonesia	Fatimah, YA; Govindan, K; Murniningsih, R; Setiawan, A	Journal Of Cleaner Production	38	230	233
Skills and capabilities for a sustainable and circular economy: The changing role of design	De los Rios, IC; Charnley, FJS	Journal Of Cleaner Production	80	222	230
Towards a Circular Economy: The Role of Dutch Logistics Industries and Governments	van Buren, N; Demmers, M; van der Heijden, R; Witlox, F	Sustainability	39	219	229

Source: Author's own research (Cisma, 2024).

Continuing, our aim was to identify journals that most frequently addressed the research topic. In the accompanying chart, journals are ranked based on the amount of articles published on this subject during the analyzed time period. The statistics makes it clear which journals have published the most articles: "Sustainability" and "Journal of Cleaner Production", each boasting nearly 200 publications from 2016 to 2023. The remaining eight journals exhibit a considerable difference in publication numbers compared to the leading two (Figure 1. Leading journals in circular economy strategy research).

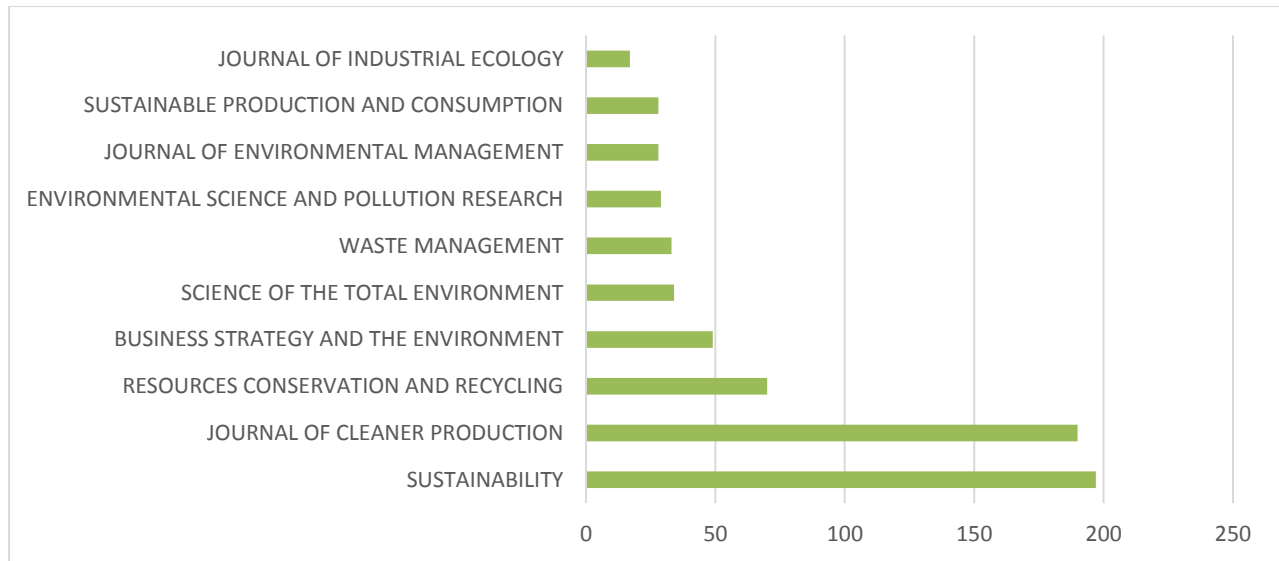


Figure 1. Leading journals in circular economy strategy research

Source: Author's own research.

An additional aim was to discern the progression of the subject matter. An upward trend in the citation count has been observed between 2016 and 2018. Surprisingly, 2018 and 2020 are the most cited years, while 2019 experiences a significant decline. Moreover, it is significant to observe that even if the articles published within two years have low numbers of citations which probably reflect their fresh release, those released between 2016 and 2019 are still not cited as much in total compared to those from the four preceding years. Based on the growing number of citations and the rising trend in publications, It may be concluded that the topic of circular economy solutions is important and of great interest, which has led to extensive research (Figure 2. Number of publications and citations).

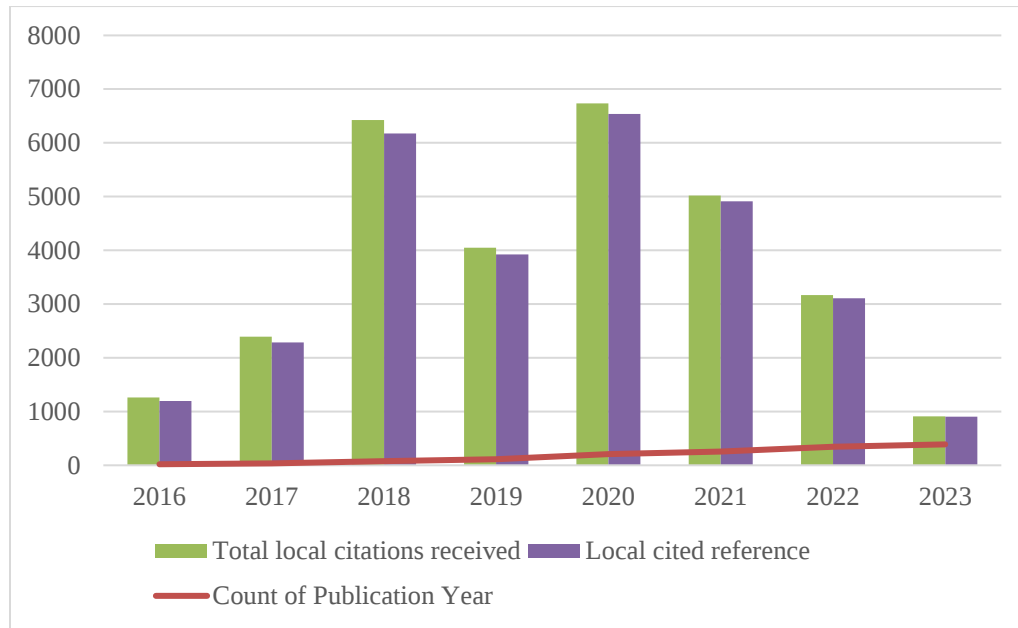


Figure 2. Number of publications and citations

Source: Author's own research.

The second objective seeks to ascertain the focal topics that are most commonly brought up in connection to strategies in the circular economy. To accomplish this, a thorough keywords examination of the 100 most influential papers using VosViewer software was performed. The quantity of citations indicated the degree of influence. The objective of the keyword analysis was to identify the specific keywords that are closely related to the concepts of "circular economy" (Figure 3. Keywords analysis of the 100 most influential papers in circular economy strategy research (circular economy perspective)) and "strategy" (Figure 4. Keywords analysis of the 100 most influential papers in circular economy strategy research (strategy perspective)). Remarkably, both concepts are intricately connected to all other essential terms. Hence, it can be affirmed that when formulating a circular strategy, one must take into account the following factors: sustainability, framework, innovation, industrial symbiosis, business models, product, design, system, supply chain management, green practices, changes, management, barriers and model.

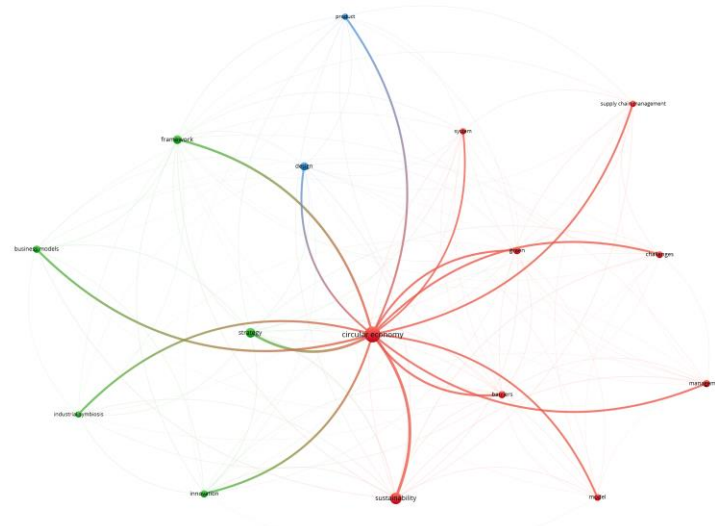


Figure 3. Keywords analysis of the 100 most influential papers in circular economy strategy research (circular economy perspective)

Source: Author's own research.

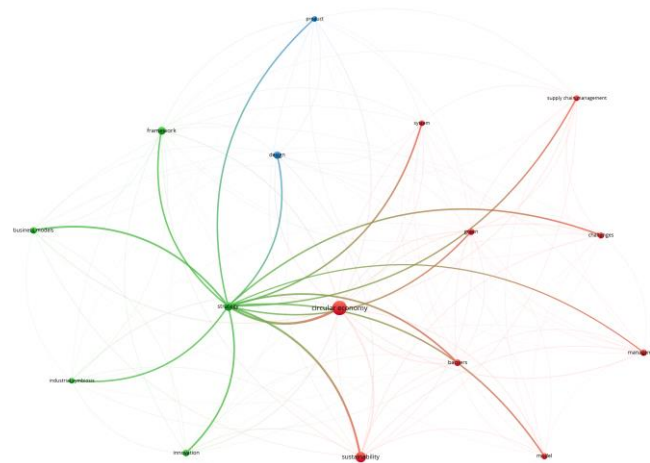


Figure 4. Keywords analysis of the 100 most influential papers in circular economy strategy research (strategy perspective)

Source: Author's own research.

The third goal is to identify the subject's primary research topics. This project determined the most-studied regions and significant themes. When constructing circular strategies, the most often referred books' concerns are often considered significant.

First, we performed a citation analysis using VosViewer software on the same 100 most frequently cited papers. After conducting a thorough analysis of the works, we were able to identify links between publications from various clusters. Following the citation analysis, links between works were uncovered, leading to the discovery of 11 clusters (Figure 5. Citation analysis of the 100 most influential papers in circular economy strategy research).

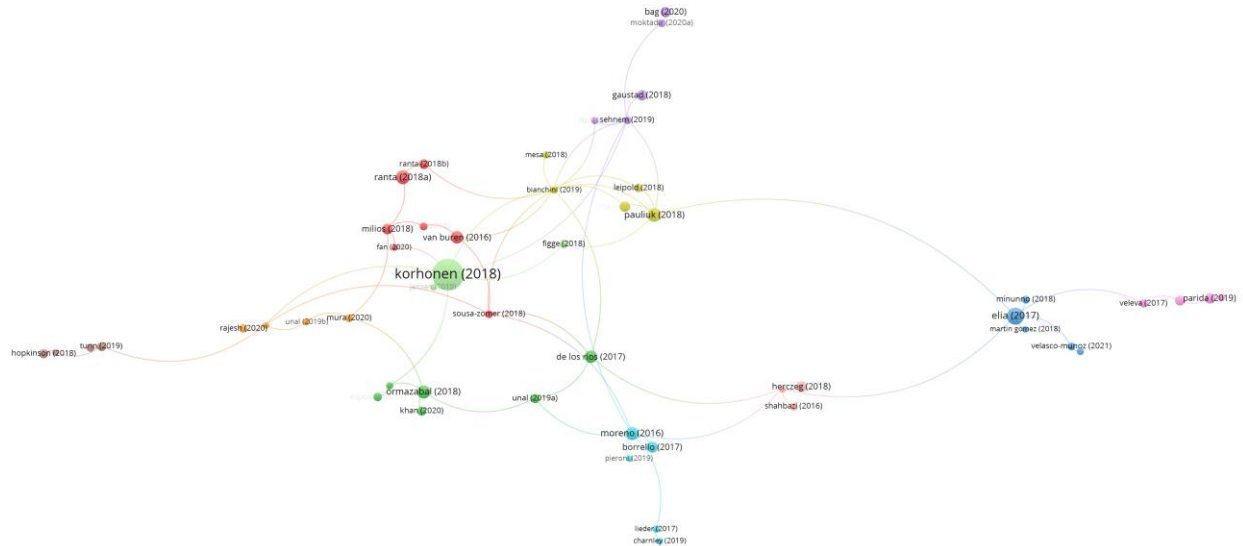


Figure 5. Citation analysis of the 100 most influential papers in circular economy strategy research
Source: Author's own research.

To have a deeper comprehension of the eleven groupings, a qualitative examination of the literature was conducted to discern the specific assertions made by authors regarding the seven research streams. The objective of these assessments is to pinpoint the crucial elements that require consideration while designing a circular approach (**Error! Reference source not found.**).

Table 2. Research streams of the 100 most influential papers in circular economy strategy research

Research Stream	Publication
Circular business model	(Tunn et al., 2019) (Díaz Lopez et al., 2019) (He et al., 2020) (Jensen et al., 2019) (Hvass & Pedersen, 2019) (Pieroni et al., 2019) (Lieder et al., 2017) (Ranta, Aarikka-Stenroos, & Mäkinen, 2018)
Key elements and capabilities	(Singhal et al., 2020) (De los Rios & Charnley, 2017) (Veleva & Bodkin, 2018) (Smol et al., 2020) (Bruel et al., 2019) (Khan et al., 2020) (Cainelli et al., 2020) (Moktadir, Kumar, et al., 2020) (Leipold & Petit-Boix, 2018)
Framework and Methodology	(Elia et al., 2017), (Parida et al., 2019) (Mayer et al., 2019) (Moreno et al., 2016) (Bianchini et al., 2019) (Konietzko et al., 2020) (Yadav et al., 2020) (Ünal & Shao, 2019)

Research Stream		Publication
		(Esposito et al., 2018) (Pena et al., 2021) (Lu et al., 2020) (Zorpas, 2020)
Assessment and Indicator		(Rajesh, 2020) (Figge et al., 2018), (Mesa et al., 2018) (Loizia et al., 2021) (Pauliuk, 2018) (Milios, 2018) (Fonseca et al., 2018) (Shen et al., 2020) (Mura et al., 2020) (Fan & Fang, 2020) (Li et al., 2020) (Oldfield et al., 2016)
Barriers and Enablers		(Korhonen et al., 2018), (Hopkinson et al., 2018), (Masi et al., 2019), (Shahbazi et al., 2016), (Sousa-Zomer et al., 2018), (Ormazabal et al., 2018), (Caldera et al., 2019) (Kardung et al., 2021), (Ranta, Aarikka-Stenroos, Ritala, et al., 2018),
Networks and Collaboration	Circular Supply Chain	(Angelis & Howard, 2018), (Gaustad et al., 2018), (Li et al., 2021), (Sehnem et al., 2019)
	Industrial Symbiosis	(Herczeg et al., 2018), (Sun et al., 2017), (Abreu & Ceglia, 2018)
	Logistic and Distribution	(van Buren et al., 2016), (Melkonyan et al., 2020)
Technology and Innovation	Industry 4.0	(Bag et al., 2020), (Fatimah et al., 2020), (Ma et al., 2020), (Yu et al., 2022), (Khanzode et al., 2021) (Ciliberto et al., 2021)
	Material, substances and technology research	(Yentekakis et al., 2021), (Afewerki et al., 2020) (Wu et al., 2020), (Assi et al., 2020) (Loizia et al., 2019)
Consumer behavior and perspectives		(Borrello et al., 2017), (Velea et al., 2017) (Mondéjar-Jiménez et al., 2016) (Steenis et al., 2018)
Industry specific	Cities/Urban	(Prendeville et al., 2018), (Liu et al., 2018 Ramaswami et al., 2017) (Fang et al., 2017) (Ramaswami et al., 2017) (Martín Gómez et al., 2018)

Research Stream		Publication
	Electronics	(Baars et al., 2021), (Bonsu, 2020), (O'Connor et al., 2016)
	Construction & Buildings	(Hao et al., 2020) (Minunno et al., 2018) (Luo & Oyedele, 2021) (Ghaffar et al., 2020)
	Agriculture	(Rhodes, 2017) (Velasco-Muñoz et al., 2021) (Yazdani et al., 2021) (Donner et al., 2020) (Gorazda et al., 2017)
	Plastic	(Foschi & Bonoli, 2019) (Paletta et al., 2019) (Horodytska et al., 2020) (Wichai-utcha & Chavalparit, 2019)
	Textile	(Moktadir, Dwivedi, et al., 2020) (Sathish et al., 2019)
	Others	(Kane et al., 2018) (Mumladze et al., 2018) (Ünal et al., 2019)

Source: Author's own research (Cisma, 2024).

The circular economy is based on this idea because various industries are interconnected. After a thorough study, multiple circular economy approach research areas were identified:

Circular Business model, Framework and Methodology, Key elements and Capabilities, Assessment and Indicator, Barriers and Enablers, Network and Collaboration, Technology and Innovation, Costumer behavior and perspective, and Industry specific. An analysis of the article count in each category indicates an even distribution, implying the significance of all features. Notably, only four of the top 100 cited publications specifically address consumer viewpoint.

Conclusion

To conclude our research, our study filled important gaps in the literature on the circular economy approach and provided a detailed picture of the multiple relationships between its elements. The bibliometric study performed on Web of Science data from years 2016 to 2023 has enabled the achievement of three main goals. Initially, the analysis determined the articles that were read by the largest number of people and the publications that were considered important. Furthermore, by conducting a comprehensive analysis of keywords linked to the top 100 most cited publications, the primary topics pertaining to circular economy activities were identified: sustainability, framework, innovation, industrial symbiosis, business models, product, design, system, supply chain management, green practices, changes, management, barriers, and model. Finally, using an extensive approach that includes keyword and qualitative analysis of the most frequently referred publications identified the most debated circular economy tactics. The main outcome underlines the importance of circular economy solutions as shown by ample academic research. The study streams mentioned include Circular Business Model, Framework and Methodology, Key Elements and Capabilities, Assessment and Indicator, Barriers and Enablers, Network and Collaboration, Technology and Innovation, Customer Behavior and Perspective, and Industry Specific. This classification makes the topic clearer by showing how complicated and diverse it is. It also portrays

a full image of all the different elements that are added up in order to create the field of circular economy. The results of the study add to what is already known by giving us new ways of looking at important issues that have gotten a lot of attention in the research about circular economy strategies. Future research should focus on further investigating and improving our understanding of these distinct streams, with the goal of advancing the development of environmentally responsible and regenerative ways of production and consumption. Equal rights are afforded to each of the authors in the process of creating the article.

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