ARTICLES

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CIRCULARITY AS A DYNAMIC CAPABILITY: A REVIEW AND FUTURE AGENDA FOR A CIRCULAR TRANSITION

Circularidade como capacidade dinâmica: Uma revisão e uma agenda para uma transição circular

La circularidad como capacidad dinámica: Una revisión y una agenda para una transición circular

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ABSTRACT

Circular economy practices are increasingly aligning with the strategies of organizations operating in innovative and dynamic environments and can be considered a new capability to be explored. This study aims to systematize knowledge about dynamic capability and the circular economy. The results reveal that an organization's ability to transition from a linear to a circular model is directly related to its capacity to develop dynamic capabilities, facilitating the integration of circular practices into its strategies and enhancing performance.

Keywords: capabilities, performance, agenda, competitiveness, circular economy.

RESUMO

Práticas de economia circular estão cada vez mais alinhadas às estratégias das organizações que atuam em ambientes inovadores e dinâmicos, podendo ser uma nova capacidade a ser explorada. O presente estudo visa sistematizar o conhecimento sobre capacidade dinâmica e economia circular. Os resultados mostraram que a habilidade das organizações de se engajar na transição do modelo linear para o circular está diretamente relacionada ao seu potencial para desenvolver capacidades dinâmicas que facilitam a integração de práticas circulares em suas estratégias, aprimorando o desempenho.

Palavras-chave: *capacidades, performance, agenda, competitividade, economia circular.*

RESUMEN

Las prácticas de economía circular están cada vez más alineadas con las estrategias de las organizaciones que operan en entornos innovadores y dinámicos, y pueden considerarse una nueva capacidad por explorar. Este estudio tuvo como objetivo sistematizar el conocimiento sobre la capacidad dinámica y la economía circular. Los resultados mostraron que la capacidad de las organizaciones para pasar de un modelo lineal a uno circular está directamente relacionada con su capacidad para desarrollar capacidades dinámicas que faciliten la integración de prácticas circulares en sus estrategias y mejoren el desempeño.

Palabras clave: *capacidades, desempeño, agenda, competitividad, economía circular.*

INTRODUCTION

Research conducted in recent decades has diligently sought to identify a new production and consumption model based on sustainable development, aiming to mitigate resource exploitation and waste (Herrero-Luna et al., 2022; Marín-Vinuesa et al., 2021; Jesus et al., 2018).

The circular economy (CE) emerges in this context, designed as restorative and regenerative. Its objective is to keep products and materials at their highest level of utility and value for as long as possible, distinguishing between technical and biological cycles and seeking to dissociate global economic development from the consumption of finite resources (Geissdorfer et al., 2017).

More research on CE is needed to understand and implement large-scale circular practices in organizations (Korhonen et al., 2018). As observed in the literature review conducted for this study and presented below, we did not find research works addressing CE as a possible dynamic capability (DC).

Several studies have been published on CE, mainly in the last decade. Merli et al. (2018) conducted an extensive systematic literature review. Among the main results, the authors state that i) most studies have a practical approach, using tools and methods to model processes and support decisions for CE implementation; ii) CE studies mainly follow two lines: the first focuses on social and economic dynamics at the macro level and the second focuses on the implementation of circular processes in companies; iii) the most investigated practices are those related to cleaner production, and the reformulation of the socioeconomic environment has not yet been sufficiently explored.

A literature review by Baxter et al. (2017) showed the contamination problem for implementing CE, influencing circular processes and creating barriers, notably downcycling, disposal, and hampered circulation.

Camacho-Otero et al. (2018) showed that cultural barriers hinder the adoption of circular business models, mainly due to the lack of consumer acceptance, pointing out that most of the scientific work on CE and circular solutions that address consumption has focused on identifying factors that drive or make it challenging to consume circular solutions. Govindan and Hasanagic (2018) also analyze the drivers, barriers, and practices that influence CE implementation, showing that the government perspective has an outstanding positive impact on CE implementation in supply chains and can be promoted through public policies.

D'Amato et al. (2017) reviewed the concepts of CE, green economy, and bioeconomy, highlighting their diversity. According to the authors, "green economy" works as an "umbrella" concept within the realm of environmental sustainability, encompassing elements of CE and bioeconomy.

Elia et al. (2017) showed that at the micro-level, the primary environmental assessment methodologies rely on indices analyzed based on their suitability for the circularity of a system. Ghisellini et al. (2016) presented the main characteristics and perspectives of CE, outlining its

origins, basic principles, advantages, and disadvantages (Peas et al., 2019), as well as its modeling and implementation at different levels (micro, meso, and macro) around the world.

Geissdorfer et al. (2017) examined the concepts of CE and sustainability, highlighting their most evident similarities and differences. Their research aligns with the study by Hussain and Malik (2020), which demonstrated that the paradigms of sustainability and CE have represented different currents. However, the studies have indicated a growing perception that these two concepts can have a mutually constitutive relationship in the context of supply chains.

The review conducted by Hollander et al. (2017) shows a fundamental difference between ecological design and circular product design. It presents a set of new concepts and definitions about product life, such as resource and recovery horizon.

Urbinati et al. (2017) propose a taxonomy of CE business models based on the degree of adoption of circularity in two main dimensions: (i) the customer value proposition and interface and (ii) the value network.

To deal with the complexity of the business environment, organizations seek ways to integrate CE as a DC into their strategies and business models. However, there is a need for further research into these practices and the capabilities of organizations where circularity becomes part of the strategy, especially in entities operating in innovative and dynamic environments.

The organizational capabilities driving competitive advantage based on environmental issues combine different resources to respond to changes (Amui et al., 2017). Resources such as organizational learning, relationship building, shared vision, cross-functional integration, and technological responses are fundamental for an eco-friendly approach (Leonidou et al., 2015). If used to change the business environment or adapt to sudden changes, these resources can be considered DCs (Teece et al., 1997).

For the transition from the linear to the circular model to occur, organizations need to be able to adapt, which requires flexibility and innovation (Arroyabe et al., 2021; Köhler et al., 2022). Additionally, internal organizational factors may generate barriers to adopting CE management practices (Chowdhury et al., 2022).

DCs allow organizations to react to changes, leading to the integration, construction, and reconfiguration of internal and external resources/competencies. Therefore, DCs lead organizations to adjust quickly to rapidly changing business models (Teece et al., 1997), as is the case with CE. The existence of DCs helps in this transition to CE.

Transitioning to a CE is promising and challenging (Lu et al., 2022). Recent research has yet to sufficiently explore the convergence of DCs and CE (Chari et al., 2022). However, this integration has attracted significant attention from scholars (Belhadi et al., 2022), and studies show that companies can achieve CE by building DCs (Moon & Lee, 2021; Nayal et al., 2022). Thus, gaps must be filled in order to increase understanding of how the transition from linear economy (LE) to CE occurs. Also, it is essential to know how the practices and strategies of DCs can help organizations to evolve in this sense (Jabbour et al., 2019; Lu et al., 2022; Sehnem et al., 2022; Seles et al., 2022).

Given the above, it is vital to understand how DCs can help organizations transition from an LE to a CE, circularity being a new DC. Thus, this study aims to systematize the available knowledge about DCs and CE, assess the current lack of research, and integrate both themes to identify gaps and opportunities for future studies in this area.

This study is conducting an integrative literature review (ILR). It focuses on identifying articles on DCs used as a strategy for introducing circular practices in organizations, classifying and coding the characteristics of these articles following the method conducted by Amui et al. (2017). Also, it offers a summary of the main objectives of the articles identified in the ILR and their results, as well as provides a framework to address existing research gaps and contribute to a future research agenda (Jabbour, 2013).

Even if adopting the research by Amui et al. (2017) as a model, we reinforce our understanding that the concepts of CE and sustainability are different, as shown by Geissdorfer et al. (2017). Thus, we recognize that the similarities and differences in the results found in the two studies contribute to the debate and confirm the existence of gaps in the two theories.

Thus, this study aligns with Geissdorfer et al. (2017) to emphasize how DCs differ in the contexts of sustainability and CE. The authors consider CE a condition for sustainability and focus on improving performance. They do not adopt a holistic view of the three dimensions of sustainability, and their concept of CE is simplified as an issue of reducing resource input, waste, and emission, with limited attention to social aspects. In this sense, CE is mainly related to economic benefits based on efficiency gains resulting from reducing production factors and waste.

Another critical difference that Geissdorfer et al. (2017) mentioned is that sustainability considers flexibility, an advantage that is difficult to operationalize. Conversely, CE is often framed narrowly, providing more precise guidelines for its implementation, emphasizing economic benefits, and simplifying the environmental perspective, which is more attractive to policymakers and private companies than competing approaches. This conceptual difference and the context of the application of sustainability and CE show that DCs can impact them differently.

Unlike the study by Amui et al. (2017), who proposed to study sustainability as a new DC, this study looks at CE as a DC. Additionally, this research offers a bibliometric analysis and makes a theoretical proposition derived from integrative analysis.

We propose to expand the discussion about the role of DCs in the transition of organizations within a logic of LE to one closer to CE, pointing out the main research gaps. In addition to academic merit, such a discussion can help managers and other professionals by providing insights into the opportunities companies can take advantage of to actively manage and generate resources to develop the organizational capabilities necessary for a CE environment (Leonidou et al., 2015).

This study adds to the insights of Amui et al. (2017) regarding DCs in CE. It unfolds a theoretical proposition derived from an integrative literature analysis, presenting managerial implications and highlighting the key DCs that aid the transition from LE to CE.

The VOSviewer software (version 1.6.7) was employed to construct and visualize bibliometric networks, identifying the main themes studied and opportunities for future research.

BRIEF CONCEPTUAL BACKGROUND ON CIRCULAR ECONOMY AND DYNAMIC CAPABILITIES

There is growing pressure to modify production methods in response to challenges related to biodiversity loss, soil pollution, depletion of scarce resources, and the pursuit of a more sustainable development model (Jesus et al., 2018). Due to the environmental impacts aggravated by the linear production model, there is a trend toward a circular model.

Unlike linear economy, which relies on exploiting natural resources, circular economy (CE) aims to eliminate waste (Marín-Vinuesa et al., 2021), optimize resources, and improve product and process design. This perspective has gained prominence in global debates aimed at a more sustainable future (Jesus et al., 2018). CE proposes a new and different approach to the organizational and operational systems of production and consumption, focusing on restoring the value of the resources used (Jabbour et al., 2019).

Against this backdrop, scholars have recently proposed dynamic capabilities (DCs) as a strategy to foster CE initiatives (Marrucci et al., 2022), although they recognize that organizations face barriers in transitioning to a CE. DCs are structured around three pillars: adaptability, absorption, and innovation capacity. The first refers to the skills of incorporating external technologies and practices into internal processes to enhance production efficiency (Katz-Gerro & Sintas, 2019). Absorption emphasizes the acquisition, storage, organization, and sharing of knowledge. Finally, innovation capacity focuses on monitoring the environment to anticipate changes for more effective resource use and the transformation of good production practices. These resources can be integrated into organizational routines aimed at improvement, generating radical innovations (Teece et al., 1997).

Teece et al. (1997) state that organizations use DCs to change their resources, routines, processes, and operations in response to environmental changes, implementing new strategic actions and becoming more competitive. Additionally, Dosi et al. (2000) state that DCs produce knowledge that leads to new products and services. It is an evolutionary process based on prior knowledge and capacities, influenced by changing contexts over time.

Eisenhard and Martin (2000) align with Teece et al. (1997) in defining the DCs as the company's processes that use specific resources in integrating, reconfiguring, and releasing resources, combining them to create market changes. Therefore, organizational and strategic routines enable companies to achieve new resource configurations as markets emerge, collide, split, evolve, and die.

According to Winter (2012), organizations that purposefully create, extend, and modify their resources can generate DCs. DCs are strongly linked to both the evolutionary economics of Nelson and Winter (1982) and to Barney's (1991) resource-based view.

CE has the potential to address sustainability challenges, so several governments have encouraged companies to implement CE to achieve their objectives through DCs (Khan et al., 2021). However, the literature lacks evidence on capabilities as a responsible governance mechanism for companies to improve their CE practices (Stekelorum et al., 2021). While most companies find CE implementation challenging, scholars suggest it can be achieved by developing DCs (Khan et al., 2020a).

Despite CE's promise as a source of innovation (Arekrans et al., 2022), many companies have been hesitant to pursue potentially disruptive circular innovations due to the profitability of their current linear business (Kuhlmann et al., 2022). CE and innovation studies have gained attention in the academic literature by showing practices, tools, and mechanisms that allow the creation of business models based on circular premises (Sehnem et al., 2022). However, it is crucial to develop organizational innovation capabilities in CE as a model to adapt existing businesses and create new ones (Khan et al., 2020a; Santa-Maria et al., 2021).

According to Seles et al. (2022), the transition to CE can decouple financial growth from adverse environmental impacts. However, this transition may require a deep understanding of what capabilities an organization needs.

Technologies can help in this transition, and some studies have shown the use of ambidexterity and the need for sustainable inter-organizational governance to enhance Industry 4.0 (I4.0) capabilities while contributing to sustainable performance (Belhadi et al., 2021).

At a micro level, eco-innovation marks a transition to CE (Hojnik et al., 2017; Portillo-Tarragona et al., 2018). Companies implementing eco-innovation establish standardized routines and controls to introduce eco-innovative processes as circular business models. However, eco-innovation implies changes in the business environment, requiring management and accounting skills to manage natural resources (Scarpellini et al., 2020a).

The literature points to ways in which DCs can help transition from a linear model to a circular model of production, which justifies the importance of this study, especially in identifying research gaps that can be explored in future studies, benefiting companies seeking this transition.

METHODS

Integrative and systematic literature reviews are essential as they contribute to debates on current issues and identify future study challenges (Jabbour, 2013). This research chose an integrative literature review (ILR), characterized by well-defined and carefully structured steps in searching and analyzing information on the investigated subject. Evaluating and synthesizing the knowledge of a given area with the available essential information supports the study in high-quality works, facilitates critical reflections on the material collected, and explains the selection and filtering criteria of the included materials, ensuring replicability (Cronin et al., 2008).

This study adopted the protocol proposed by Cronin et al. (2008) to gather information and achieve its objective, involving the following steps:

a. Formulation of the research question: How can dynamic capabilities (DCs) help organizations migrate from a linear economy (LE) to a circular economy (CE)?

b. Definition of inclusion and exclusion criteria: Web of Science and Scopus were the scientific databases used, considered the two databases with the most significant scope, capillarity, and international prestige. In addition, they are multidisciplinary scientific bases, which is crucial considering the CE's broad scope of action. No temporal cut-off was set for the start date of the searches, but the end date established was August 16, 2022. Only complete articles were selected, excluding other types of work, such as dissertations, theses, books, book chapters, and grey literature. The terms used and Boolean operators were: ("dynamic* capabili*") AND ("circular economy"). Searches considered the title, abstract, and keywords.

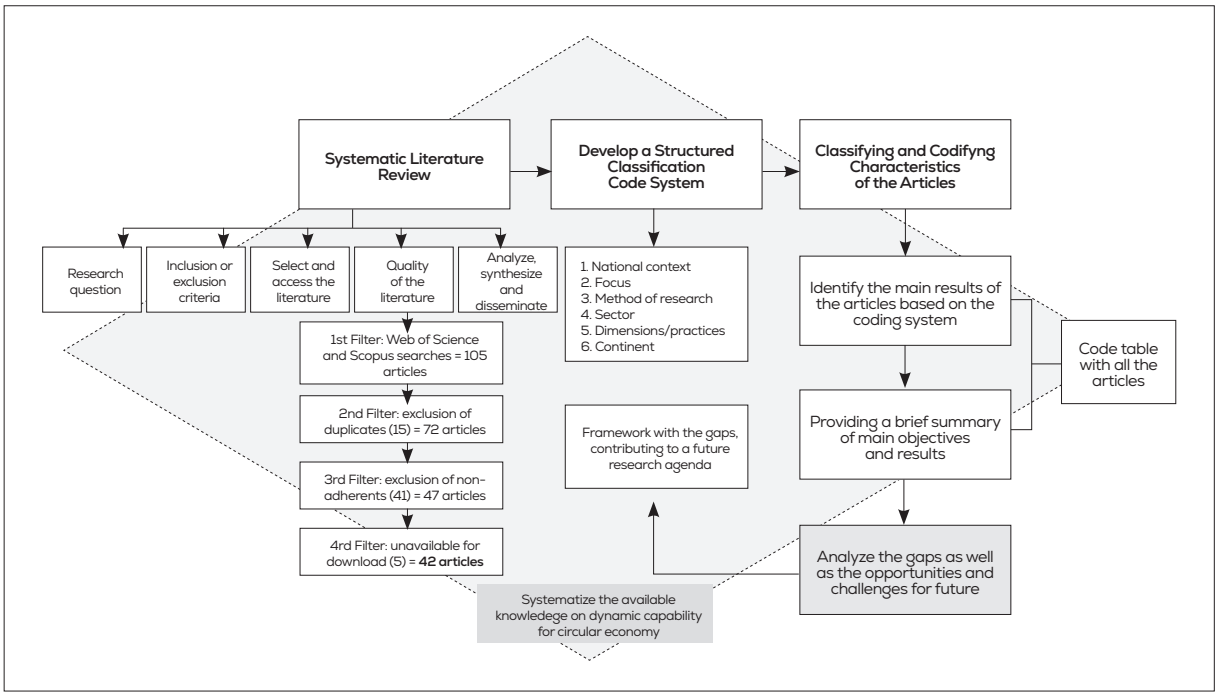
c. Selection and access to the literature: 66 articles were identified on the Web of Science and 39 on Scopus, totaling 105 articles. After locating the articles in the databases, an analysis was conducted to ensure that all articles discussed DC and CE issues.

d. Evaluation of the quality of the literature included in the review: The 105 articles were uploaded to Mendeley, JabRef software, and later to Excel. After excluding duplicates (33), 72 articles remained, which we evaluated based on titles, abstracts, keywords, introduction, and conclusion. Only those clearly adhering to the study's objective were considered for the analysis. At this point, 25 out of the 72 articles were excluded for not addressing both themes, and the other five were unavailable for download. Thus, 42 articles were considered for this review and passed to the last stage of the protocol.

e. Analysis, synthesis, and dissemination of results: In this step, an in-depth analysis was conducted to understand each article better. Tables and figures were prepared to present the leading bibliometric indicators, results, and a research agenda for future studies.

The methodological scheme used in this research is an adaptation of Amui et al. (2017), as shown in Figure 1. After analyzing the studies found in the databases, a classification table was developed using number and letter codes to categorize the articles and support data analysis (Table 1).

Figure 1. Methodological Research Scheme



Source: Adapted from Amui et al. (2017).

Table 1. Framework with Classification and Codes for Analyzing the Studies

Classification		Codes
Context	Developed countries	1A
	Developing countries	1B
	Not applicable	1C
Focus	Dynamic capability as the main theme	2A
	Dynamic capability as the support theory	2B
Method	Qualitative	3A
	Quantitative	3B
	Theoretical/review	3C
	Empirical	3D
	Case studies/interviews	3E
	Survey	3F

Continue

Table 1. Framework with Classification and Codes for Analyzing the Studies — Concludes

Classification		Codes
Sector	Manufacture	4A
	Services	4B
	Manufacture and services	4C
	Not applicable	4D
Practices/dimensions	Technical aspects	5A
	Human aspects	5B
	Both	5C
Origin/Continents	America	6A
	Europe	6B
	Asia	6C
	Africa	6D
	Oceania	6E

Source: Adapted from Amui et al. (2017).

The categories follow an adaptation of the proposal by Amui et al. (2017), covering dimensions such as:

- National context analyzed in the studies (1), coded from A to C;
- Focus on the theory of DCs (2), encoded in A and B;
- Research method (3), coded from A to F;
- Research analysis sector (4), coded from A to D;
- Practices/dimensions used in the research (5), coded from A to C;
- Continent/geographical origin (6), coded from A to E.

Following the approach of Amui et al. (2017) and Fahimnia et al. (2015), a map was created, illustrating the distribution of scientific knowledge about DCs and CE worldwide. Additionally, a research agenda was formulated to guide future and current research on the subject.

RESULTS

We present the research gaps and proposals for future studies in Table 2 in Section 5. This table was created with support from the classification and codification of Table 1.

Table 2. Brief Description of the Objectives and Results of the Articles

Article cited in references	Context	Focus	Method	Sector	Practices	Origin
2	1A	2B	3A,3D,3E	4A	5A	6A/6B
3	1B	2A	3B,3D,3F	4A	5A	6C/6D
4	1B	2A	3B,3D,3F	4A	5C	6B/6D/6E
5	1B	2A	3B,3D,3F	4A	5A	6A/6B/6D
8	1C	2A	3A,3C	4A	5C	6A/6B/6C/6D
9	1A,1B	2B	3A,3B,3D,3E,3F	4C	5A	6A/6B/6D
11	1A	2A	3A,3D,3E	4A	5C	6B
12	1A	2A	3A,3D,3E	4A	5C	6B
13	1B	2B	3B,3D,3F	4C	5B	6B/6C
16	1C	2A	3B,3D,3F	4C	5C	6A/6B/6C
18	1C	2A	3A,3C	4C	5A	6A/6B/6C
22	1A	2A	3A,3D,3E	4A	5A	6B
29	1C	2B	3A,3C	4D	5A	6B
30	1A	2A	3B,3D,3F	4A	5C	6A/6B
31	1A	2A	3B,3D,3F	4A	5C	6C
33	1A	2B	3B,3D,3F	4B	5A	6B
35	1A,1B	2B	3A,3D,3E	4C	5A	6A/6C/6E
36	1A	2B	3B,3D,3F	4A	5C	6B
37	1A	2A	3A,3D,3E	4C	5C	6B
38	1A	2A	3B,3D,3F	4B	5A	6B
39	1A	2A	3B,3D,3F	4A	5A	6B
40	1A	2A	3B,3D,3F	4C	5C	6B
41	1A	2B	3A,3D,3E	4A	5C	6B
43	1A	2B	3B,3D,3F	4C	5A	6B
44	1A	2B	3A,3D,3E	4A	5A	6B
47	1C	2B	3A,3C	4A	5A	6B
48	1A	2A	3B,3D,3F	4B	5A	6B

Continue

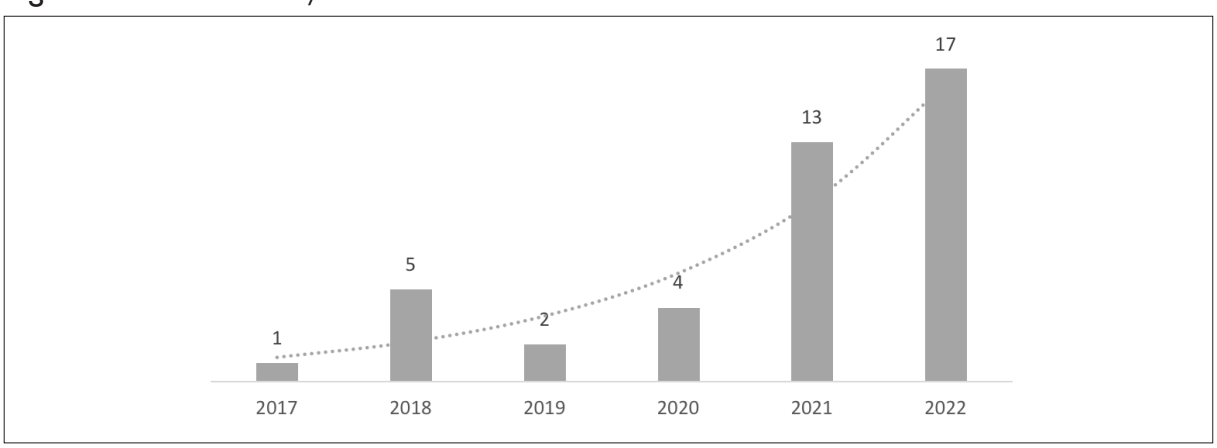
Table 2. Brief Description of the Objectives and Results of the Articles — Concludes

Article cited in references	Context	Focus	Method	Sector	Practices	Origin
49	1A	2A	3B,3D,3F	4C	5A	6B
51	1A	2A	3A,3D,3E	4A	5A	6C
52	1A	2B	3B,3D,3F	4A	5A	6A/6C
55	1C	2B	3A,3C,3E	4A	5A	6B
56	1A	2A	3A,3D,3E	4A	5A	6B
57	1A	2B	3A,3D,3E	4B	5A	6B
59	1A	2A	3A,3D,3E	4A	5C	6B
60	1A	2A	3B,3D,3F	4A	5A	6B
61	1A	2B	3B,3D,3F	4A	5A	6B
62	1A	2A	3B, 3D, 3F	4A	5A	6B
63	1C	2B	3A,3C	4D	5C	6A
64	1C	2A	3A,3C	4D	5C	6A/6B
65	1A	2A	3B,3D,3F	4A	5A	6B/6C
68	1C	2B	3A,3C	4A	5C	6B
70	1A	2B	3A,3D,3E	4A	5A	6E

Source: Adapted from Amui et al. (2017).

The results show the reduced number of publications addressing circular economy (CE) and dynamic capabilities (DCs) and how recent they are. Figure 2 shows the increased academic interest in the subject in the last two years, showing the growing relevance and timeliness.

Figure 2. Publications by Year



The articles were published in 14 journals. The journal "Business Strategy and The Environment" published 17 articles, followed by the "Journal of Cleaner Production" with 6 publications. The third journal with the most articles published was "Sustainability," featuring 3 articles.

Regarding authorship, the articles were written by 153 authors from different areas. Sabina Scarpellini, published the most on this topic (5 publications), followed by Tiberio Daddi, Fabio Iraldo, and Pilar Portillo-Tarragona, each contributing four publications.

Before codifying the articles, they were analyzed using the VOSviewer software (version 1.6.7). These networks, enabled by the text mining functionality, were used to build and visualize co-occurrence and co-citation networks of the critical terms in the literature, representing a way of pointing out the main topics studied and the opportunities for future research.

The journal co-citation network was noteworthy. Figure 3 shows that, among the analyzed articles, we set the prominent cited journals into three main clusters. The first cluster (the red one) is mainly related to environmental sustainability. The second cluster (blue) is related to business strategy. The third cluster (green) is related to social responsibility policies. It is possible to perceive the importance of the "Journal of Cleaner Production," the most cited journal among the 42 articles, which we can explain by the high relevance that the journal has in environmental sustainability and recent publications related to the CE.

Figure 3. Co-citation of Journals

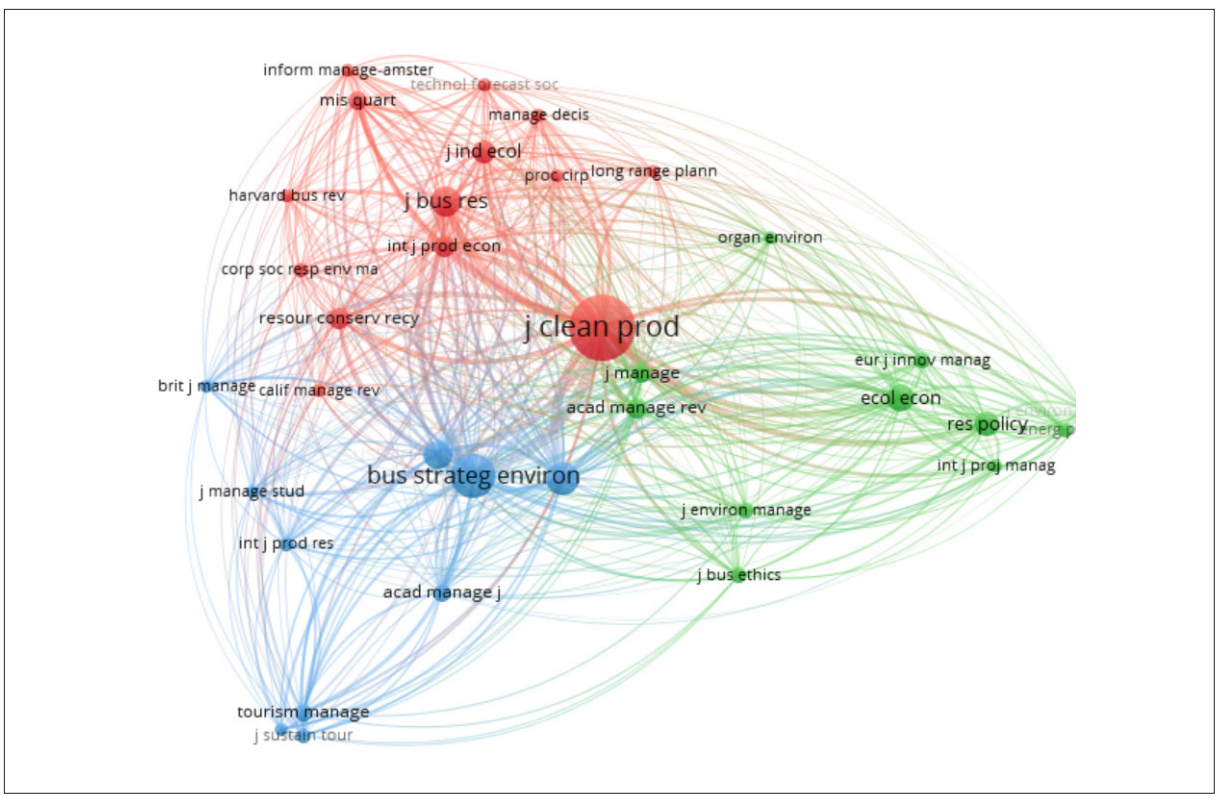


Figure 4 shows a co-citation analysis of the authors most frequently cited in the reference sections of the articles selected for the ILR. The most cited authors were David John Teece, a central and influential figure on the network (dominating the DC theme), Martin Geissdoerfer (dominating the CE theme), and Owais Khan.

Figure 4. Most Cited Authors in References

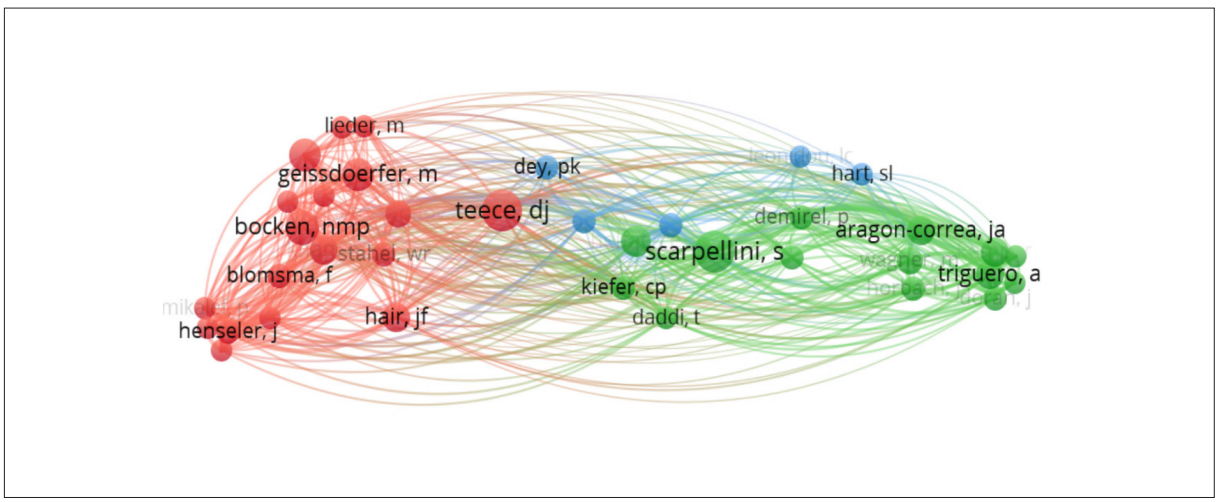
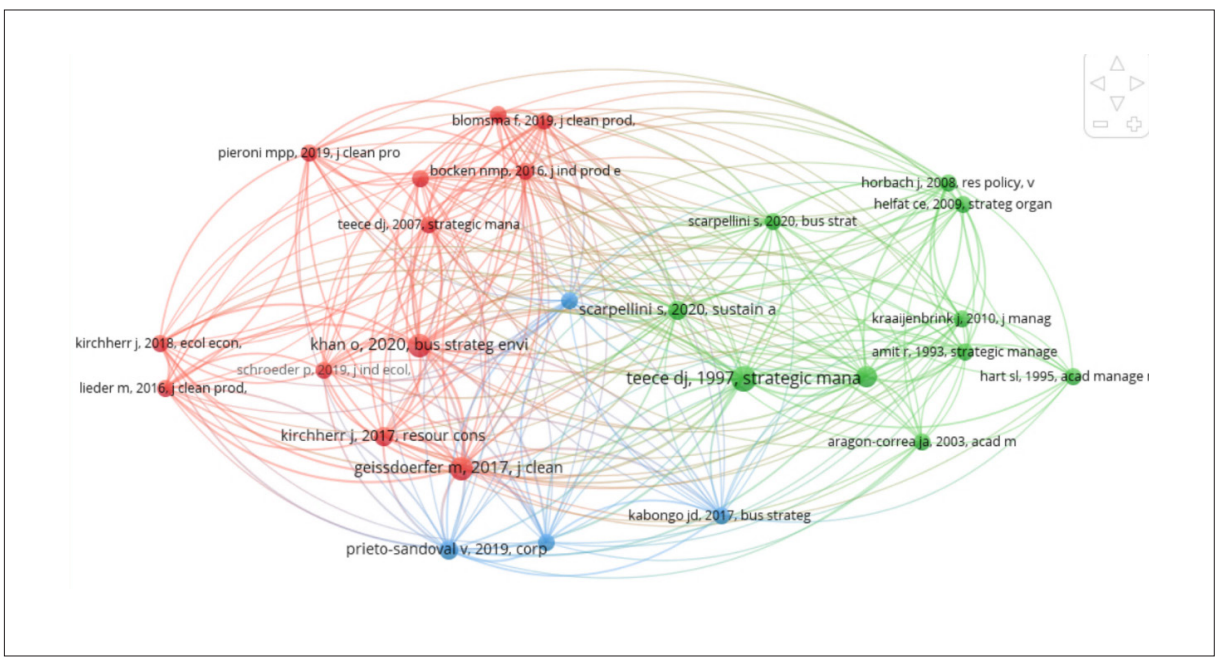


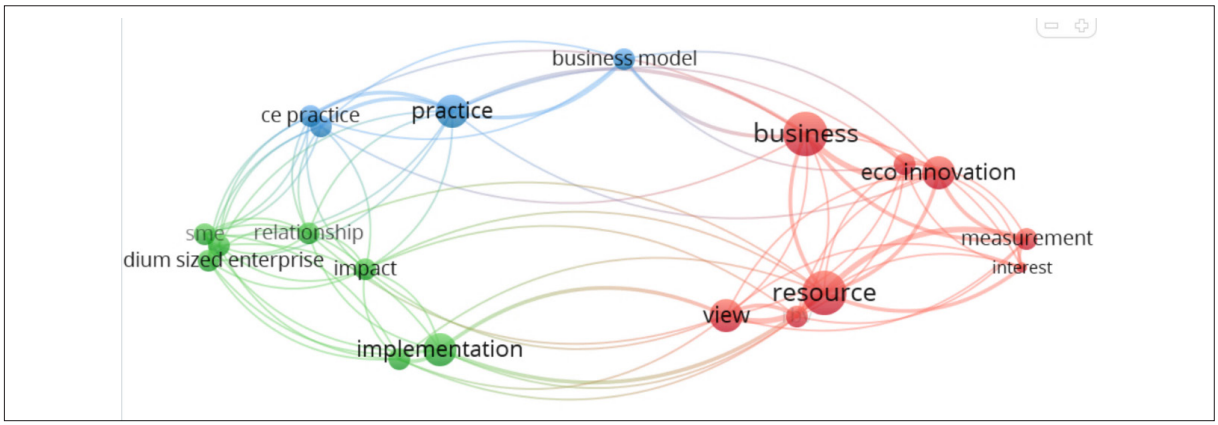
Figure 5 shows the most cited authors in the body of articles selected for this review. Teece was again one of the most cited authors (14 times) and a significant influence linking authors in the network, surpassed only by Scarpellini, also mentioned 14 times, but with greater influence in the connections among authors.

Figure 5. Most Cited Authors in the Body of the Article



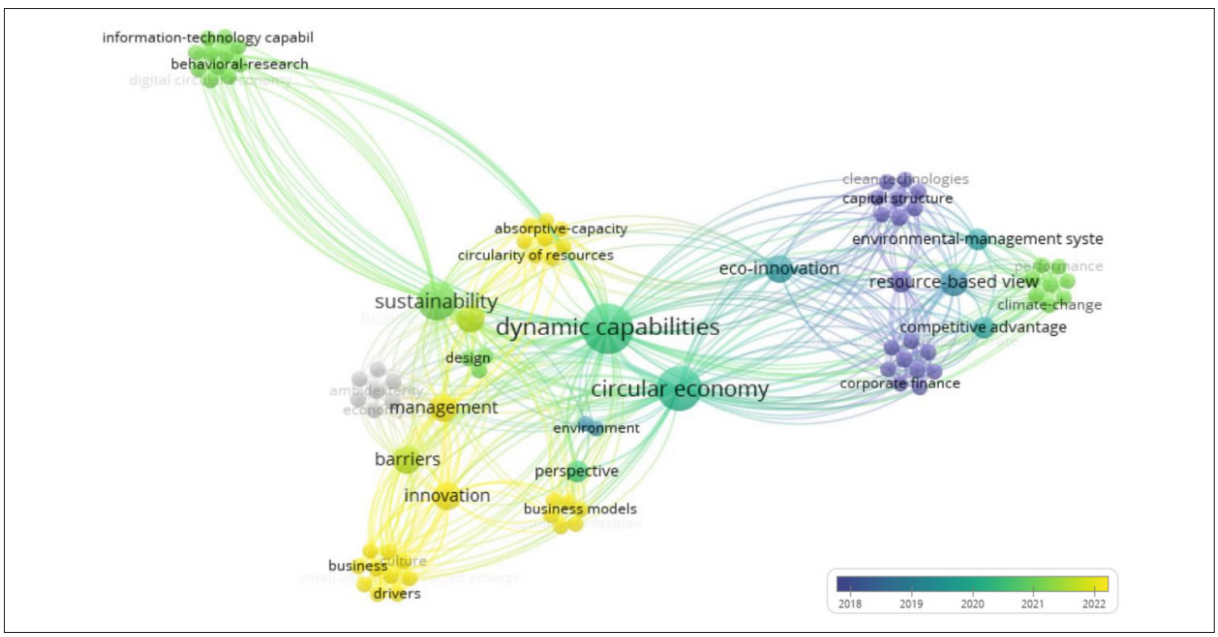
Additionally, the analysis of the most frequent words and terms in the titles and abstracts of the articles is presented in Figure 6. Three clusters were identified. The red cluster is more related to the resources and capabilities that support the implementation of CE in organizations. The green cluster provides information on the implementation and impact of CE on organizations, while the blue cluster is related to the business models in which CE practices have been implemented.

Figure 6. Significant Words and Terms that Appear in the Titles and Abstracts of Articles



The co-occurrence analysis of the keywords of the articles reveals that DCs (125 links) and CE (99 links) were predominant and linked to practically all other words cited throughout the texts (Figure 7). CE is mainly related to sustainability, which is also linked to DCs, indicating that many articles focus on DCs that facilitate the implementation of circular practices in organizations.

Figure 7. Analysis of the Co-occurrence of Keywords in the Articles



Furthermore, the "hottest" themes (from 2021 to 2022) were precisely those related to the purpose of this study, such as absorptive capacity, the circularity of resources, sustainability, management, barriers, innovation, business models, and business drivers.

Summary of the main objectives and results of the articles

The results showed that the capabilities influence the organizations' strategies in migrating from an LE to a CE in several sectors of the economy, showing its capillarity and penetration capacity. We present all capabilities mentioned in the objectives and results of the articles, which helped transition from the linear to the circular model in Figure 8. Additionally, Table 3 presents the existing studies in the literature on each of these capabilities that impacted the transition from an LE to a CE and how each one facilitates this transition.

Figure 8. Capabilities that Help in the Transition from the Linear to the Circular Model

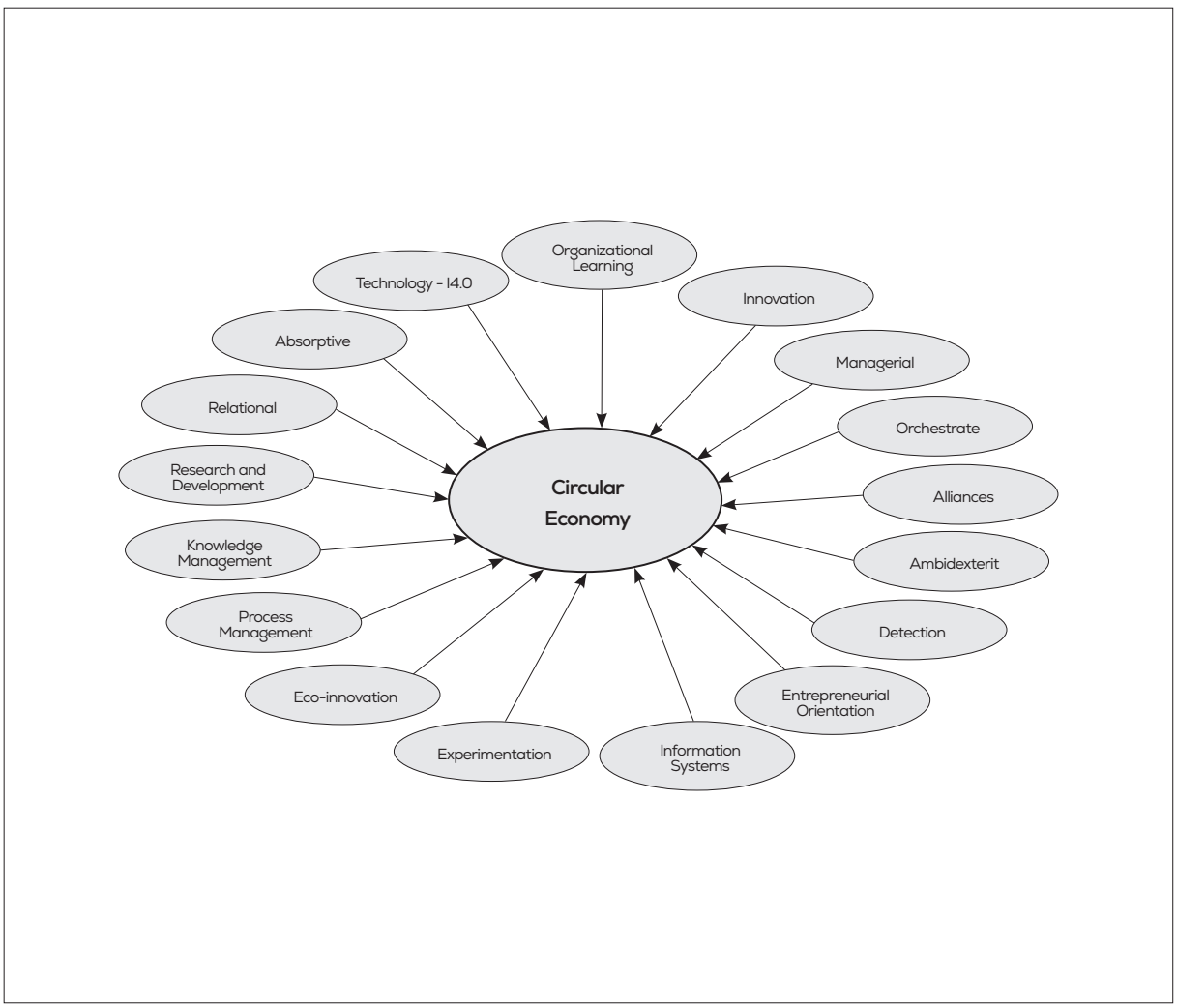


Table 3. Brief Description of how Capabilities Facilitate the Transition from LE to CE and Published Studies

Capability	How it facilitates the transition from LE to CE	Published studies
Innovation	Developing new products/services that reduce the extraction of raw materials. Optimizing the use of inputs with a focus on regeneration or the use of renewable materials. Introducing practices of virtualization, restoration, recycling, remanufacturing, reuse, and extending the useful life of the product.	55,48,59,16,44,41,70,63,29,2.
Managerial	Improving production efficiency and creating new products and services with a focus on sustainable organizational management practices.	30,18,60,38,33,39,49,11,13.
Orchestrate	Flexibility is generated through coordinating and managing computer systems, applications, and services, as well as adopting artificial intelligence and IoT, which facilitates transitioning to CE practices.	52,43.
Alliances	They facilitate waste reduction, improve energy use, redesign products and services, use renewable energy, and improve water use.	36,31,40,57,3,22,11,41,44.
Ambidexterity	Balances the innovation portfolio by sustaining business value in the present, integrating circular principles in the design of future business models.	9, 59, 65.
Detection	Makes it easier to identify CE opportunities, implementing sustainable practices and CE strategies.	37,49.
Entrepreneurial Orientation	It generates the potential to implement circular practices, as it is more open to developing sustainable business strategies.	51.
Information Systems	It makes it easier to analyze available information to support decisions, helping to select suppliers that adopt circular practices.	65,16.
Experimentation	It facilitates the implementation of new ideas or circular solutions at all levels of the organization.	70.
Eco-innovation	Promoting the reduction of consumption of natural resources, greenhouse gas emissions, and waste generation, reconfiguring and adapting the production cycle, and including new ethical, social, and environmental values.	30,56,61,40,57,62,4.
Process Management	Improving production efficiency by developing new management processes that influence the adoption of investments in circular projects.	61,63,64.
Knowledge Management	Facilitates the improvement of organizational efficiency by promoting the adoption of circular practices through the knowledge acquired.	16,41,63,35,68.
Research and Development	Facilitates the creation of new product solutions, processes, methodologies, and equipment with a focus on circularity.	44.
Relational	Are associated with the prospect of synergy with relevant stakeholders in the production chain in which the CE is being executed.	63.
Absorptive	Those seeking to develop new products and processes by absorbing knowledge to create innovative products.	63.
I4.0	I4.0 facilitates the transition to CE because it seeks to digitalize industrial processes to automate production, reduce losses of raw materials and electrical energy, and optimize processes.	9,5,52,8,12,47.
Organizational Learning	The ability to learn at all levels of the organization makes it easier to introduce new circular practices.	44,40.

Research results have shown that eco-innovation is the capability that most helps in the transition. It was also found that the adoption of circular practices helps to improve the performance of organizations.

Hojnik et al. (2017) demonstrated that eco-innovation affects the efficiency of companies, regardless of their innovation potential. However, it is positively associated with efficiency only among innovative companies that are more likely to engage in eco-innovation, reducing production costs.

Prieto-Sandoval et al. (2019) state that small and medium-sized enterprises (SMEs) are essential in implementing the CE. Bag et al. (2022) state that social structures may enhance the performance of SMEs. For the authors, these companies have a positive relationship with eco-innovation, which is positively associated with green supply chain management (Liu et al., 2018). These two concepts significantly relate to building capabilities to facilitate the transition from LE to CE.

Portillo-Tarragona et al. (2018), Scarpellini et al. (2018), and Kiefer et al. (2019) demonstrated that the implementation of eco-innovation projects brings better economic, financial, and environmental results. Also, they show that the age of the companies, the availability of specialized human capital, and the project deadline should be considered relevant factors to adopt these projects.

Scarpellini et al. (2020a, 2020b) and Arroyabe et al. (2021) showed that there is a positive relationship when adopting some eco-innovation practices in the transition to the circular model. Khan et al. (2020a, 2020b) also showed that, although most companies perceive the difficulty of implementing a CE, this is already possible through developing DCs related to eco-innovation.

The studies by Moon and Lee (2021) and Marrucci et al. (2022) also show that to achieve CE, it is essential to implement eco-innovation practices, increase competitiveness, and contribute to the internalization of the environmental management system.

Analysis of gaps, opportunities, and challenges for the future

Several articles focused on national contexts, which have been considered an essential factor to be analyzed (Amui et al., 2017; Jabbour, 2013). Twenty-nine studies were conducted in developed countries and only six in developing countries. Only two articles compared developed and developing countries (A and B), a finding that corroborates the results by Amui et al. (2017). Also aligned with Amui et al. (2017), the collaboration among the group of authors was not decisive in the choice of the national context of the studies, which means that authors from developed countries analyzed developing countries and vice versa.

The discussion is based on the extent to which a study considered DCs as the central or contextual theme, classified as 2A, or used as support for the research, classified as 2B, as proposed by Amui et al. (2017). Most studies had DCs as the main theoretical approach (57%), while some (43%) considered DC as a secondary approach.

Based on Amui et al. (2017, p. 314), the methodological approach of each article was analyzed. There was a usual association between codes A, D, and E for qualitative, empirical, and case studies/interviews; B, D, and F for quantitative, empirical, and survey methods; and A and C for qualitative and theoretical studies, as Amui et al. (2017) proposed.

The results showed that a) most of the studies are empirical (34); b) there is a balance between quantitative (22) and qualitative (21) research; and c) only one article adopted mixed qualitative and quantitative methods using case studies and surveys.

Regarding the economic sectors, the articles analyzed organizations in the manufacturing (4A) and services (4B) sectors. Four articles studied the service sector, 26 studied the manufacturing sector, nine approached the two, and three did not analyze a specific sector (these articles were categorized as 4D).

It is important to emphasize that most studies involve the micro transition level to CE, focused on companies, processes, and products. Only a few works involve the meso level (industrial symbiosis, eco-parks) or macro level (cities, regions, countries). The study by Saavedra et al. (2018) showed that the evolution of CE would not be possible without the existence of industrial ecology concepts and tools, especially with tools such as industrial symbiosis and eco-parks.

According to Amui et al. (2017), technical aspects may include technologies, structure, technical knowledge, and processes, while human aspects may include training, decisions, teams, and culture-related aspects. Most articles in this review (26) studied technical aspects concerning DCs, only one studied human aspects, and 15 studied both.

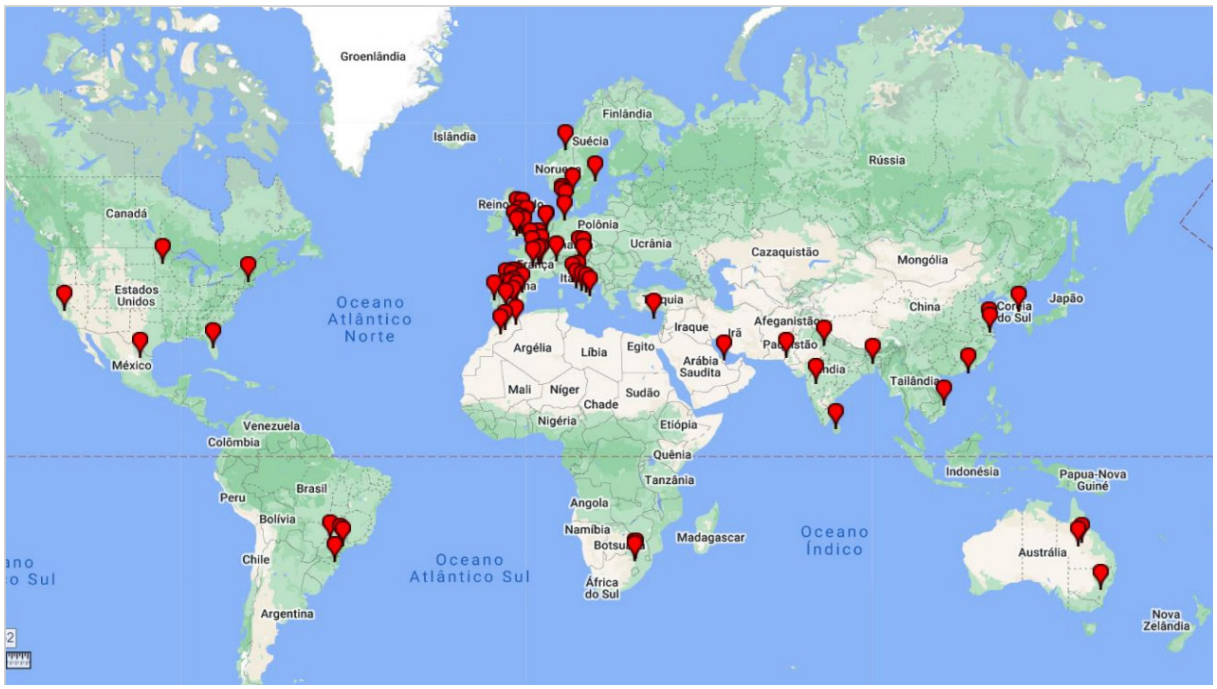
As Jabbour (2013) stated, technical and human aspects influence the adoption of sustainable practices, and both may improve performance (Ioannidis et al., 2021) since companies need to be flexible to meet sustainable demands continuously.

Based on the proposal by Fahimnia et al. (2015) and Amui et al. (2017), this classification shows the regional origin of the studies, analyzing the authors' affiliation. Studies on the European continent focused on Spain (11), the UK (9) and France (7). Few studies were carried out by researchers from Asia, most in China (3), as well as few studies in the Americas, most in Brazil (4) and USA (4), only six studies in Africa (three in South Africa and three in Morocco), and only two in Australia. The results show a lot of room for developing studies in Asia, America, Africa, and Oceania. A huge concentration of studies was carried out in Europe, which, together with partnerships from other continents, represented 35 studies, 83% of the total.

This result shows that Europe has more consolidated discussions and policies regarding the transition to CE. The Green Deal proposed reducing emissions, eliminating single-use plastic, and transitioning to CE. Some researchers claim that in Europe, in the case of developed countries, and in China, in emerging countries, most studies focus on the micro perspective of the transition to CE (European Commission, 2022). Su et al. (2013) showed that the successful application of a CE can be seen as a way for China to address its urgent problem of environmental degradation and resource shortages.

The map in Figure 9 shows each region's contribution to the literature on DCs and CE. For each affiliation, the analyzed city was located. Using gpsvisualizer.com, as done by Fahimnia et al. (2015) and Amui et al. (2017), the map shows the geographic locations of the countries that contributed to the literature.

Figure 9. Geographical Locations of all the Contributing Countries and Partnerships



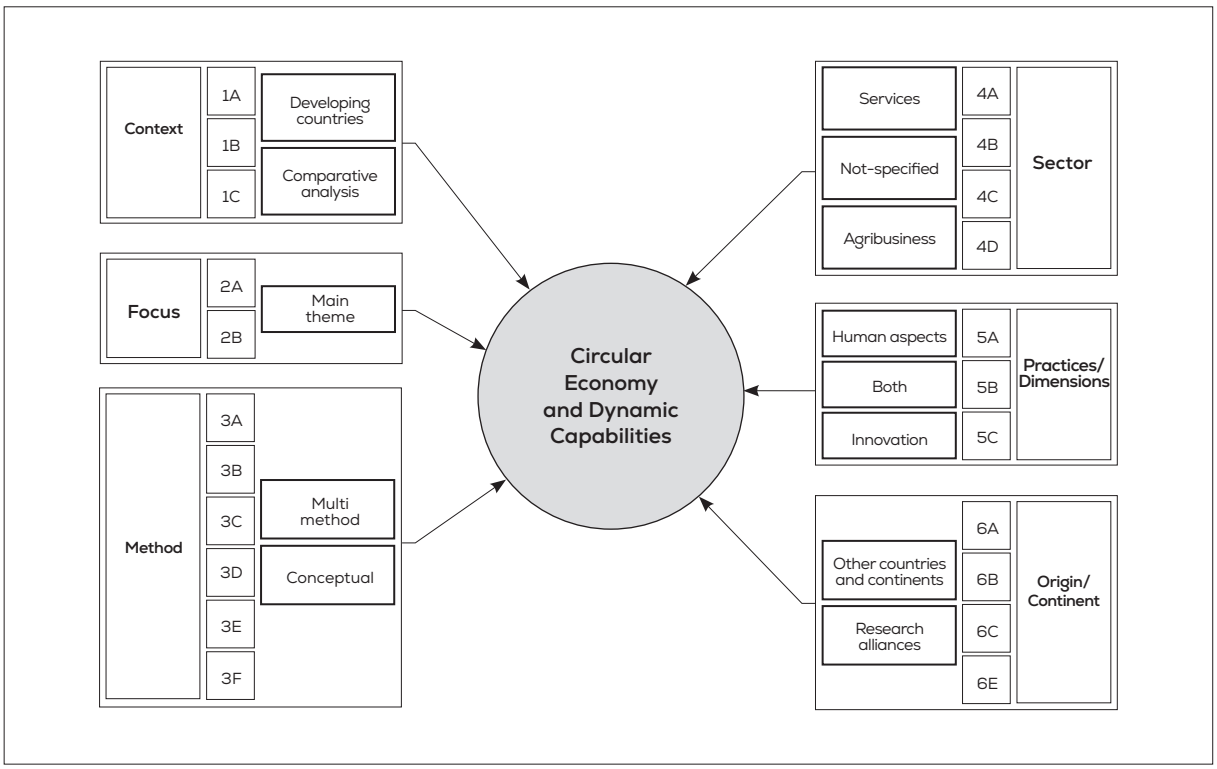
Source: Adapted from Amui et al. (2017).

We identified 21 joint research efforts from researchers around the world. It is important to emphasize that 13 studies were conducted in partnership with researchers from different continents and eight with authors from other countries belonging to the same continent. This data highlights future opportunities for research alliances among continents and foreign countries.

Discussion

This study showed the main aspects of articles discussing circular economy (CE) from a dynamic capability (DC) perspective, and we propose a framework for a future research agenda on the topic, illustrated in Figure 10. Category 1 reveals that only 14% of published articles investigated developing countries, and 5% carried out comparative analyses, with opportunities for future investigations. Considering the focus of the studies (category 2), 24 out of the 42 articles discussed DCs for CE as their central topic, which means that there is room for further studies.

Figure 10. Main Aspects from the Systematic Review and Research Agenda



Source: Adapted from Amui et al. (2017).

Regarding the methodological choice (category 3), 19% of the articles were theoretical/conceptual studies. Only one article combined qualitative and quantitative methods using case studies and surveys. This finding reveals the need for more conceptual studies and research using mixed methodologies, which is a conclusion also reached by Amui et al. (2017).

The economic sector analysis in the studies (category 4) shows that the manufacturing sector represented 62% of the articles analyzed. Only 10% of the articles studied organizations operating in services, while 21% compared these two sectors, indicating the need for more comparative studies. Additionally, none of the articles found in this integrative literature review (ILR) addressed the primary sector (raw materials, agribusiness), which is an aspect representing a research opportunity.

In category 5, the technical and human aspects (both) used as drivers of CE and DC strategies were used in only 36% of the studies. Most studies considered the technical aspects (62%), and only 2% considered the human element, opening an opportunity for further research addressing human aspects. Sustainable innovations emerged as a central DC, representing an essential aspect in the results of studies on DC (Teece et al., 1997) and requiring future studies.

In the last category (6), 33% of the studies originated from partnerships between researchers from different continents. There was a concentration of studies that took place exclusively in Europe (57%). This result suggests that more studies are needed in Asia, the Americas, Africa, and Oceania. These results are similar to those by Amui et al. (2017) and show that there is much

room for the development of studies globally and, mainly, for research alliances with other countries and on different continents.

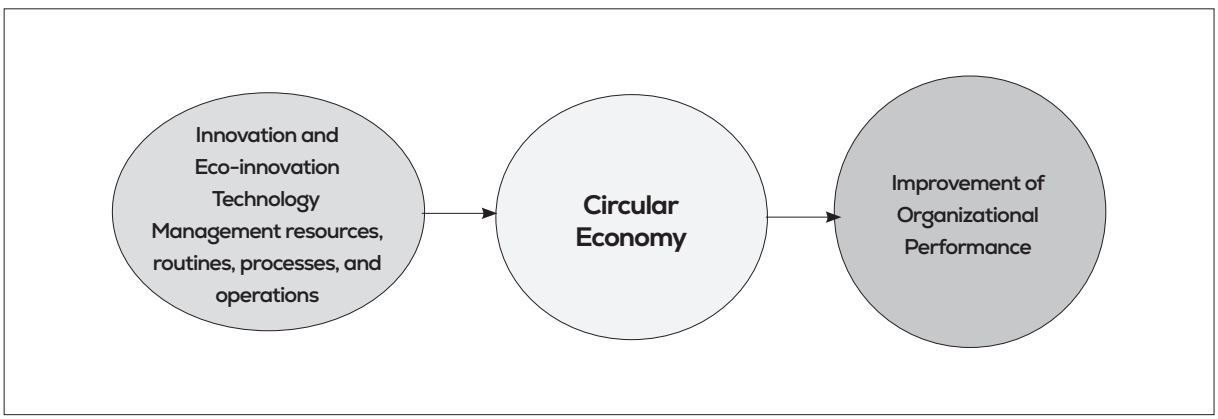
Theoretical proposition derived from integrative analysis

Most of the studies showed that innovation and eco-innovation capabilities help to make the transition to the circular economy (CE) (Arekrans et al., 2022; Bag et al., 2022; Herrero- Luna et al., 2022; Pieroni et al., 2021; Portillo-Tarragona et al., 2018; Santa-Maria et al., 2021; Scarpellini et al., 2018; Scarpellini et al., 2020b; Sehnem et al., 2022; Uhrenholt et al., 2022). Also noteworthy are the studies that showed that the adoption of technologies helps in the transition from linear economy (LE) to CE (Arroyabe et al., 2021; Bag et al., 2021; Belhadi et al., 2022; Lu et al., 2022; Moon & Lee, 2021; Stekelorum et al., 2021). Studies aligned with the concept of dynamic capabilities (DCs) proposed by Teece et al. (1997), related to resources, routines, processes and operations, showed that these also help make the transition to CE (Cavicchi et al., 2022; Chowdhury et al., 2022; Jabbour et al., 2019; Jayarathna et al., 2022; Katz-Gerro & Sintas, 2019; Khan et al., 2021; Portillo-Tarragona et al., 2018; Scarpellini et al., 2020b; Wade et al., 2022).

The studies that showed that capabilities support the transition and even help to improve the performance of organizations are: Bag et al. (2022); Chowdhury et al. (2022); Elf et al. (2022); Bag and Rahman (2021); Nayal et al. (2022); Belhadi et al. (2021); Hong et al. (2018). The literature showed that organizations are developing capabilities that help transition from LE to CE and put their strategies into circular practices. Many articles selected for this review also showed how adopting circular practices helps improve organizations' performance.

The evidence of the integrative synthesis of this study allowed us to build a conceptual framework (Figure 11), which gave rise to a theoretical proposition: DCs positively influence the transition to CE based on innovation, technology, and resource management and help to improve organizations' performance. This theoretical proposition can be tested in future studies using the research gaps identified in this research.

Figure 11. Conceptual Structure of Integrative Analysis



Managerial implications

Our study shows that DCs contribute to overcoming organizational barriers and suggests that the ability to implement circular practices (circularity) is a new DC and that this can be integrated into the professional life of organizations. Importantly, studies show that DCs can be managed by all types of organizations, regardless of their size, paving the way for small and medium-sized companies to adopt circular practices using their DCs.

The results of this research present information that organizations can use about the DCs that are being used to adopt circular practices, and the resources and capabilities needed to transition to circularity. Therefore, companies can better understand which DCs can be used and how they can help in this transition, making them more prepared for competitiveness in a CE context.

Our findings also indicate that companies should invest in DCs related to innovation/eco-innovation and technology, in addition to seeking improvements in the management of their resources/routines/process/operations, as these open up new market opportunities (in the case of the first two) and has the potential to improve efficiency (in the case of the third), bringing improvements in performance and increasing the competitiveness of companies. For the DCs related to technology, enterprises should seize the opportunities of the information age and focus on using information technology to improve supply chain dynamics to build a flexible, efficient, and dynamic environment to better respond to environmental changes and promote sustainable competitive advantage.

Additionally, our findings can help companies realize the importance of CE and how their practices impact business design, leverage their DCs to drive CE deployment in their operations and communicate and collaborate with their supply chain partners to achieve sustainable goals and generate lasting competitive advantages.

CONCLUSIONS

This article presented an integrative literature review of dynamic capabilities (DC) and circular economy (CE). We discussed a research agenda with 13 recommendations as proposals for future studies. The results showed that more research is necessary using DCs as the central theme, with methodological choices based on conceptual works and mixed approaches, as Amui et al. (2017) pointed out.

The findings suggest the need for more studies on this topic examining organizations in the service sector and focusing on human aspects. Furthermore, investigating developing countries is a good path for future studies, as well as making comparisons between developed and emerging countries. Another important recommendation is to develop new research alliances between countries to conduct future studies in this area. These results are similar to those of Amui et al. (2017).

Considering that the transition to the circular economy involves various stakeholders, including manufacturers, retailers, importers, distributors, academia, consulting firms, research and development companies, governments, and consumers, the conflicting interests should

be considered. There are particularities at the micro and meso levels, and it is important to delve deeper into the study of this phenomenon. We recognize that the transition, primarily at the macro level in terms of legal instruments, policies, and roadmaps, can create a conducive environment for the transition at the meso and micro levels.

Therefore, there is still a lack of studies with theoretical approaches that explore the relationships between these stakeholders and how they can influence the transition and the implementation of CE. Among these theoretical approaches, we mention the stakeholder theory but also other sociological and political theories.

Moreover, this study significantly contributes to the literature on CE and DCs. Identifying and synthesizing studies addressing DCs for CE is a step toward clarifying the complex issues involved in the process of sustainable business development, paving the way for future research to understand what skills and knowledge can enable the implementation of a CE embedded in the companies' core competence, unlike sustainability, as proposed by Amui et al. (2017). This study can be helpful to researchers and practitioners acting in this area.

The limitations of this study are mainly related to the fact that the article is based on a protocol of systematic literature review using filters to select the corpus of the literature analyzed, so other protocols and filters can produce different results. This is a qualitative literature review, which does not involve meta-analysis. Future research can compare the results of this article with other studies using different protocols and filters.

There are several opportunities for future studies that identify what kind of DCs can be developed to overcome the challenges of implementing a CE. In addition, just like Amui et al. (2017), there are opportunities to organize the literature based on dimensions such as strategy, supply chain, drivers, barriers, stakeholder roles, and levels of transition to CE. Topics related to capabilities and relational view, orchestration (Kristoffersen et al., 2021), ambidexterity, experimentation, alliances, and Industry 4.0 technologies will be crucial for the transition movement to occur successfully at all levels (macro, meso, and micro). Also, new studies may advance in other methodological approaches like secondary data analysis, interpretivism, sensemaking, and even ethnography.

These results allowed us to verify that the ability of organizations to change from the linear to the circular model is directly related to the ability to develop DCs that help to put their strategies into circular practices, which also helps in improving the performance of organizations, showing that the ability to make this transition has characteristics of a DC, entitled capacity for circularity (Wade et. al., 2022).

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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Fabricio Oliveira Leitão: Conceptualization, data curation, formal analysis, financing acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing – original draft; Writing – review and editing.

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