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Rethinking dynamic capabilities in light of sustainability: A bibliometric analysis

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Abstract

The literature on sustainable dynamic capabilities is becoming increasingly relevant in business research. In this study, we adopt a bibliometric approach to analyze the development of the literature, provide an overview of its theoretical and empirical evolution, and identify future research paths. To reach this goal, we collected 602 scientific documents from Scopus published between January 2002 and May 2023. The analysis is based on a two-step process. First, we created and analyzed thematic maps for two different time periods (2002–2016 and 2017–2023) to assess the changes in the themes investigated. Second, we used bibliographic coupling to measure the influence and similarity between 147 scientific documents that were selected from leading scientific journals. Results show the adequacy of the dynamic capabilities framework for understanding the integration of sustainability within business strategies while opening up new perspectives (i.e., stakeholder engagement) and themes. Overall, we observe an increasing interest in reconceptualizing dynamic capabilities while considering their sustainability dimension, with reference to the identification of new micro-foundations and the level of analysis (from an individual or organizational level to an inter-organizational level). This study also proposes avenues for future research, including an exploration of new contexts, such as new industries, through a cross-sectoral analysis approach or the underexplored context of family firms. We also highlight the need to advance our understanding of sustainable dynamic capabilities by focusing on the social dimension, which remains understudied.

KEYWORDS
bibliometric analysis, circular economy, dynamic capabilities framework, inter-organizational level, resource-based view, sustainable dynamic capabilities

Abbreviations: BM, business model; BMI, business model innovation; CE, circular economy; DCs, dynamic capabilities; RBV, resource-based view.

1 | INTRODUCTION

In recent years, the dynamic capabilities framework, which was introduced by Teece et al. (1997) as a means to explain how companies innovate their business models by considering sustainable approaches, has received renewed research interest (Amui et al., 2017; Inigo & Albareda, 2019). The result is a progressively deeper integration of this research stream with sustainability research. This integration is a direct consequence of the increasing importance of sustainability in our society. Indeed, the focus toward sustainability in business also emerged because of community interest and the interventions of public authorities, which support and encourage businesses to adopt new policies and regulations (SDSN, 2022). In response to governments' new standards of compliance and changing consumer requests, companies are required to innovate their approaches to creating value (Husted & Allen, 2009; Yang et al., 2017). Business-as-usual is no longer an option for firms seeking to grow and achieve success in the market (Bocken et al., 2016), and the development of new strategies has become vital.

The integration of sustainability requirements into business model innovation has received increasing attention from policymakers, businesses, and academics (Bocken et al., 2014; Geissdoerfer et al., 2017; Lozano, 2018; Pan et al., 2022; Preghenella & Battistella, 2021). With this approach, we can better understand how companies gain competitive advantage, comply with national and international legislation, and improve their market reputation. Sustainable business model innovation is essential to address social and environmental problems (Laasch, 2018). However, it is intrinsically more complex to implement than conventional business model innovation (Bocken & Geradts, 2020) as it tends to embed all the pillars of the triple bottom line (economic, social, and environmental) in a long-term-oriented transformation. Therefore, companies show different levels of integration of sustainability into their business models.

Research on this topic has received increasing attention (Pan et al., 2022), and scholars have progressively focused on identifying factors that support the development of these models, both theoretically and empirically, such as the capabilities supporting the transition and speeding up of this long-term evolution (Bocken & Geradts, 2020; Dressler, 2023; Inigo et al., 2017; Oliveira-Dias et al., 2022; Santa-Maria et al., 2022; Scarpellini et al., 2020). The dynamic capabilities framework (Teece, 2018; Teece et al., 1997) has become central to studying and explaining the transition toward sustainability. Dynamic capabilities are defined by Teece et al. (1997, p. 516) as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments," and their interdependence with business modeling is widely recognized by scholars (e.g., Schoemaker et al., 2018; Teece, 2018). Filser et al. (2021) highlighted the importance of sustainability and dynamic capabilities in business model innovation. The dynamic capabilities framework offers insights into how companies maintain their competitive advantage by continuously recombining their resources. As sustainability has become crucial in business, the recombination of such resources has focused more on social, environmental, and economic issues. These high-order capabilities play an important role in developing proactive socio-environmental practices and related economic performance (Annunziata et al., 2018), and a growing number of studies have discussed dynamic capabilities for sustainability or green dynamic capabilities (Buzzao & Rizzi, 2021; Cezarino et al., 2019; Wu et al., 2013; Zhang et al., 2020). Wu et al. (2013, p. 256) defined dynamic capabilities for sustainability as a "special kind of organizational capabilities that enable firms to systematically sense and seize sustainable development opportunities from the rapidly changing stakeholders' expectations, so as to simultaneously achieve economic, environmental and social benefit." This definition extends and enriches the sense, seize, and reconfigure disaggregation of dynamic capabilities suggested by Teece (2007). In this vein, companies need to understand and sense sustainability-related opportunities or threats. For instance, climate change issues and new ethical standards can pose a threat to old business models and thus require proper changes to allow businesses to survive. These changes must be implemented (seized) through right-time investments oriented toward new sustainable products, processes, services, and behaviors by focusing on stakeholders' needs through a continuous transformation (reconfiguration) of resources (Teece, 2007). In line with this perspective, researchers have considered dynamic capabilities as a pivotal element in achieving a strategic shift to sustainability (e.g., Cillo et al., 2019; Eikelenboom & de Jong, 2019) while others have investigated the drivers of developing these capabilities (e.g., Khan et al., 2020; Singh et al., 2022). Within these two main strands, researchers have investigated dynamic capabilities in relation to other topics linked to sustainability, such as the circular economy (Bag et al., 2022; Coppola et al., 2023; De Angelis et al., 2023), sustainable supply chain (Bag & Rahman, 2023; Beske et al., 2014; Chari et al., 2022), and green product design (Bhatia & Jakhar, 2021; Chen & Chang, 2013; Dangelico et al., 2017).

The dynamic capabilities framework, albeit recent, can no longer be considered a novelty in the sustainability debate and is becoming more integrated with other streams related to the triple bottom line. Teece and colleagues introduced this framework in 1997, and the idea of linking dynamic capabilities with sustainability-related concepts became popular at the beginning of the 21st century. The rapid proliferation of scientific research requires an in-depth analysis of the debate, its sources, and current trends, which will help understand the state of the art of the literature and the future paths that still need to be taken. Amui et al. (2017) were the first to look at these aspects through a systematic literature review. However, the large number of documents published after 2017 has increased the need to investigate the resulting large amount of (new) scientific knowledge in depth. Hence, the current study aims to address the following research questions: How has the field of sustainable dynamic capabilities evolved in recent years? What are the key thematic areas and the prevailing conceptual frameworks? Which research paths should be explored in the future?

In our analysis, we use a bibliometric approach to map the cumulative scientific knowledge of the topic in the last decades, considering that "knowledge is cumulative if it references or is discursively

embedded in a broader field of inquiry, and increases the extent and density of intertextual links in that field" (Richardson, 2018, p. 564). This study aims to show how specific disciplines, scientific domains, and research fields are conceptually, intellectually, and socially structured (Cobo et al., 2011) so as to identify knowledge gaps and potential avenues for future research. According to Etemad and Lee (2003) and García-Lillo et al. (2017), intellectual structures or knowledge networks describe how conceptual items associated with a research field are organized and interrelated in the literature (Marsilio et al., 2011). Bibliometric analyses apply science mapping to understand the evolution of these conceptual items in their scientific disciplines (Zupic & Čater); this approach is suitable for detecting relational patterns and conceptual structures underlying the research field. Hence, network analysis techniques are adopted to quantitatively assess the role of specific themes in the literature.

The rest of the paper is structured as follows: Section 2 discusses our methodological approach, including the data collection process and the analytical methods used in this study. Section 3 presents the results of the bibliometric analysis. Section 4 describes our critical examination of the results. Finally, Section 5 concludes the study and provides suggestions for future research.

2 | METHODOLOGY

Bibliometric analysis has become extremely popular in recent years mainly because of the increased accessibility to a wide number of scientific documents available online and the recent advancements in analytical tools and software (Donthu et al., 2021). Bibliometrics is "the use of statistical analyses to study publication patterns" (McBurney & Novak, 2002, p. 109), and allows the exploration of large volumes of bibliographic data at both the macro and micro levels (Kokol et al., 2021). Its success lies in the fact that it can be used for different purposes: mapping scientific collaborations, detecting patterns of emerging or declining topics in the literature, identifying research areas that have received less attention, and, in general, critically assessing the state of the art of a specific research stream (Linnenluecke et al., 2020; Zupic & Čater, 2015). Bibliometrics enables researchers to explore different aspects of a research field, including the temporal and spatial features of the related literature, thus providing new insights into available scientific knowledge (Kokol et al., 2021). In this study, we combined a bibliometric approach with synthetic knowledge synthesis based on the works of Kokol et al. (2018) and Kokol et al. (2022). After collecting the bibliometric data, we performed a quantitative analysis using the tools described in the next paragraphs to map the research themes and knowledge networks (and clusters) in the literature. The outputs were then analyzed using a qualitative approach, linking themes and clusters to identify research dimensions that have been explored in depth in the past and others that have recently become more appealing in the literature.

According to Zupic and Čater (2015), bibliometric methods are mainly used for performance analysis and science mapping. The former focuses on assessing the scientific production of individuals and institutions, whereas the latter allows us to understand the dynamics occurring in a scientific field in terms of topics explored and scientific findings. The same authors also suggested a precise five-step procedure for science mapping. First, a research question must be defined, along with the bibliometric method that can help address it. Different methods can be employed in bibliometric studies (Chang et al., 2015; Cobo et al., 2011; Donthu et al., 2021), and they are discussed in more depth in the next paragraph, where we present the approach adopted in this study. Second, researchers must decide on the data collection process: what documents should be examined, what sources should be used (i.e., journals, books, handbooks, and scientific reports), and where these documents should be collected. Third, data should be analyzed according to the analytical techniques chosen by the researchers. Fourth, researchers should visualize the data because science mapping aims to visualize network structures derived from the interconnections between topics and documents. Finally, the results should be interpreted in light of the findings from the document analysis.

In this type of research, the choice of bibliometric method is key. As we are interested in measuring the influence and similarity between documents and topics, we used bibliographical coupling and co-word analysis. According to Zupic and Čater (2015, p. 434), "bibliographic coupling uses the number of references shared by two documents as a measure of the similarity between them." This approach is particularly indicated in our research because most documents on dynamic capabilities and sustainability have been recently published, and we are not specifically looking at the most important publications in terms of citations. As highlighted by Bartolacci et al. (2020), references in scientific articles are always the same; therefore, in contrast to citation or co-citation analyses, analyses conducted with bibliographic coupling are not influenced by the time when they are performed. In our work, we mapped knowledge networks by considering articles as nodes in the network and the relationship between two articles (or permanent relationship, according to Small, 1973) as a connection because they share the same references. Meanwhile, co-word analysis enables us to examine the content of documents, thus facilitating content analysis. If two words appear in the same document, they have a thematic relationship; the more frequent their co-occurrence in multiple documents, the stronger the relationship associated with each document because of words' co-occurrence. In this study, we looked at authors' keywords and their co-occurrence in all the documents (i.e., abstract, title, and keyword list) included in our dataset. This approach enabled us to identify clusters made by different keywords underlying the presence of specific themes using the Walktrap algorithm. Co-word analysis can be used to understand the dynamics of certain concepts in a research field; by adopting a historical bibliometric approach, one can obtain an overview of the importance of a concept in the literature, that is, its centrality in the scientific debate and its relationship with other concepts discussed in the literature (Kokol et al., 2021; Zupic & Čater, 2015).

We adopted the following approach for the data collection: First, we used Scopus as the source of the bibliometric data. As discussed by Aria and Cuccurullo (2017), the choice of database is not neutral. In our work, we chose Scopus because it is one of the largest

databases of scientific documents in the world, together with Web of Science; however, compared with Web of Science, Scopus covers a larger number of publications in the social sciences (Mongeon & Paul-Hus, 2016). Regarding the search criteria for the documents to be considered in our analysis, we searched the titles, abstracts, and/or keywords for "dynamic capabilit*" AND "green* supply chain" OR "green* product*" OR "sustainable supply chain" OR "circular supply chain" OR "circular economy business model*" OR "circular business model*" OR "sustainable business model*" OR "esg" OR "environmental sustainab*" OR "social sustainab*" OR "social responsib*" OR "circular economy" OR "corporate social respons*" OR "environmental perf*" OR "social perf*" OR "sustainab* development" OR "ecol*" OR "environmental innovation" OR "green* innovation" OR "environmental manag*." In several cases, we used the truncated version of a keyword (using the "*" symbol) to avoid problems caused by plural forms or other language variations. These keywords were chosen according to the literature on dynamic capabilities and sustainability (Fahimnia et al., 2015; Jain & Tripathi, 2023; Vogel & Güttel, 2013; Ye et al., 2020) as they represent the main themes discussed in the research field. As the selection of keywords would generate the database to be analyzed, the process must be implemented carefully (Cronin et al., 2008). Hence, we decided that two researchers should fill in two pre-structured tables independently and then crosscheck the results obtained (Franklin et al., 2010). Subsequently, the results were discussed with a third researcher, who was pivotal in resolving disagreements and making the final decision when necessary. We launched our data collection in May 2023 and found 602 documents, all written in English, from 281 sources published between 2002 and 2023. We did not impose a time constraint; that is, we did not specify 2002 as the starting point for our data collection because the dynamic capabilities concept did not exist before 1997 and between 1997 and 2002, we did not find papers exploring the interlinkages between dynamic capabilities and sustainability. We retained all of the above documents for the analysis, in addition to those published in business- or management-related sources, because we aimed to understand the evolution of the topic across disciplines. Subsequent data analysis and visualization were conducted using the *bibliometrix* R package (Aria & Cuccurullo, 2017) and VOSviewer (Van Eck & Waltman, 2010), and the results are presented in the next section.

3 | RESULTS

The key information and descriptive statistics of the dataset are presented in Table 1. As previously reported, we collected 602 documents from 281 sources published between 2002 and 2023. These documents are mainly research articles (468), and only 79 of them were written by a single author; on average, the annual growth rate is approximately 22%, and one-third of all documents (34.55%) were the result of international collaborations. The average number of citations per document was 41.34, with the work of Teece (2007) having the highest number of citations (6599) and with 98 documents having no citations at all.

TABLE 1 Descriptive statistics.

Main information	Result
Timespan	2002–2023
Number of sources	281
Number of documents	602
Annual growth rate	22.08%
Average citations per document	41.34
Number of authors' keywords	1610
Number of authors	1496
Single-authored documents	79
International co-authorship	34.55
Document type: Article	468
Document type: Book chapter	22
Document type: Conference paper	84
Document type: Conference review	9
Document type: Retracted	1
Document type: Review	18

Figure 1 shows the scientific production in the time window covered by our dataset. Until 2016, the number of documents published on the topic was relatively stable. After that year, the number exponentially increased, peaking in 2022 with 151 documents (however, 2023 data are partial as the data collection was completed in May 2023; more documents could have been published in 2023). Six sources published at least 10 documents on the topic: the *Journal of Cleaner Production* (52 documents), *Business Strategy and the Environment* (43 documents), *Sustainability* (38 documents), *Technological Forecasting and Social Change* (16 documents), *International Journal of Production Economics* (14 documents), and *Corporate Social Responsibility and Environmental Management* (13 documents).

As highlighted in Table 1, the number of authors' keywords was 1610. Approximately 13% of these 1610 keywords referred to just one keyword: dynamic capabilities (other synonyms, such as dynamic capability, also appeared as keywords and were merged in the analysis). This outcome was expected as "dynamic capabilit*" was our main search term in combination with other keywords related to sustainability. Among the latter, keywords such as "sustainability," "circular economy," "corporate social responsibility," "sustainable development," and "environmental performance" were prevalent. This result was a natural consequence of our research query, but these keywords were indeed particularly frequent.

The authors' keywords were used for the first part of our analysis, that is, the co-word analysis. To monitor and assess the presence (and prevalence) of specific themes in the literature, we used the thematic mapping approach developed by Cobo et al. (2011) and Aria and Cuccurullo (2017). In this approach, keywords are considered representative of specific themes and can be mapped onto a two-dimensional diagram according to the following measures: centrality (the degree of interaction between keywords belonging to different themes, which measures their importance) and density (the strength of the relationship between keywords associated with the same theme). Figures 2

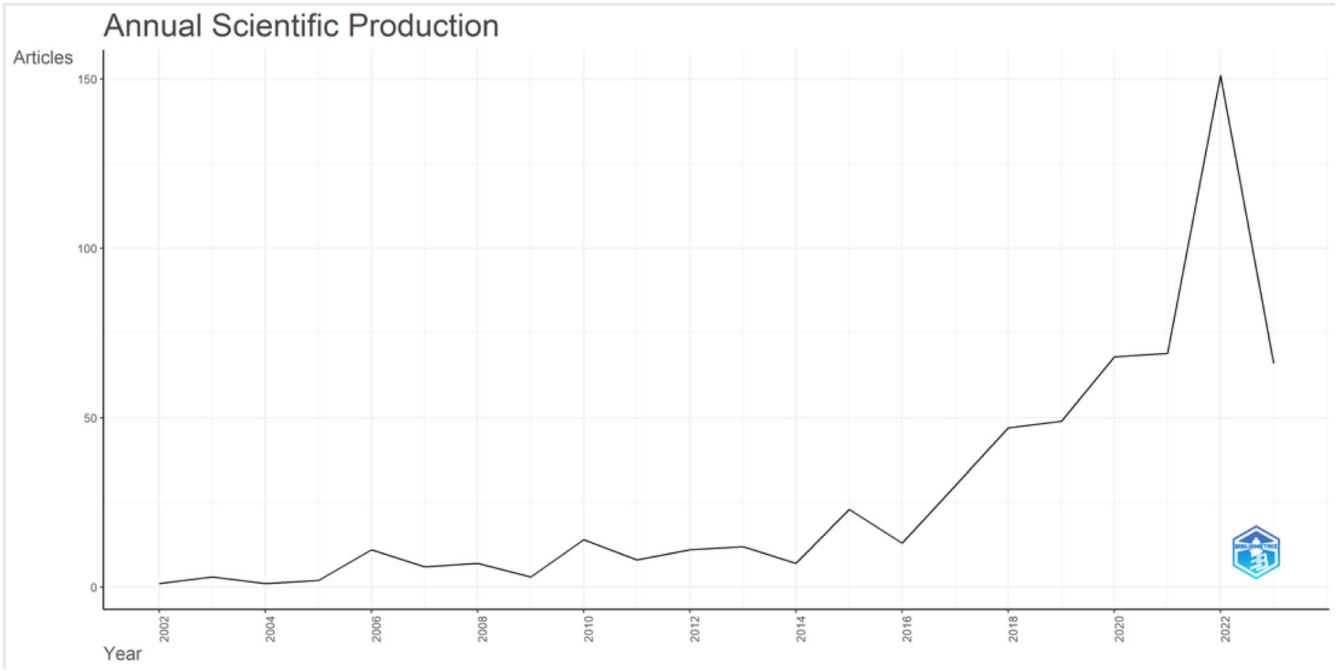

FIGURE 1 Annual scientific production.

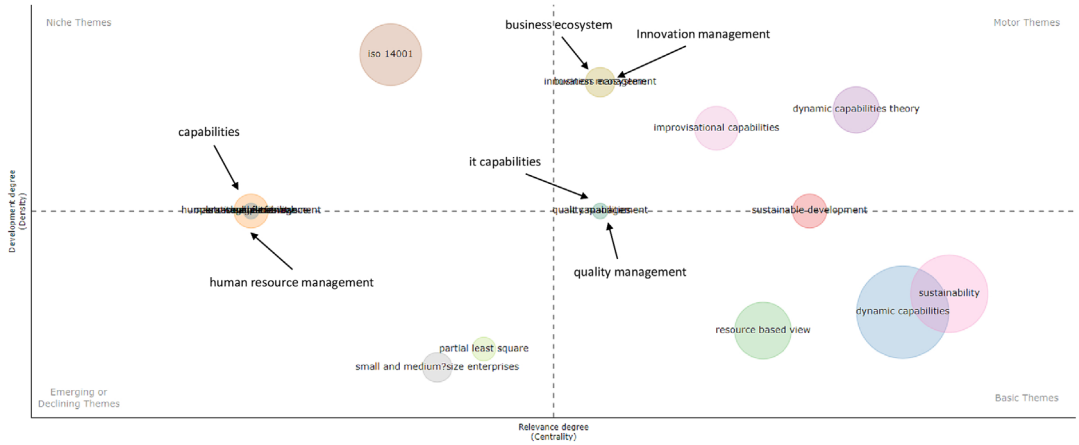

FIGURE 2 Thematic map 2002–2016.

and 3 show the diagrams created to map the themes characterizing the 2002–2016 and–2017–2023 periods. We decided to split our time window into two parts because of the scientific production trend over the years. As shown in Figure 1, publications exponentially increased after 2016, and we wanted to check if this change was also reflected in the themes investigated before and after 2016.

Both diagrams are divided into four sections: motor themes (upper right section), basic themes (lower right section), emerging or declining themes (lower left section), and niche themes (upper left section). The *x*-axis shows the density of a theme, and the *y*-axis shows its centrality. Themes are represented by bubbles, and they can include more keywords. Figures 2 and 3 show that only one keyword is associated with each bubble, but the full list of keywords associated with all bubbles is included in Appendix A (Tables A1 and A2).[1] By observing the two thematic maps, we noted a clear increase in the themes involved and a shift in some of them to different quadrants. The proliferation of publications spread streams of interest in dynamic capability research. In the first map, we also noticed unique attention to the food industry, which also remains central in the second map. However, in the second map, we observed an increase in the contexts (e.g., the textile and clothing, hotel, and automotive industries).

In the motor theme section of the first map, we identified the following: "innovation management," "quality management," "dynamic capabilities theory," and "improvisational capabilities." In particular, "improvisational capabilities" comprises keywords such as "new product development" and "environmental turbulence," and it refers to adaptation strategies and innovativeness for overcoming periods characterized by uncertainty and turbulence. The "dynamic capabilities

[1]Bubbles/themes are labelled according to the most frequent keyword.

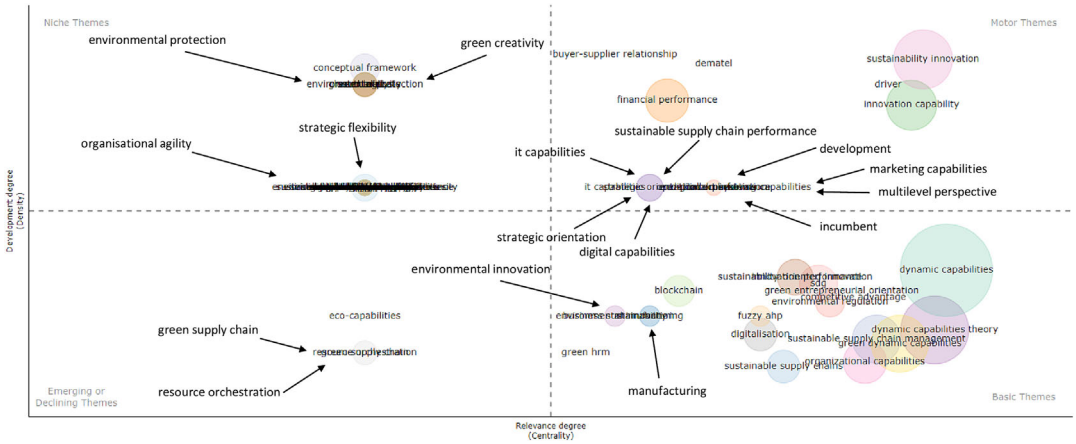

FIGURE 3 Thematic map 2017–2023.

theory" theme includes keywords such as business process management and sustainable competitive advantage, and it represents the theoretical framework for interpreting managerial processes. Sustainable competitive advantage does not refer to social or environmental dimensions. Indeed, in the first phase (2002–2016), the concept of sustainability was sometimes used to express the idea of durability and was not always related to the triple bottom line. In this period, we recognized only one theme as a niche theme, and it included keywords associated with intra-organizational dynamics and structures (e.g., "ISO 14001," "environmental management system," "financial performance," "organizational learning," "ems," "impact," and "triple bottom line"). Meanwhile, the basic themes were rather predictable: "sustainability" (including keywords such as "corporate social responsibility" and "innovation"), "dynamic capabilities" (including keywords such as "competitive advantage" and "environmental management"), and "resource-based view" (including keywords such as "institutional theory" and "stakeholder theory"). In the 2017–2023 period, the situation changed radically. We noted that the most important motor themes were "sustainability innovation," "driver," and "innovation capability." The theme "sustainability innovation" is strongly focused on innovation from an organizational perspective, and it includes keywords such as "organizational culture," "green intellectual capital," and "organization design." The other themes are mainly focused on the macro aspects of global and environmental change. Moreover, the number of niche themes increased, and several themes can be considered as basic themes; they included "dynamic capabilities," as in the previous period; "green dynamic capabilities" (which in turn incorporates innovative green product development); and "sustainable supply chain management." The cluster "dynamic capabilities" included new keywords such as "circular economy," "sustainable development," "environmental performance," and "green innovation." It thus introduced concepts related to the triple bottom line dimension (e.g., circular economy, sustainable development, corporate social responsibility, environmental performance, green innovation, and eco-innovation) and was no longer linked to the idea of durability. In addition, we noticed that the "dynamic capabilities" theme incorporates the sustainability keyword, which was under a separate theme in the previous map. Within this theme, we also found keywords related to new technologies, such as "big data," "digital transformation," "technological innovation," "technological capabilities," and "digital transformation." and in the same section (the basic one), we noticed that themes related to new technology opportunities have emerged such as "digitalisation," or "blockchain," a theme including blockchain and "supply chain ambidexterity" and which is nowadays widely discussed by policymakers and scholars because of the opportunities they can provide to businesses. In this second map, the "dynamic capabilities" theme comprises related business model concepts, such as business, circular business, and sustainable business models. Meanwhile, in the first map, the keyword "business model" is included within the "sustainable development" theme, and the "business model innovation" concept is completely absent.

Finally, we observed that little attention was directed to the social dimension in the first period (2002–2016) . As for the 2017–2023 period, environmental aspects continued to prevail, and the social dimension emerged through the following keywords: "social performance under the financial performance" theme, "social innovation and social impact" under the "dynamic capabilities" theme, "social sustainability" under the "dynamic capabilities theory" theme, and "social sustainability performance" under the "buyer–supplier relationship" theme.

Figure 4 shows the results of the second part of the analysis, that is, bibliographical coupling. We created a network in which the nodes are the documents and ties are based on the presence of shared references among them. We did not use all 602 documents to create this network because we wanted to concentrate on those published in highly ranked sources in consideration of their greater impact on scientific debate and their ability to influence its future path. The selection criterion, based on the current impact of scholarly journals, is not new in the literature (Massaro et al., 2016). In particular, we selected only the articles belonging to journals with an H-index greater than or equal to 150 (see Appendix B). The H-index is a metric used to assess the quality of the scientific production of individual authors and journals and is based on the number of citations received (Bornmann & Daniel, 2007; Mingers et al., 2012). We found this criterion suitable

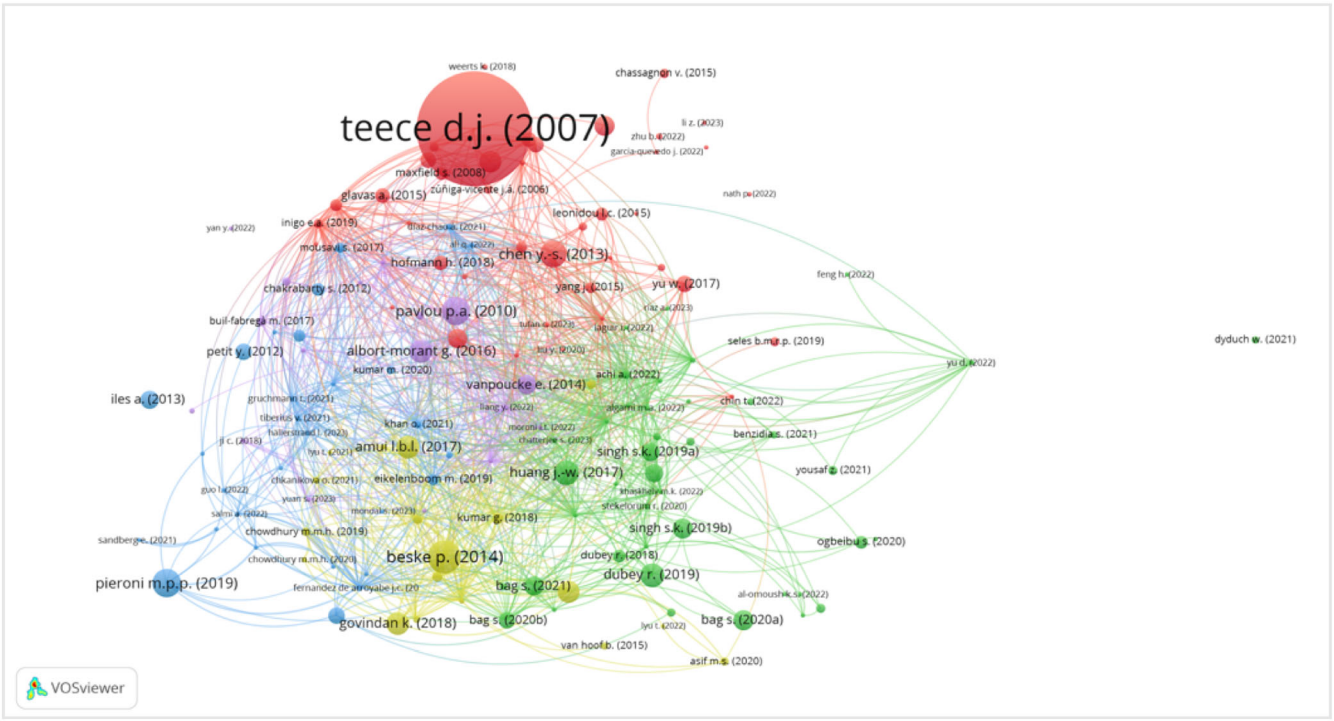

FIGURE 4 Bibliographic coupling based on documents.

for our research purposes. Moreover, it enabled us to maintain the (original) temporal distribution of the scientific documents. Once the network comprising 147 documents from 31 sources met the H-index criterion, we proceeded with the clustering using the approach implemented by Waltman et al. (2010). Each cluster was identified by color, and five clusters were mapped. The red and green clusters included 41 documents while the blue, yellow, and purple clusters comprised 30, 18, and 17 documents, respectively.

Table 2 combines the outputs from the thematic analysis and the bibliographic coupling to identify meaningful streams of research and to find interconnections between themes and clusters related to the different topics discussed in the literature. This table presents the main studies belonging to certain disciplines and knowledge areas that focus on specific themes. Not all clusters included themes for each category (niche, emerging/declining, basic, and motor): in one case, we even have a cluster (Cluster 2 in the 2002–2016 period) that is made by post-2017 studies only, and therefore there are no themes to discuss about in 2002–2016 period. The results of the knowledge synthesis approach are discussed in the following sections.

4 | DISCUSSION OF CLUSTERS

4.1 | Cluster 1 (red)—At the roots of sustainable dynamic capabilities

This cluster includes 41 papers on the founding characteristics of sustainable dynamic capabilities. This cluster is characterized by seven theoretical papers and 34 empirical papers, of which 27 employ quantitative methods while seven employ qualitative ones. The most cited paper of the cluster is that of Teece (2007), which provides a theoretical explanation of the nature and micro-foundations of dynamic capabilities; with its 6596 citations, this work represents a pillar in the field. Also, the conceptualization of sustainable dynamic capabilities seems to be well-founded on this article, as it shows 116 connections out of the 147 papers considered in the analysis.

The cluster shows frequent theoretical references to the resource-based view (RBV) that are less prevalent in the other clusters. The main claim of the RBV is that the competitive advantage of firms depends on their resource endowment. From this perspective, organizational capabilities are one of the most critical elements in ensuring the long-term competitiveness of firms because they cannot be easily acquired (Barney, 1991). Dynamic capabilities, which represent a more recent construct and, for some authors, an evolution of the RBV itself, are considered more effective in explaining the competitiveness of firms in changing environments (Eisenhardt & Martin, 2000). As Teece (2007) argued, "While the resource-based approach is inherently static, it is also relevant to dynamic capabilities." The RBV is used to frame dynamic capabilities in their evolution toward sustainability. For example, Ambrosini et al. (2016) expressed the necessity of extending the boundaries of the dynamic capabilities concept to consider businesses' sustainability needs. They suggested that the original framework should include not only the business environment, as in the work of Teece (2007), but also the natural environment. What remains unclear from this study is the extension of the natural environment, whose conceptual boundaries require further investigation. Nath and Siepong (2022) explored marketing capabilities to address customers' sustainability requests by extending the

TABLE 2 Relationship between themes and knowledge clusters in the literature.

2002–2016								
	Emerging/ declining	**Main documents**	**Niche**	**Main documents**	**Basic**	**Main documents**	**Motor**	**Main documents**
Cluster1: At the roots of sustainable dynamic capabilities			iso 14001 (includes triple bottom line)	Glavas and Mish (2015)	Resource based view	Glavas and Mish (2015); Miller (2003)	Business ecosystem; Rela innovation management	Teece (2007) Chassagnon and Haned (2015)
Cluster2: The interplay between sustainable dynamic capabilities and new technologies	No documents	No documents	No documents	No documents	No documents	No documents	No documents	No documents
Cluster3: Rethinking dynamic capabilities for new sustainable business models					Sustainable development (includes business model)	Iles and Martin (2013)	Sustainable development (includes business model)	Iles and Martin (2013)
Cluster4: Sustainable dynamic capabilities to manage the supply chain					Dynamic capabilities (includes sustainable supply chain management and food industry)	Beske et al. (2014) Van Hoof and Thiell (2015) Beske et al. (2014)		
Cluster5: Influencing performance by retroacting on sustainable dynamic capabilities	Partial least square	Albort-Moran et al (2016)			Dynamic capabilities (includes performance)	Glover et al. (2015) Albort-Morant et al. (2016)		
2017–2023								
	Emerging/ declining	Main documents	Niche	Main documents	Basic	Main documents	Motor	Main documents
Cluster1: At the roots of sustainable dynamic capabilities							Marketing capabilities Sustainability innovation	Nath and Siepong (2022) Inigo and Albareda (2019)
Cluster2: The interplay between sustainable dynamic capabilities and new technologies			Organisational agility	Dwivedi et al. (2022)	Blockchain	Chin et al. (2022)		

TABLE 2 (Continued)

2002–2016								
	Emerging/ declining	**Main documents**	**Niche**	**Main documents**	**Basic**	**Main documents**	**Motor**	**Main documents**
Cluster3: Rethinking dynamic capabilities for new sustainable business models	Resource orchestration	Sandberg (2023)					Dynamic capabilities (includes business model, business model innovation, circular business model and sustainable business model)	Bocken and Konietzko (2022) Pieroni et al. (2019) Guo et al. (2022)
Cluster4: Sustainable dynamic capabilities to manage the supply chain	Green supply chain	Lyu et al. (2022)			Dynamic capabilities (including food industry)	Govindan (2018)	Sustainable supply chain management	Siems et al. (2021)
Cluster5: Influencing performance by retroacting on sustainable dynamic capabilities					Dynamic capabilities (including supply chain management, sustainability performance, and organisational performance)	Yuan & Pan (2023) Mohaghegh et al. (2021)		

RBV and dynamic capabilities framework to the marketing context. These sustainability-related marketing capabilities are a motor theme in the second thematic map (2017–2023) in the current study, and this characterization highlights their centrality in driving the future discussion on marketing practices (Table 2). Marcus and Anderson (2006) discussed the necessity of bridging the strategy and stakeholder literature. The same was confirmed by Hueske and Guenther (2021) and Watson et al. (2018). The latter, in the field of environmental innovation processes, found the need to extend and integrate the dynamic capabilities framework with the stakeholder engagement literature (Herremans et al., 2016). According to Watson et al. (2018), stakeholder engagement can be considered a dynamic capability that is pivotal to succeeding in the environmental innovation process because it allows access to new expertise and helps solve complex problems and gain social legitimacy. In this vein, Glavas and Mish (2015) found that companies that simultaneously prioritize economic, social, and environmental objectives focus on collaborative advantage instead of competitive advantage. Through a qualitative study involving nine companies in different industries, they showed how sustainability-oriented companies stand out for their collaborative approach to stakeholders. Taking into account the various arguments in the literature, we maintain that the evolution of the dynamic capabilities concept extends the analysis beyond the business environment by spanning the boundaries of a company's internal resources and considering new customers' needs while maintaining a strong anchorage with the RBV. The evolution of the literature toward sustainable dynamic capabilities shows that the traditional RBV grounding remains important in explaining firms' competitiveness, which creates conditions that also affect future research. This same is confirmed by the results of the synthetic knowledge synthesis approach (Table 2), which shows that in cluster 1, the RBV is a basic theme that is widely used (Glavas & Mish, 2015).

Another important aspect of this cluster is innovation. More precisely, it relates to the practices, processes, and products implemented or made by companies to make innovation efforts consistent with the strategic direction toward sustainability requirements (Adams et al., 2016). No document mentions business model innovation, which characterizes another cluster (Cluster 3, as described later in the text). Hence, this cluster contains papers that explore innovation without considering its impact on business models. The articles included in this cluster consider dynamic capabilities as enablers of sustainable innovation. For example, Chassagnon and Haned (2015) focused on innovation leadership as dynamic capabilities that are concretized through a proactive investment policy and enhanced

innovativeness to implement environmental innovations. Similarly, Garcés-Ayerbe and Cañón-de-Francia (2017) discussed environmental proactivity as a dynamic capability. As previously mentioned, Watson et al. (2018) discussed stakeholders' engagement as a dynamic capability to achieve environmental innovation. Garcia-Quevedo et al. (2022) considered the introduction of new environmental management systems as a dynamic capability that supports the adoption of radical eco-innovation technologies. Mousavi et al. (2018) found that sensing, seizing, and reconfiguring capabilities have a significant direct effect on innovation toward sustainability. Meanwhile, their study also sheds light on the importance of sensing activities that directly affect sustainable innovation. This insight is particularly interesting and is of greater value as it means that the first steps in observing the environment, its opportunities, and threats are superior to seizing and reconfiguring activities in determining sustainable innovation. Inigo and Albareda (2019) observed different types of dynamic capabilities to achieve sustainable-oriented innovation by clustering them into adapting, expanding, and transformative sustainable-oriented innovation capabilities and then identifying sectoral differences. In sum, the idea that dynamic capabilities are a prerequisite for achieving sustainable innovation is well-established in the literature, and no document in this cluster questions this relationship. The results presented in Table 2 show that innovation is a motor theme in this cluster both in the first period (2002–2016) and in the second one (2017–2023), even if it is possible to appreciate the evolution from a broader discussion of innovation management (Chassagnon & Haned, 2015) to a more specific one relating to sustainable innovation (Inigo & Albareda, 2019).

Analyzing the papers in the cluster, we noticed that several of them addressed sustainability without diving deeper into the dimensions of the triple bottom line but considered it as a unicum. For example, Glavas and Mish (2015) discussed triple-bottom-line firms as companies that simultaneously consider economic, social, and environmental objectives. Others focused on corporate social responsibility or social responsibility simply to identify the new challenges that companies are facing in their business environment (Crittenden et al., 2011; Forcadell & Aracil, 2021; Watson et al., 2018). Only Hueske and Guenther (2021), in their systematic review of the barriers and drivers of sustainable transformation in higher educational institutions, emphasized the differences between the three dimensions. Thus, in this cluster, the social aspect mainly refers to all interventions that go beyond the business dimension, and it is not explicitly linked to more traditional themes such as social justice.

4.2 | Cluster 2 (green)—The interplay between sustainable dynamic capabilities and new technologies

This cluster includes 41 papers published after 2017 that are interested in emerging topics such as new technology opportunities. It is populated by empirical studies only, and these studies mainly adopt quantitative methods, with only one exception employing mixed methods (Bag et al., 2022). The most cited paper is that from Huang and Li (2017), who analyzed the information and communication technology industry and showed that dynamic capabilities and coordination capabilities are positively related to green product and green process innovations. The idea that dynamic capabilities are an antecedent of sustainable innovation is confirmed in this cluster (e.g., by Chin et al., 2022; Feng et al., 2022; Yousaf, 2021; Yu et al., 2022). Moreover, the cluster highlights a profound interest in the investigation of the role played by new technologies in the supply chain, with specific attention to collaboration and integration. First, we noticed that in this cluster, "organizational agility" is a niche theme that has the potential to be explored further and take on greater centrality (Table 2). Organizational agility can affect various internal processes and company functions and determine the ability to implement and exploit new technological opportunities, thereby contributing to performance. Dwivedi et al. (2022) found that the use of enterprise social media alone may not provide the desired performance outcomes because of its dependence on other related elements, such as organizational agility. Second, previous research has built different patterns outlining the relationship between new technologies and dynamic capabilities for sustainability. Through the dynamic capabilities framework, some studies have provided new theoretical explanations of the link between digital technologies (big data, Internet of Things, cloud computing, artificial intelligence, machine learning, blockchain, etc.), sustainable performance (Li, 2022; Trujillo-Gallego et al., 2022), and green innovation (Feng et al., 2022). Other studies have specifically focused on big data, which are considered facilitators of sustainable improvements. For example, Dubey et al. (2019) conceptualized big data and predictive analytics as dynamic capabilities that affect social and environmental sustainability in the supply chain. Similar assumptions were made by Bag, Wood, Xu, et al. (2020), Bag et al. (2022), Dubey et al. (2018), and Singh and El-Kassar (2019). All these studies emphasized the importance of big data in raising and improving collaboration along the supply chain, which is needed to achieve sustainability. Benzidia et al. (2021) suggested that blockchain technology can have a similar impact and explored the role of this technology in supply chain integration, process information, and innovation development, stressing the importance of balancing relational and technological capital in buyer–supplier relationships through dynamic capabilities. However, gaining a more profound understanding of the functions and processes through which a company integrates these elements requires a qualitative approach. Chin et al. (2022) found that blockchain technology fuels the implementation of ecosystem-based business models based on what they call the value creation dynamic capability. Despite the increasing importance of the topic, only one study included artificial intelligence in its analysis (Rahman et al., 2023), highlighting that artificial intelligence-based customer relationship management optimizes the dynamic capabilities of companies aiming to achieve socially sustainable improvements. In this study, the relationship between dynamic capabilities and new technologies is reversed; artificial intelligence optimizes firms' dynamic capabilities, enabling them to achieve sustainable results. Considering that artificial intelligence involves the introduction of disruptive and novel elements with reference to the simulation of human thought, we

could reasonably argue that its integration into scientific debate could have an impact on reshaping the usual configuration, especially when discussing capabilities. The same pattern was embraced by Singh and El-Kassar (2019), who studied the role played by big data analytics in developing sustainable capabilities, and by Bag, Wood, Xu, et al. (2020) and Li (2022). Other studies have considered technology-related capabilities as dynamic capabilities for achieving sustainable performance (e.g., Bag, Wood, Mangla, & Luthra, 2020; Dubey et al., 2018; Trujillo et al., 2022). Others have also considered dynamic capabilities to be facilitators of sustainable improvements through digital technologies (Chin et al., 2022). Therefore, three different patterns outline the relationship between new technologies and dynamic capabilities for sustainability:

- New technologies serve as enablers of the dynamic capabilities needed to increase the sustainability of the company.
- New technologies are dynamic capabilities to increase the sustainability of the company.
- And dynamic capabilities are as enablers for the exploitation of new technologies that serve to increase the sustainability of the company.

These different patterns highlight that the structure of the knowledge on the topic is still under development.

4.3 | Cluster 3 (blue)—Rethinking dynamic capabilities for new sustainable business models

This cluster comprises 30 papers. The characteristic topic of the cluster is business model and/or business model innovation from a sustainable perspective, which is investigated by applying the dynamic capabilities framework. We noticed a research tendency to collect experiences in a variety of contexts and industries using both quantitative and qualitative approaches, with the latter showing obvious prevalence (by employing single and multiple case studies). Dynamic capabilities are widely recognized in the mainstream business model literature, but evidently, they have also been investigated in terms of their role in the creation of sustainable or circular business models. In the first phase (2002–2016), the business model concept was primarily connected to the broader domain of sustainable development (Iles & Martin, 2013) as a basic and motor theme. In the subsequent period (2017–2023), the concept acquired greater specificity with reference, for example, to the circular economy concept. The higher precision and awareness in dealing with the topic is also evident from the identification of a specific nomenclature such as "circular business model" or "sustainable business model," which are motor themes (Table 2). However, we noticed a prevalence of articles that associate the concept of business models or business model innovation with circular economy instead of sustainability. Sustainable and circular business models are indeed treated separately. As the most cited study of the cluster, Pieroni et al. (2019) performed a theoretical review of the approaches for business model innovation for a circular economy and/or sustainability, based on the three stages (sense, seize, and transform) of the dynamic capabilities view. The authors highlighted the importance of distinguishing and comparing sustainable ls and circular business models, which present differences that are not always discussed by previous research.

Several studies seek to identify the dynamic capabilities that facilitate the implementation of circular or sustainable business models while others go a step further and investigate the micro-foundation of these sustainable dynamic capabilities. Among the former, Fernandez de Arroyabe et al. (2021) investigated how circular economy-related capabilities (e.g., the management of green products, experience in industrial symbiosis and cascading use of resources, and establishment of rules on product design) affect the development of products and processes that are compatible with circular economy business models. The multiple case study of Salmi and Kaipia (2022), which involved seven fashion brand companies facing high pressure to abandon their linear models, contributes to the understanding of the sense, seize, and reconfigure capabilities needed in the transformation process toward circular economy business models. Finally, Iles and Martin (2013), with their multiple case study on three chemical companies that produce bioplastic and by applying the standard tripartite format of dynamic capabilities (sensing, seizing, and reconfiguring), investigated how these companies implement a business model that effectively bring a sustainable product to market. An interesting argument of this study concerns the industry's specificity in formulating the sustainability concept around which the business model takes shape. In this case, the authors focused on the influence stemming from the chemical industry's reluctance to acknowledge the societal criticism of its production, which impedes the establishment of dialogue with societal actors. A reasonable conclusion is that in the discussion of sustainable dynamic capabilities for the implementation of new business models, one could not ignore industry specificity, ranging from its technical processes up to the history that characterized it or, for example, its geographical area of development.

The papers belonging to the second type focus on identifying the micro-foundations of sustainable dynamic capabilities as if to response to the need to re-examine the "distinct skills, processes, procedures, organizational structures, decision rules, and disciplines" (Teece, 2007, p. 1319) in light of sustainability integration within business models. We noticed a tendency to explore the topic through qualitative approaches to collect experiences across sectors and contexts. For example, Sandberg and Hultberg (2021), through their empirical research employing multiple case studies in the fashion sector, explored the variety of micro-foundations involved in different logics of scaling practices for circular business models. Their study takes a step forward with respect to the business model and business model innovation topics by deepening the dynamic capabilities for their scaling logic. This advancement highlights the consolidation of circular business models in practice and opens up a new exploratory phase for companies and new horizons for research. Bocken and Konietzko (2022) conducted multiple case studies on circular business model innovation in the context of multinational consumer-facing corporations. In a different setting, Cavicchi et al. (2022), in their study

on the agricultural sector, identified energy management and auditing capabilities as the micro-foundations of the dynamic capabilities needed to transform the business model into a circular one. This study has the merit of exploring the micro-foundations of sustainable dynamic capabilities within the context of small and medium-sized enterprises. The exploration of the topic in this context is important because of the elements characterizing small and medium-sized enterprises, such as resource constraints, which are valuable in the discussion of capabilities. In their multi-case study on seven technologically intensive companies, Van Eechoud and Ganzaroli (2023) identified nine dynamic capabilities and their micro-foundations that support companies in leveraging the potential of Industry 4.0 technologies in the transition to circular business models.

We found a common denominator among the papers on circular economy business models or initiatives, that is, the idea that inter-organizational collaboration can be considered a major success enabler for deviating from linear practices. For example, Khan et al. (2021) identified three micro-foundations for seizing capabilities, namely, strategic planning, business models and governance, and collaboration. According to them, firms cannot implement circular economy opportunities without collaborating for the requisite knowledge, skills, and recyclable materials. Similarly, among the new capabilities and practices that contribute to the transition to circular business models, Fernandez de Arroyabe et al. (2021) identified the collaboration between and among the private and public sectors as one such practice. In their study of the enablers of green entrepreneurship among micro, small, and medium-sized enterprises in a circular economy, Mondal et al. (2023) found that companies need proper coordination and collaboration among stakeholders. This study identified the latter as facilitators of green entrepreneurship in a circular economy; however, further investigation is needed to understand the specific mechanisms and practices required to make them work. Belhadi et al. (2022) investigated the integration of the circular economy and Industry 4.0 principles in closed-loop supply chains and identified them as dynamic capabilities with the potential to create sustainable collaboration along the supply chain through, among other things, the facilitation of real-time information exchange. Guo et al. (2022), in their longitudinal case study, found that specific collaboration with stakeholders generates a sustainable business model owing to the leveraging effect of four dynamic capabilities: sensing, learning, integrating, and coordinating. Their study outlined a new space for the analysis of sustainable dynamic capabilities related to stakeholder management. Their accounts have the potential to be useful starting points for identifying other dynamic capabilities in this domain. Finally, Sandberg (2023) integrated in their analysis the concept of orchestration capabilities and emphasized their importance in designing collaborations. Resource orchestration is an emerging or declining theme in this cluster (Table 2), but it could be crucial for providing a more in-depth analysis of the motor theme (business model innovation) with reference to the explanation of the "how." This interpretation key is relevant especially when business model innovation is based on internal resources and involves external resources, such as alliances (Sandberg, 2023).

Only one study in the cluster investigated family businesses (Tiberius et al., 2021). More precisely, the study stressed that despite the role that family businesses play from an economic, social, and environmental perspective, the research on sustainable dynamic capabilities in family businesses is scarce. This study identified innovative mindset, human capital investments, and participation in decision making as the micro-foundations related to the social and economic dimensions of sustainable dynamic capabilities in family firms.

4.4 | Cluster 4 (yellow)—Sustainable dynamic capabilities to manage the supply chain

The fourth cluster includes 18 empirical and theoretical papers. The focus is on a sustainable supply chain, which is a topic already observed in the second cluster but in a different manner. In the second cluster, the supply chain is treated with reference to new technology opportunities, an avenue that is not discussed in this cluster, except for the work of Heldt and Beske-Janssen (2023). Sustainable supply chain management (Beske et al., 2014; Van Hoof & Thiell, 2015), which was a basic theme with higher relevance in the first period of the analysis (2002–2016),also developed because of its diffusion and importance, becoming a motor theme in the second phase (2017–2023) as shown in Table 2. In this cluster, the documents published in the last 10 years show a deep connection between sustainable supply chains and dynamic capabilities. The most cited paper (Beske et al., 2014) is a theoretical work that encouraged the integration of the two themes. More precisely, this study conducted a literature review on sustainable supply chains in the food industry through which the authors identified specific dynamic capabilities (e.g., knowledge sharing) as practices of sustainable supply chain management. The food industry has been extensively explored in this domain (as shown in Table 2, it is a basic theme in both periods of analysis) because, as explained by Govindan (2018), the growing world population has a great impact on the sustainability of this industry. This intuition was embraced by other researchers in the following years, and Siems et al. (2021) emphasized the need to revise the work of Beske et al. (2014). Their study also extended the analysis to the automotive industry. Thus, this recent study confirmed the continuous interest in the topic and, considering the diverse practices and capabilities observed, stressed the importance of extending the analysis to other industries to yield additional insights.

Several studies with different levels of sharpness have discussed supply chain dynamic capabilities. Mathivathanan et al. (2017) identified 40 influential dynamic capabilities that enhance the performance measures of a firm's sustainable supply chain. More explicitly, Hong et al. (2018, p. 3510) found a positive impact of sustainable supply chain management practices on supply chain dynamic capabilities, defined as "the ability of adjusting supply chain." Similarly, Lyu et al. (2021) discussed supply chain dynamic capabilities and reported that supply chain sensing has a positive impact on supply chain agility and adaptability, which positively influence the competitive advantage of the companies involved. Chowdhury et al. (2019) considered as a

dynamic capability the ability to implement supply chain sustainability strategies in response to stakeholder needs. Their contributions highlighted the need for sustainable practices to adapt to stakeholders' evolving sustainability requirements. The changeability of the sustainability discourse underscores the adequacy of the dynamic capabilities framework in analyzing the topic. To conclude, Graham (2018) found that internally based environmental efforts are antecedents to the development of internal environmental capabilities that influence the environmental efforts of the supply chain as a whole. Considering the content of these studies, we could reasonably conclude that even with a clear tendency to broaden the dynamic capabilities concept beyond firms' boundaries, existing studies on sustainability continue to consider companies as the unit of analysis.

4.5 | Cluster 5 (purple)—Influencing performance by retroacting on sustainable dynamic capabilities

This cluster includes 17 papers, of which 16 are empirical. Most of these articles apply quantitative approaches (15 out of 16), with the partial least squares structural equation models being the most prevalent. The only theoretical paper (Boscoianu et al., 2018) emphasized the inter-correlation between innovation, dynamic capabilities (considered a tool for creating high-level strategies), and the paradigm of real options to achieve innovative enterprises, which is fundamental for sustainable development. This framework proposes active control over the extended performance of innovative enterprises. Performance represents the pillar of this cluster. For example, Albort-Morant et al. (2016) identified dynamic and ordinary capabilities as antecedents of green innovation performance. Through their empirical study of 112 Spanish firms, they built a research model that links dynamic capabilities, relationship learning capabilities (an ordinary capability that comprises information sharing, joint sense-making, and knowledge integration capabilities), and green innovation performance. In this model, dynamic capabilities influence green innovation performance by reconfiguring relationship learning capabilities. However, this study did not consider the different external sources of knowledge that may be of interest to companies. Therefore, this study is open to further detailed investigations into appropriate learning mechanisms (dynamic capabilities) to align with different interlocutors. Mohaghegh et al. (2021) identified dynamic capabilities as a link between lean practices and sustainable business performance. They distinguished between lean adopters and lean duplicators, identifying only the former as capable of achieving sustainable business performance because of the development of high-order lean-related capabilities. Liang et al. (2022) explored the dynamic capabilities needed to implement environmental, social, and corporate governance (ESG) strategies and investigated the derived sustainable management performance (including social and environmental). They found that companies that concretize ESG strategies are more likely to achieve sustainable management performance. Similarly, Moroni et al. (2022) found a positive and significant relationship between dynamic remanufacturing capabilities and eco-innovation and between eco-innovation and business performance (defined as operations, market, and finance performance) but without a specific reference to sustainable performance. Yang and Yang (2022) investigated the relationship between dynamic capabilities embedded in ESG management and corporate performance by identifying the costs and benefits of this relationship. More precisely, dynamic ESG capabilities improve performance only in the presence of an organizational adaptation strategy for managing uncertainty. Indeed, the latter moderates the dynamic capabilities–performance relationship. Despite the large amount of information that can be collected from companies' sustainability reports, this study is the only one in the cluster and one of the few in the analysis that employed this alternative source for data collection rather than relying on interviews or surveys.

This cluster contains the only study in this analysis that adopts a gender perspective to investigate dynamic capabilities for sustainability (Buli-Fabrèga et al., 2017). Despite the increasing importance of this topic, its integration into the literature remains limited. With reference to individual dynamic capabilities, this study highlights women's greater attention to the social and environmental performance of a company. Another interesting aspect is that studies exploring dynamic capabilities for sustainability in family firms are peripheral despite the importance of family firms in the economic and social landscape. Only one study focused on this topic (Pütz et al., 2023), particularly discussing the importance of corporate social responsibility in linking family-specific resources and the ability to absorb external knowledge. Corporate social responsibility is used to build long-term relationships with stakeholders that are willing to share information with family firms.

5 | CONCLUSION AND RESEARCH IMPLICATIONS

In recent decades, the dynamic capabilities framework has strongly characterized scientific research on firms' competitiveness and innovation. In light of the increased diffusion and relevance of sustainability, we have also witnessed a rapid proliferation of scientific documents extending this framework toward sustainable dynamic capabilities. The current study describes the development of the literature on sustainable dynamic capabilities by using a bibliometric approach. It also provides an overview of the theoretical and empirical evolution of this construct in the last 20 years.

The first insight of our study relates to the theoretical robustness of the RBV–dynamic capabilities framework that proves suitable for evolving the conceptualization of dynamic capabilities toward sustainability. Even when companies change or adapt their business activities toward sustainability, dynamic capabilities retain their meaning and value as organizational activities that enable change, innovation, and, thus, business model innovation. Previous research has emphasized that dynamic capabilities play an essential role in the innovation process that companies implement to transform their business while pursuing social, environmental, and economic performance objectives. Furthermore, the traditional RBV–dynamic capabilities framework

applied to sustainability enables the identification of new forms of dynamic capabilities that are oriented toward not only gaining a competitive advantage for the company itself but also creating value that can be redistributed to its partners or stakeholders. In this view, we shed light on the progressive renewal of the theoretical framework of dynamic capabilities by, for instance, opening up to new perspectives such as stakeholder engagement while retaining a solid anchorage to the RBV. Therefore, our research shows scholars specializing in sustainable innovation processes, sustainable business model innovation, and, more generally, business strategies and firms' strategic decision making that they can leverage the renewed framework of dynamic capabilities to interpret the different paths taken by companies as they advance toward sustainability.

The second insight is the identification of three patterns that explain the link between dynamic capabilities and new technologies. The extant literature has so far devoted itself to collecting empirical evidence without systematizing and producing a synthesis of the prevailing orientations; hence, significant weaknesses naturally exist in the theoretical understanding of the topic. The current analysis contributes to overcoming this limitation by suggesting three different patterns. The first pattern identifies new technologies as enablers of dynamic capabilities to increase sustainability. The second one identifies new technologies as dynamic capabilities for improving sustainability. The third pattern identifies dynamic capabilities as enablers of exploiting new technologies to improve corporate sustainability. Therefore, this new knowledge is useful for scholars exploring emerging technologies and their antecedents or impacts on organizations. These three patterns highlight the existence of alternative paths of causality and represent a starting point for gaining deeper insights, particularly in relation to the unique characteristics of each emerging technology that influence its interaction with organizational capabilities on a large scale and, more specifically, with dynamic capabilities. This theoretical advancement warrants further investigation.

The third insight refers to the ongoing process of reconceptualizing the micro-foundations of dynamic capabilities for business model innovation toward sustainability and a circular economy. Although the results are still fragmentary, the previous literature accounts for how, in light of sustainability, companies strive to sense future opportunities, seize them in the present, and reconfigure the enterprise by decoupling it from past routines and practices. The literature is mainly characterized by qualitative studies that support theoretical efforts. Research is conducted in a large variety of contexts, which result in the need to investigate and redefine micro-foundations in light of the integration of dynamic capabilities with sustainability. We found an evolution over time in the business model construct in relation to dynamic capabilities. Indeed, the analysis of the thematic maps shows a limited presence of the "business model" keyword in the 2002–2016 period and a significantly stronger presence in the following period (2017–2023). Furthermore, the integration and reformulation of this concept toward sustainability is recognized. Scholars have introduced the concepts of the "circular business model" and "sustainable business model" within the dynamic capabilities framework, an integration that has emerged in recent years. We also found that the concept of business model innovation has been discussed more recently in relation to sustainability (see Table A2), which shows how the evolution of dynamic capabilities toward sustainability has been observed by scholars during business model innovation processes. Furthermore, the papers examined show that inter-organizational collaboration plays a crucial role in the transition from linear to circular business models and in the implementation of sustainable ways of creating and delivering value. Therefore, the relevance of inter-organizational collaboration highlighted in this study can be useful to scholars engaged in advancing the theoretical understanding of the micro-foundations of dynamic capabilities for the innovation of sustainability-oriented business models.

Building on the above argument that involves all clusters, the fourth insight is the observation of a supra-organizational level of analysis of sustainable dynamic capabilities. Previous literature has investigated dynamic capabilities at the individual and organizational levels but has yet to consider the configuration of dynamic capabilities that take place fully and have a unitary identity through the involvement of multiple organizations that integrate via collaborative relationships. Indeed, the centrality of inter-organizational collaborations has emerged in the literature on sustainable dynamic capabilities because of the interdependence between companies to achieve sustainable objectives. Hence, the analysis of sustainable dynamic capabilities must go beyond the organizational level and observe different forms of network relationships, such as supply chains or ecosystems. In the absence of a supra-organizational analysis perspective, the observation and research on sustainable dynamic capabilities may be incomplete and may not allow a full understanding of their constituent elements and their interactions. We observed that activities and organizational processes leading to dynamic capabilities are not restricted within the companies' boundaries but involve and connect different ones. Hence, we argue that the diffusion of sustainability has matured the need to follow new research paths that theorize sustainable dynamic capabilities by overcoming the boundaries of a single company.

Finally, our study reveals unexplored directions for future research. An example is the investigation of the different strategic approaches established by companies with specific governance forms, such as family firms. Furthermore, only some industries have been analyzed, and numerous opportunities can be taken to expand our understanding of this phenomenon in a cross-sectoral manner. Researchers have attempted to identify the patterns that represent the impact of sustainable dynamic capabilities on performance. However, no definitive results have been reported thus far. As shown in Cluster 5, performance is a basic theme in both periods considered (Table 2); hence, the topic has high relevance and popularity but needs to be completely developed. Another important direction for future research is a more comprehensive understanding of the green supply chain (Lyu et al., 2022) functioning, which was identified as an emerging or declining theme (Table 2) in the yellow cluster. A detailed analysis of resource optimization and consumption patterns within the entire supply chain may be an interesting avenue for future research. In addition, our analysis revealed some form of polarization of the literature on sustainable dynamic capabilities; that is, the literature has strongly focused on the

environmental dimension while little has been said about the social dimension. To advance our understanding of sustainable dynamic capabilities, future research should deepen the social dimension, which relates to the protection of people and social justice.

In addition to the aforementioned theoretical contributions, this study has several managerial implications. Indeed, the analysis of previous literature that identifies practices and behaviors facilitating sustainable business model innovation can be valuable for companies undergoing a transition toward sustainability. This work can be considered as a comprehensive guide detailing the skills, processes, and mechanisms that are needed to develop the sustainable dynamic capabilities required to navigate change. For example, this study shows that the development of sustainable dynamic capabilities is not confined to internal processes within the company as it requires a broadening of its horizons through close collaboration. Thus, managers can become aware of the chance to sense potential opportunities in this direction. Furthermore, this analysis helps them gain awareness of the adequacy and state of progress of a company's internal intangible resources needed to seize sustainable opportunities and address the transition. For example, they can evaluate the presence of new technologies and their interplay with their dynamic capabilities for sustainability to seize margins and improve their exploitation. Awareness of the adequacy of the internal and intangible resources needed is crucial for companies initiating the change process toward sustainability and for those that must continually make improvements to already sustainable business models in response to the growing requests from civil society and governments.

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CONFLICT OF INTEREST

None of the authors have conflict of interest to disclose.

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APPENDIX A

TABLE A1 Thematic map 2002–2016.

Occurrences	Words	Cluster	Cluster label
3	Sustainable development	1	Sustainable development
2	Business model	1	Sustainable development
55	Dynamic capabilities	2	Dynamic capabilities
10	Competitive advantage	2	Dynamic capabilities
7	Sustainable supply chain management	2	Dynamic capabilities
4	Environmental management	2	Dynamic capabilities
3	Environmental sustainability	2	Dynamic capabilities
2	Food industry	2	Dynamic capabilities
2	Knowledge management	2	Dynamic capabilities
2	Performance	2	Dynamic capabilities
10	Resource based view	3	Resource based view
3	Institutional theory	3	Resource based view
2	Stakeholder theory	3	Resource based view
5	Dynamic capabilities theory	4	Dynamic capabilities theory
2	Business process management	4	Dynamic capabilities theory
2	Sustainable competitive advantage	4	Dynamic capabilities theory
3	Capabilities	5	Capabilities
2	Grounded theory	5	Capabilities
4	iso 14001	6	iso 14001
3	Environmental management system	6	iso 14001
3	Financial performance	6	iso 14001
3	Organisation learning	6	iso 14001
2	Ems	6	iso 14001
2	Impact	6	iso 14001
2	Triple bottom line	6	iso 14001
12	Sustainability	7	Sustainability
10	Corporate social responsibility	7	Sustainability
6	Innovation	7	Sustainability
4	Case studies	7	Sustainability
3	Supply chain management	7	Sustainability
2	Conceptual framework	7	Sustainability
2	Supplier management	7	Sustainability
2	Sustainability practices	7	Sustainability
4	Small and medium? Size enterprises	8	Small and medium? Size enterprises
2	Strategic flexibility	9	Strategic flexibility
2	Operational performance	10	Operational performance
2	Innovation management	11	Innovation management
2	Product service system	11	Innovation management
3	Improvisational capabilities	12	Improvisational capabilities
3	New product development	12	Improvisational capabilities
2	Environmental turbulence	12	Improvisational capabilities
3	Partial least square	13	Partial least square

TABLE A1 (Continued)

Occurrences	Words	Cluster	Cluster label
2	Business ecosystem	14	Business ecosystem
2	Multinational corporation	14	Business ecosystem
2	Human resource management	15	Human resource management
2	Knowledge network	16	Knowledge network
2	Quality management	17	Quality management
2	It capabilities	18	It capabilities

TABLE A2 Thematic map 2017–2023.

Occurrences	Words	Cluster	Cluster label
2	Cluster analysis	1	Cluster analysis
2	Organizational agility	1	Cluster analysis
2	Supply chain agility	2	Supply chain agility
5	Innovation capability	3	Innovation capability
4	Interpretive structural modeling	3	Innovation capability
4	Triple bottom line	3	Innovation capability
3	Developing countries	3	Innovation capability
3	Environmental collaboration	3	Innovation capability
3	Hotel industry	3	Innovation capability
3	Literature review	3	Innovation capability
2	Best-worst method	3	Innovation capability
2	Environmental pollution	3	Innovation capability
2	Responsible innovation	3	Innovation capability
28	Dynamic capabilities theory	4	Dynamic capabilities theory
17	Covid-19	4	Dynamic capabilities theory
18	Industry 4.0	4	Dynamic capabilities theory
9	Resilience	4	Dynamic capabilities theory
9	Supply chain	4	Dynamic capabilities theory
7	Digital technologies	4	Dynamic capabilities theory
6	Big data analytics	4	Dynamic capabilities theory
6	Manufacturing companies	4	Dynamic capabilities theory
5	Competitiveness	4	Dynamic capabilities theory
4	Agility	4	Dynamic capabilities theory
4	Social sustainability	4	Dynamic capabilities theory
4	Supply chain resilience	4	Dynamic capabilities theory
3	Proactive environment strategy	4	Dynamic capabilities theory
3	Stakeholder theory	4	Dynamic capabilities theory
2	Flexibility	4	Dynamic capabilities theory
2	Organizations	4	Dynamic capabilities theory
4	Financial performance	5	Financial performance
3	Adaptive capability	5	Financial performance
3	Social performance	5	Financial performance
2	Absorptive capabilities	5	Financial performance
2	Corporate sustainability performance	5	Financial performance
2	Regional development	5	Financial performance
2	Social enterprise	5	Financial performance

(Continues)

TABLE A2 (Continued)

Occurrences	Words	Cluster	Cluster label
2	s-d logic	6	s-d logic
2	Sustainable entrepreneurial orientation	6	s-d logic
8	Organizational capabilities	7	Organizational capabilities
7	Performance	7	Organizational capabilities
3	Organizational sustainability performance	7	Organizational capabilities
5	Digitalisation	8	Digitalisation
3	Aiiot	8	Digitalisation
200	Dynamic capabilities	9	Dynamic capabilities
57	Sustainability	9	Dynamic capabilities
55	Circular economy	9	Dynamic capabilities
43	Sustainable development	9	Dynamic capabilities
29	Corporate social responsibility	9	Dynamic capabilities
22	Environmental performance	9	Dynamic capabilities
20	Green innovation	9	Dynamic capabilities
19	Small and medium? Size enterprises	9	Dynamic capabilities
18	Firm performance	9	Dynamic capabilities
17	Partial least square	9	Dynamic capabilities
16	Innovation	9	Dynamic capabilities
15	Business model innovation	9	Dynamic capabilities
14	Sustainability performance	9	Dynamic capabilities
13	Absorption capacity	9	Dynamic capabilities
13	Case studies	9	Dynamic capabilities
13	Eco-innovation	9	Dynamic capabilities
13	Environmental uncertainty	9	Dynamic capabilities
11	Organisational performance	9	Dynamic capabilities
9	Knowledge management	9	Dynamic capabilities
10	Resource based view	9	Dynamic capabilities
10	Supply chain management	9	Dynamic capabilities
9	Capabilities	9	Dynamic capabilities
9	Environmental management	9	Dynamic capabilities
9	Environmental sustainability	9	Dynamic capabilities
8	Digital transformation	9	Dynamic capabilities
8	Economic performance	9	Dynamic capabilities
8	Microfoundations	9	Dynamic capabilities
8	Natural resource based view	9	Dynamic capabilities
8	Organisation learning	9	Dynamic capabilities
7	Corporate sustainability	9	Dynamic capabilities
6	Food industry	9	Dynamic capabilities
6	Green supply chain management	9	Dynamic capabilities
6	Strategic management	9	Dynamic capabilities
5	Big data	9	Dynamic capabilities
5	China	9	Dynamic capabilities
5	Circular business model	9	Dynamic capabilities
5	Collaboration	9	Dynamic capabilities
5	Sustainable competitive advantage	9	Dynamic capabilities
5	Technological innovation	9	Dynamic capabilities

TABLE A2 (Continued)

Occurrences	Words	Cluster	Cluster label
4	Ambidexterity	9	Dynamic capabilities
4	Business model	9	Dynamic capabilities
4	Green process innovation	9	Dynamic capabilities
3	Information and communication technologies	9	Dynamic capabilities
4	Malaysia	9	Dynamic capabilities
4	Organizational resilience	9	Dynamic capabilities
4	Sensing	9	Dynamic capabilities
4	Sustainable operations	9	Dynamic capabilities
3	Automotive industry	9	Dynamic capabilities
3	Change management	9	Dynamic capabilities
3	Emerging country	9	Dynamic capabilities
3	Environmental management system	9	Dynamic capabilities
3	Environmental turbulence	9	Dynamic capabilities
3	Family business	9	Dynamic capabilities
3	iso 14001	9	Dynamic capabilities
3	Logistics	9	Dynamic capabilities
3	Organizational ambidexterity	9	Dynamic capabilities
3	Predictive analytics	9	Dynamic capabilities
3	Social innovation	9	Dynamic capabilities
3	Stakeholders	9	Dynamic capabilities
3	Strategy	9	Dynamic capabilities
3	Supply chain performance	9	Dynamic capabilities
3	Value creation	9	Dynamic capabilities
2	Aquaculture	9	Dynamic capabilities
2	Asia	9	Dynamic capabilities
2	Closed loop supply chains	9	Dynamic capabilities
2	Companies	9	Dynamic capabilities
2	Corporate finance	9	Dynamic capabilities
2	Customer pressure	9	Dynamic capabilities
2	Disruptive innovation	9	Dynamic capabilities
2	Ema	9	Dynamic capabilities
2	Ems	9	Dynamic capabilities
2	Enablers	9	Dynamic capabilities
2	Environmental assets	9	Dynamic capabilities
2	Environmental policy	9	Dynamic capabilities
2	Frugal innovation	9	Dynamic capabilities
2	Fuzzy set qualitative comparative analysis	9	Dynamic capabilities
2	Information systems	9	Dynamic capabilities
2	Innovation management	9	Dynamic capabilities
2	micro small and medium scale manufacturing enterprises (msmes)	9	Dynamic capabilities
2	Operations management	9	Dynamic capabilities
2	Reconfiguring	9	Dynamic capabilities
2	Seizing	9	Dynamic capabilities
2	Social impact	9	Dynamic capabilities
2	Stakeholder engagement	9	Dynamic capabilities
2	Standards	9	Dynamic capabilities

(Continues)

TABLE A2 (Continued)

Occurrences	Words	Cluster	Cluster label
2	Sustainable business model	9	Dynamic capabilities
2	Technological capabilities	9	Dynamic capabilities
2	Technology	9	Dynamic capabilities
2	Textile and clothing industry	9	Dynamic capabilities
2	Digital ecosystems	10	Digital ecosystems
14	Sustainable supply chain management	11	Sustainable supply chain management
8	Supply chain dynamic capabilities	11	Sustainable supply chain management
3	Practices	11	Sustainable supply chain management
2	Ready-made garment industry	11	Sustainable supply chain management
7	Sustainability innovation	12	Sustainability innovation
6	Systematic literature review	12	Sustainability innovation
5	Leadership	12	Sustainability innovation
3	Bibliometric	12	Sustainability innovation
4	Organisational culture	12	Sustainability innovation
4	Sustainable business model innovation	12	Sustainability innovation
3	Green intellectual capital	12	Sustainability innovation
3	New product development	12	Sustainability innovation
3	Open innovation	12	Sustainability innovation
3	Organization design	12	Sustainability innovation
2	r&d	12	Sustainability innovation
3	Start-ups	12	Sustainability innovation
3	Sustainability practices	12	Sustainability innovation
2	Creativity	12	Sustainability innovation
2	Exploitation	12	Sustainability innovation
2	Exploration	12	Sustainability innovation
2	Process innovation	12	Sustainability innovation
2	Product innovation	12	Sustainability innovation
2	Review	12	Sustainability innovation
2	Small and medium manufacturing enterprises	12	Sustainability innovation
2	Supply chain integration	13	Supply chain integration
19	Green dynamic capabilities	14	Green dynamic capabilities
10	Innovative green product development	14	Green dynamic capabilities
6	Bda capabilities	14	Green dynamic capabilities
5	Institutional pressure	14	Green dynamic capabilities
5	Social responsibility	14	Green dynamic capabilities
3	Environmental management accounting	14	Green dynamic capabilities
3	Green innovation strategy	14	Green dynamic capabilities
3	Green value co-creation	14	Green dynamic capabilities
2	Individual dynamic capabilities	15	Individual dynamic capabilities
3	Business performance	16	Business performance
2	Stakeholder management	16	Business performance
3	Manufacturing	17	Manufacturing
5	Blockchain	18	Blockchain
2	Supply chain ambidexterity	18	Blockchain
2	Environmental innovation ambidexterity	19	Environmental innovation ambidexterity
7	Sdg	20	Sdg

TABLE A2 (Continued)

Occurrences	Words	Cluster	Cluster label
3	Sustainable entrepreneurial performance	20	Sdg
2	Sustainable competitive	20	Sdg
2	Sustainable dynamic capabilities	21	Sustainable dynamic capabilities
3	Fuzzy ahp	22	Fuzzy ahp
2	Technology transfer	23	Technology transfer
2	Smart cities	24	Smart cities
3	Strategic orientation	25	Strategic orientation
2	Digital capabilities	25	Strategic orientation
4	Sustainability-oriented innovation	26	Sustainability-oriented innovation
4	Sustainability transition	26	Sustainability-oriented innovation
2	Sustainable entrepreneurship	26	Sustainability-oriented innovation
2	Boundary spanning	27	Boundary spanning
2	Conceptual framework	28	Conceptual framework
2	Resource complementarity	28	Conceptual framework
2	Sustainable consumption and production	28	Conceptual framework
3	Environmental regulation	29	Environmental regulation
3	Moderating effect	29	Environmental regulation
8	Sustainable supply chains	30	Sustainable supply chains
2	Tax credits	31	Tax credits
2	Environmental protection	32	Environmental protection
2	Environmental strategies	32	Environmental protection
4	Resource orchestration	33	Resource orchestration
3	Business sustainability	34	Business sustainability
2	Hospitality	35	Hospitality
2	Environmental proactivity	36	Environmental proactivity
3	It capabilities	37	It capabilities
2	Sustainable supply chain performance	37	It capabilities
7	Competitive advantage	38	Competitive advantage
7	Entrepreneurship	38	Competitive advantage
5	Social capital	38	Competitive advantage
4	Entrepreneurial orientation	38	Competitive advantage
2	Circularity	38	Competitive advantage
2	Small business	38	Competitive advantage
3	Eco-capabilities	39	Eco-capabilities
2	Sustainability capability	40	Sustainability capability
2	Dematel	41	Dematel
2	Institutional theory	41	Dematel
2	Sustainable procurement	41	Dematel
2	Environmental dynamic capabilities	42	Environmental dynamic capabilities
3	Incumbent	43	Incumbent
2	Multilevel perspective	43	Incumbent
2	Sustainability strategy	44	Sustainability strategy
2	Indonesia	45	Indonesia
3	Organisational agility	46	Organisational agility
2	Successful green products	46	Organisational agility
2	Sustainable development performance	47	Sustainable development performance

(Continues)

TABLE A2 (Continued)

Occurrences	Words	Cluster	Cluster label
2	South Africa	48	South Africa
2	Supply chain visibility	48	South Africa
4	Driver	49	Driver
3	Higher education	49	Driver
2	Barrier	49	Driver
2	Sustainability transformation	49	Driver
4	Green supply chain	50	Green supply chain
4	Green hrm	51	Green hrm
3	Marketing capabilities	52	Marketing capabilities
2	Development	52	Marketing capabilities
5	Green entrepreneurial orientation	53	Green entrepreneurial orientation
2	Green innovation performance	53	Green entrepreneurial orientation
3	Buyer–supplier relationship	54	Buyer–supplier relationship
2	Cultural intelligence capability	54	Buyer–supplier relationship
2	Relational governance	54	Buyer–supplier relationship
2	Social sustainability performance	54	Buyer–supplier relationship
2	Fsqca	55	Fsqca
2	System dynamics	56	System dynamics
2	Green entrepreneurship	57	Green entrepreneurship
2	Knowledge-based view	58	Knowledge-based view
2	Green creativity	59	Green creativity
2	Green transformational leadership	59	Green creativity
4	Innovation performance	60	Innovation performance
2	Innovation capacity	60	Innovation performance
2	Business process	61	Business process
3	Environmental innovation	62	Environmental innovation
2	Eco-product innovation	63	Eco-product innovation
2	Social value	64	Social value
2	Sustainable supply chain	65	Sustainable supply chain
2	Government support	66	Government support
2	Operational performance	67	Operational performance
2	Green production	68	Green production
2	Strategic flexibility	69	Strategic flexibility

APPENDIX B

Journal	H-Index
Decision Support Systems	170
Ecological Economics	236
Energy Economics	187
Environmental Science And Pollution Research	154
Frontiers In Psychology	157
Ieee Access	204
Industrial Marketing Management	161
Information Systems Research	177
International Journal Of Environmental Research And Public Health	167
International Journal Of Operations And Production Management	155
International Journal Of Production Economics	214
International Journal Of Production Research	170
International Journal Of Project Management	167
Journal Of Business Ethics	229
Journal Of Business Research	236
Journal Of Cleaner Production	268
Journal Of Environmental Management	218
Journal Of International Business Studies	219
Journal Of Management Studies	206
Journal Of Operations Management	210
Journal Of Product Innovation Management	162
Journal Of The Academy Of Marketing Science	194
Plos One	404
Proceedings Of Spie - The International Society For Optical Engineering	187
Resources, Conservation And Recycling	170
Small Business Economics	157
Strategic Management Journal	318
Technological Forecasting And Social Change	155
Technovation	150
Tourism Management	236