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A BIBLIOMETRIC ANALYSIS OF RESILIENCE AND BUSINESS MODEL USING VOSviewer

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Abstract: Emerging disruptive events in recent years have highlighted the importance of building organizational resilience, particularly in the context of the accepted logic of value creation. Bringing these issues, i.e. resilience and business models being a specific tool for creating, delivering and capturing value, an area of research that has been gaining importance in recent years is presented. Nevertheless, studies presenting the results of bibliometric analyses combining these two terms are still rare. The main aim of this article is to present the results of a bibliometric analysis allowing for the mapping of cognitive structures in resilience and business models (R&BM) and to discuss current research directions in this area. The study used data from the Scopus database from 2009 to 2023. Research trends and keyword co-occurrence analysis were included in the bibliometric analysis, and VOSviewer software was used to visualize the data.

Key words: resilience, business model, bibliometric analysis, organization

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Introduction

Disruptive events caused by pandemics, war and climate change over the past few years have highlighted the importance of organizational resilience. Today, organizations are not just dealing with a 'dynamically changing business environment' but with leaps and bounds. Organizations identify crises or disruptive events by looking at specific aspects, as mentioned by Coccia (2020). These aspects include problems that immediately threaten the organization, situations with surprise or shock, and complex problems that are unexpected and uncertain. These factors pressure the organization to make timely and effective critical decisions. In this context, organizations are looking for sources and ways to build resilience that, above all, maintain the value of the organization emphasized in the business model. The combination of resilience and organizational value translates into theory building and research development dedicated to resilient business models.

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It is accepted in the literature that the term 'business model' first appeared in the late 1950s (Bellman, 1957) and in the title of the article three years later (Jones, 1960). Wider interest in the subject began in the mid-1990s (Timmers, 1997) and developed significantly in the new millennium. Three strands of research dominate the concept of the business model. The first is concerned with defining the term, the second describes types of models, and the third strand presents the components of a model. Ritter and Lettl (2018), in their work, highlight five meta-theoretical perspectives on business models. The first is concerned with describing the activities of organizations (Zairi and Sinclair, 1995; Johnson et al., 2008; Demil and Lecocq, 2010; Cyfert, 2011; Fjeldstad and Snow 2018), while the second is concerned with the logic of business models (including the creation, delivery and capture of value) (Magretta, 2002; Chesbrough and Rosenbloom, 2002; Afuah and Tucci, 2001; Osterwalder et al.; 2014; Afuah, 2014; Amit and Zott, 2017; Baldassarre et al, 2017; Evans et al., 2017; Freudenreich et al., 2019; Otola et al., 2020; Brzóska et al., 2022). In these first two perspectives, the predominant definition of a business model is where the central element of business models is their value creation logic, which describes how value is generated by specific processes within the company (Amit and Zott 2001). Against this background, the respective structures and relationships between the different approaches to the value creation logic are described. This conceptualizes the organization as a system that is a set of logically interconnected elements that allow the company to create, deliver and capture value and enable the benefits of that value. A third perspective involves the presentation and analysis of business model archetypes (i.e., descriptions of typical business models that transcend industry boundaries) (Baden-Fuller and Haefliger, 2013; Bocken et al., 2014; de la Puerta González-Quevedo, 2018; Gassmann et al., 2020). Another perspective presents the configuration of business models, i.e., descriptions of the basic elements of doing business. Original approaches to business model configuration are available in the literature. Many researchers have proposed original concepts in this area (Slywotzky et al., 2007; Afuah and Tucci, 2001; Johnson et al., 2008; Osterwalder and Pigneur, 2010; Zott and Amit, 2007, 2010; Prahalad and Krishnan, 2008; Gassmann et al., 2020). The last platform is about adapting the business model, giving it a specific character or type, e.g., innovative business model (Massa and Tucci, 2021; Ibarra et al., 2018; Schaller and Vatanan-Thesenvitz, 2019; Filser et al., 2021), sustainable business model (Schaltegger et al., 2016; Evans et al, 2017; Geissdoerfer et al.; 2018; Bilan et al., 2020; Minatogawa et al., 2022; Pan et al., 2023), business models and Industry 4.0 (Ibarra et al., 2018; Dobrowolska and Knop, 2020; Agostini and Nosella, 2021; Grabowska and Saniuk, 2022), business models and digitalisation (Caputo, 2021; Del Giudice et al., 2021; Mostaghel et al., 2022). Wider research in this area is presented by Ryszko and Szafraniec (2022). Research on the resilience of business models should be added to the last perspective. Resilience is a concept that is widely defined in the literature. The concept of resilience is considered at the level of economy, community, enterprise, organization or business models. It has many meanings and is used in many scientific fields,

including psychology, sociology, ecology, materials engineering, biology and medicine, organizational theory, economics, public administration and political science. However, defining resilience is not straightforward and often needs to be related to different levels of analysis. Initially focusing on the individual, resilience concepts and research have been extended to groups and systems (Martin-Breen and Anderies, 2011). The first work on resilience was related to ecological systems and meant a measure of a system's ability to absorb change and become completely self-organized (Holling 1973). In the cited definition of resilience, two approaches can be distinguished. The first focuses on the ability of systems to absorb change and survive after a shock caused by external change. The second approach examines resilience to disruptions and the return speed to a pre-existing equilibrium (Annarelli and Nonino, 2016). Since then, resilience has infiltrated other disciplines, such as psychology, engineering or management science, with many sub-disciplines – supply chain management, supply chain management, disaster management, crisis management, human resources or strategic management (Otola et al., 2024 in press). As the concept has evolved, so has the definition of resilience. This means that a resilient organization can not only survive but also emerge from turbulence stronger and thrive over time (Koronis and Ponis, 2018).

Most often, researchers refer to a complex adaptive system (Fiksel, 2006; Pumpuni-Lenss, 2017), rational choice theory, complexity theory (Pina Cunha and Vieira Cunha, 2006), resource-based view (Do et al., 2022), and dynamic capability (Lin and Wu, 2014). An analysis of the literature also indicates a strong interest in researching the meaning and measurement of resilience from different research perspectives. Research in this area has been conducted by Walker et al. (2004), Cutter et al. (2010), and Norris et al. (2008). A review of the literature also indicates original approaches to identifying attributes, measuring and assessing organizational and business model resilience by Osterwalder and Pigneur (2010), Taeuscher and Abdelkafi (2015) and Jabłoński (2019). Jabłoński defines business model resilience as the systemic ability to recognize, inactivate (neutralize) and destroy negative factors and structures affecting the business model. More generally, resilience means actively and passively protecting the business model from organizational pathogens. Furthermore, cited author assumes that the resilience of the business model stems from and is embedded, among other things, in the DNA of the organization and its life cycle. In this context, a resilient business model is a model that has a systemic capacity for resilience to change, ensuring the consumption of value and the permanent development of resources and processes in a way that enables the stabilization and balancing of the built configuration of model attributes, under the conditions of the interaction of the environment and, respectively, model components, adapting existing resources and competences to new situations and operating conditions (Jabłoński, 2019).

In response to the growing interest in research combining business model (BM) and resilience (R) – (R&BM), the authors of this article assumed that a bibliometric

analysis of business models and resilience (R&BM) had become necessary and interesting, both from a cognitive and practical point of view.
Therefore, the primary aim of the article is to conduct a bibliometric analysis that maps cognitive structures in R&BM and to discuss current research directions in this field.
In particular, the study aimed to answer the following research questions:
RQ1: In which journals do research in the area of R&BM appear most frequently?
RQ2: Which articles and which authors are most frequently cited in the area of R&BM research?
RQ3: What are the existing research clusters, and how are publications on R&BM grouped?
RQ4: What was the thematic development of R&BM research during the examined period?
The article consists of the following sections: an introduction, research methodology, research results, and conclusions, along with the limitations of the research.

Research Methodology

In order to carry out bibliometric research in relation to business models and resilience, specific guidelines were adopted, i.e.:
- narrowing the search to the area of Business, Management and Accounting,
- including in the keywords, title or abstract wording relating to business models and resilience,
- focus on scientific articles written in English,
- scope of years 2009-2023.

Step 1 - Preliminary studies	Initial studies covering resilience and business models (R&BM)
Step 2 - Specifying search source	The study chose to use Scopus as the largest bibliographic database of peer-reviewed literature, characterized by consistent scholarly output across subject areas and better subject coverage compared to other databases (Scopus indexes 66.07% more unique journals as compared to Web of Science) (Singh, et al., 2021).
Step 3 - Specifying search fields	In order to search for articles discussing R&BM, the search was narrowed down to the areas of business and management and accounting and the wording R&BM in the keywords, title or abstract. Articles written between 2009 and 2023 in English were selected for the study.
Step 4 - Specifying query string	TITLE-ABS-KEY (("resilience" OR "resiliency" OR "resilient") AND ("business model" OR "business models")) AND PUBYEAR > 2008 AND PUBYEAR < 2024 AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (SUBJAREA , "BUSI")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English"))
Step 5 - Search results filtering and merging	205 publications meeting the criteria were identified
Step 6 - Search results filtering using expert review	Final number of publications after analysis of titles, keywords, abstracts and main content: 195 publications
Step 7 - Bibliometric analysis of search results	The bibliometric analysis in this study includes the following categories: publication trend analysis and analysis of keyword co-occurrence
Step 8 - Results and discussion	In line with the bibliometric analysis carried out in the previous steps, the results of the study and the final conclusions, including limitations, are presented.

Figure 1: Research steps for R&BM bibliometric analysis

The research was based on scientific articles found in the Scopus database. Up to 2009, three scientific articles meeting the above criteria were published (excluding a range of years), but content analysis did not allow their research to be included. In view of the above, our bibliometric study of R&BM starts from 2009. As a result, 205 publications meeting the above criteria were identified. The publications surveyed include 172 already published and 23 in press. A detailed analysis of abstracts and, in some cases, entire articles obliged us to exclude 10 publications from the study. In these publications, the assumed phrases were present in the keywords, title or abstract, but the content indicated a lack of connection with the subject matter. Therefore, 195 articles were selected for further analysis, and the VOSviewer tool was used to visualise the data. A thesaurus was employed to rectify errors arising from variations in keyword spellings during analyses. This involved consolidating keywords such as 'SME' and 'SMEs,' 'business model' and 'business models,' 'covid-19' and 'covid-19 pandemic,' and 'pandemic'.

Analysis of Results

Publication Trend Analysis

The following analysis presents the answers to the two research questions, i.e., RQ1, related to the most important journals in the field of R&BM topics and RQ2, related to the most important authors and publications in the field of R&BM research.

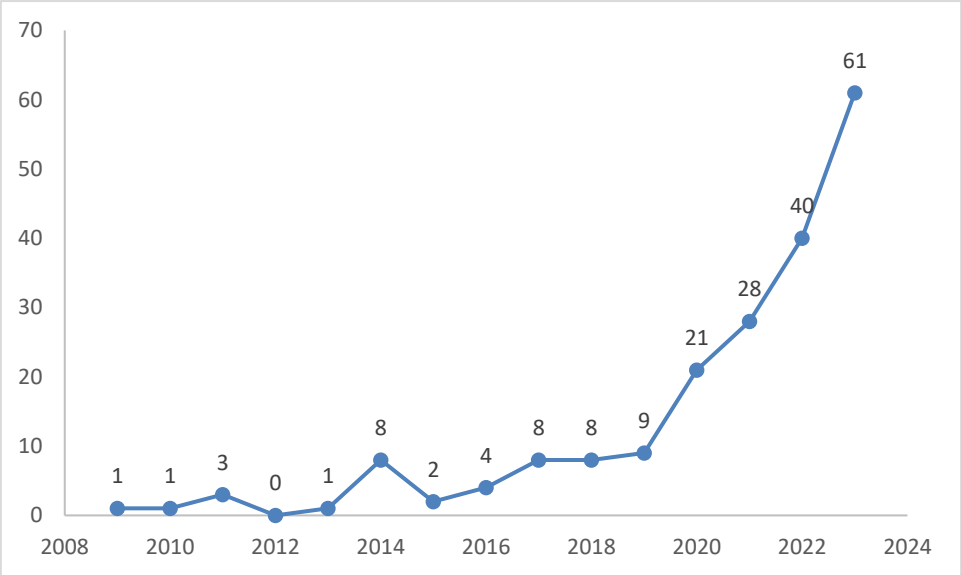

Figure 2: The number of publications in the field of R&BM topics in Scopus per year
Source: Scopus

Until 2019, a few R&BM scientific articles were published annually. From 2020 onwards, increased interest in the scientific topics discussed is evident, resulting in an increasing number of publications.

The study identified 134 journals in which the topics of resilience and business models appeared. The five journals in which the topics discussed appeared most frequently are shown in Table 1. The largest number, 12 research articles, were published in the Journal of Cleaner Production, representing 6.2% of all publications. 3% of publications appear in Business Strategy and the Environment. In contrast, the International Journal of Entrepreneurial Behaviour and Research and the Journal of Business Research and Technology in Society each published 2.6% of all articles. One article per journal was published in 103 journals (52% of all articles) and two articles in each of 19 journals (19.5% of all articles), indicating a wide dispersion of topics between journals.

Table 1. Number of publications and citations by journals in the field of R&BM topics

Source	No of papers (citations)	Most frequent keyword	Most cited article		
			Authors	Title of article	Year (citations)
Journal of Cleaner Production	12 (564)	Sustainable development	Ma, Y., Lan, J., Thornton, T., Mangalagiu, D., Zhu, D.	Challenges of collaborative governance in the sharing economy: The case of free-floating bike sharing in Shanghai	2018 (153)
Business Strategy and the Environment	6 (132)	Circular economy, sustainability	Shashi, Centobelli, P., Cerchione, R., Ertz, M.	Managing supply chain resilience to pursue business and environmental strategies	2020 (84)
International Journal of Entrepreneurial Behaviour and Research	5 (44)	Business model	Gavrila Gavrila, S., De Lucas Ancillo, A.	Entrepreneurship, innovation, digitization and digital transformation toward a sustainable growth within the pandemic environment	2022 (34)
Journal of Business Research	5 (195)	Single keywords	Burström, T., Parida, V., Lahti, T., Wincent, J.	AI-enabled business-model innovation and transformation in industrial ecosystems: A framework, model and outline for further research	2021 (95)
Technology in Society	5 (107)	Covid-19	Watanabe, C., Naveed, K., Neittaanmäki, P., Fox, B.	Consolidated challenge to social demand for resilient platforms - Lessons from Uber's global expansion	2017 (49)

Source: Authors' elaboration based on Scopus

Table 2 presents the citation counts of all articles, while Table 3 shows the scientific articles that were cited more than 200 times. The criteria for very high citation counts were met by 4 scientific articles. In contrast, 5 scientific articles were cited more than 100 but less than 200 times. 16% of the articles had not been cited to date, and 46% had been cited a minimum of once but no more than 9 times.

Table 2. Citability of articles in the field of R&BM topics

Range of citation counts	No of articles
≥ 200	4
≥ 150 < 199	2
≥ 100 < 149	3
≥ 50 < 99	13
≥ 40 < 49	8
≥ 30 < 39	9
≥ 20 < 29	10
≥ 10 < 19	25
≥ 1 < 9	90
0	31

Source: Authors' elaboration based on Scopus

Table 3. Most cited scientific articles in the field of R&BM topics

Title of article	Authors	Journal	Year	Citation counts
Resilience in Business and Management Research: A Review of Influential Publications and a Research Agenda	Linnenluecke, M.K.	International Journal of Management Reviews	2017	709
Closing the marketing capabilities gap	Day, G.S.	Journal of Marketing	2011	616
Antecedents of organizational resilience in economic crises - An empirical study of Swedish textile and clothing SMEs	Pal, R., Torstensson, H., Mattila, H.	International Journal of Production Economics	2014	288
Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms	Rapaccini, M., Saccani, N., Kowalkowski, C., Paiola, M., Adrodegari, F.	Industrial Marketing Management	2020	238

Source: Authors' elaboration based on Scopus

The most cited paper exceeded 700 citations, which is not surprising, as this article discusses research on resilience in business and management between 1977 and 2014. Linnenluecke (2017) points out that interest in resilience topics in business and management developed after the attack on the WTC on 11 September 2001, mainly due to the focus on coping and response mechanisms under high environmental uncertainty. Notably, the author identifies five research strands concerning resilience, and one of these strands is the adaptability of business models.

Another highly cited article discusses the issue of how businesses respond to market signals from the perspective of marketing activities. Day (2011) highlights the benefits of an adaptive perspective on market orientation, which will translate into reconfiguring business models and thus building resilient businesses. Relevant to the topic of R&BM is the article (Pal et al., 2014) in which the authors identify solutions to foster enterprise resilience in the SME sector. According to the authors, the development of resilience is linked to the key broadly defined three areas: (i) assets and resourcefulness, (ii) dynamic capabilities, and (iii) learning and culture. The fourth most cited article is related to research conducted in the region of northern Italy most affected by the pandemic. The authors presented a conceptual four-stage model for crisis management, indicating that in these times, building resilience should be based on smart digital innovation and collaboration.

Keyword Co-Occurrence Analysis

The discussion in this subsection is intended to illustrate the research clusters (RQ3) and to discuss the thematic development of R&BM research along a timeline (RQ4). The keywords identify around which themes research is being conducted in relation to resilience and business models. Using the VOSviewer software, a co-occurrence mapping analysis of keywords based on their frequency was conducted. The study assumed that a keyword must occur a minimum of five times. The analysis of 195 publications identified 1,075 keywords, but only 24 met the criterion. Table 4 presents the most frequently occurring keywords, links, and total link strength (TLS). For keyword mapping analysis, a link indicates the co-occurrence of a keyword with another keyword, while TLS indicates the number of publications in which two keywords appear together (Tamala et al., 2022; Guo et al., 2019; Otola and Szczepańczyk, 2023).

The most common keyword was 'resilience' (it appeared in 51 publications, representing 26% of all publications), which was combined with other keywords 21 times. The TLS shows 82 publications where 'resilience' was completely linked to other keywords. The second keyword that appeared just as frequently was 'covid-19' with 49 occurrences (25% of all publications), and the third was 'business model' with 45 occurrences (23% of all publications). The average publication year indicates that the earliest in the overview were articles with the keyword 'strategy', while researchers now focus on 'circular economy'.

Table 4 Most highly co-occurring keywords

Keyword	Links	Occurrences	Total link strength	Average publication year
resilience	21	51	82	2020.76
covid-19	18	49	73	2021.96
business model	19	45	74	2020.76
innovation	12	20	33	2021.60
sustainability	17	17	38	2021.06
business	14	12	28	2021.33
business model innovation	11	12	17	2021.00
digital transformation	10	12	18	2022.42
sustainable development	13	12	20	2020.67
circular economy	11	11	27	2022.55
sme	10	11	24	2021.00
strategy	13	10	16	2019.90

Source: Authors' elaboration

The keyword co-occurrence analysis was carried out and presented in two maps: network visualization (Figure 3) and overlay visualization (Figure 4). Network visualization allows keywords to be connected as nodes in a network, whereby the larger the node, the greater the importance of the keyword, while a small distance between nodes indicates greater strength of the link. Overlay visualization, on the other hand, shows the relevance of keywords over a range of time, from blue indicating the earliest keywords used in publications to yellow indicating the most recent keywords.

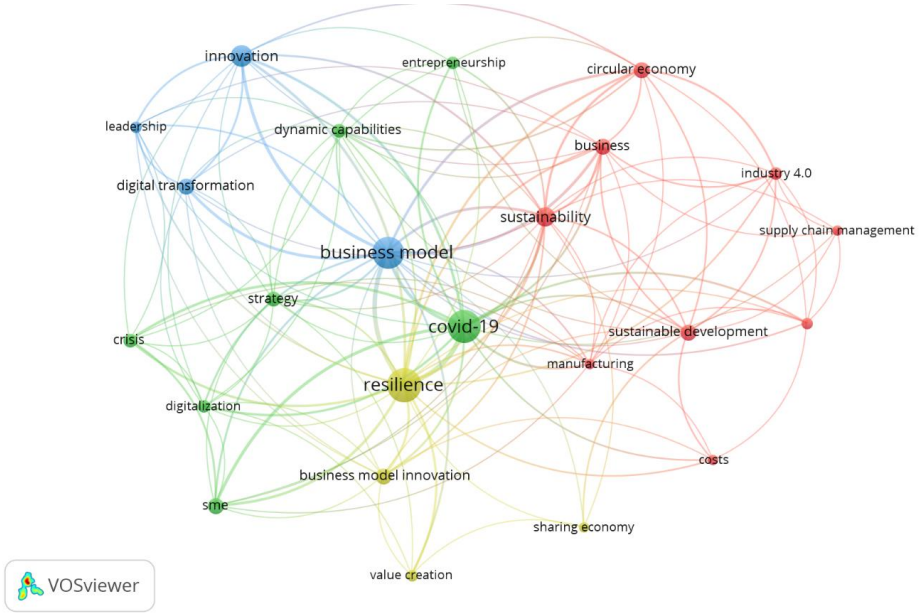

Figure 3:
Analysis of keywords co-occurrence – network visualization
Source: Authors' elaboration using VOSviewer

Table 5. Clusters of keyword co-occurrences

Cluster (No of items and colour)	Keywords
1 (9, red cluster)	Business, circular economy, costs, industry 4.0, manufacturing, supply chain management, supply chains, sustainability, sustainable development
2 (7, green cluster)	Covid-19, crisis, digitalization, dynamic capabilities, entrepreneurship, sme, strategy
3 (4, blue cluster)	Business model, digital transformation, innovation, leadership
4 (4, yellow cluster)	Business model innovation, resilience, sharing economy, value creation

Source: Authors' elaboration based on VOSviewer

A keyword co-occurrence analysis (Figure 3 and Table 5) distinguished four clusters, each grouped according to the main keyword, i.e. cluster 1 - sustainability, cluster 2 - Covid-19, cluster 3 - business model, cluster 4 - resilience.
The research articles carried out within the first cluster focus on the broad topic of sustainability and issues related to supply chains, running a business and Industry 4.0. This cluster has the highest number of keywords. However, the size of the nodes indicates a weaker importance. The most significant keyword, ‘sustainability’, has a

co-occurrence weighting of 17. The cluster also addresses the topic of business models in relation to a strategic orientation directed towards sustainability and the circular economy (Alfano et al., 2023; Levänen et al., 2023).

Cluster two refers to research related to building the resilience of businesses due to the disruptive event that occurred – Covid-19. The keyword 'Covid-19' has the highest co-occurrence weighting with the other keywords, i.e. 49. The research conducted in this cluster refers primarily to the impact (negative as well as indications of opportunities) of the pandemic on entrepreneurship and the sector of SME (Aier et al., 2022; Khurana et al., 2022; Purnomo et al., 2021). Another important aspect is the consideration of digitalization as an alternative to face-to-face contact (Bürgel et al., 2023).

Cluster 3 is centered around the keyword 'business model', which occurred in 47 publications (24% of total publications) with a TLS of 74. Another relevant keyword is 'innovation' (occurrence 20, TLS 33). Analysis of the keywords included in this cluster indicates the themes of business models linked to innovation and digital transformation. In publications relating to the perspective of dynamic capabilities, knowledge management, innovation, the determinants of business stability and resilience are indicated (Florek-Paszkowska et al., 2021; Granig and Hilgarter, 2020). However, digital transformation is fundamental to reconfiguring business models in the post-pandemic era (Yang et al., 2023).

The final fourth cluster mainly focuses on the keyword 'resilience', which appeared in 51 publications (26% of total publications) with a TLS value of 82. It was considered in the context of other keywords such as 'business model innovation, 'sharing economy' and 'value creation'. The issues mentioned were mainly related to business model innovation, which responds to changes in the environment and, at the same time, builds organizational resilience (Buliga et al., 2016; Eriksson et al., 2022). Research on value creation, delivery and capture has also been considered in the context of the sharing economy (Ma et al., 2018; Watanabe et al., 2017).

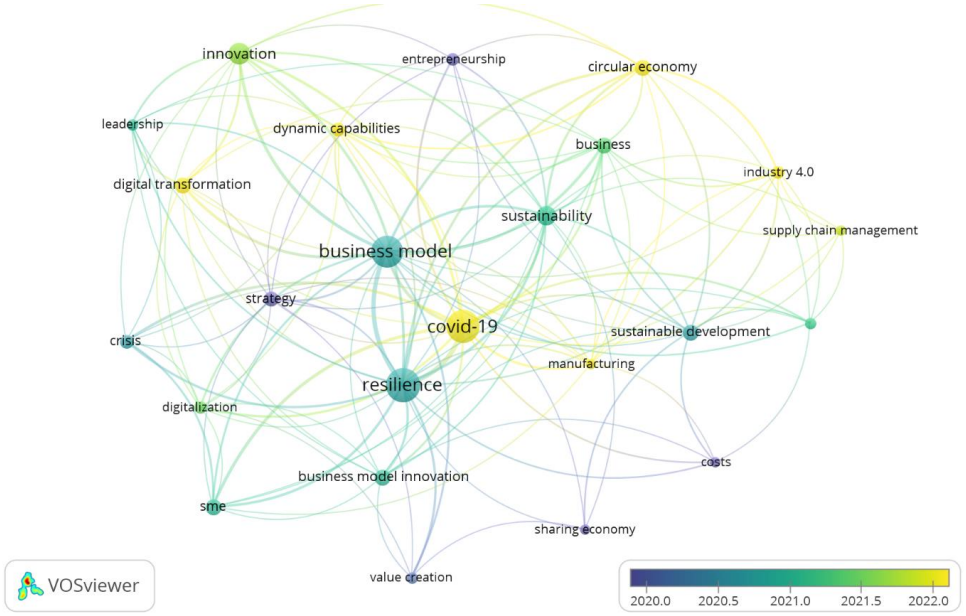

Figure 4:
Analysis of keywords co-occurrence overlay visualization
Source: Authors' elaboration using VOSviewer

Creating a map on a timeline allows us to illustrate research trends over the years (Figure 4). Initial research on R&BM focused on strategy, sharing economy, entrepreneurship, and value creation themes. These were concepts of building organizational resilience through a new approach to business models incorporating green activities, positively impacting the external environment, and identifying sources of value creation (McPhee, 2014). R&BM was then discussed from the perspectives of sustainability, sustainable development, business model innovation, leadership, and small and medium enterprises. The main focus was on sustainable business models, which are also tasked with maintaining organizational resilience.
Further down the line, researchers focused on supply chain, digitalization, innovation, and business. The growing interest in digital technologies translated into implementing innovative solutions to support business processes. The latest research interests in R&BM relate to pandemics, digital transformation, dynamic capabilities, circular economy, industry 4.0, supply chain management and manufacturing. Notably, R&BM issues were discussed mainly in terms of radical changes in business models through, among other things, the adoption of digital technologies and sensing, grasping and transforming dynamic capabilities, which ultimately builds resilience.

Conclusion

The conducted analysis has highlighted relevant journals, authors and publications in the field of R&BM. As of 2020, researchers' increased interest in resilience in combination with business models is evident. This is undoubtedly influenced by disruptive events (Covid-19, Ukraine-Russia war and climate change), which have contributed to a change of perspective on how organizations' create, deliver and capture value. In doing so, it becomes crucial to build the business model so that it has a systemic capacity for resilience to change, ensuring the consumption of value and the permanent development of resources and processes in a way that allows companies to function in a volatile environment. An important aspect is the implementation of innovation in business models, considering the latest developments in digitalization and digital transformation. The bibliometric analysis shows that the authors of the publications undertake to establish new resilience frameworks, identifying trends and highlighting factors/elements contributing to business success.

The study's main limitation was the choice of one database - Scopus. Future R&BM scientific explorations should include the Web of Science database. It is worth emphasizing that the bibliometric analysis aims to map recent trends in the literature by research cluster. A content analysis of selected papers should be carried out to complement the systematic literature review. The authors note that a combined new theme of resilient business models is emerging from the research areas discussed in this article, i.e. resilience and business models (R&BM). Dynamic changing environments and disruptive events require new approaches to business models taking into account their resilience. In view of this, the authors intend to focus their future research around the RBM - resilient business model. This is an important issue in terms of both theoretical considerations and practical implications in the area of identifying key resilience criteria and factors.

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ANALIZA BIBLIOMETRYCZNA ODPORNOŚCI I MODELU BIZNESOWEGO PRZY UŻYCIU VOSVIEWER

Streszczenie: Pojawiające się w ostatnich latach distruptive events podkreśliły znaczenie budowania odporności organizacji, szczególnie w kontekście przyjętej logiki tworzenia wartości. Łącząc te zagadnienia, tj. odporności i modeli biznesu, będących szczególnym narzędziem tworzenia, dostarczenia i przechwytywania wartości, zaprezentowano obszar badań, który w ostatnich latach nabiera wagi. Niemniej jednak, badania prezentujące wyniki analiz bibliometrycznych łączących te dwa terminy są nadal rzadkie. Głównym celem artykułu jest przedstawienie wyników analizy bibliometrycznej pozwalającej na zmapowanie struktur poznawczych w zakresie odporności i modeli biznesu (R&BM) oraz omówienie bieżących kierunków badań w tym zakresie. W badaniu wykorzystano dane z bazy Scopus z lat 2009 – 2023. W analizie bibliometrycznej uwzględniono trendy badawcze oraz analizę keywords co-occurrence, do wizualizacji danych zaś użyto oprogramowania VOSviewer.

Słowa kluczowe: odporność, modele biznesu, analiza bibliometryczna, organizacja