

Exploring the Role of Big Data in Driving Business Model Innovation: Research Trends and Hotspot Identification (2014–2024)

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Abstract

Big data has transformed business paradigms by influencing the evolution of business models, highlighting their essential role in facilitating technological advancement and strategic development. The main objective of this study is to conduct a comprehensive analysis and identify significant research trends and hotspots in the relationship between big data and business models. This study uses VOSviewer and ScimagoGraphica to analyse scholarly articles concerning the significance of the role of big data in enabling business model innovation from 2014 — 2024. A stringent screening process yielded 428 relevant papers from the searched Web of Science database. The analysis reveals a steady rise in research on big data and business model innovation, peaking in 2022, with subsequent stabilisation. China leads the research, followed by contributions from Europe and North America. The study identifies key research hotspots, including Industry 4.0, artificial intelligence, the Internet of Things, sustainability and the circular economy. This study enhances researchers' understanding of the connection between big data technology and business model innovation, potentially creating new opportunities for sustainable development.

Keywords: Business Models; Big Data; VOSviewer; Visualisation Analysis; ScimagoGraphica

1. Introduction

The transformative influence of big data and data science on modern business has fundamentally reshaped organisational strategies and industry ecosystems (Wamba et al., 2017; Sivarajah et al., 2024). These improvements have allowed firms to process large quantities of data, promote innovation, improve consumer experiences, and secure enduring competitive advantages (George et al., 2021). The incorporation of big data into business operations has emerged as a vital facilitator in tackling intricate issues related to digital transformation and sustainable development, highlighting the imperative for an in-depth analysis of how data-driven insights are reshaping business models and enhancing adaptability in swiftly changing markets (Ciacci & Penco, 2023).

The concept of the business model was created in the 1970s and linked to IT system designs (Buckley & Tian, 2017). Since the 1990s, advancements in organisational and strategic theories, along with technological breakthroughs, have propelled the rise of this idea (Wirtz et al., 2010; Carmo et al., 2023). The traditional business model has significantly evolved, leading to the emergence of business model innovation (Andreini et al., 2022). Business model innovation focuses on transformative methods for restructuring key processes and strategic frameworks, thereby maintaining organisational competitiveness and sustainability amid technological change (Huang & Ichikohji, 2023). Progress in digital technologies, such as big data, artificial intelligence, and the Internet of Things, has been crucial in this evolution, facilitating real-time decision-making, predictive analytics, and process automation, which collectively propel strategic development and sustainable success (Ancillai et al., 2023). This study focuses on the convergence of big data, data science, and business models, emphasising the benefits and problems these technologies pose for transforming corporate operations.

This study intends to comprehensively examine the academic contributions that investigate the dynamic relationships among big data, data science, and business models via a bibliometric methodology. It employs analytical instruments such as VOSviewer and ScimagoGraphica to examine publishing trends, regional

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contributions, keyword co-occurrence patterns, and theme clusters. The study aims to elucidate the current research goals and delineate this field's intellectual framework, so it offers a thorough comprehension of its evolution and suggests strategic pathways for future inquiry.

This subsequent research is organised as follows. Section 2 outlines the techniques and data sources. Section 3 establishes the findings, encompassing insights from categories, publication countries, keyword networks, and research trends. The discussion and conclusion ultimately examine the implications of these findings, the study's limitations, and prospective directions for further research, providing a thorough comprehension of this significant research topic.

2. Methods and Data Sources

2.1 Methods

The relationship between fundamental knowledge can be demonstrated through the use of a graphical analysis tool in conjunction with the bibliometric analysis of data (Ren et al., 2023; Li, 2024). This study implements bibliometric and visualisation analysis with VOSviewer and ScimagoGraphica. Many academics prefer VOSviewer, which was one of the first tools for bibliometric and graphical analysis developed (Medina et al., 2022; Zare & Persaud, 2024; Zhang et al., 2024). Owing to its plain output and user-friendly interface, VOSviewer 1.6.20 (0) is utilised in this inquiry. The sketching of images for geographic visualisation is accomplished with the help of ScimagoGraphica (Liu et al., 2024; H. Li et al., 2024).

2.2 Data Sources and Preparation

In this study, the dataset utilised was sourced from the Web of Science database. The search data used for analysis was updated until 24 November 2024. The researchers identify the Topic = "business model" OR "business mode" OR "commercial model" OR "commercial mode" AND "big data" OR "data science", and NOT document types = "Review Article" OR "Proceeding Paper" OR "Book Chapters" OR "Retracted Publication" OR "Editorial Material" OR "Book Review" OR "Correction", and NOT languages = "Russian" OR "Afrikaans" OR "Spanish". And 428 articles (365 published in and before 2023 and 63 in 2024) were selected for visualisation analysis.

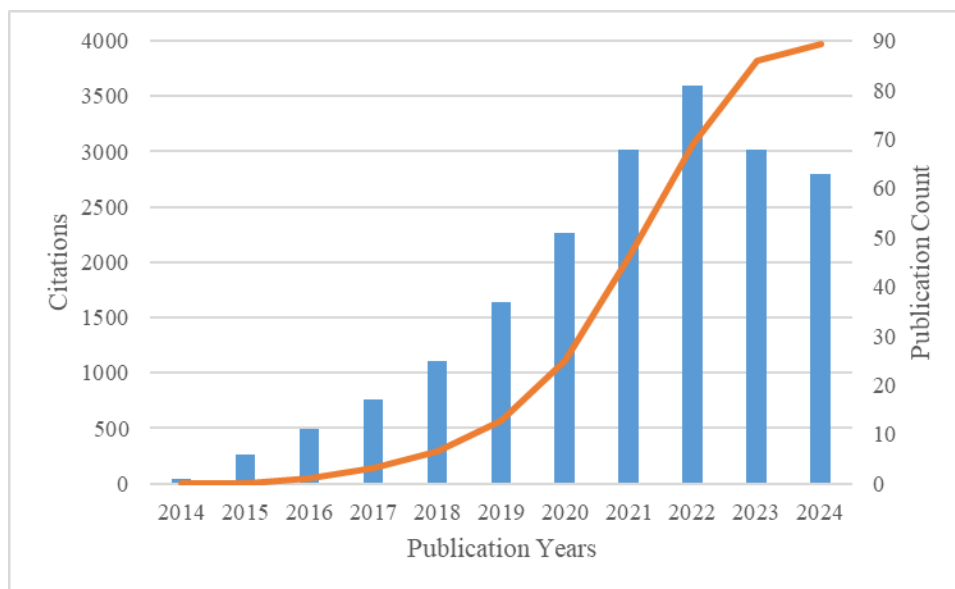


Figure 1: Publication Years and Citations

Figure 1 illustrates a consistent increase in research effort, with publication counts progressively increasing from 2014 (1 publication) to a peak in 2022 (81 publications), followed by stabilisation at lower levels in 2023 (68) and 2024 (63). Citations, however, increased dramatically, especially after 2020, peaking at 3,826 in 2023 and 3,976 in 2024, signifying the growing academic importance and relevance of prior works. The increase in publications is due to the increasing significance of digital transformation and data-driven decision-making in business, as big data has emerged as an essential instrument for innovation in business models (Ciampi et al., 2021). The reduction in publication figures after 2022 may indicate a move from exploratory investigations to more developed research or a stagnation in scholarly interest as the discipline evolves towards practical applications (Fang et al., 2023; Wang

et al., 2023). The significant increase in citations underscores the field's impact on academia, as big data and business model innovation have become essential to competitive strategy and organisational success (Malik et al., 2024).

Table 1: Top 5 Publication Periodicals

Publication Titles	Record Count	% of 428
Sustainability	42	9.813
Journal of Business Research	17	3.972
Technological Forecasting and Social Change	15	3.505
IEEE Access	7	1.636
Industrial Marketing Management	7	1.636
International Journal of Information Management	7	1.636
Information Systems Frontiers	6	1.402
Journal of Cleaner Production	6	1.402
Journal of the Knowledge Economy	6	1.402
Technology in Society	6	1.402
Technovation	6	1.402
Total	125	29.206

Table 1 presents the top 5 journals which account for 29.2% of the 428 records. Owing to big data's role in sustainable business models, sustainability leads with 42 publications (9.81%). The Journal of Business Research (17 articles, 3.97%) and Technological Forecasting and Social Change (15 publications, 3.51%) emphasise business–technology integration. IEEE Access and Industrial Marketing Management include 7 publications (1.64%) focusing on technology and marketing.

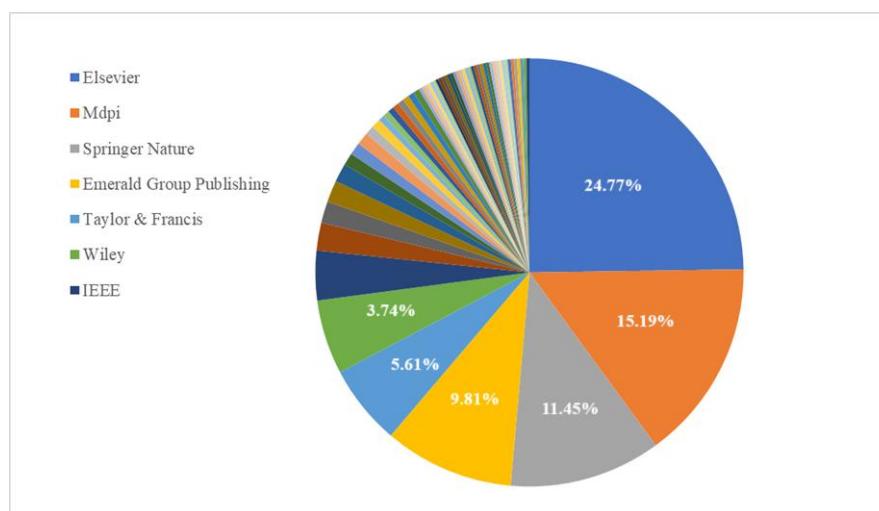


Figure 2: Publishers

Figure 2 shows the contributions of multiple publishers to research on big data and business model innovation. Elsevier leads with 106 publications, accounting for 24.77% of the total records, presumably owing to its comprehensive journal portfolio in business, technology, and data science. The MDPI accounts for 65 records (15.19%), which is indicative of its open-access model that promotes wider diffusion. Springer Nature (49 records, 11.45%) and Emerald Group Publishing (42 records, 9.81%) demonstrate considerable involvement in this interdisciplinary domain. Taylor & Francis and Wiley account for 6.08% and 5.61%, respectively, but IEEE's 16 records (3.74%) highlight the technological dimension of big data. The variety of publishers underscores the extensive scholarly interest and interdisciplinary character of the topic.

3. Results

The initial section examines the categories, affiliations, and countries of the writers involved in the study. Subsequently, the co-occurrence of all study terminology related to big data, data science, and business models is analysed.

3.1 Descriptive Analysis

Table 2 shows the study's subject area. More than 52.34% of the 428 documents in the dataset pertain to Management and Business, underscoring the crucial impact of big data in revolutionising traditional business models by augmenting strategic decision-making, refining consumer insights, and enabling value co-creation (Dai & Liang, 2022; Wang et al., 2023). Environmental Sciences and Green Sustainable Science Technology account for 12.38% and 11.92%, respectively, of the 428 documents, highlighting the integration of big data into sustainable business models, where organisations adopt innovative strategies to balance profitability with environmental and social responsibility (Yang, 2023). The next notable domain is Computer Science Information Systems, comprising 11.45% of the 428 publications, highlighting the technological and analytical foundations that drive innovations in business models, including process automation and real-time decision-making (Hu & Xu, 2022; Yin, 2022). The course focuses primarily on Management and Business, surpassing all other topic areas. Specifically, certain studies encompass natural science fields, including Environmental Sciences, Green Sustainable Science, Technology, and Computer Science Information Systems.

Table 2: Categories of the Study

Web of Science Categories	Record Count	% of 428
Management	115	26.87
Business	109	25.47
Environmental Sciences	53	12.38
Green Sustainable Science Technology	51	11.92
Computer Science Information Systems	49	11.45
Environmental Studies	48	11.22
Information Science Library Science	33	7.71
Operations Research Management Science	24	5.61
Engineering Electrical Electronic	22	5.14
Engineering Industrial	22	5.14
Computer Science Theory Methods	19	4.44
Telecommunications	19	4.44

Table 3 describes the ten foremost affiliations contributing to articles within the collection. The Chinese Academy of Sciences holds 10 records, 2.336% of the total, indicating China's significant focus on research on big data and business models. Prominent institutions, such as Loughborough University (8 records, 1.869%), the Polytechnic University of Milan, the University of Sheffield, and the University of Turin (each with 7 records, 1.636%), make substantial European contributions, mainly from the UK and Italy. Other schools, such as Delft University of Technology and the Indian Institutes of Technology, emphasise the international scope of this study, featuring contributions from technologically advanced universities in the Netherlands and India. The existence of entities such as the Centre National De La Recherche Scientifique and the Ministry of Education and Science of Ukraine illustrates the significance of both national and institutional research frameworks in promoting innovation.

Table 3: Top 10 Affiliations

Affiliations	Record Count	% of 428
Chinese Academy of Sciences	10	2.336
Loughborough University	8	1.869
Polytechnic University of Milan	7	1.636
University of Sheffield	7	1.636
University of Turin	7	1.636
Delft University of Technology	6	1.402
Indian Institute of Technology System	6	1.402
Lulea University of Technology	6	1.402
University of London	6	1.402
Centre National De La Recherche Scientifique	5	1.168
Chongqing University	5	1.168
Indian Institute of Technology Kharagpur	5	1.168
Ministry of Education Science of Ukraine	5	1.168
Parthenope University Naples	5	1.168
State University System of Florida	5	1.168
University of Nicosia	5	1.168
University of Science Technology of China Cas	5	1.168
University of St Gallen	5	1.168
University of Vaasa	5	1.168
Uppsala University	5	1.168

According to Table 4 and Figure 3, the authors of 428 publications originated from 71 nations and regions. The geographical distribution of publications indicates that China dominates with 130 records (30.37%), reflecting its robust emphasis on technical progress and corporate innovation. Italy (13.55%), the UK (13.55%), and the USA (9.81%) are next in line. Additional significant donors include Germany (6.31%), France (5.37%), and Finland (5.14%). The extensive involvement of nations from Europe, Asia, and North America underscores the worldwide importance of this study domain. This trend is likely propelled by the growing significance of big data in enhancing business models for competitive advantage and sustainable development in both established and emerging nations.

Table 4: Top 10 Publication Countries

Countries/Regions	Record Count	% of 428
CHINA	140	32.710
ITALY	58	13.551
UK	58	13.551
USA	42	9.813
GERMANY	27	6.308
FRANCE	23	5.374
FINLAND	22	5.140
SOUTH KOREA	21	4.907
SWEDEN	21	4.907
SPAIN	20	4.673

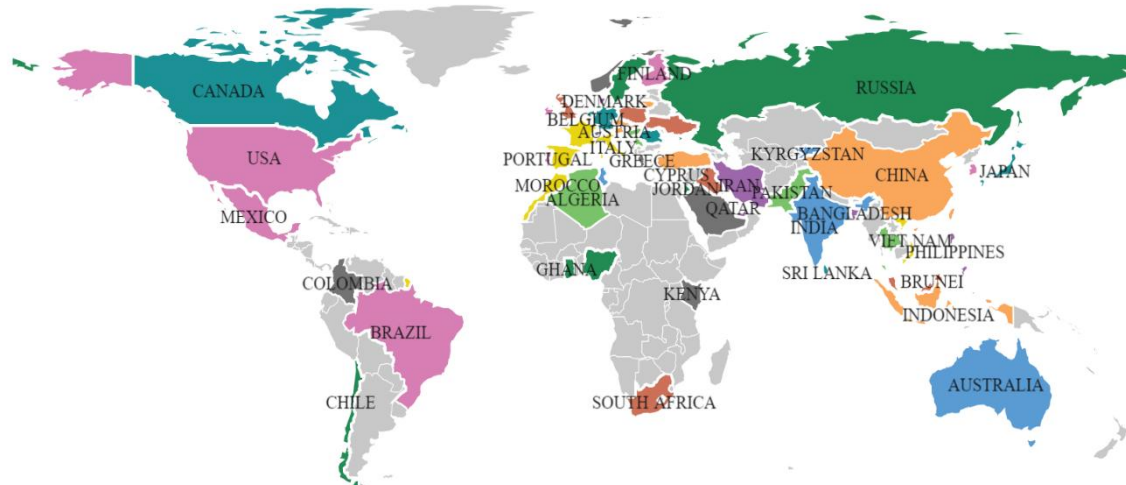


Figure 3: Publication Countries

3.2 Keyword co-occurrence analysis

The researchers perform a co-occurrence analysis utilising all keywords in this area. Figure 4 illustrates the co-occurrence network of research terms related to big data, data science, and business models. Researchers have established the minimal threshold for keyword occurrences at five. 41 keywords out of 1460 meet the requirements. This study identified 253 linkages and seven clusters within the keyword co-occurrence network.

Cluster 1 specifies 12 nodes, focusing on how enterprises utilise digital instruments and methods to develop business models and adjust to evolving markets. Business model innovation is the primary term (Total line strength = 139, Occurrences = 89). The second keyword is digital transformation (Total line count = 54, Frequency = 34). The third term is digital technology (total lines = 30, occurrences = 14). Cluster 2 comprises 8 nodes, focusing on the convergence of technology, sustainable business models, and business practices. The paramount word is big data (Total line count = 106, Frequency = 81). The second keyword is digitalisation (Total line length = 64, Frequency = 33). The third is the case study (total number of lines = 10, Occurrences = 8). Cluster 3 delineates 7 keywords, focusing on the integration of sophisticated technologies, such as the IoT and cloud computing, with sustainable practices as the central theme. Industry 4.0 is the predominant keyword (Total line strength = 69, Occurrences = 40). The second term is sustainability (Total line count = 41, Frequency = 22). The third term is the circular economy (total lines = 41, occurrences = 21). The research topic focused on the increasing significance of data-driven decision-making in entrepreneurship, data mining, and digital servitisation, represented by 15 nodes in Cluster 4. The paramount phrase is artificial intelligence (Total line strength = 49, Instances = 26). The second keyword is machine learning (Total lines = 15, Frequency = 10). The third is digital servitisation (total line strength = 14, Occurrences = 16). The study topic focused on the strategic dimensions of developing business models to optimise economic and societal value and is represented by four nodes in Cluster 5. The primary term is value creation (Total line strength = 44, Frequency = 15). The second keyword is value capture (Total line count = 31, Frequency = 9). The third component is the bibliometric analysis (Total strength of lines = 13, Number of occurrences = 6). Cluster 6 identifies three nodes, highlighting fundamental components of business model innovation. The primary keyword is business models (Total line strength = 19, Frequency = 14). The second keyword is business strategy (Total lines: 8, Frequency: 5). The third category is platforms (Total line strength = 6, Occurrences = 5). The influence of technology on fostering transparency, efficiency, and trust in corporate operations is illustrated by two nodes in Cluster 7. Big data analytics is the primary keyword (Total line strength = 30, Frequency = 18). The second keyword is blockchain (Total lines: 14, Frequency: 6).

Business model innovation is the most often mentioned term, appearing 89 times. The map illustrates significant clusters associated with BMI, encompassing technical innovations such as big data (81 instances), Industry 4.0 (40), artificial intelligence (26), and the Internet of Things (20), which serve as catalysts for the transformation of conventional business models (Yin, 2022; Liu et al., 2024). Moreover, sustainability (22) and the circular economy (21) highlight the increasing focus on ecologically responsible and resource-efficient methodologies in BMI research. Digital transformation and digitalisation exemplify the transition towards technology-driven ecosystems (Ciacci & Penco, 2023; Liu et al., 2024). These clusters demonstrate how BMI

functions as a central point for merging technology, sustainability, and digital methods to foster innovation and adaptation in a changing global economy.

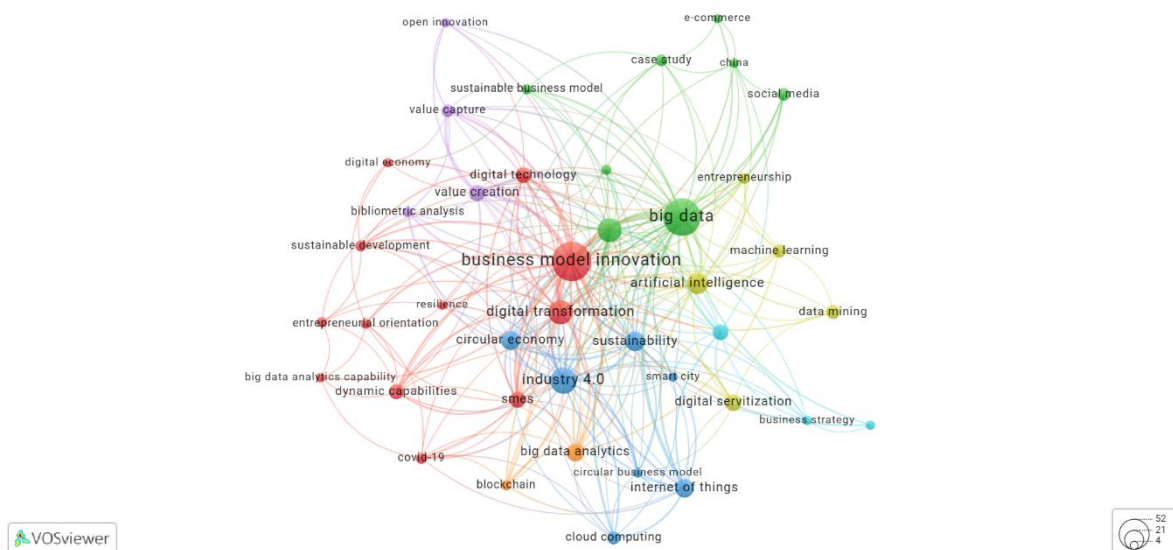


Figure 4: Keyword Co-Occurrence Network. Web link: <https://tinyurl.com/28bxyl6t>

Figure 5 illustrates the overlay network of keyword co-occurrence. Researchers have identified the latest five prominent phrases utilising the overlay network. The essential phrase is the entrepreneurial orientation (Total line strength = 10, Instances = 6). The second keyword is the resource-based view (Total line count = 6, Frequency = 6). The third aspect is sustainable development (Total strength of lines = 15, Occurrences = 7). The fourth is bibliometric analysis (Total strength of lines = 13, Number of occurrences = 6). The fifth capacity is big data analytics capability (Total strength of lines = 6, Occurrences = 5). These findings suggest a direction for future research that emphasises the intersection of big data, sustainability, and entrepreneurial endeavours, and the importance of data-driven innovation in cultivating sustainable business model innovation is anticipated to grow.

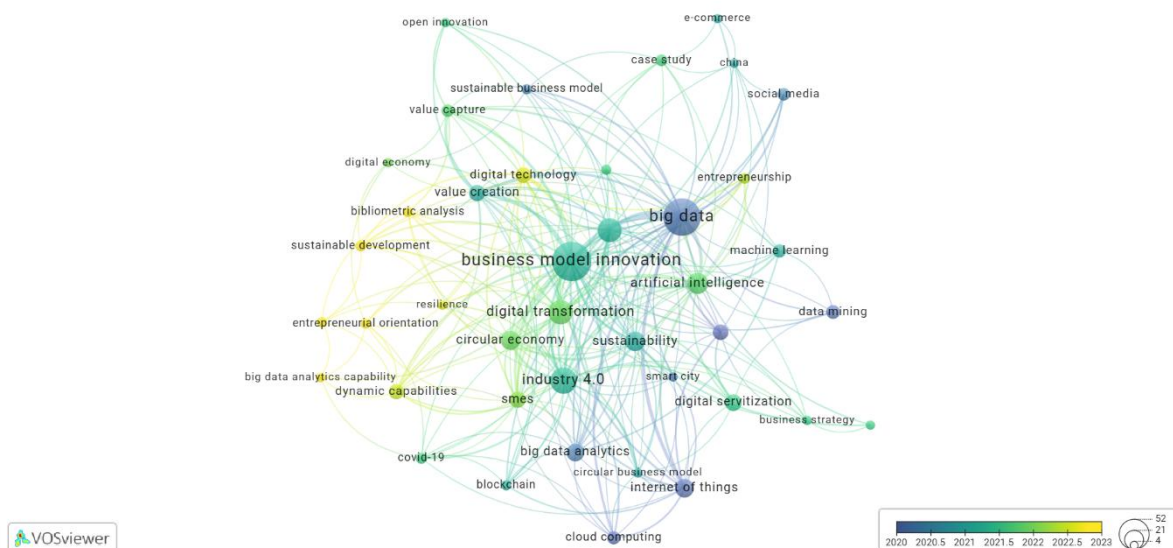


Figure 5: Keyword Co-Occurrence Overlay. Web link: <https://tinyurl.com/28bxyl6t>

4. Discussion

This study constitutes a bibliometric analysis and seeks to deliver an unbiased evaluation of the current literature examining the influence of big data on business model innovation. The analysis spans approximately eleven years, from 2014 to 2023, and elucidates research categories, affiliations, and countries. This study includes keyword co-occurrence and keyword co-occurrence overlay. Consequently, five principal findings are shown below:

I. Existing research on big data and business models predominantly emphasises the social sciences, with Management and Business comprising more than 50%, highlighting the revolutionary capacity of big data in improving strategic decision-making, customer insights, and value co-creation.

II. Affiliation analysis indicated that the primary contributors to big data and business model innovation research are institutions located in China, Europe (notably Italy and the UK), and India.

III. The geographical examination of the publications indicated substantial contributions from China, followed by Italy, the UK, and the US, highlighting a pronounced focus on the integration of big data into business strategies for competitive and sustainable development.

IV. The keyword relationship analysis indicates a strong connection among digital technologies, business model innovation, and sustainability, highlighting clusters focused on big data, digital transformation, and Industry 4.0, in conjunction with key concepts such as sustainability and the circular economy.

V. The keyword co-occurrence overlay network indicates that recent research emphasises the intersection of big data, sustainability, and entrepreneurship, highlighting the influence of big data analytics capability in promoting sustainable business model innovation.

5. Conclusion and limitations

This study aims to explore the correlations among big data, data science, and business model innovation via bibliometric analysis, pinpointing research trends and hotspots. This research aims to elucidate the role of big data technologies in facilitating business model innovation. This study uses VOSviewer and SCImagoGraphica to evaluate the selected dataset. The selected dataset comprises 428 articles from the Web of Science. The bibliometric analysis underscores the global focus on the impact of big data in transforming business model innovation. The key research hotspots include technological innovations such as Industry 4.0, artificial intelligence, and the Internet of Things, as well as sustainability. Recent research has emphasised entrepreneurial orientation, the resource-based view and sustainable development.

The limitations of this study derive from its reliance on the Web of Science database, which potentially excludes pertinent papers from alternative platforms. The study's dependence on bibliometric tools such as VOSviewer and ScimagoGraphica, although proficient in trend mapping, may fail to encapsulate the intricate qualitative dimensions of individual studies. To address these constraints, future studies should incorporate additional databases such as Scopus or Google Scholar to ensure comprehensive coverage. Moreover, including qualitative methodologies, such as comprehensive literature reviews or case studies, may yield profound insights into the mechanisms by which big data influences BMI.

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