THE RISE OF INTELLIGENT MARKETING: A BIBLIOMETRIC REVIEW OF DIGITAL TRANSFORMATION RESEARCH

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Abstract

The rapid advancement of digital technologies has intensified the use of big data in marketing decision making, yet the evolution and research structure of this domain remain fragmented. This study examines through bibliometric analysis, the development and thematic structure of big data research in digital marketing from 2015-2025. The dataset comprises 1.076 documents retrieved from Scopus database and analyzed using performance analysis and science mapping methods to identify publication trends, influential sources, and thematic clusters. The findings reveal a significant increase in publication output, with an average annual growth rate of 8.48%, particularly between 2019 and 2023, aligning with the global acceleration of digital transformation following the pandemic. Keyword network analysis identifies two main thematic clusters: (1) business and marketing dimensions, represented by keywords such as big data, marketing, and commerce; and (2) supporting technologies, including artificial intelligence and the Internet of Things. Geographically, research productivity is dominated by China (likely 363 documents), India (505), and the United States (409). Citation analysis indicates that earlier publications receive higher average citations, suggesting that time positively influences scientific recognition. Overall, this study provides a comprehensive overview of the intellectual landscape of big data research in digital marketing. It contributes by mapping the field's evolutionary trajectory and identifying future research directions, particularly regarding the integration of advanced technologies and data-driven innovation in digital business practices

Keywords: ***Bibliometric Analysis, Big Data, Business, Digital Marketing, Real-time Engagement***

PENDAHULUAN

In the past decade, Big Data has emerged as a pivotal technological innovation, driving transformation across diverse sectors such as business, healthcare, finance, and marketing. Since it's rise in 2010, Big Data has proven instrumental in enhancing decision-making, improving marketing analytics, and supporting product and process innovation. The growing importance of Big Data is further amplified by rapid technological advancements-particularly in Artificial Intelligence (AI) and real tie data processing-which have enabled organizations to derive deeper insights and make faster, more informed strategic decisions. As the world transitions toward industry 4.0, the ability to collect, manage, and analyse vast amounts of information has become essential for maintaining competitiveness and fostering sustainable growth. The evolution of this technology has been marked by a substantial expansion in its applications, initially in the domains of data storage and basic analytics, and subsequently to more sophisticated uses across multiple sectors, including business, healthcare, finance, and marketing [1]. Since its emergence as a widely discussed topic in 2010, Big Data has proven its importance in enhancing decision-making [2], [3], improving marketing

analytics [4], [5], boosting operational efficiency [6], and supporting product development [7]. The progress is additionally hastened by technological innovations over the last five years, facilitating improved data management and the rise of Artificial Intelligence (AI) to handle Big Data in real-time [8]. These advancements have enabled more profound data analysis, quicker decision-making, and enhanced business insights.

The discussion surrounding Big Data is expected to become increasingly vigorous as its applications evolve, propelled by technological progress and the transition to Industry 4.0 [8], [9]. This shift is driving companies towards digital transformation, leading to a rapid surge in data creation and intensifying the need for quicker and more precise decision-making. Originally, Big Data focused mainly on data storage and offline analysis [10]; however, it has since been incorporated into intricate systems for real-time decision-making and forecasting analysis. These advancements may enhance data processing speeds and accuracies, thereby generating new possibilities for optimization across various industries, particularly in business.

A field where Big Data is applied is digital marketing. Big Data in digital marketing refers to various data types, such as consumer information, web analytics, social media insights, customer journey data, email marketing metrics, location data, app user statistics, and customer feedback. The gathering of information from these sources allows businesses to create more efficient strategies [11], enhance personalization [12], and improve user experience [13]. Utilizing real-time analytics, marketers can react to consumer behavior immediately, customizing messages and offers according to live interactions. This has been shown to improve customer satisfaction while simultaneously boosting engagement and conversion rates, making digital marketing more focused and effective.

Looking at the bigger picture, using Big Data for digital marketing helps to keep a business sustainable in the long term. With the marketplace ever changing, businesses need to keep up with lucrative customer demands and forecast into the future trends in order to stay competitive and powerful. This is in line with SDG 9 on building resilient infrastructure, promoting inclusive and sustainable industrialization, and encouraging innovation [14]. The strategic application of big data in marketing has demonstrated its ability to accelerate a company's adaptation to digital transformation, thereby enhancing.

For this purpose, this study utilizes bibliometric techniques to examine the incorporation of big data in real-time interaction. Despite the growing academic and practical attention to this topic, previous research on Big Data in digital marketing remains fragmented. Existing studies tend to focus on specific tools, technologies, or case applications, with limited effort to map the intellectual structure, thematic evolution, and research collaboration networks in this field. As a result, there is still a lack of systematic understanding of how Big Data has evolved conceptually and methodologically within the digital marketing domain—particularly regarding its real-time interaction and engagement capabilities. This systematic examination outlines current studies and highlights key research works, significant themes, and developing trends in this area. It can additionally recognize trends in publishing results, partnership networks, and significant fields of research. These insights are key to understanding the development of big data applications in digital marketing.

METHODS

This research systematically examines the expansion, characteristics, and thematic structure of scholarly works related to Big Data in digital marketing, concentrating particularly on its real-time engagement element through a

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bibliometric approach. Bibliometric analysis is highly valued for its methodological accuracy in evaluating the intellectual landscape of scientific fields, enabling researchers to quantitatively assess production, collaboration, and thematic evolution [15], [16]. Its ability to generate substantial amounts of diverse literature renders it particularly valuable in new, interdisciplinary fields.

The bibliographic data used in this study were extracted from the Scopus database in May 2025. To analyse a various multidisciplinary content with high quality indexing with analytical tools like Bibliometric, Scopus is widely utilised in bibliometric research [17]. To find publications that address the implications of digital transformation in business, the following keywords were used: ("big data" OR "data analytics" OR "data-driven") AND (marketing OR "digital marketing" OR "online marketing" OR "consumer behavior" OR "customer engagement" OR "marketing strategy" OR "marketing analytics") AND ("Entrepreneurship" OR "Business Strategy" OR "Business Innovation"). The use of a thematic keyword structure is supported in bibliometric methodology as it balances sensitivity and specificity in topic retrieval [18].

An initial total of 6,428 documents were retrieved. To improve the analytical focus and ensure high-quality data, six filtering criteria were applied. The time span of publications was limited from 2015 to 2025, capturing a dynamic and rapid digital adoption that happened during the COVID-19 pandemic [19]. Secondly, the analysis was limited to documents published in English to maintain consistency in semantic and linguistic processing. Third, the search was confined to two key subject areas: Business, Management and Accounting and Computer Science, which together reflect the academic dimensions where the application of Big Data and customer engagement are most actively discussed. Fourth, the keyword limited to Big Data and Marketing. Fifth, the source type limited to Conference Proceeding. Lastly, due to peer-reviewed content is more likely to reflect mature conceptual growth, the study was limited to conference paper, articles and reviews to assure academic quality.

1,076 documents retrieved the final dataset after these filters were applied. Then, R version 4.4.3 was used for data analysis, together with Biblioshiny and the Bibliometrix package. An open-source R-based package, Bibliometrix, was developed for bibliometric analysis and science mapping to provide statistically supported, repeatable, and adaptable approaches [20].

In this study, two primary analytical techniques were used. The first was performance analysis, which measured the number of publications, authorship trends, productivity of journals, influence of citations, and international cooperation. The second was science mapping, which involved co-word analysis to detect thematic clusters, bibliographic coupling to identify intellectual structure, and thematic evolution analysis to trace changes in topic salience over time. These approaches are widely used in bibliometric literature to explore both the social and cognitive structure of research domains.

RESULTS

Summary Statistic

This study's bibliometric dataset shows in Table 1 comprises 1,076 documents published from 2015 to 2025, sourced from 646 publications. The yearly growth rate of publications attained 8,48%, with an average document age of 5.62 years, signifying that the literature in this domain remains comparatively novel and dynamic. Each document garnered an average of 6.204 citations, indicating substantial scientific influence. The dataset contained a total of 19,451 cited references.

Regarding scientific collaboration, there were 3,271 contributing authors, of whom 161 authored individual articles. The level of collaboration was high with an average of 3.34

authors per document and 13,94% of documents involved international collaboration. In addition, 2,788 author's keywords and 6,180 Keywords Plus were found, which formed the basis for exploring the thematic structure of the research.

Table 1. Main Information

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1998:2025
Sources (Journals, Books, etc)	646
Documents	1076
Annual Growth Rate %	8,48
Document Average Age	5,62
Average citations per doc	6,204
References	19451
DOCUMENT CONTENTS	
Keywords Plus (ID)	6180
Author's Keywords (DE)	2788
AUTHORS	
Authors	3271
Authors of single-authored docs	161
AUTHORS COLLABORATION	
Single-authored docs	165
Co-Authors per Doc	3,34
International co-authorships %	13,94
DOCUMENT TYPES	
conference paper	1076

Performance Analysis

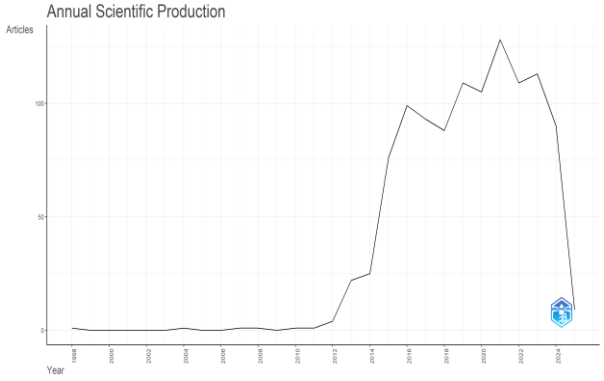

Fig. 1. Annual Scientific Production

Figure 1 illustrates the annual publications about Big Data in a digital marketing context resulting an fluctuation trend. The publications commenced with 76 documents in 2015 and significantly increased to 109 documents by 2019. In 2021, the total reached its peak of 128 documents, subsequently declining to 90 documents in 2024. The substantial rise during the 2019-2023 period aligns with the rapid advancement of the implementation of Big Data worldwide because of the COVID-19 pandemic, underscoring the growing importance of this subject in both academic and business contexts.

Keyword Network Analysis

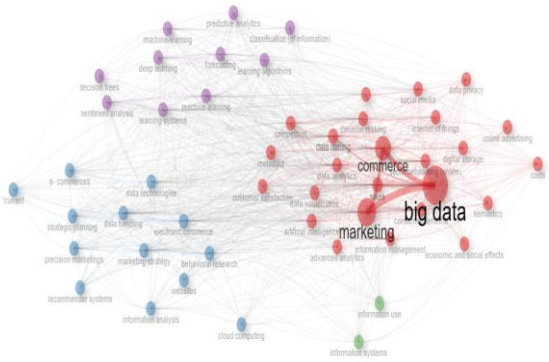

Fig. 2. Keyword Network Anlysis

As demonstrated in Figure 2, co-occurrence network analysis of author keywords reveals that the term 'big data' occupies a central position, with the highest betweenness value (171.283) and PageRank (0.130). This indicates strong connections with various themes within the primary cluster. The first cluster comprises keywords such as marketing, commerce, data analytics, sales and data mining, which collectively form the main thematic network.

Within Cluster 1, the keyword "marketing" holds a significant role with a betweenness of 70.620 and a PageRank of 0.086, thus demonstrating its function as a key connector in the network. Furthermore, it is notable that terms such as "commerce" and "sales" also possess supporting betweenness and PageRank values, thereby underscoring their significance within the digital business paradigm.

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Cluster 2 is characterised by a preponderance of themes pertaining to technology and governance, with keywords such as "artificial intelligence" exhibiting a betweenness of 1.965 and a PageRank of 0.021, and "digital marketing" demonstrating a betweenness of 0.745 and a PageRank of 0.014. The terms "Internet of Things", "social media" and "online advertising" demonstrate relatively low betweenness and PageRank values, thus indicating limited linkage to the network centre.

The following interpretations can be drawn from the analysis of the two main clusters that have emerged in the network: firstly, the focus of the first cluster is on business and digital transformation issues; secondly, the focus of the second cluster is on technology and governance aspects. This finding suggests a thematic separation between digital business development and the adoption of advanced supporting technologies.

Most Relevant Sources

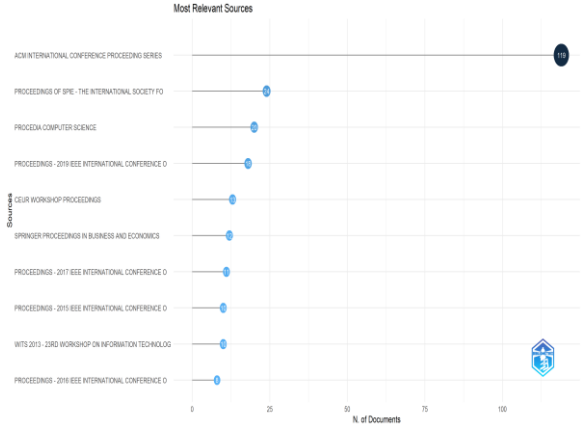

Fig. 3. Most Relevant Sources

As demonstrated in Figure 3, ACM International Conference Proceeding Series is the source with the highest number of publications related to Big Data in Digital Marketing within business context, with a total of 119 documents. The publications are then followed by the Proceedings of SPIE – The International Society for Optics and Photonics, which comprises 24 documents; the Procedia Computer Science, which comprises 20 documents; the Proceedings of the 2019 IEEE International Conference On, which comprises 18 documents; and finally, the CEUR Workshop Proceedings, which comprises 13 documents.

Further pertinent sources encompass the following publications: Springer Proceedings in Business and Economics (12 documents), Proceedings - 2017 IEEE International Conference On (11 documents), Proceedings - 2015 IEEE International Conference On (10 documents), WITS 2013 - 23rd Workshop on Information Technology and Systems (10 documents), and Proceedings - 2016 IEEE International Conference On (8 documents).

Countries Production over Time

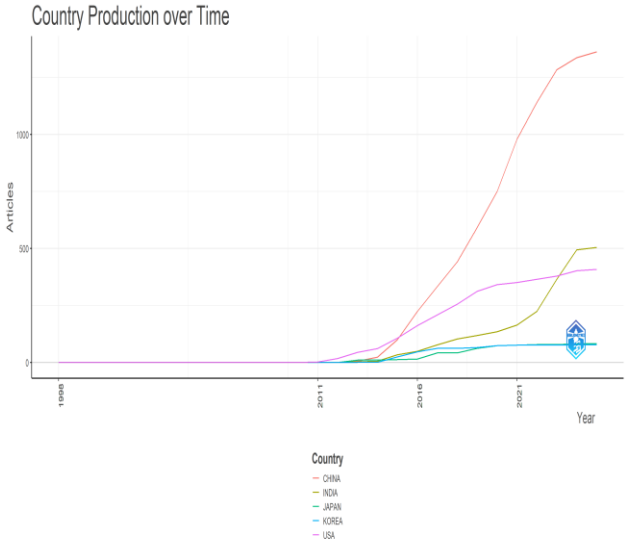

Fig. 4. Countries Production Over Time

As demonstrated in Figure 4, China recorded the highest number of publications with a total of 1,363 documents as of 2025. The next highest number of documents was recorded in India, with 505 documents, followed by the USA with 409 documents, Japan with 83 documents, and Korea with 78 documents.

The annual trend demonstrates a consistent increase in publications from all countries commencing from the early 2010s. The most significant spike occurred in China beginning in 2015, accelerating rapidly to peak in recent years. It is evident that India has also demonstrated considerable growth, commencing approximately in 2015, and achieving a publication count that exceeds 500

by 2025. The USA has exhibited a consistent growth trajectory, with a gradual escalation from a modest number in 2007 to over 400 publications by 2025. Japan and Korea, on the other hand, demonstrate comparatively slower and more stable growth in publication output over the same period.

Average Citation per Year

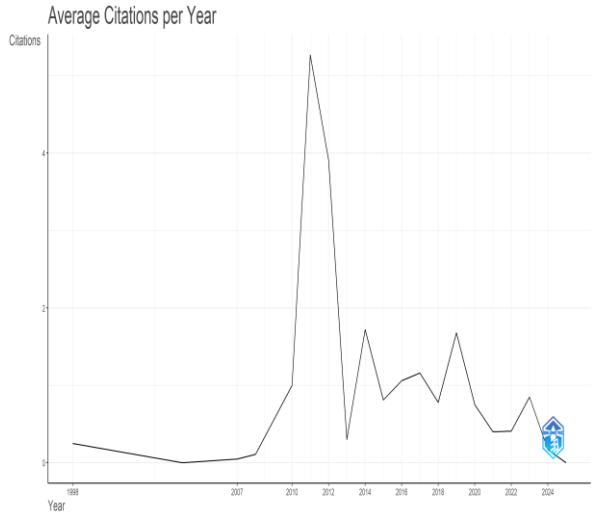

Fig. 5. Average Citation per Year

Figure 5 provides a quantitative illustration of this phenomenon, demonstrating a clear peak in meanTCperYear in 2011 with 5.27 citations and a subsequent decline to 3.91 in 2012. Subsequent to these peaks, a general decreasing trend in average citations per year is evident, reaching a nadir in 2025 with 0.00 citations.

A moderate increase is evident around 2019, with an average citation of 1.68, followed by a gradual decline from 2020 to 2025. This distribution indicates that articles published in earlier years have a tendency to accumulate a higher average annual citations rate than those published more recently, which is consistent with the time required for articles to be cited.

DISCUSSION

Beyond the descriptive findings, several broader implications can be drawn from the current bibliometric results. First, the separation between business-oriented and technology-oriented clusters highlights a conceptual gap between marketing practitioners and technology developers. This suggests that although marketing research increasingly adopts digital and data-driven approaches, interdisciplinary integration between marketing strategy, artificial intelligence, and data analytics remains limited. Future studies should therefore focus on developing conceptual frameworks that bridge managerial decision-making and algorithmic intelligence to enhance the impact of data-driven marketing models.

Second, the dominance of Asian countries, particularly China and India, indicates a geographic shift in research leadership from Western economies to emerging digital ecosystems. This reflects the rapid technological adoption, massive data generation, and supportive policy environments in Asia that accelerate digital transformation. However, the relative underrepresentation of research collaboration across regions suggests the need for more cross-national partnerships to diversify methodological approaches and contextual understanding of intelligent marketing practices.

Third, the evolution of publication trends around the COVID-19 pandemic period demonstrates how crises can accelerate technological innovation and scholarly attention. The surge of studies between 2019 and 2023 suggests a strong link between external disruptions and the adoption of real-time analytics, automation, and personalization in marketing. This reinforces the idea that digital transformation is not only a technological process but also an adaptive organizational response to environmental uncertainty.

Fourth, the declining citation trend in recent years should not be interpreted as reduced relevance, but rather as a function of publication recency. As emerging topics such as generative AI, predictive personalization, and ethical data governance gain traction, newer studies may attract higher citations in the near future. The growing attention to

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sustainability and responsible marketing practices also signals a shift from purely efficiency-driven analytics toward socially responsible and human-centered digital transformation.

Lastly, this study contributes to the broader understanding of **"intelligent marketing"**—a concept that merges data analytics, artificial intelligence, and customer-centric strategies to create adaptive, real-time marketing ecosystems. The results demonstrate that the future of digital marketing research lies in the integration of predictive intelligence, emotional analytics, and autonomous decision systems. Scholars and practitioners should thus pursue interdisciplinary collaborations to design marketing systems capable of learning, adapting, and co-creating value with consumers in real time.

REFERENCES

[1] M. Tasueva, S. Vazkayeva, and A. Akhmadov, "Big Data and its Applications in Various Industries," *SHS Web of Conferences*, vol. 172, p. 01014, 2023, doi: 10.1051/SHSCONF/202317201014.

[2] H. Yousuf and A. Y. Zainal, "Quantitative approach in enhancing decision making through big data as an advanced technology," *Advances in Science, Technology and Engineering Systems*, vol. 5, no. 5, pp. 109–116, 2020, doi: 10.25046/AJ050515.

[3] Q. A. Nisar, N. Nasir, S. Jamshed, S. Naz, M. Ali, and S. Ali, "Big data management and environmental performance: role of big data decision-making capabilities and decision-making quality," *Journal of Enterprise Information Management*, vol. 34, no. 4, pp. 1061–1096, 2020, doi: 10.1108/JEIM-04-2020-0137.

[4] N. Bouhtati, L. Alla, and B. Bentalha, "Marketing big data analytics and customer relationship management: A fuzzy approach," *Integrating Intelligence and Sustainability in Supply Chains*, pp. 75–86, Oct. 2023, doi: 10.4018/979-8-3693-0225-5.CH004.

[5] S. K. Tewari, "Data-driven marketing in emerging markets: Navigating challenges for sustainable development," *Digital Transformation for Business Sustainability and Growth in Emerging Markets*, pp. 171–196, Feb. 2025, doi: 10.1108/978-1-83549-109-620251007/FULL/XML.

[6] S. Bag, L. C. Wood, L. Xu, P. Dhamija, and Y. Kayikci, "Big data analytics as an operational excellence approach to enhance sustainable supply chain performance," *Resour Conserv Recycl*, vol. 153, p. 104559, Feb. 2020, doi: 10.1016/J.RESCONREC.2019.104559.

[7] Z. Wang, H. Liu, X. Fan, and T. Zhang, "Integrating machine learning and robust optimization for new product development: A consumer and expert preference-based approach," *Comput Ind Eng*, vol. 197, Nov. 2024, doi: 10.1016/J.CIE.2024.110520.

[8] S. K. Jagatheesaperumal, M. Rahouti, K. Ahmad, A. Al-Fuqaha, and M. Guizani, "The Duo of Artificial Intelligence and Big Data for Industry 4.0: Review of Applications, Techniques, Challenges, and Future Research Directions," Apr. 2021, Accessed: May 15, 2025. [Online]. Available: http://arxiv.org/abs/2104.02425

[9] Z. Sun, "Big Data 4.0: The Era of Big Intelligence," *Journal of Computer Science Research*, vol. 6, no. 1, pp. 1–15, Jan. 2024, doi: 10.30564/JCSR.V6I1.6054.

[10] A. Gandomi and M. Haider, "Beyond the hype: Big data concepts, methods, and analytics," *Int J Inf Manage*, vol. 35, no. 2, pp. 137–144, Apr. 2015, doi: 10.1016/J.IJINFOMGT.2014.10.007.

[11] L. V. Sharakhina and V. Skvortsova, "Big Data, Smart Data in Effective

Communication Strategies Development," *Proceedings of the 2019 IEEE Communication Strategies in Digital Society Seminar, ComSDS 2019*, pp. 7–10, May 2019, doi: 10.1109/COMSDS.2019.8709651.

[12] A. Mirza and S. K. Sharma, "Personalization and Customization of Governance Products and Services for Citizens Using Big Data Analytics and Artificial Intelligence," in *Augmenting Customer Retention Through Big Data Analytics*, Apple Academic Press, 2024, pp. 277–289. Accessed: May 15, 2025. [Online]. Available: https://www.scopus.com/record/display.uri?eid=2-s2.0-85216610160&origin=resultslist&sort=plf-f&src=s&sot=b&sdt=b&cluster=scosubjabbr%2C%22BUSI%22%2Ct&s=TITLE%28%22big+data%22+personalization%29&sessionSearchId=8511d367317d25b15321f88e422e47f1&relpos=1

[13] A. A. Adewojo and A. O. Dunmade, "From big data to intelligent libraries: Leveraging analytics for enhanced user experiences," *Business Information Review*, vol. 41, no. 3, pp. 104–109, Sep. 2024, doi: 10.1177/02663821241264707.

[14] M. Petrescu and A. S. Krishen, "Co-creating transformative value in marketing analytics," *Journal of Marketing Analytics*, vol. 10, no. 1, pp. 1–2, Mar. 2022, doi: 10.1057/S41270-022-00159-6/FIGURES/1.

[15] N. Donthu, S. Kumar, D. Mukherjee, N. Pandey, and W. M. Lim, "How to conduct a bibliometric analysis: An overview and guidelines," *J Bus Res*, vol. 133, pp. 285–296, Sep. 2021, doi: 10.1016/J.JBUSRES.2021.04.070.

[16] A. Ismail, H. Munsi, A. M. Yusuf, and P. Hijjang, "Mapping One Decade of Identity Studies: A Comprehensive Bibliometric Analysis of Global Trends and Scholarly Impact," *Social Sciences 2025, Vol. 14, Page 92*, vol. 14, no. 2, p. 92, Feb. 2025, doi: 10.3390/SOCSCI14020092.

[17] J. Baas, M. Schotten, A. Plume, G. Côté, and R. Karimi, "Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies," *Quantitative Science Studies*, vol. 1, no. 1, pp. 377–386, Feb. 2020, doi: 10.1162/QSS_A_00019.

[18] A. Parlina, K. Ramli, and H. Murfi, "Theme Mapping and Bibliometrics Analysis of One Decade of Big Data Research in the Scopus Database," *Information 2020, Vol. 11, Page 69*, vol. 11, no. 2, p. 69, Jan. 2020, doi: 10.3390/INFO11020069.

[19] A. Petropoulou, E. Angelaki, I. Rompogiannakis, I. Passas, A. Garefalakis, and G. Thanasas, "Digital Transformation in SMEs: Pre- and Post-COVID-19 Era: A Comparative Bibliometric Analysis," *Sustainability 2024, Vol. 16, Page 10536*, vol. 16, no. 23, p. 10536, Nov. 2024, doi: 10.3390/SU162310536.

[20] M. Aria and C. Cuccurullo, "bibliometrix: An R-tool for comprehensive science mapping analysis," *J Informetr*, vol. 11, no. 4, pp. 959–975, Nov. 2017, doi: 10.1016/J.JOI.2017.08.007.