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ORIGINAL

Is Big Data Adoption Shaping Business Landscapes? An Overview of Current Hotspots and Future Trends

¿Está la adopción de Big Data configurando el panorama empresarial? Panorama de los focos actuales y las tendencias futuras

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ABSTRACT

Introduction: most bibliometrics reviews in the prior studies have focused on tracking the evolution, applications, and implications of Big Data in business through different sectors using Web of Science or Scopus databases. Moreover, none of these studies has addressed the differences between developed and developing countries. These gaps indicate that we need a bibliometric review that can identify current trends and unexplored areas.
Objectives: this study aims to use a bibliometric approach to examine how Big Data is used in businesses using WoS and Scopus databases.
Method: a Systematic Literature Review was conducted based on the country's economic status using the SPAR-4-SLR protocol for this research.
Results: the results show a significant growth in publications since 2013 among developed countries and since 2014 among developing ones such as the United States and the United Kingdom, along with China and India, respectively. Also, Machine Learning Overlaps Artificial Intelligence alongside Analytics, fueling innovative data-driven business processes around Big Data.
Conclusions: this article explores the transformative power of Big Data across domains, stressing its ability to cause substantial breakthroughs within the digital economy.

Keywords: Big Data; Business Transformation; Big Data Adoption; Bibliometric Analysis.

RESUMEN

Introducción: la mayoría de las revisiones bibliométricas de los estudios previos se han centrado en rastrear la evolución, aplicaciones e implicaciones del Big Data en los negocios a través de diferentes sectores utilizando las bases de datos Web of Science o Scopus. Además, ninguno de estos estudios ha abordado las diferencias entre los países desarrollados y los países en desarrollo. Estas lagunas indican que necesitamos una revisión bibliométrica que pueda identificar las tendencias actuales y las áreas inexploradas.
Objetivos: este estudio pretende utilizar un enfoque bibliométrico para examinar cómo se utiliza el Big Data en las empresas utilizando las bases de datos WoS y Scopus.
Método: se realizó una Revisión SistemáticaLiteraria basada en el estatus económico del país utilizando el protocolo SPAR-4-SLR para esta investigación.
Resultados: los resultados muestran un crecimiento significativo de las publicaciones desde 2013 entre los entre los países desarrollados y desde 2014 entre los países en desarrollo, como los Estados Unidos y el

Reino Unido junto con China e India, respectivamente. Además, el aprendizaje automático se superpone a la inteligencia artificial junto con la analítica, impulsando innovadores procesos de negocio basados en datos en torno al Big Data.
Conclusiones: este artículo explora el poder transformador de Big Data en todos los ámbitos, destacando su capacidad para causar avances sustanciales dentro de la economía digital.

Palabras clave: Big Data; Transformación Empresarial; Adopción de Big Data; Análisis Bibliométrico.

INTRODUCTION

Over the past few years, innovative technology has revolutionized several sectors. This progress has increased productivity, efficiency, and effectiveness at individual and corporate levels. Big Data has significantly changed how several industries operate. As suggested by researchers and practitioners, Big Data is widely accepted as an essential ingredient for enhancing business intelligence (H. Chen et al., 2012). Companies depend hugely on advanced Artificial Intelligence (AI) models, such as machine learning algorithms, to extract useful information from complicated data. Analytics can no longer be ignored if businesses are to thrive in competitive markets (McAfee et al., 2012). To increase the relevance of BD for STIP communities, bridging Big Data with real-world STI policy challenges involves examining its implications and formulating practical strategies for various sectors (Nobre & Tavares, 2017). Though there was an optimistic expectation that non-IT sectors would adopt BDA for transformative change, this has not happened, although most IT firms are increasingly embracing it (Yi Zhang et al., 2019).

Currently, there is a need to appreciate differences in the various analytical techniques, explore the historical trajectory of Big Data studies, and appreciate relationships that could broaden the influence of Big Data's dominance. Previous research has utilized diverse methodologies such as bibliometrics and network analysis to investigate Big Data Analytics (BDA) for enhancing Science, Technology, and Innovation (STI) (Huang et al., 2018). However, integrating these advancements in AI with traditional bibliometric practices and research remains relatively uncommon. Prior research has shown that static computational models are not adequate in capturing data, which is temporal and changes with science titles (Lu et al., 2014). Besides, the rate at which the modern Big Data industry is developing is leading in technological developments and thereby limiting the use of classical strategies (Bughin et al., 2010). To overcome these issues, this article proposes a learning-based method called scientific evolutionary pathways (Yi Zhang et al., 2017). This paper aims to explore the evolution of Big Data in business and identify the areas for further exploration of Big Data.

Related Work

The literature review comprehensively examines the Big Data phenomenon in multiple academic domains, synthesizing various studies on its history, usage, and values (Abdian et al., 2023; Aboelmaged & Mouakket, 2020; Ardito et al., 2019; Batistič & van der Laken, 2019; Chavez et al., 2022; El-Alfy & Mohammed, 2020; Fauzi et al., 2023; Kalantari et al., 2017; Karaboğa et al., 2022; Khanra et al., 2020; Kulakli & Osmanaj, 2020; Lafuente-Lechuga et al., 2021; Liu et al., 2019; Lundberg, 2023; Mishra et al., 2018; Ragazou et al., 2023; Reshi et al., 2023; Rialti et al., 2019; Shi et al., 2021; X. Zhang et al., 2021; Yi Zhang et al., 2019; Yucheng Zhang et al., 2021). Most of them were on value creation, analytics adoption, and organizational performance while the application of Big Data in business activities is not well explored. There is no such comprehensive coverage of Big Data applications in business and management that has appeared in the earlier literature.

This gap underscores the urgent need for a current and relevant bibliometric review to find out the existing trends in research and those that have not been explored. Additionally, the above studies focused on the use of the Web of Science (WoS) or Scopus. However, none have compared findings across these platforms to harness their unique benefits that could enhance the credibility and comprehensiveness of the study. Moreover, no previous study has compared results based on countries' development levels. It is evident that analyses should consider both developed and developing contexts that each demonstrates how countries are expected to adopt Big Data and its impact studies, potentially revealing differences in Big Data studies or applications between the categories.

This research aims to provide a bibliometric review of the usage of Big Data in the business and management contexts, addressing the identified gaps in the literature, research evolution and new directions, and yet unexplored areas. This work will make use of both WoS and Scopus databases for the analysis and combine the literature on the country's economic status to categorize developed and developing countries.

Motivation and Research Questions

A bibliometric analysis provides a quantitative summary of developments in corporate Big Data research (Kozlowski et al., 2017). In this respect, this research employs co-citation analysis – a very relevant technique

of clustering topics and authors, as well as studying their interaction (Kwilinski, 2023). It similarly indicates the number of articles that are sometimes cited together to create networks or the most cited articles in the recent past (C. Chen et al., 2014). Also, it looks into the journals where the papers that are known to be useful are published (Yucheng Zhang et al., 2021). Furthermore, tracking the evolution of keywords reveals the thematic directions in Big Data research (Yucheng Zhang et al., 2021). Therefore, the main objective is to conduct a bibliometric analysis that systematically documenting and visualizing the advancement along with trends of Big Data research in business, focusing on the distinction between developed and developing countries. Thus, this study is poised to explore the following research questions:

RQ1: how has Big Data evolved in business research subfields across developed and developing countries?

RQ2: which countries are leading in Big Data research within business research, and in which disciplines is it highly utilized? Also, what topics are they concentrating on? Over the years, which aspects of Big Data in business have diminished in importance, which continue to dominate, and which new areas are emerging as significant in developed and developing countries?

RQ3: what are the hotspots in Big Data within business research, and how are they influencing the field?

RQ4: looking towards the future, what are the emerging research frontiers in Big Data within business research?

This research paper is structured into seven sections. After this introductory overview, Section 2 extensively explores Big Data in literature. Section 3 outlines the research methodology and specifics of the data. Section 4 presents the study's findings and delves into a thorough discussion. Section 5 provides concluding insights. The final section, Section 6, discusses the limitations encountered during the research.

Big Data in Business

Academic and industry professionals increasingly leverage new data types to gain valuable insights into the emerging domain of 'Big Data', offering significant potential (Yucheng Zhang et al., 2021). The digital age has brought dynamic changes, challenging traditional business paradigms, including organizational structures, cultural norms, and strategic decision-making processes (Gerar George et al., 2014). (Merendino et al., 2018) illustrate how Big Data transforms executive decision-making by reducing cognitive biases and information overload, improving adaptability. The business research community extensively explores Big Data, contributing to growth and innovation (Agarwal & Dhar, 2014). However, there is a noted literature gap specifically addressing Big Data tools' use and their potential to drive new theoretical and practical developments (Gerar George et al., 2014).

Management scholars face three main challenges in Big Data within the business field. The first is acquiring high-quality Big Data due to its pervasive nature and the difficulty in assessing its quality and impact (Gerar George et al., 2014). The second challenge is improving data analytical methods to create value for individuals and businesses. The characteristics of Big Data—variety, velocity, and volume—generate vast amounts of unstructured data, such as social media interactions. This requires business researchers, accustomed to structured datasets, to adapt their methods for extracting pertinent information from Big Data (Archak et al., 2011). The third challenge is applying Big Data methodologies to validate existing theories and develop new ones. Despite Big Data's growing popularity in practice, scholarly exploration of its applications remains limited (Gerar George et al., 2014). Most current studies in business and management rely on small-sample, deductive research methods. Given Big Data's unique attributes, scholars must develop novel questions and establish innovative theoretical frameworks (Gerard George et al., 2016).

METHOD

In this investigation, the systematic literature review (SLR) was applied in a standardized manner as a methodological framework for acceptably conducting this research. It does relate to the issues of specifying unambiguous research questions and identifies the existing gaps in research in the areas using an orderly synthesis and assessment of the extant literature on the specific topic (Tranfield et al., 2003). Although the PRISMA statement (Moher et al., 2009) and its extension PRISMA-P (Moher et al., 2015) are useful and applicable in a more or less abstract way; systematic reviews in which the two guidelines structure face some challenges (Paul et al., 2021).

To overcome these problems, (Paul et al., 2021) presented SPAR-4-SLR, which is designed to improve SLRs by making them more relevant and precise. The SPAR-4-SLR replaces the review of literature by the examination of the three '3 As' (assembly, arrangement, and appraisal) sections for a timely and complete literature review of the advancement of the body of knowledge in the academy. This intricate approach makes way for the 'two Ss', representing the integration of conclusions as well as propounding the exploration of more within the confines of the review (Paul et al., 2021). Specifically, this paper addresses the domain-specific SLR concerning the role of Big Data in business (Paul et al., 2021). To gain a comprehensive understanding of the process following the SPAR-4-SLR protocol, see table 1.

Table 1. The SPAR- 4- SLR protocol

Phase	Sub- phase	Standard	Reasons
Assembling	Identification	Field	Big data in business
		Research question	RQ1: How has Big Data evolved in business research subfields across developed and developing countries? RQ2: Which countries are leading in Big Data research within business research, and in which disciplines is it highly utilized? Additionally, who are the authoritative organizations, and who are the best scholars in these regions? What topics are they concentrating on? Over the years, which aspects of Big Data in business have diminished in importance, which continue to dominate, and which new areas are emerging as significant in developed and developing countries? RQ3: What are the hotspots in Big Data within business research, and how are they influencing the field? RQ4: Looking towards the future, what are the emerging research frontiers in Big Data within business research?
		Source type	Inclusion: Journal
		Source quality	WoS and Scopus
	Acquisition	Search material acquisition and mechanism	WoS and Scopus
		Search period	Scopus: From 2006 to 2023 WoS: From 2009 to 2023
		Search keyword(s)	(‘Big data’ OR ‘Data science’)
Arranging	Organization	Organizing codes	Including article type, year, abstract, keywords, journal title, institution, and country.
	Purification	Article type	‘ARTICLE’ or ‘REVIEW’.
Assessing	Evaluation	Analysis method	Excel scrutinized several things, including yearly publication tallies, distribution by countries and institutions and statistical approaches.
		Agenda proposal method	In the future, this subject can be further analyzed by using more databases over a longer period. Future researchers should find different ways of overcoming this limitation to improve accuracy in bibliometric analysis.
	Reporting	Reporting convention	Table, Fig., and words. The data covers WoS and Scopus, while the review is confined to information sourced from articles. This study received no funds. We thank the reviewers for their helpful comments during the peer-review process.

With the review of relevant literature, two terms can be distinguished for the definition of Big Data such as ‘big data’ (BD) and ‘data science’ (DS) (Yucheng Zhang et al., 2021). After that, appropriate retrieval techniques were used to find the appropriate information for the analysis. The data for the search was current as of December 31, 2023. Within WoS, the search string was: ((TS=(‘Big Data’)) OR TS=(‘Data Science’))) (Kraus et al., 2022) AND PY=(2009–2023) (Kraus et al., 2022) AND (CTGS==(‘MANAGEMENT’ OR ‘BUSINESS’ OR ‘BUSINESS FINANCE’ OR ‘OPERATIONS RESEARCH MANAGEMENT SCIENCE’)) (Yucheng Zhang et al., 2021) AND (DT==(‘REVIEW’ OR ‘ARTICLE’)) (These academic sources enrich the domain (Paul et al., 2021)). A total of 6464 publications were obtained from developed countries and 4092 articles from developing countries.

Within Scopus, the search query is outlined as follows: (TITLE-ABS-KEY (‘Big Data’) OR TITLE-ABS-KEY (‘Data Science’) AND PUBYEAR >2006 AND PUBYEAR < 2023 AND (LIMIT-TO (SUBAREA, ‘Business, Management and Accounting’) OR (LIMIT-TO (SUBAREA, ‘Social Sciences’) OR (LIMIT-TO (SUBAREA, ‘Economics, Econometrics, and Finance’) OR (LIMIT-TO (SUBAREA, ‘Decision Sciences’) OR (LIMIT-TO (SUBAREA, ‘Energy’) OR (LIMIT-TO (SUBAREA, ‘Environmental Science’) (Tandon et al., 2021) AND (LIMIT-TO (DOCTYPE, ‘ar’) OR LIMIT-TO (DOCTYPE, ‘re’)). A total of 17 516 publications from developed countries and 10 056 from developing countries were obtained. Table 2 displays a collection of indexed articles.

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Table 2. The list of articles indexed and processed

Item	WoS	Scopus
Topic	'Big Data' OR 'Data Science'	'Big Data' OR 'Data Science'
Publication Years	Scopus: From 2006 to 2023	Scopus: From 2006 to 2023
	WoS: From 2009 to 2023	WoS: From 2009 to 2023
Type of documents	'REVIEW' OR 'ARTICLE'	'REVIEW' OR 'ARTICLE'
Time of Retrieval	December 31, 2023	December 31, 2023
Retrieved Articles	10 556	27 572
Duplicates Deletion	0	0
Valid Articles	10 556	27 572
Cleaning of data (merging synonyms keywords)	1. Merging bigdata into big data.	1. Merging bigdata into big data.
	2. Merging BD into big data.	2. Merging BD into big data.
	3. Merging the science of data into data science.	3. Merging the science of data into data science.
Analysing Tool	VOS viewer, Excel	VOS viewer, Excel

The choice of the WoS database from the Thomson Reuters Institute of Scientific Information for comparative analysis is motivated by its comprehensive archival coverage since 1990 and its predominantly English journal content, enhancing accessibility (Chadegani et al., 2013). Alternatively, Elsevier pleads in favor of the selection of the Scopus database based on its scope of access to copious amounts of peer-reviewed content which includes recent findings and extensive citation lists (Ragazou et al., 2023). These two databases are being updated now and then while broadening their coverage and the number of citations every quarter across the various scientific spheres (Harzing & Alakangas, 2016). Thus, by employing both of those databases, one can compare WoS and Scopus which enhances the credibility of the research as there are both similarities and differences in the outcomes obtained (Yubo et al., 2023). For this purpose, in this study, both WoS and Scopus were utilized.

Two critical factors determine the selection of the period of the search. As observed, the first publications about Big Data either emerged in 2009 according to WoS, or in 2006 according to Scopus, meaning that the rise of Big Data scholarship began in the late 2000s (Shukla et al., 2020). Also, conceivably adhering to the Structure of Scientific Revolutions Theory (Kuhn, 2012) shifts of certain knowledge domains are usually accompanied by the emergence of new paradigms. These paradigmatic shifts require institutions and scholars to comprehend and assimilate new ideas; therefore, to continue making progress, it is essential to have an extensive understanding of the subject. Therefore, WoS and Scopus articles from 2009 to 2023, and 2006 to 2023 respectively, and about Report on Big Data were analyzed.

DISCUSSION

The Current State of Big Data in Business

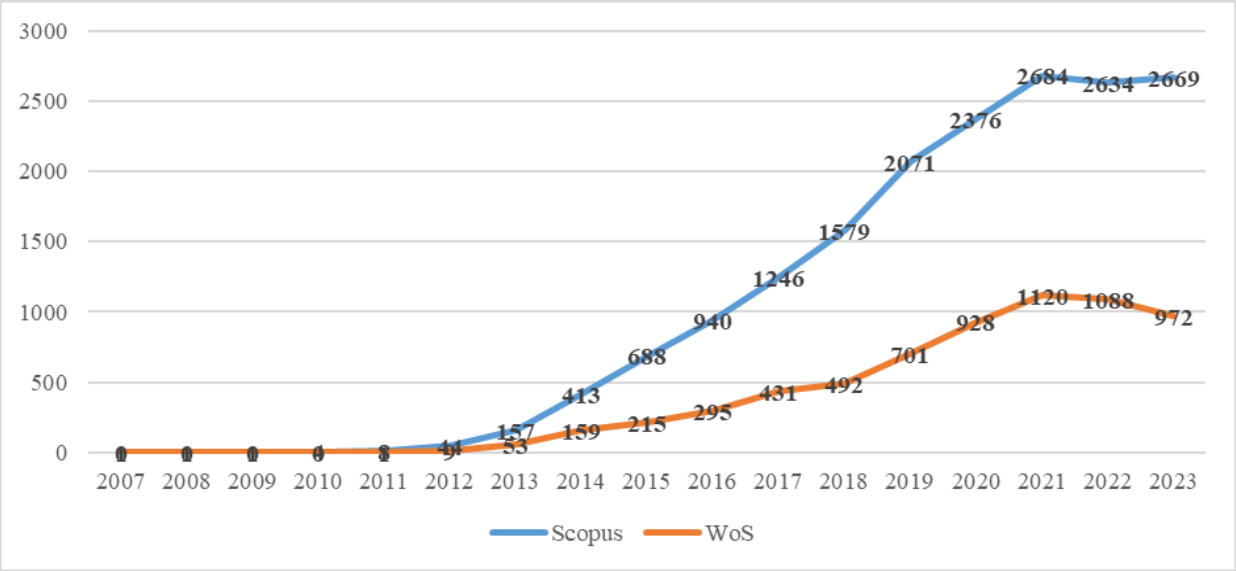
The Trends of Annual Publications

The trends of Big Data publications in the business industry in both developed and developing nations are depicted graphically in figures 1 and 2. Certain figures make use of information from Scopus and WoS covering the periods of 2007 to 2023 and 2009 to 2023 respectively, which have been constructed using Microsoft Excel. The clarification attempts led to the conclusion that various nations are increasingly adopting Big Data into their respective business sectors, and supporting reinforcement of the findings made by previous studies (Aboelmaged & Mouakket, 2020; Ardito et al., 2019; Chavez et al., 2022; Fauzi et al., 2023). More specifically, both databases report a marked increase in developed countries starting from 2013 and developing countries starting in 2014 in the number of publications, suggesting that growing interest in Big Data spans developing and developed economies (Aboelmaged & Mouakket, 2020; El-Alfy & Mohammed, 2020; Khanra et al., 2020; Liu et al., 2019; Ragazou et al., 2023).

The trend of Big Data whose interest is seen in its mapping within the Scopus and WoS indices as a researched theme at first did not seem very remarkable but was confirmed by several studies including (Abdian et al., 2023; Chavez et al., 2022; El-Alfy & Mohammed, 2020; Fauzi et al., 2023). In developed countries, Scopus dated the official wearing of Big Data only 3 years after WoS did, dating back to 2009. Scopus indexed six articles on Big Data and geometric averages from 2007 to 2010 with WoS remaining blank on Big Data publications until 2011. But Scopus while conducting its bibliometric study within developing countries, dated its first Big Data

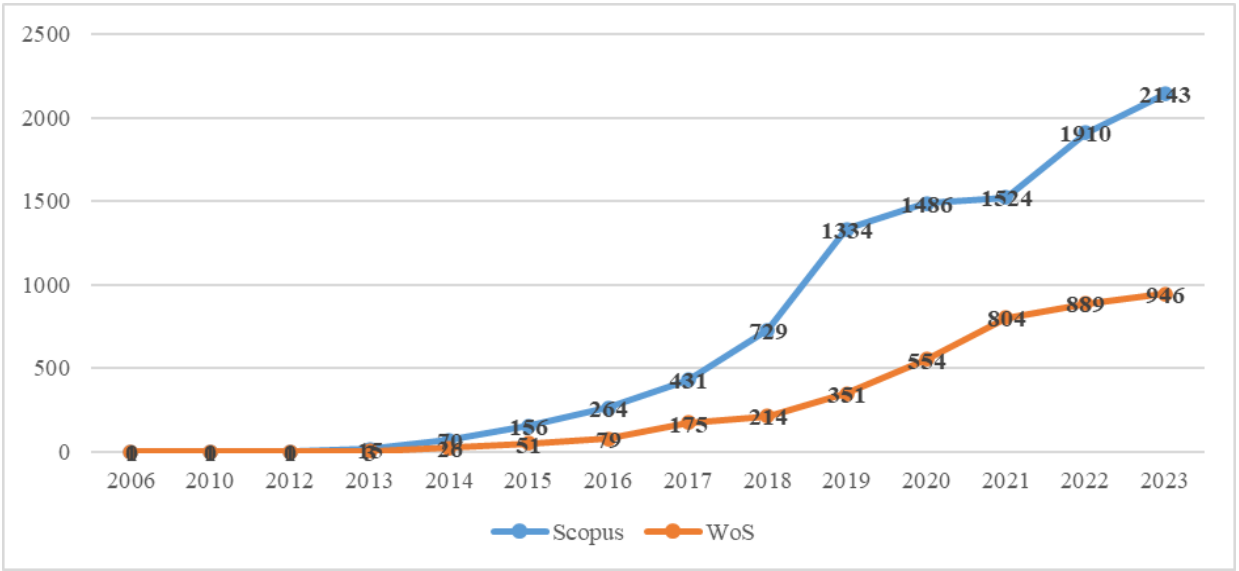
article to 2006. Further, by attending the studies mentioned above, during the year 2013, Scopus cataloged 15 articles that showed growing attention even though WoS paralleled 3 articles in the same year and so forth (Aboelmaged & Mouakket, 2020; Chavez et al., 2022; El-Alfy & Mohammed, 2020; Fauzi et al., 2023). This underscores the even more statistically assured finding that there is a uniform tendency of Scopus to record more publications every year as compared to WoS under the same search parameters (Falagas et al., 2008) that Scopus is broader in the range of journals. Also (Shukla et al., 2020) support the presence of this lag for the beginning of the recording of Big Data articles in WoS in 2009 and in Scopus in 2006.

According to Scopus for 2020, there were 2376 Big Data papers published for businesses in developed nations, a leap compared to WoS which indexed only 928 papers. In developing countries, Scopus indexed 1486 articles and WoS 554 during the same year, reflecting a notable rise from the previous year, as observed (Fauzi et al., 2023). In 2021, the number of Scopus articles in developed countries peaked at 2684, with WoS growing to 1120 publications. Meanwhile, in developing countries, the Scopus count increased to 1524 articles and WoS to 804, a trend also noted by (Fauzi et al., 2023). However, 2022 witnessed a slight reduction in developed countries, with Scopus at 2634 articles and WoS at 1088. Conversely, developing countries saw a significant leap in 2022, with Scopus reaching 1910 articles and WoS 889. In contrast to the 972 papers published by Web of Science, there were slightly more Scopus articles in developed countries – 2669 – in 2023. The upward trend persisted in developing countries into 2023, with Scopus documenting 2143 articles and WoS 946.



Source: From 2007 to 2023 in WoS and Scopus

Figure 1. The trend of annual publications on Big Data in business in developed countries



Source: From 2006 to 2023 in WoS and Scopus

Figure 2. The trend of annual publications on Big Data in business in developing countries

This trend indicates an increase in business-oriented Big Data publications produced in developed and developing nations, suggesting higher academic attention and activity towards this area. The upward direction demonstrates that Big Data is still relevant and useful within the business context, thereby showing that Big Data continues to shape enterprise strategies and inform scholarly investigations within economically advanced areas.

Another thing to note is that following the COVID-19 outbreak, there has been a surge of interest in pandemic-led BDA due to its importance when processes are changed or regulated differently (Ragazou et al., 2023). This also means that because of COVID-19, more people have done research, which has resulted in many articles being written in later years (Yubo et al., 2023). Additionally, technology has been crucial in adjusting work and life routines during the pandemic, leading to shifts in both organizational and individual practices through technological interventions (Lim et al., 2022). Finally, the steady increase in publications since the early 2000s, with significant upsurges post-2013 in developed countries and post-2014 in developing countries, indicates a solidifying trend in Big Data business research. As per the theory of the Structure of Scientific Revolutions (Kuhn, 2012), this upward trend is likely to persist, given the substantial role of Big Data in driving business innovation and strategic planning.

The Cooperation and Distribution of Countries

Figures 3 and 4 illustrate the top 10 countries that contributed the most studies on Big Data in the business domain published in Scopus and WoS databases. This evaluation of the global comparison of academic productivity brings into perspective the nations of these nations, particularly the developed world, and their rich contribution. The data shows that the USA and the UK remain at the forefront as noted by (Abdian et al., 2023; Aboelmaged & Mouakket, 2020), which underlines the relevance of the USA in a highly competitive market for academic research. According to Scopus's data, American publications are somewhat better than WoS in volume, which gives Scopus even wider opportunities in terms of including US research than WoS. The presence of European countries such as Germany, France, and Spain across databases reveals the presence of strong academic institutions in these nations. In the Scopus table, Italy appears to be placed higher than Australia, but it is the contrary in the Wolters Kluwer ranking.

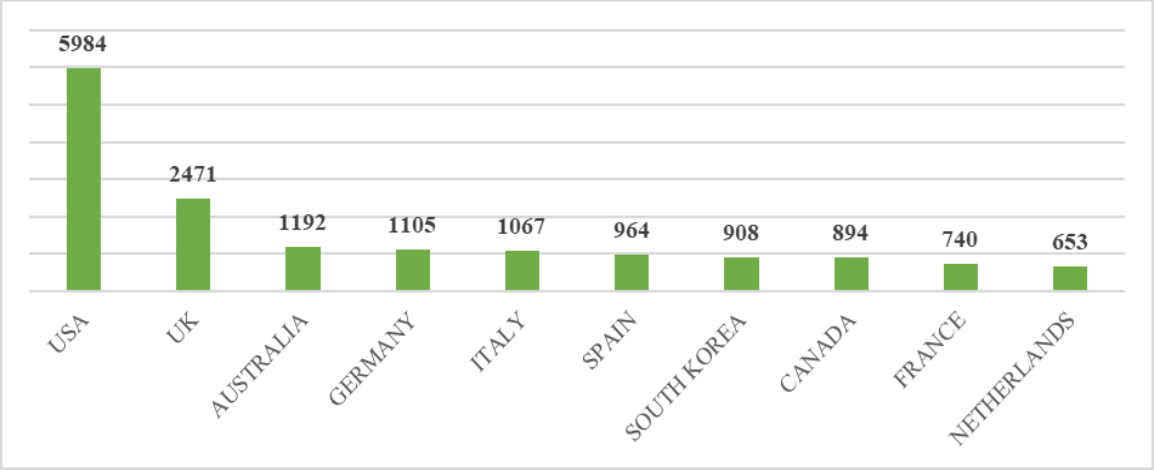


Figure 3. The top 10 developed countries in Scopus

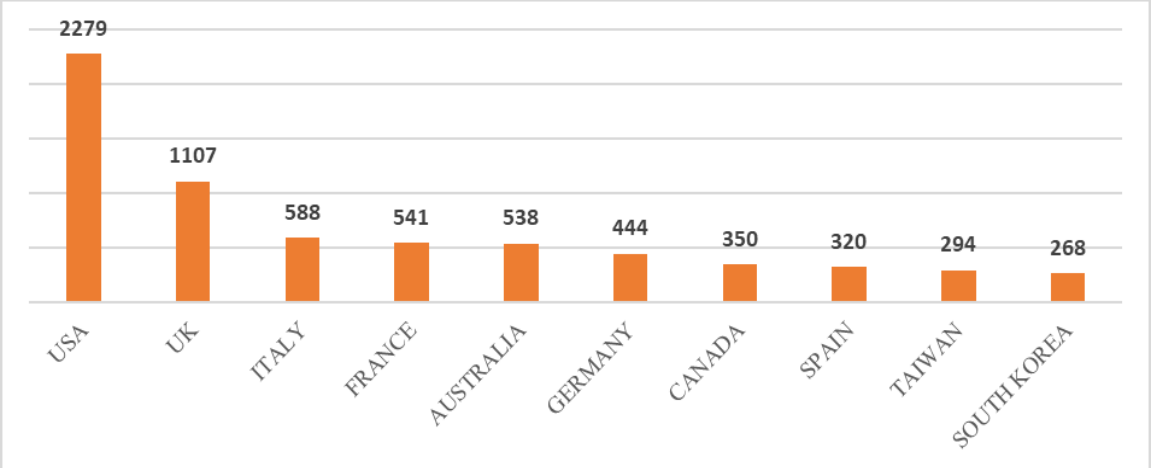


Figure 4. The top 10 developed countries in WoS

On the contrary, France has a higher rank of Scopus than that of WoS. This puts Australia in the third position in Scopus ranking and fifth in WoS World rankings reflecting his great effort in the global research activities. South Korea also appeared in both lists and other Asian nations, and again South Korea was well positioned in Scopus. Taiwan's name appears in the top ten according to the WoS, while it is absent in Scopus. This probably means that some of the databases have different coverage or different areas of interest. Canada, too, makes a large contribution. The Netherlands, however, performs very well on Scopus compared to WoS rankings which imply variation in research covered or areas of the journals.

Figures 5 and 6 show the distribution of articles from developing countries in Scopus and WoS databases on Big Data in business, offering insights into their research dynamics. China and India lead, with China's publications comprising over 62 % in Scopus and 64 % in WoS and India contributing more than 16 % in both databases (Aboelmaged & Mouakket, 2020; Chavez et al., 2022; El-Alfy & Mohammed, 2020). This highlights significant research advancements in these nations. Russia, Brazil, and Iran also show substantial research output, reflecting their growing research capabilities. Differences in database rankings may stem from regional coverage variations or indexing preferences. Including countries from Southeast Asia (Indonesia), the Middle East (Iran, Pakistan, Jordan), Africa (South Africa, Morocco), and Latin America (Brazil, Mexico) underscores the global diversity in research contributors. Figures 7 and 8 show the distribution and collaboration of countries in WoS and Scopus using VOSviewer.

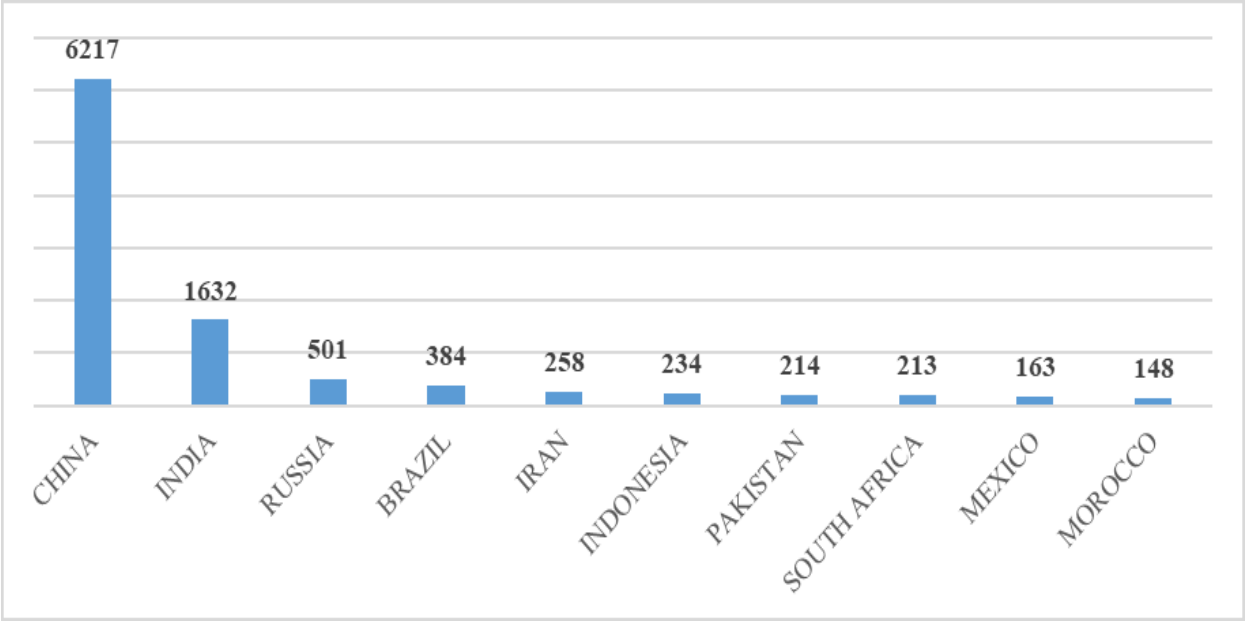


Figure 5. The Top 10 Developing Countries in Scopus

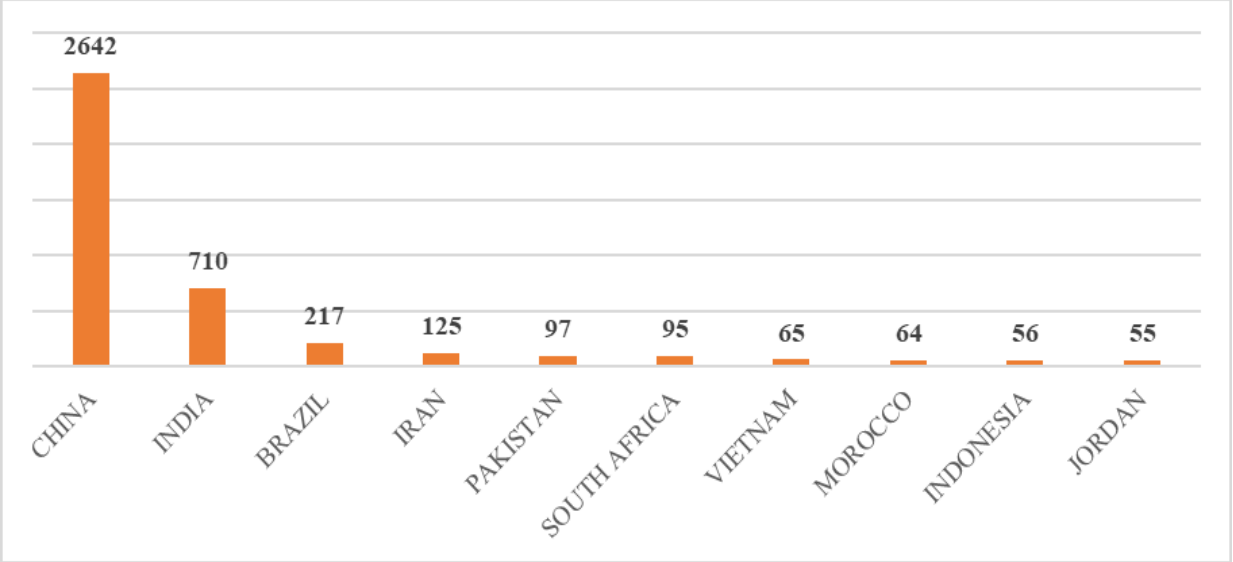


Figure 6. The top 10 developing countries in WoS

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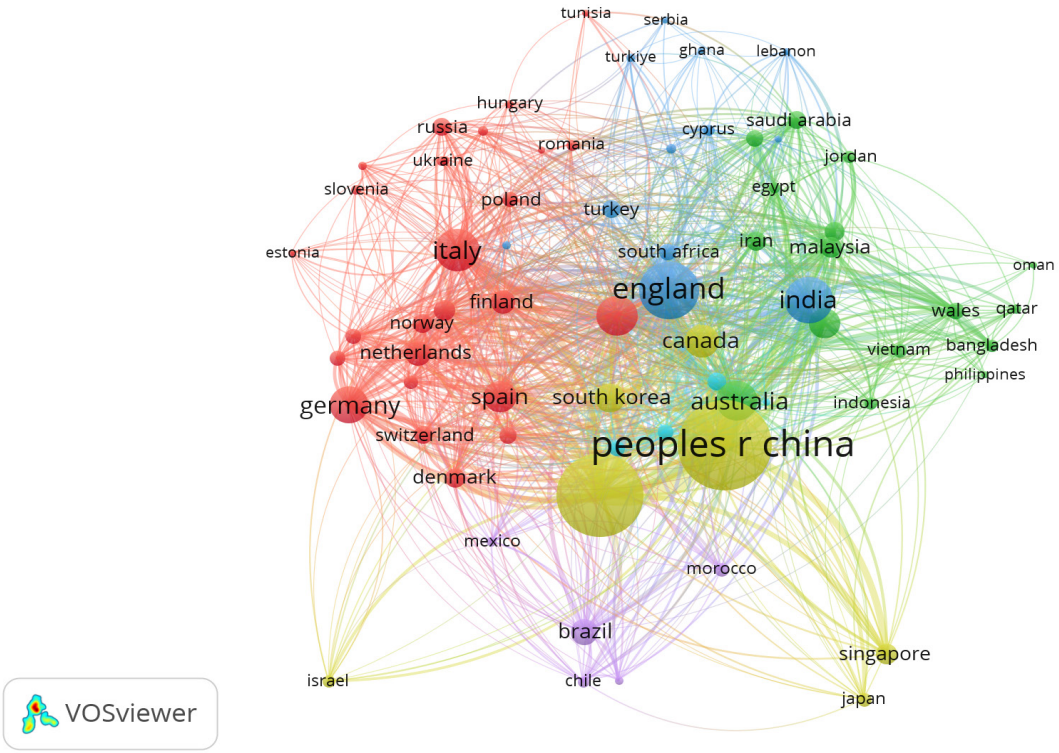

Figure 7. WOS distribution and collaboration of countries

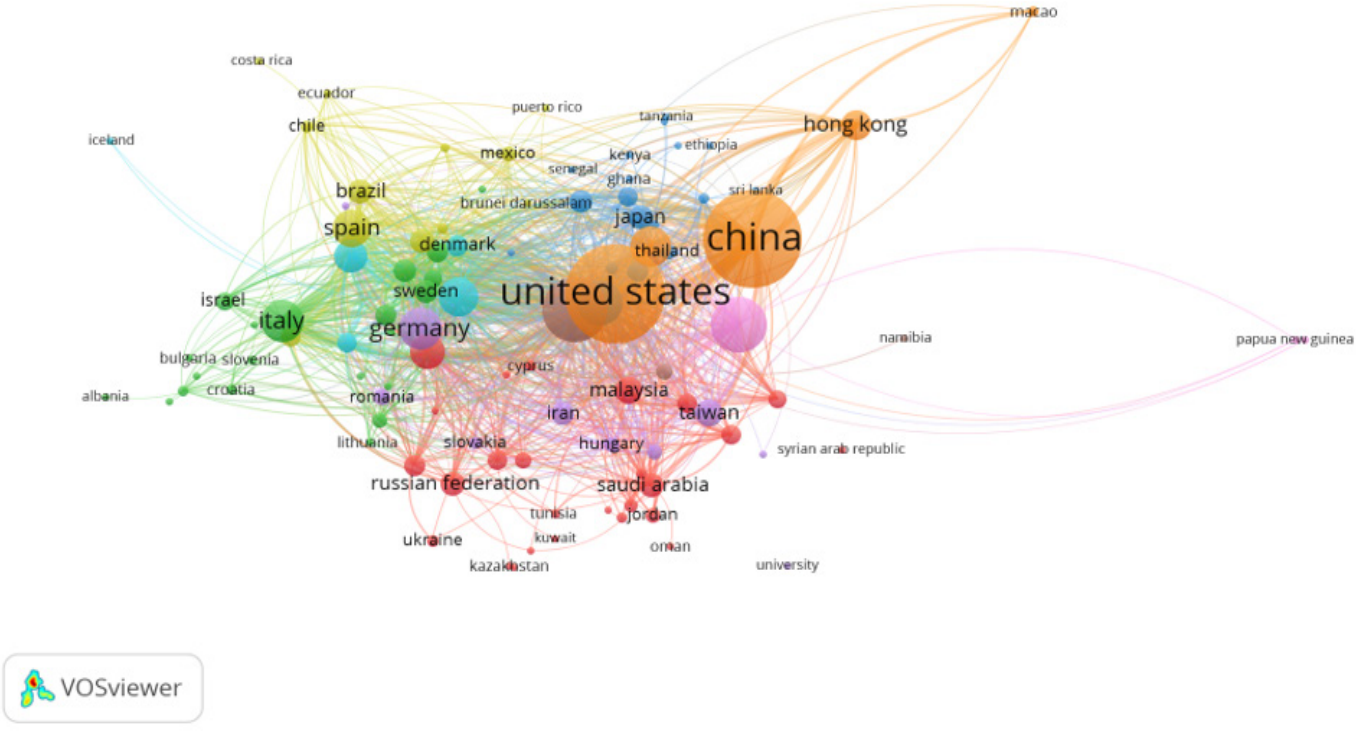

Figure 8. The cooperation and distribution of nations in Scopus

The discussion brings out the argument that some countries, both developed and emerging, have a concentrated body of scholarly work which in terms of Big Data research output creates an imbalance. Such inequality could be due to a lack of equity in available resources, inclusive of infrastructure or government backing for research work. Ranked positions of various nations within Scopus and WoS show discrepancies that point out the insufficiency of the scope purposed by only one bibliometric database causing. It also explores this data and reveals that in various domains, the leading articles originate from affluent regions, indicating improved research capabilities, additional sources of finances, and a wider range of outlets for publishing papers (Rassenfosse & Seliger, 2019).

However, even if that's the case some patterns emerging from excessive dependence of developing countries on research activities that are solely dependent on government funding and therefore budget troubled (Gonzalez-Brambila et al., 2016).

The Distribution of Disciplines

Employing WoS and Scopus graphical techniques, interesting orientations may be observed in the diffusion of Big Data research in the context of business. Figure 9 describes the volume of publications on Big Data about other fields of study across the business sector in mid and high-income countries as per the data from the Scopus database. Notably, developed countries have published considerably more articles (8887) in the field of social sciences than developing countries (3930), suggesting a more robust level of research activity or greater access to publishing opportunities in the social sciences within these more affluent nations. Similarly, in the environmental science discipline, developed countries lead with 3238 articles to developing countries' 2658, indicating a somewhat lesser but still significant disparity that highlights the importance of environmental research in developing regions. The pattern of developed countries leading in publication counts persists across various disciplines, with nearly twice as many articles in business, management, and accounting (4851) compared to developing countries (2576).

In decision sciences, the divide is even more pronounced, with developed countries publishing 4114 articles against developing countries' 2081, underscoring a pronounced focus on this area within the research ecosystem of more developed nations. Interestingly, the energy discipline is an exception, where developing countries have published more articles (1902) than their developed counterparts (1684). This reversal may highlight the prioritization of energy research in developing countries, likely driven by their critical energy challenges. In the realm of economics, econometrics, and finance, the trend of developed countries leading in publication volume continues, with 1661 articles compared to 676 from developing countries. This consistency across disciplines reinforces the overall pattern of developed nations dominating the research landscape in these fields.

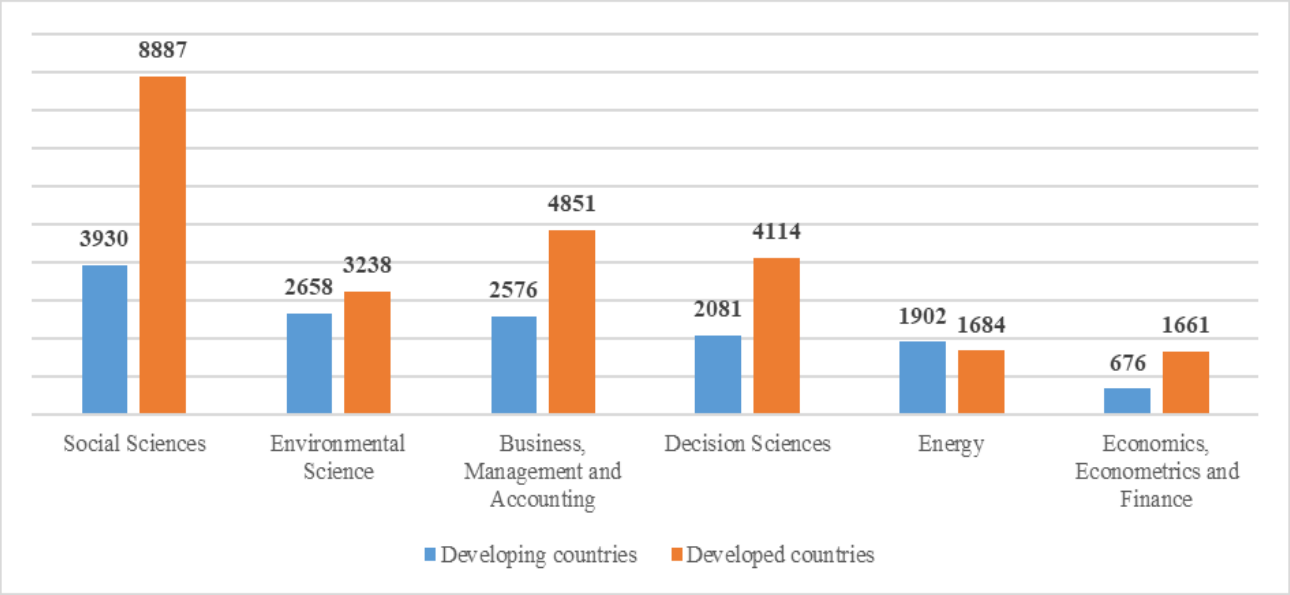

Figure 9. The distribution of categories in the Scopus database

Figure 10 compares Big Data research publications within business-related fields, contrasting the outputs from developed and developing countries based on the WoS database. Developed countries significantly outpace their developing counterparts in the management discipline, publishing almost twice as many articles (2809 compared to 1557), highlighting a more substantial research output in management related to Big Data in these more affluent regions. Similarly, in the business discipline, developed countries more than doubled the publications of developing countries (2187 to 1025), indicating a pronounced research interest and capacity in Big Data business studies within developed nations. This finding aligns with observations by (D. Cetindamar et al., 2019), who noted an increasing preference and emphasis on business and management research methodologies in academic inquiries.

However, the disparity narrows in the operations research and management science disciplines, where developed countries have published 2060 articles against 1792 from developing countries. This smaller gap suggests a relatively stronger engagement or interest from developing countries in these areas, particularly concerning Big Data. Consistent with the broader pattern, the business finance discipline also sees developed countries leading in research output, publishing nearly twice as many articles (749 to 393) as their developing counterparts. This trend underscores the overall dominance of developed countries in Big Data research across various business sectors.

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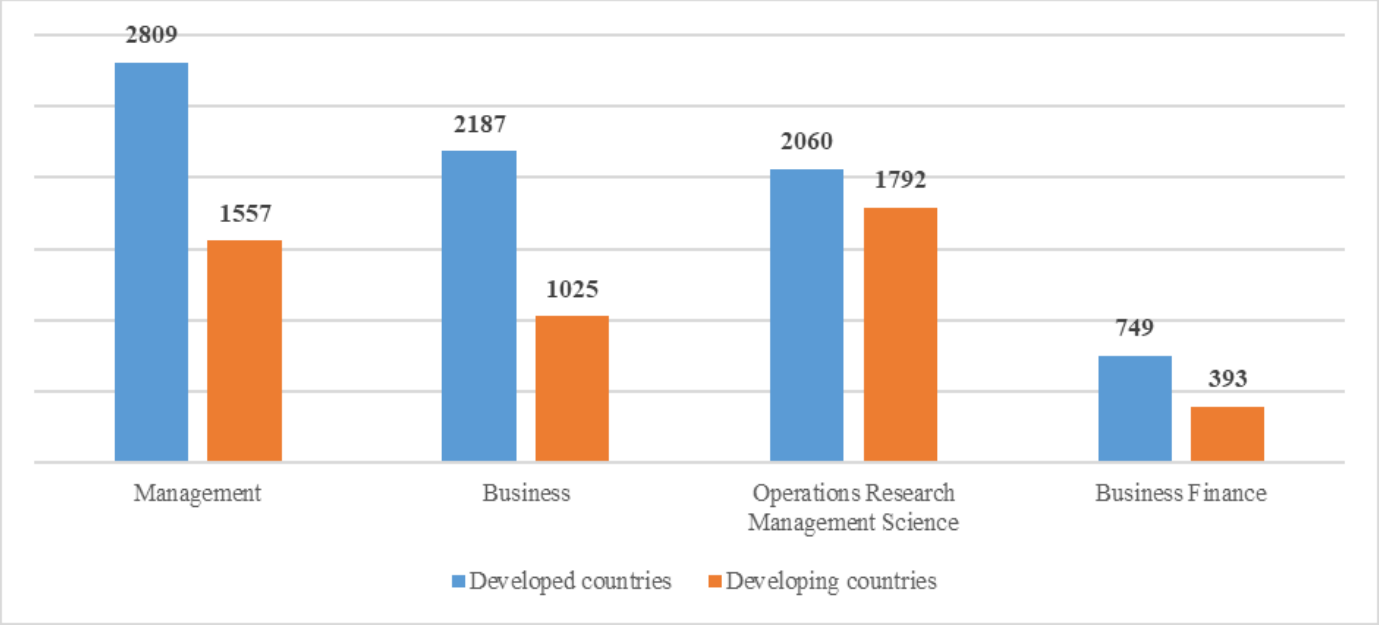

Figure 10. The distribution of categories in the WoS database

The Research Hotspots of Big Data in Business

Keywords' Co-Occurrence

Keywords are essential for condensing and generalizing article content, serving as crucial tools for bibliometric analysis (Sun et al., 2020) and effectively revealing trends within fields (Khan & Wood, 2015). By examining shifts in keyword frequency, researchers can track thematic hotspots and developments over time. Table 3 displays the top 10 keywords by co-occurrence frequency from the Scopus and WoS databases, highlighting the most researched topics. Both Scopus and WoS show a high presence of "Big Data, " demonstrating its relevance in current research. According to the percentages, Scopus has it at 41,4 % while WoS is at 31,5 %. Additionally, 'Machine Learning' is highly ranked with a rate of 9,8 % in Scopus and 8,1 % in WOS, which means it also plays a crucial role in modern data analysis.

Other common words that appear in both lists are 'Artificial Intelligence,' 'Big Data Analytics' and 'Data Science,' this further reflects their synthesis and significant function in the study of complex data systems. Both databases target some verticals like Deep Learning, Social- Media, COVID-19, Internet of Things (IoT), Data Mining, and Sustainability among other keywords that consist of some data sets appearing on the list but in varying orders that seek to show elements of current and active research that has aspects of many technical and social factors. However, both databases have been targeted in the same area in particular on Big Data and its computational technology suggesting that they are also playing a crucial role in forming the current research environment (Kalantari et al., 2017; Lafuente-Lechuga et al., 2021; Lundberg, 2023; J. Z. Zhang et al., 2021). Figures 11 and 12 demonstrate the keyword co-occurrence of WoS and Scopus databases.

Table 3. Co-occurrence frequency of the top 10 keywords in Scopus.

Scopus				WoS			
No.	**Keywords**	**Count**	**% of (16 142)**	**No.**	**Keywords**	**Count**	**% of (5 627)**
1	Big Data	6676	41,4	1	Big Data	1771	31,5
2	Machine Learning	1581	9,8	2	Machine Learning	456	8,1
3	Data Science	970	6	3	Big Data Analytics	432	7,7
4	Artificial Intelligence	949	5,9	4	Artificial Intelligence	365	6,5
5	Big Data Analytics	856	5,3	5	Industry 4	275	4,9
6	Deep Learning	572	3,5	6	Social Media	219	3,9
7	Social Media	507	3,1	7	Data Analytics	196	3,5
8	COVID-19	436	2,7	8	Digital Transformation	172	3,1
9	Internet of Things	406	2,5	9	Data Science	164	2,9
10	Data Mining	387	2,4	10	COVID-19	155	2,8

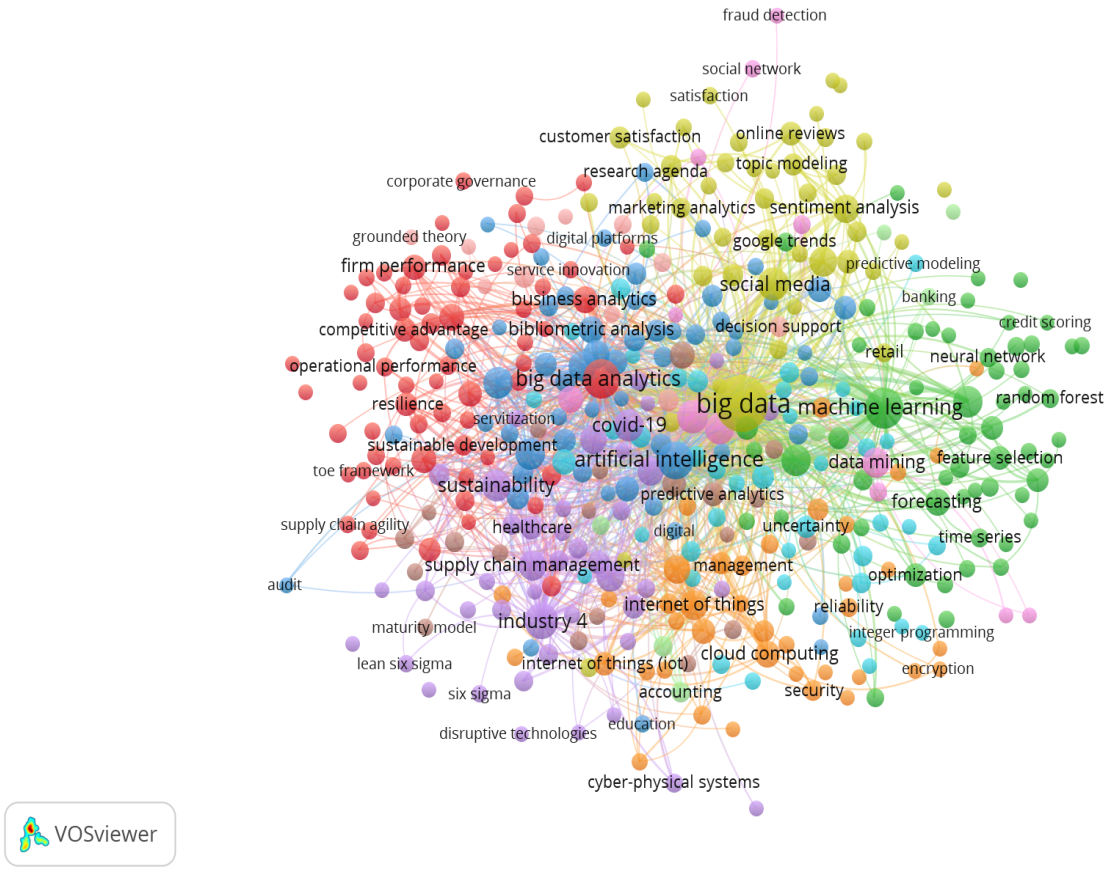

Figure 11. Keyword Co-occurrence in WoS

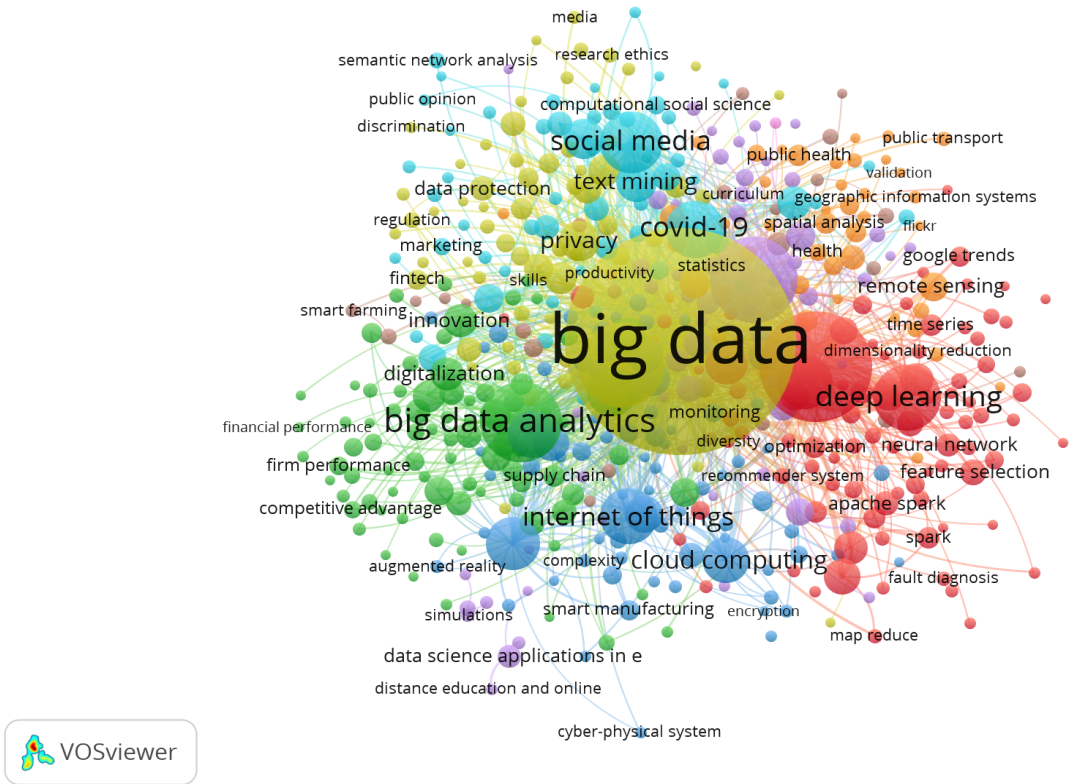

Figure 12. Keyword Co-occurrence in Scopus

https://doi.org/10.56294/dm2025536

The Evolution Trend of Big Data in Business

The studies available within Scopus and WoS databases and performed in the fields of Machine Learning, Big Data, Data Science, and Artificial Intelligence indicate the preparation of internet-based intelligent data processing systems. Further research includes Big Data Analytics, Deep Learning as well as Internet of Things suggesting technological diversity. Social Media and global issues like COVID-19 are also significant topics. WoS similarly emphasizes Big Data and Machine Learning, focusing on Big Data Analytics and Digital Transformation. Industry 4.0, data analytics, and digitalization apply technology in industrial and digital contexts. Sustainability and Supply Chain Management integrate technological advances with sustainable practices. Scopus emphasizes foundational technologies, while WoS emphasizes applied technologies and industrial integration, showcasing robust research into technological advancements and practical applications.

The research underscores the critical impact of digital technologies on business operations, enhancing stakeholder engagements and enabling solutions within complex innovation processes (Dilek Cetindamar & Phaal, 2023). Machine learning continually evolves learning processes, while AI integrates data and algorithms, addressing problem-solving tasks and fostering open innovation (Verganti et al., 2020). Organizations must adapt through digital transformation, leveraging Big Data to update value creation, business models, and organizational structures (Dilek Cetindamar & Phaal, 2023). Big Data analytics (BDA) crucially develops AI and business intelligence, enhancing digital products and services (Loebbecke & Picot, 2015).

The IoT and BDA significantly boost organizational performance, enhancing productivity and efficiency (Du et al., 2022). Industry 4.0 is associated with such concepts as Big Data, IoT, and AI and these mark a big leap in the Fourth industrial revolution (Kipper et al., 2020). In that regard, digital transformation is likely to change how salespeople will sell, with the support of technology (Fischer et al., 2023). While every financial failure is a loss of business opportunity, successful digital transformation means increased innovation, better customer experience, lower costs, and better business performance as a whole (Bouarar et al., 2022). It is important to realize that Big Data has a pivotal role when it comes to finding ways in which something interesting and useful can be created (Delias & Kitsios, 2023). That said, adequate levels of cybersecurity should be taken to prevent any breaches associated with Big Data, IoT, and AI which would compromise the integrity of data and confidence in the client. The consideration of cybersecurity issues at the early stages of technological development is not only recommended but also necessary in the establishment of a safe cyberspace.

Limitations

Although achieving our goal required the analysis of both databases (WoS and Scopus) to reduce bias induced by the usage of one database only, the important point that must be delineated is that the outcomes outlined in this paper rest mainly on only these two databases restricted to clearly defined periods. Further comparison of these databases should be done for longer periods so that more constraints can be reduced. How resolving duplicate articles that exist in both the WoS and Scopus databases could have worked out had been analyzed. Given the scope of the methodology used and time resources, it was difficult to remove the duplicates. This will assist future researchers to come up with ways in which the problem can be dealt with, thus improving the quality of bibliometric analyses.

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