big data and cognitive computing

MDPI

Article

Big Data Analytics Applications in Information Management Driving Operational Efficiencies and Decision-Making: Mapping the Field of Knowledge with Bibliometric Analysis Using R

Konstantina Ragazou [1,2,*], Ioannis Passas [3], Alexandros Garefalakis [2,3], Emilios Galariotis [4] and Constantin Zopounidis [4,5]

[1] Department of Accounting and Finance, University of Western Macedonia, GR50100 Kozani, Greece
[2] Department of Business Administration, Neapolis University Pafos, Pafos 8042, Cyprus
[3] Department of Business Administration and Tourism, Hellenic Mediterranean University, GR71410 Heraklion, Greece
[4] Department of Finance, Audencia Business School, 44300 Nantes, France
[5] The Financial Engineering Laboratory, Technical University of Crete, GR73100 Chania, Greece
* Correspondence: koragazo@uth.gr

Abstract: Organizations may examine both past and present data with the aid of information management, giving them access to all the knowledge they need to make sound strategic choices. For the majority of contemporary enterprises, using data to make relevant, valid, and timely choices has become a must for success. The volume and format of data have changed significantly over the past few years as a result of the development of new technologies and applications, but there are also impressive possibilities for their analysis and processing. This study offers a bibliometric analysis of 650 publications written by 1977 academics on the use of information management and big data analytics. The Bibliometrix function in the R package and VOSviewer program were used to obtain the bibliographic data from the Scopus database and to analyze it. Based on citation analysis criteria, the top research journals, authors, and organizations were identified. The cooperation network at the author level reveals the connections between academics throughout the world, and Multiple Correspondence Analysis (MCA) identifies the research holes in the area. The recommendations for further study are influenced by the findings.

Keywords: agile management; business model; data analytics; decision-making; efficiency; information management; operational performance; SMEs

Citation: Ragazou, K.; Passas, I.; Garefalakis, A.; Galariotis, E.; Zopounidis, C. Big Data Analytics Applications in Information Management Driving Operational Efficiencies and Decision-Making: Mapping the Field of Knowledge with Bibliometric Analysis Using R. *Big Data Cogn. Comput.* **2023**, *7*, 13. https://doi.org/10.3390/bdcc7010013

Academic Editor: Domenico Ursino

Received: 18 October 2022
Revised: 7 January 2023
Accepted: 10 January 2023
Published: 12 January 2023

1. Introduction

The corporate climate might be characterized as sumptuous in terms of novel prospects and chances, as well as challenges brought on by the recent COVID-19 crisis. The modernization of administrative procedures and the enhancement of decision-making processes have been essential for businesses to properly address these new issues [1–3]. Thorough insights into the environment, the business, and the timely implementation of crucial information are prerequisites for making better judgments; however, many academics throughout the world concur that one of an organization's most significant assets is information. The aforementioned explains why information management (IM) has lately been the focus of attention in the corporate sector [4,5].

Information management (IM) is a strategy used by organizations to maximize the efficiency with which they plan, gather, organize, use, control, store, distribute, and dispose of their information. It also ensures that the information's value is recognized and fully used [6]. Additionally, IM allows a company to learn, assess circumstances and events, forecast trends and upcoming occurrences, and innovate [7]. The gathered data is converted

into knowledge that the administrative team uses to take suitable actions, enabling the development and successful completion of business objectives. Systems used by IM are specialized data systems that offer reliable information. The data used to create the information is qualitative and aggregated, and it is analyzed using software. The capabilities of these systems, which enable speedier information access, simpler system querying and report creation, enhanced data analysis, and improved data quality, are responsible for the improvement in information quality [7].

The services that may be offered that are connected to information management are changing as a result of advances in software and modern technology. Since improper data organization will undoubtedly result in higher costs and inadequate business alignment, the overall architecture and organizing principles are more crucial. In the last several years, there has been a great increase in the use of big data and analytical technologies as firms have brought more data under management and done more with that data through analytical discovery. Big data is a phrase typically used to describe data sets that are too big to be efficiently acquired, managed, and handled by widely used software solutions. A new class of technologies and techniques to address it have emerged as a result of the sheer bulk of the data, complexity of analysis, and economic necessity to produce value from it [8–10]. Descriptive, predictive, and prescriptive analytical techniques, as well as data-mining technologies, have become well-known in business analytics along with advancements in data creation and administration. As a result, the variety of applications used by enterprises to handle their information positively enhances operational effectiveness and productivity [11].

Business operations at several levels, including supply chain management, risk management, product management, and financial controls, can be facilitated by IM and big data. When applied to the supply chain, for instance, IM and big data techniques can offer data on inventory levels and costs difficulties at various points throughout the chain. Customer satisfaction is assured, and the proper administration of revenues and costs is carried out [12]. Moreover, all the actions that organizations make entail some level of risk, therefore IM can offer the tools that allow for a better assessment of these risks by analyzing past data and developing customer "risk profiles" against which to analyze potential new clients. According to the logic of product management, one of the main goals of businesses in the product manufacturing industry is to cut production times so that their products can keep up with consumer demand. Profits quickly grow as a result of doing this. At this stage, IM and big data provide precise and prompt feedback on the degree of the product-related decisions' success. Financial controls are also crucial for a corporation, to summarize [13]. In order to increase profit margins and decrease expenses, IM and big data might be used. The quantity of items, customers, and geographical regions that are lucrative for the firm are identified using extensive information about every aspect of corporate operations. All things considered, the aforementioned benefits of IM may guarantee firms a simple boost in their productivity and operational effectiveness.

Nevertheless, none of the academics, scholars, or practitioners have applied a bibliometric analysis in the context of the investigation of the relationship between big data analytics and management phenomena, specifically information management and the decision-making process. Only the contribution of big data analytics to the transition of businesses to big data analytics and firm resources, capabilities, and performance has been briefly discussed in the scientific article, entitled "A bibliometric analysis of research on big data analytics for business and management" by Ardito et al. The above research paper was one of the first attempts to comprehend the research streams which, over time, have paved the way to the intersection between big data analytics and management fields [14]. Therefore, the goal of this study was to demonstrate, for the first time through bibliometric analysis, how the incorporation of big data analytics has changed the academic field of information management in the digital era. Simply, this study aims to illustrate how information management has changed as a result of the incorporation of big data analytics and to demonstrate how these two concepts—information management and big data

analytics—help businesses become more operationally efficient and improve their decision-making processes [4]. The investigation of information management and big data analytics as a self-sufficient research topic and the presentation of the key journals, organizations, and authors in the field under study were conducted using a six-step methodological approach that is based on bibliometric analysis. The results of the bibliometric analysis aid in mapping the theoretical underpinnings of the subject area and suggest potential directions for future study. Additionally, bibliometric analysis demonstrated the global network of author collaboration while outlining and examining the research clusters that have evolved in the field under study. Additionally, as was already noted, the last phase involved integrating the results and moving forward with suggestions for additional research. As previously noted, 650 articles' worth of bibliographic information were taken from the Scopus database from the years 2013 to 2022 and examined using the Bibliometrix function in the R package and the VOSviewer program.

The rest of this study is organized as follows. The review of the literature is presented in Section 2. The materials and methods used are described in Section 3. The bibliometric analysis and results are presented in Section 4, and the discussion of the results, a list of restrictions, suggestions for further study, and a conclusion are all presented in Section 5.

2. Big Data Analytics and Information Management for Operational Effectiveness and Decision-Making

We are currently living in cutting-edge information ecosystems built on big data. Organizations are searching for ways to efficiently collect and analyze information to provide valuable information for better information management. Information is key in computer science, management, accounting, and decision sciences. Information can refer to "any news that is transferred from one system to another or describing what happened or did not happen or used as a tool for the investigation of a phenomenon or a set of phenomena" [15,16]. Creating information begins with collecting facts and primary data. Subsequently, these data are processed and analyzed appropriately and used in decision-making and problem-solving [15]. A dynamic business model used by companies in the last decade for information management, especially in the accounting field, is that of the Accounting Information System (AIS) [17]. The AIS, like all information systems, registers, collects, stores, and processes data of accounting interest to provide information to the executives of businesses and proceed to a rational decision-making process. The complex information from a quantity and value invoice that indicates an accounting event is transformed by the AIS into information and knowledge that will be processed and reproduced to spread messages that can ensure the viability of the business [18]. The functions of AIS are: (i) the transformation of data into information such as the classification, calculation, grouping, and comparison of data in order to provide appropriate and valuable information to the executives of the company, as well as third parties who are interested in it, (ii) the promotion and reliability of necessary controls in order to protect the company's assets from risks and external threats, and (iii) the accuracy and control of information [19].

Moreover, Enterprise Resource Planning (ERP) systems are integrated information systems that aim to support all business activities [20]. These systems integrate all the important activities of the business as well as all the processes in a central control system, providing an overall picture of the operation of the business. In the 1970s, we saw the emergence of Material Requirement Planning (MRP) systems based on the concept of planning production. In the following decade, MRP systems which included other functions such as production and distribution were developed. The integration they incorporated made them particularly attractive to other functions and thus gradually spread their influence into finance, human resources, and project management. MRP II, therefore, gradually evolved into ERP systems [21,22]. The utility and power of ERP systems lie beyond the functional limits of MRP II. Today ERP systems play an important role in supporting business activities as they automate business operations and unify business processes through

a common database. The flow of an ERP system consists of functional programs (functional modules), allowing the company to install only those it deems necessary. An ERP system provides the ability to support and organize information related to the following business activities: (i) finance and accounting, (ii) management, (iii) human resources, (iv) production planning, (v) workflow management, (vi) inventory and materials management, and (vii) purchasing management [23].

The Paris Industrial Exhibition in 1801 is where the history of information management can be found. Punch cards were invented there by Joseph Marie Charles Jacquard. These cards, which were used in weaving machines to create detailed patterns in cloth, were comparable to the punch cards used by computers for most of the 20th century. The origins of management information systems might be disputed, even though the history of IM can be broken down into five distinct periods (Figure 1).

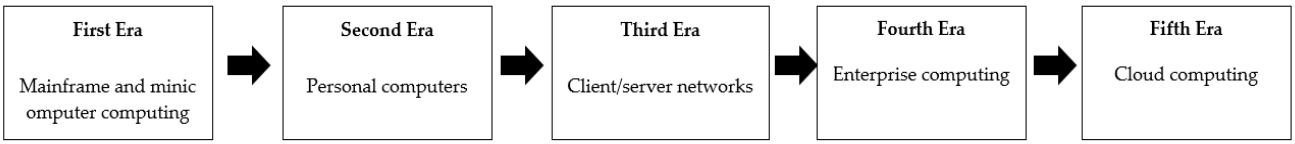

Figure 1. Timeline of information management.

However, recent studies have received a lot of traction to help businesses navigate the numerous organizational and technological opportunities and difficulties that come with using big data analytics (BDA) and information management (Figure 2). BDA, often described as a firm's capacity to handle, process, and analyze big data, is becoming a popular topic among academics and in information management. The benefits of BDA within organizations are being highlighted in a rapidly growing body of literature. For instance, Hagel (2015) demonstrated how BDA is rapidly becoming an important part of decision-making processes in many types of enterprises, as a part of a new proactive and forward-looking attitude [24]. The value that may be derived from data, though, partly depends on the effectiveness of the many procedures used to gather and analyze the data. Numerous participants from various disciplines, as well as various procedures and techniques, are frequently needed for this [25,26]. Managers must coordinate the organizational culture and competencies already in place throughout the whole organization in order to fully benefit from big data. The primary difficulty in utilizing big data, according to Barton and Court (2012), is ensuring that all employees can trust and comprehend it [27]. They served as an example of how front-line workers in the retail sector were hesitant to embrace big data because they either did not rely on a big-data-based model or were unable to comprehend how it worked. Shah et al. (2012), for instance, stated that business analytics knowledge is still restricted to the "expert" level and has not yet been shared throughout organizations [28]. Although, in order to maximize the benefits of using big data, it is imperative that all levels of employees are knowledgeable about big data, which can be achieved through training. Without the ability of staff members at all levels to comprehend and use data in their decision-making, the return on investment in big data will not materialize.

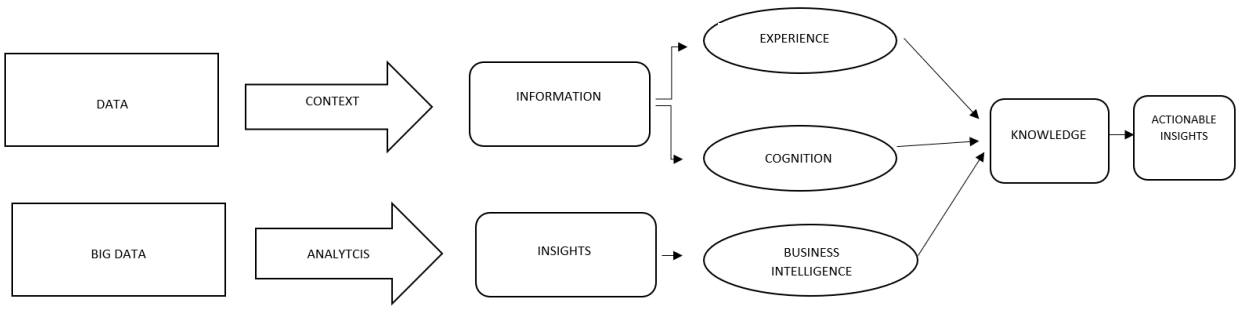

Figure 2. The convergence of information management and big data analytics.

Consequently, the new decision-making process brought about by big data analysis results in a shift in how choices are made and by whom. It made sense to delegate the task to well-positioned individuals up until this point, without taking into account the information provided by big data, because these individuals typically base their decisions on patterns and relationships they have noticed, as well as experience they have gained through their careers. The decision-maker and the so-called highest-paid person's opinions will lose value as a result of the shift brought on by big data because of its analytical knowledge [29]. In essence, managers may focus on more successful interventions in areas where gut instinct and intuition have previously reigned rather than facts and rigor. By developing the habit of asking, "What do the data say?" executive managers may make decisions based on big data. Despite this, some researchers believe that just two in three corporate executives have confidence in the data they use to make choices. Therefore, "if information is not of adequate quality by the time it has been merged with other data and information, a spurious correlation might result in the company making an inaccurate interpretation of a business opportunity" [25,30].

Moreover, according to Yiu (2012), BDA enables more inventive methods to organize, learn, and develop as well as better data-driven decision-making. This leads to better management of various company operations, such as CRM, operational risks, and production efficiency, which improves performance. Information management (IM) and resource-based view (RBV) research from the past have demonstrated that an organization's capacity to process information has a favorable impact on company performance, such as improved profitability or return on investment [31]. Organizational capacities may comprise practices and skills for converting knowledge inputs into more valuable outputs. The capacity of an organization to gather, prepare, and analyze massive data might therefore make a difference, especially if the organization makes these procedures challenging to mimic due to quirks or route dependence effects. Businesses should integrate and utilize a variety of firm-level resources and competencies in order to gain a competitive edge. Big data is not enough in this scenario to develop BDA skills [32]. Therefore, in order to develop these superior, uncommon, and difficult-to-imitate capabilities, a complex interrelationship between various financial, human, physical, and organizational resources is necessary. This leads to better performances, such as improved customer retention or return on investment, as well as an increase in sales growth and profitability.

Finally, information management may be set up and managed to improve the performance of the organization through efficient action. The three recognized primary IM processes are information gathering, conversion, and application. Information conversion refers to making the gathered information valuable for the organization by arranging it or turning it into explicit information. Information acquisition is the procedure utilized to produce new knowledge from the received data [33]. Accordingly, IM encompasses the company's procedures for gathering new information, transforming it into a form that can be used and easily accessed, and using this information throughout the organization to affect firm performance. In order to increase customer happiness, market share, and financial success, businesses can use information management (IM) techniques to efficiently collect, store, and transmit information [34].

3. Materials and Methods

As it enables them to manage huge amounts of data and provide a high level of research impact, bibliometric analysis is a widely accepted study approach among academics and researchers throughout the world. Using a set of criteria to examine and classify the articles, this approach seeks to categorize the published materials in a study field [35]. With regard to the current study, we based our analysis on Bibliometrix, which provides all the resources necessary to carry out a comprehensive bibliometric analysis in accordance with the Science Mapping Workflow. Its reputation is founded on a number of attributes, such as the creation, availability, and use of a large number of bibliometric tools included in the R package, a computer language used for statistical computation and graphics. The R

package and its software-based bibliometric application, Biblioshiny, were both utilized. Acquiring the data from the Scopus bibliographic database was the initial stage in the R process. The data was then uploaded into R studio, which is the R environment that aids in performing the analysis on the study topic and exporting dynamic graphics [35–37].

3.1. Bibliometric Analysis Method

The research issue for the current study was addressed using a six-step bibliometric methodological approach (Figure 3). The information gathered through a thorough literature study is referred to as Step 1. Step 2 is divided into two sections: the first (2a) focuses on a thorough evaluation of the field through bibliometric citation analysis, and the second (2b) presents a network analysis to identify the research trends of the publications of the most influential journals, research works, institutions, and authors, with the goal of highlighting the network of collaboration between scholars around the world. Content analysis is demonstrated in Step 3, while bibliographic coupling analysis is presented in Step 4. Moreover, cluster analysis is illustrated in Step 5 and combines MCA and factorial analysis. Finally, the results and potential future study areas are presented and discussed in Step 6.

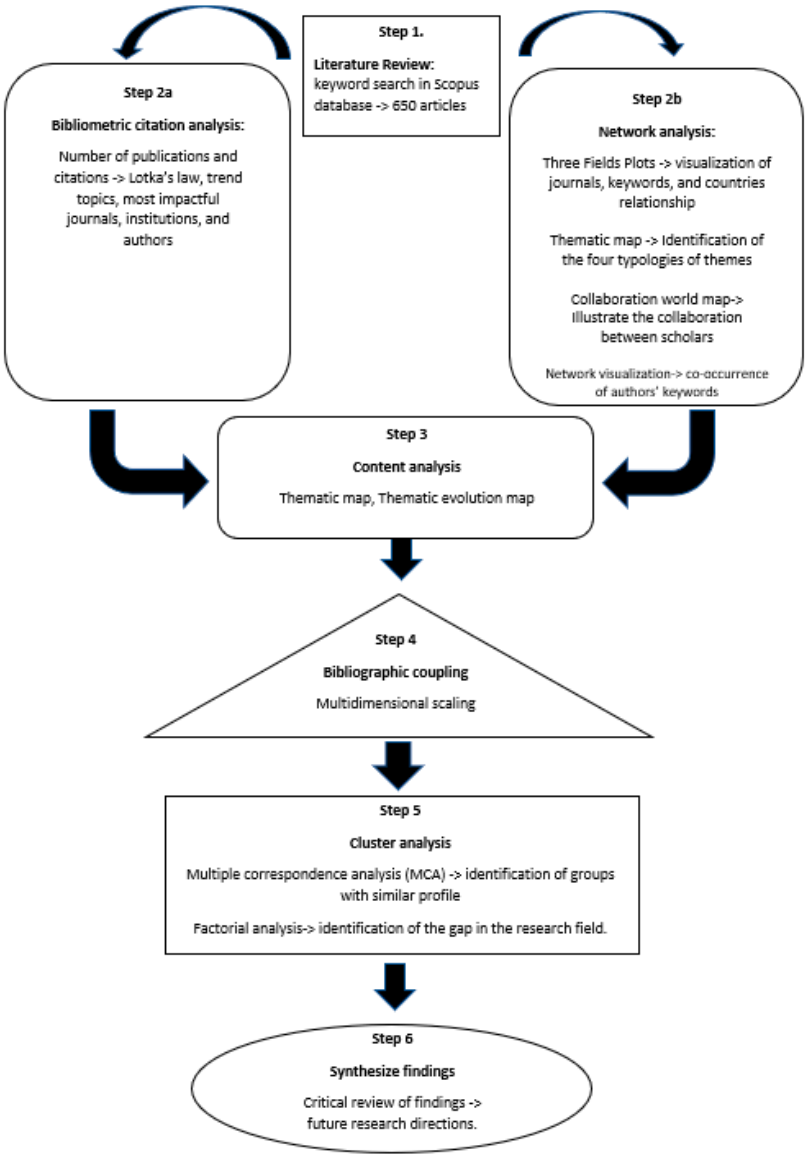

Figure 3. Methodological workflow for bibliometric analysis.

In order to: (i) test Lotka's law; (ii) illustrate an overview of the research trends; (iii) find the most pertinent journals and articles, as well as the most influential authors globally; (iv) illustrate the thematic map; and (v) develop the collaboration world map, various bibliometric citation analysis measures were applied after retrieving the bibliographic data of 650 articles from the Scopus database [38]. Authors' frequency of publishing in the scientific literature is described by Lotka's law. Its main premise is that, while a sizable portion of authors only create one article, very few authors are very productive in any given topic area. According to Lotka's law, the number of authors who publish x number of articles is approximately $1/x^b$ of those who publish only one article [39,40]. Thus, a high b value highlights a higher degree of concentration of authors, and a low value indicates the absence of a specific group of authors in a particular scientific discipline. The general formula of Lotka's law is the following:

$$x^n * y = c \quad (1)$$

where c: a constant term,

y: relative frequency of authors with frequency x number of articles,
n: illustrates an exponent that is a constant for a given set of data,
x: indicates the number of the published articles.

In addition to Lotka's law, a three-fields-plot based on a Sankey diagram has been developed and helped to illustrate the relationships between journals, keywords, and nations. Additionally, the underpinning research cluster was investigated, and a map of current research trends was created using the bibliographic coupling technique. The method of Multiple Correspondence Analysis (MCA), the major objective of which was to examine the bibliographic data and combine it into a collection of components, was finally implemented. Using this technique, authors may emphasize the research gap in a particular scientific field and summarize the bibliographic data.

3.2. Data Extraction

The well-known database Scopus served as the basis for this study's data collection for the bibliometric analysis. Elsevier established the Scopus database in 2004. It serves as a multidisciplinary repository for reports. It is one of the biggest "peer-reviewed" databases in the world, including more than 24,000 active academic journal titles on a variety of subjects with a high level of research interest, including life, social, and health sciences. More than 230,000 book titles and more than 10,000,000 conference papers are also included in Scopus [37,41]. Scopus has the fewest "inconsistencies" in content verification and quality compared to other academic-research databases (like Google Scholar or Web of Science). Accurate information is available through Web of Science and Google Scholar; however, they include double copies of certain citations, even triple copies in some situations. As a result, the same information can appear in a large number of reports, which results in erroneous statistics. Additionally, Scopus offers its customers access to online bibliometric analysis tools for their publications, including the h-index calculation and statistical analysis tools like frequency charts of publications over time and more.

While the key-word search is shown and thoroughly explained in Table 1, the bibliographic data were retrieved from Scopus in May 2022. In Step 10, a final keyword with four parts emerged. Big-data-analytics-related articles are contained in the first portion ("big data analytics" OR "big data" OR "data analytics"). The second portion ("information management") discusses big data analytics' important role in revolutionizing the information management industry. The third part of the formula ("operational performance" OR "operational productivity" OR "efficiency" OR "productivity") demonstrates the contribution of the transformation of information management with the use of big data analytics to the enhancement of operational performance. The fourth and final element of the Boolean function, "decision-making process", highlights the close connection between operational effectiveness, contemporary information management based on big data analytics, and the

decision-making process. Thus, 650 papers were still available after research purification for evaluation and bibliometric analysis. Only articles were included in the chosen papers, hence all other document types have been disregarded (i.e., conference paper, review, book, book chapter, editorial). Additionally, only publications from the years 2013 to 2022 were chosen for the analysis. The following information was combined with the data from the bibliometric search: (i) the title of the paper, (ii) the date of publication, (iii) the main author details (name/s and affiliation/s), (iv) the title of the article, (v) the authors' keywords, (vi) the abstract, and (vii) the number of citations. The data was analyzed and presented using R Studio's Biblioshiny packages and VOSviewer [36,42]. Both tools provided graphs and maps, such as thematic maps, country cooperation maps, and network visualizations, that demonstrate the research scenario and the dynamics of the new model of information management, which improves the operational effectiveness of enterprises all over the world.

Table 1. Keyword search process in Scopus database.

Step	Keyword Search	Articles
1	"big data" AND "information management"	8902
2	"data analytics" AND "information management"	1865
3	"big data analytics" AND "information management"	802
4	"operational performance" AND "information management"	149
5	(("big data analytics" OR "big data" OR "data analytics") AND "information management" "operational performance")	901
6	(("big data analytics" OR "big data" OR "data analytics") AND "information management" AND ("operational performance" OR "operational productivity"))	902
7	(("big data analytics" OR "big data" OR "data analytics") AND "information management" AND ("operational performance" OR "operational productivity" OR "efficiency"))	1354
8	(("big data analytics" OR "big data" OR "data analytics") AND "information management" AND ("operational performance" OR "operational productivity" OR "efficiency" OR "productivity"))	1454
9	(("big data analytics" OR "big data" OR "data analytics") AND "information management" AND ("operational performance" OR "operational productivity" OR "efficiency" OR "productivity") AND "decision making")	3210
10	(("big data analytics" OR "big data" OR "data analytics") AND "information management" AND ("operational performance" OR "operational productivity" OR "efficiency" OR "productivity") AND ("decision making process") (LIMIT-TO (DOCTYPE, "ar"))	650

4. Results

This research aims to review the transformation of information management through big data analytics, which helps businesses improve their operational efficiency and decision-making processes globally. The reviewed sample includes 650 related studies that were published in the period 2013–2022. These documents were written by 1977 authors, with an average of 4.027 citations per document. Most of the authors (96.6% of the total sum) are part of multi-authored studies (1910 authors), while only 3.4% are single-authored studies (67 authors).

4.1. Information Management and Big Data Analytics: A Discrete Research Domain

Authors' scientific productivity (Table 2), calculated based on the theorem of Lotka's Law in information management and big data analytics research, shows that 1801 authors have produced only one scientific paper in the studied field. However, findings present that those two authors have contributed to a maximum of six published articles. Thus, information management and big data analytics and their contribution to the operational

efficiency of businesses can be characterized as discrete research domains but with a high degree of authorship concentration.

Table 2. Author productivity through Lotka's Law.

Documents Written	N. of Authors	Proportion of Authors
1	1801	0.911
2	140	0.071
3	22	0.011
4	10	0.005
5	2	0.001
6	2	0.001

4.2. Annual Publication and Timespan Trend

Figure 2 shows the number of studies in the subject of big data analytics and information management that have been published, along with how these studies have helped firms operate more effectively and make better decisions. Prior to 2017, there was very little research growth, but after 2018, publications began to rise. To be more precise, 51 articles were produced over the first four years of study (2013–2016), which is much less than the 602 publications produced during the previous five years (2017–2022). The most publications were made in the year 2021, but 2022 appears to have a high record of publications as well, as evidenced by the findings in Figure 4, which indicate that in the first half of 2022, the number of publications was nearly equal to that of the prior year. This indicates that there is a persistent increase in interest in IM and big data analytics research. Additionally, Figure 2 depicts the impact of publications that have been published through the number of citations (TCPY and TCPA) in the research area each year. The overall citation per year is shown in the first measure, while the total citation per article is shown in the second. Results from both measures indicate that there are not many citations for publications that were published recently, which is predicated on time, as new research takes time to sink in and have an influence on the academic community.

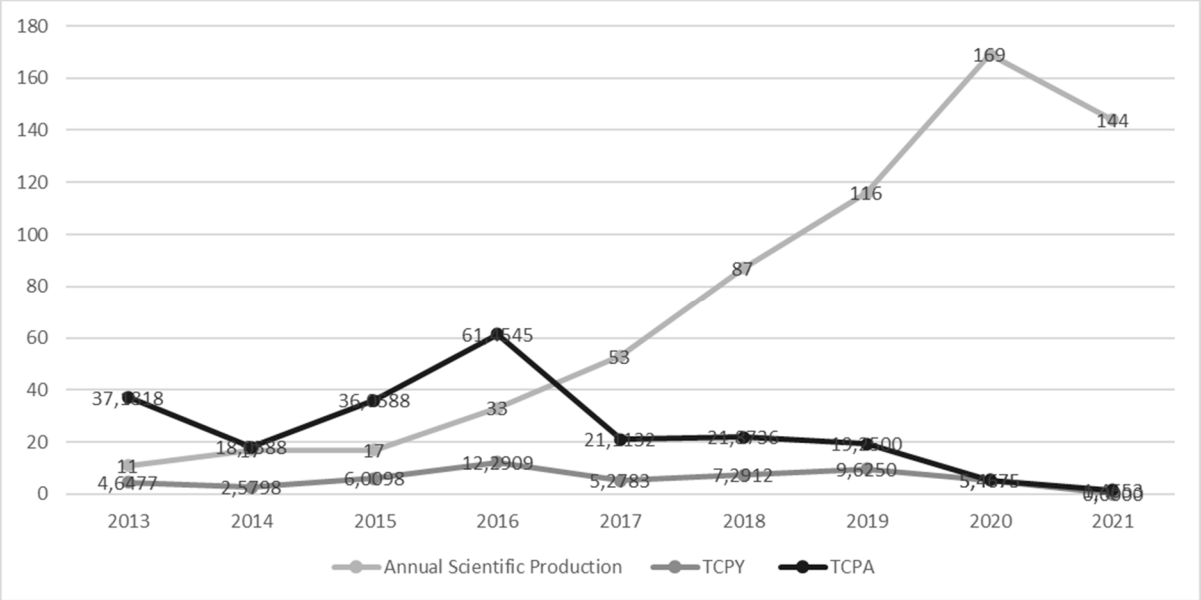

Figure 4. Annual research growth (TCPY: total citation per year, TCPA: total citation per article).

4.3. Most Influential Journals, Institutions, Authors, and Documents

For the period of 2013 to 2022, Table 3 lists the journals that have published the most papers on big data analytics and information management that have a positive impact

on operational effectiveness and corporate decision-making. The corpus of knowledge on information management and big data analytics has been significantly impacted by "Sustainability," which is in the frontier journal with the most papers published in the study subject (68) throughout the research timespan 2013–2022. The journal "Benchmarking" came in third with 50 articles, while the "International Journal of Production Economics" came in second with 56 published papers. There were 42 articles in the "Production Planning and Control" journal. The list of the top five research-related journals was completed by the "International Journal of Supply Chain Management". Additionally, Scopus, Sci-mago, and ABS list have indexed a large number of the most widely read journals in information management and big data analytics.

Table 4 lists the most significant companies that disseminate research on information management and big data analytics to help enterprises operate more effectively and make better decisions. The top five universities, which account for the majority of research-related publications, have offices in various locations. The Politecnico Di Milano in Milan, Italy, is the institution that has published the most (20 papers) in the subject of research. The Hong Kong Polytechnic University is in third place with eighteen published papers, followed by the Najran University in fourth place with thirteen articles, and the Universiti Kebangsaan Malaysia in fifth place with five publications. The Universiti Kebangsaan Malaysia ranks in second place overall (eleven articles). The fact that technical colleges make up the majority of the institutions illustrates the significant impact that new technologies, such as big data analytics, have made to information management.

Examination of the most prominent writers can help shape the research domain after the bibliometric analysis [42]. Table 5 illustrates the authors with the highest impact in the research community of the studied field, while the metric of the articles fractionalized of the individual authors has been integrated and presents the fraction of their co-authored publications. According to Table 5, Dwivedi Yk is recognized as the most related author in the research domain, and Akter S. is ranked in second position in the list of the most relevant authors of the studied field. Figure 5 represents the authors' collaboration network. Each node highlights an author, and the edges indicate the co-authorship relation between them [43]. The blue cluster can be characterized as the most impactful and essential collaboration network between authors. The purple cluster consists of four authors' networks, while the red, orange, and brown clusters consist of three authors' networks. Moreover, the green cluster indicates the weakest collaboration network, as it consists only of two authors' networks. It is noteworthy that neither of the clusters are linked, so there is enough space for improving the overall author collaboration within the information management and big data analytics field.

Table 3. Most relevant resources in the research field.

Sources	Subject Area	Number of Articles	h-Index	Ranking by ABS List	Ranking by Scimago List
Sustainability (Switzerland)	Management, Monitoring, Policy and Law	68	109		Q1
International Journal of Production Economics	Decision Sciences	56	197	3 ***	Q1
Benchmarking	Business and International Management	50	66	1 *	Q1
Production Planning and Control	Decision Sciences	42	85	3 ***	Q1
International Journal of Supply Chain Management	Decision Sciences	41	20		
International Journal of Production Research	Decision Sciences	37	153	3 ***	Q1
International Journal of Operations and Production Management	Decision Sciences	36	146	4 ****	Q1
Journal of Enterprise Information Management	Decision Sciences	35	67	2 **	Q1
International Journal of Logistics Management	Business and International Management	33	80	1 *	Q1
Supply Chain Management	Business and International Management	33	125	3 ***	Q1
Business Process Management Journal	Business and International Management	29	87	2 **	Q1
International Journal of Information Management	Decision Sciences	28	132	2 **	Q1
TQM Journal	Business and International Management	26	72	1 *	Q2
Industrial Management and Data Systems	Decision Sciences	25	109	2 **	Q1
Journal of Cleaner Production	Strategy and Management	24	232	2 **	Q1
Uncertain Supply Chain Management	Decision Sciences	19	19		Q2
International Journal of Productivity and Performance Management	Business and International Management	18	67	1 *	Q2
Technological Forecasting and Social Change	Business and International Management	18	134	3 ***	Q1
Journal of Operations Management	Business and International Management	17	199	4 ****	Q1
International Journal of Logistics Research and Applications	Decision Sciences	15	38	1 *	Q2

* This symbol is referred to those scientific papers that are published by Journals that are indexed by the Academic Journal Guide and produced by the Chartered Association of Business Schools (CABS). The journals are given a star rating from 1 * to 4 * (the highest).

Table 4. Most relevant institutions.

Affiliations	Articles
Politecnico Di Milano	20
Universiti Kebangsaan Malaysia	20
The Hong Kong Polytechnic University	18
Najran University	13
Lut University	11
Norwegian University of Science and Technology	11
University of Minho	11
Universiti Teknikal Malaysia Melaka	10
Universiti Teknologi Malaysia	10
University of Malaya	10
Notreported	9
Rmit University	9
Spiru Haret University	9
Swansea University	9
University of Ljubljana	9
University of Lorraine	9
Cefet/Rj: Federal Center for Technological Education of Rio De Janeiro	8
Chang'an University	8
Dalian University of Technology	8
De Montfort University	8

Table 5. Most impactful authors.

Authors	Articles	Articles Fractionalized
Dwivedi Yk	6	1.62
Akter S	5	1.37
Mikalef P	5	1.25
Gunasekaran A	4	1.20
Hawash B	4	0.78
Krogstie J	4	1.00
Kumar A	4	1.20
Macchi M	4	1.08
Polenghi A	4	1.08
Teixeira L	4	1.50
Wang H	4	1.05
Yusof Zm	4	0.78
Zhang Z	4	1.33
Ali S	3	0.83
Chatterjee S	3	0.83
Foropon C	3	0.92
Gupta S	3	0.75
Ismail Z-A	3	3.00
Jayakrishnan M	3	0.83

Finally, the most influential academic papers in the fields of big data analytics and information management are presented in Table 6. The table below contains published scientific publications that were based on both qualitative and quantitative analyses. Additionally, some of them have investigated how big data analytics can help businesses perform better, as described in the paper "Big data analytics and firm performance: Findings from a mixed-method approach", which draws on complexity theory to look into the resource configurations and environmental variables that contribute to performance gains from big data analytics investments. However, neither paper has discussed how big data analytics might help manage information or enhance the decision-making process.

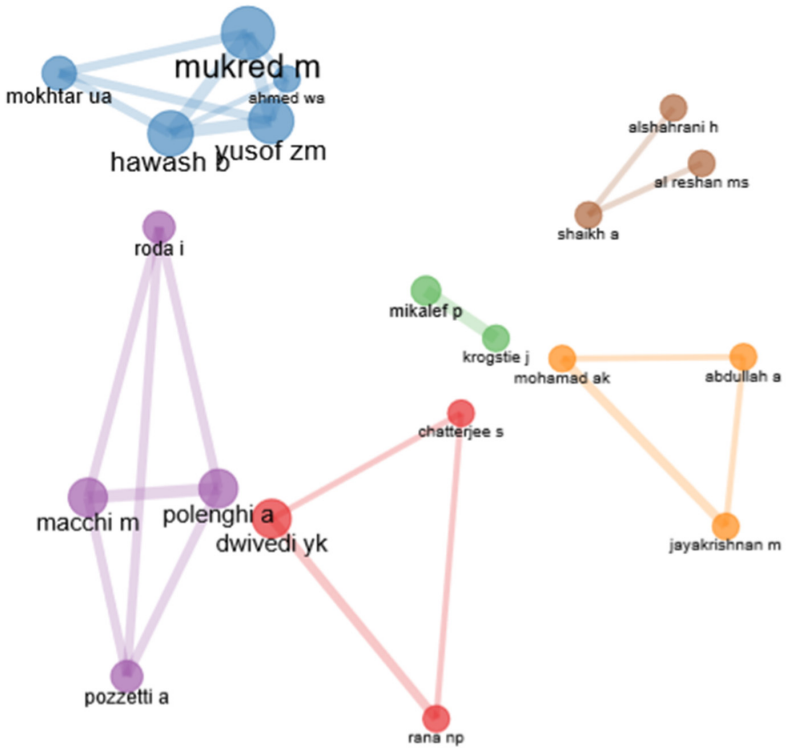

Figure 5. Author collaboration network.

Table 6. Most impactful scientific articles in the field of big data analytics and information management.

Paper	Total Citations	TC per Year	Normalized TC
Critical analysis of Big Data challenges and analytical methods [44]	931	133	7.1261
Big data analytics in E-commerce: a systematic review and agenda for future research [45]	347	43,375	4.6344
The Internet-of-Things: Review and research directions [46]	305	43,571	2.3345
Assessing business value of Big Data Analytics in European firms [47]	228	32,571	1.7452
Exploring the relationship between big data analytics capability and competitive performance: The mediating roles of dynamic and operational capabilities [48]	224	56	7.4692
Agri-food 4.0: A survey of the supply chains and technologies for the future agriculture [49]	213	53,25	7.1024
A unified foundation for business analytics [50]	210	21	1.7872
Big Data Analytics Capabilities and Innovation: The Mediating Role of Dynamic Capabilities and Moderating Effect of the Environment [51]	207	41,4	5.6573
Big data analytics and firm performance: Findings from a mixed-method approach [52]	203	40,6	5.5479
The Effect of Big Data and Analytics on Firm Performance: An Econometric Analysis Considering Industry Characteristics [53]	177	29,5	4.1788
Roles of artificial intelligence in construction engineering and management: A critical review and future trends [54]	172	57,333	14.5858
Identification of critical success factors, risks and opportunities of Industry 4.0 in SMEs [55]	167	41,75	5.5686
Industrial information integration—A literature review 2006–2015 [56]	161	20,125	2.1503
Operational research from Taylorism to Terabytes: A research agenda for the analytics age [57]	158	17,556	3.1349
Getting value from Business Intelligence systems: A review and research agenda [58]	157	22,429	1.2017
A framework for Big Data driven product lifecycle management [59]	156	22,286	1.1941
The impact of big data analytics on firms' high value business performance [60]	143	23,833	3.3761
Leveraging Customer Involvement for Fueling Innovation: The Role of Relational and Analytical Information Processing Capabilities [61]	142	20,286	1.0869
Consumers' Decision-Making Process on Social Commerce Platforms: Online Trust, Perceived Risk, and Purchase Intentions [62]	139	34,75	4.6349
Understanding the determinants of big data analytics (BDA) adoption in logistics and supply chain management: An empirical investigation [63]	139	23,167	3.2816

4.4. Network, Content, Bibliographic Coupling, and Cluster Analysis

Visualizing the linkage between authors, countries, and research topics can offer interesting insights into the scientific community [43,64]. Thus, Figure 4 presents the innovative three-field plot, which presents the interchange among the most related authors (left), countries (middle), and keywords (right) within the research domain of information management and big data analytics. Results show that American, British, and Indian scholars mostly author studies on big data analytics. However, emerging technologies such as artificial intelligence (AI) and machine learning (ML) seem to be integrated into the information management search domain. Figure 6 presents Italian and Chinese scholars with the most publications in AI and ML. Generally, the USA, UK, and India have excellence in big data analytics, Italy in ML, and China in AI.

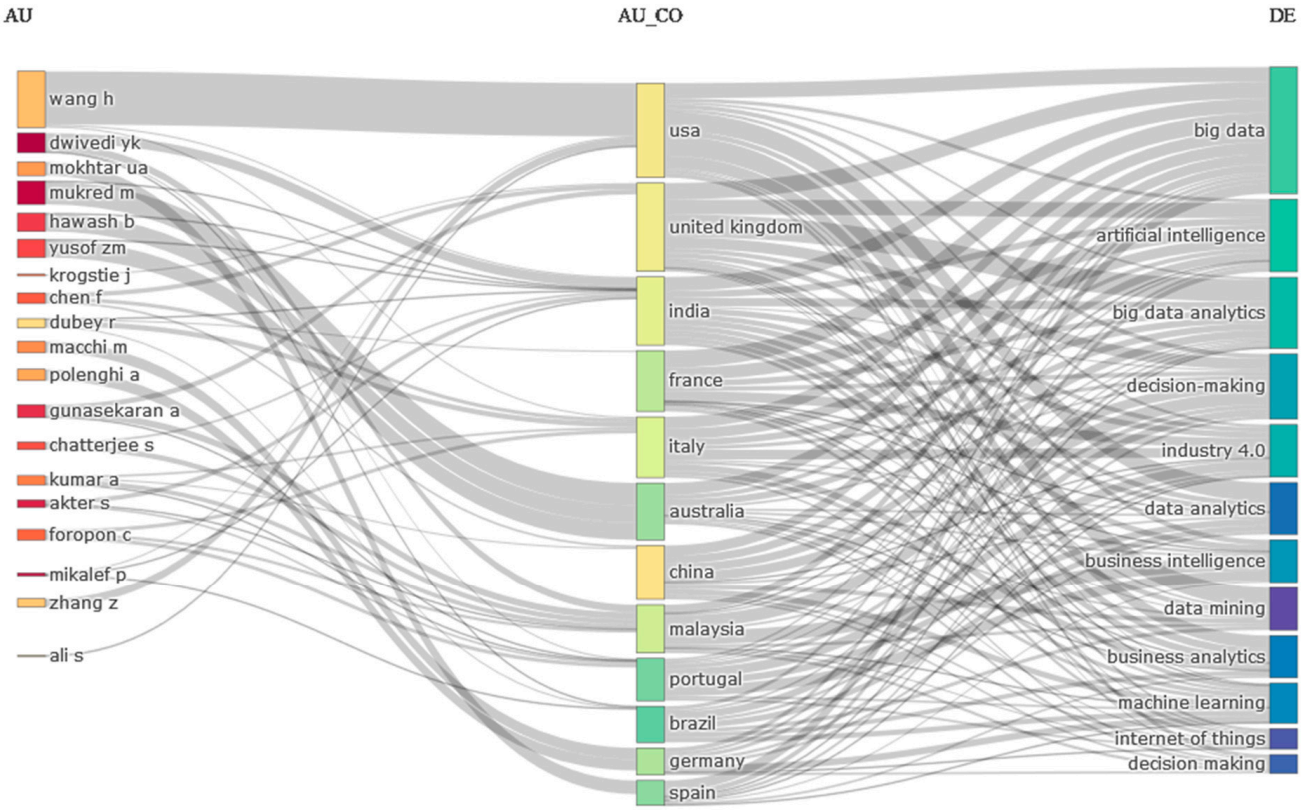

Figure 6. Three-Fields Plot.

Moreover, Figure 7 presents the geographical collaboration of the authors in the research domain of information management and big data analytics [37]. The visualization of this scientific collaboration was actualized using the tool Bibliometrix, denoted as Biblioshiny. This geographical collaboration analysis aims to highlight the social structure of the research community in the studied field. The nodes in the graph represent the authors, while links represent their co-authorship. The map shows that the USA is the origin of most of the scientific collaborations in the field. The most robust scientific channel is between USA—China and USA—India. Additionally, American scholars have developed a strong scientific collaboration with the Europeans. Specifically, the British and Italians are linked with the Americans, as well as with the Indian and Chinese scholars in the subject area of information management and big data analytics with a view on the contribution of operational performance and decision-making process. Furthermore, the collaboration map between the scholars confirms the findings of the three-fields plot and bibliographic coupling based on countries (Figure 8).

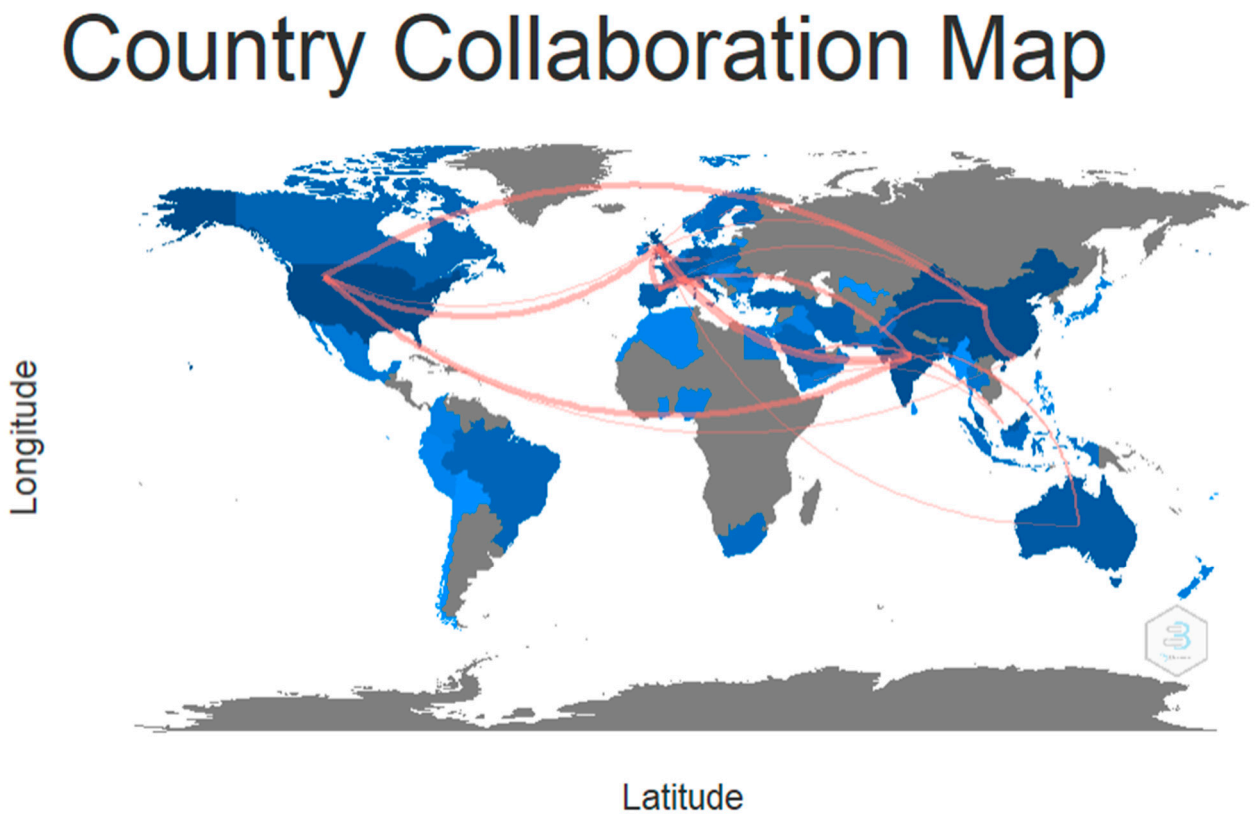

Figure 7. Country collaboration map.

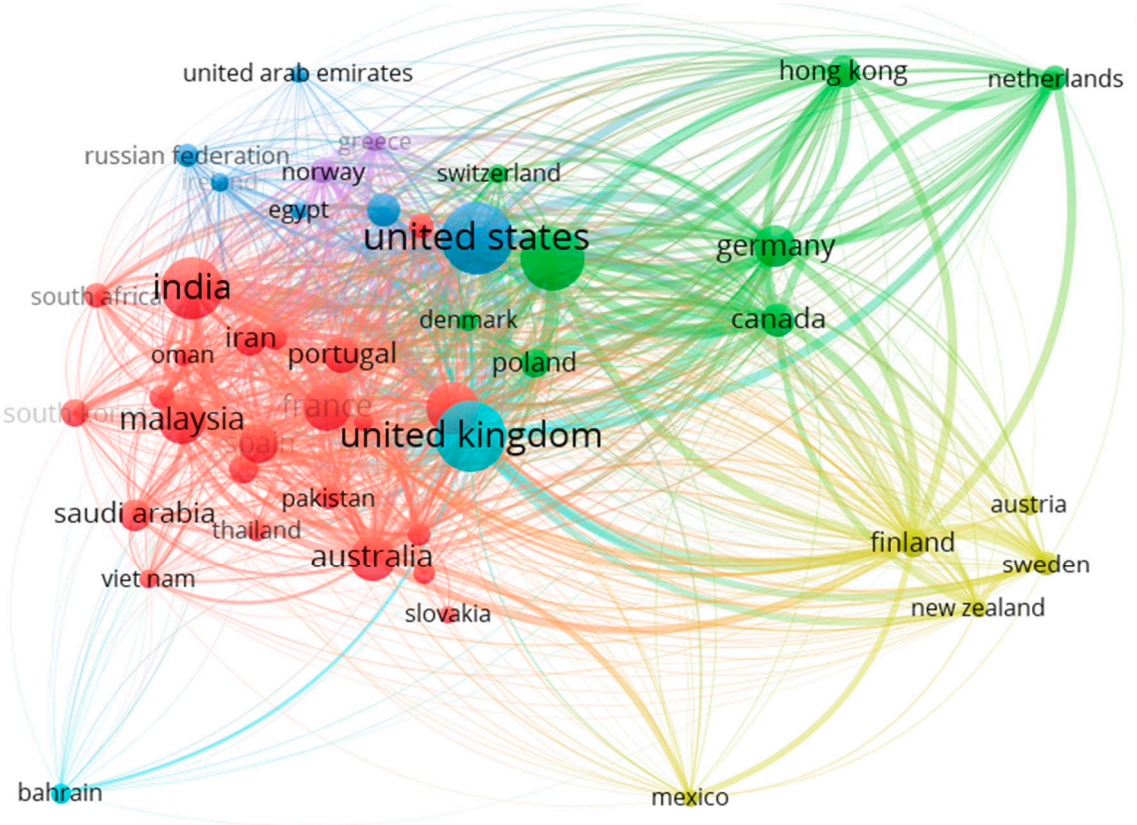

Figure 8. Bibliographic coupling based on documents.

Keyword analysis, which is a component of network analysis, is a useful technique that offers insightful information. The goal of a keyword analysis is to draw attention to the distinction and important trends within a study topic. Based on the co-occurrence of the writers' keywords, Figure 9 shows a network visualization. The VOSviewer program was employed to show the co-occurrence of the writers' key terms. VOSviewer is software that aids in the development of a bibliometric network and the display of the data inside it. Each circle in the graph represents an instance. The greater the co-occurrence of writers' terms, the larger the circle size [36,65]. The circles of a similar color signify a cluster of keywords, and the lines connecting the circles illustrate a connection between the keywords. 120 keywords in total were chosen, and five clusters were created, each with a unique color. The blue cluster draws attention to the close connection between information management and decision-making. The significance of big data in the field of information management research is shown by the cluster in green.

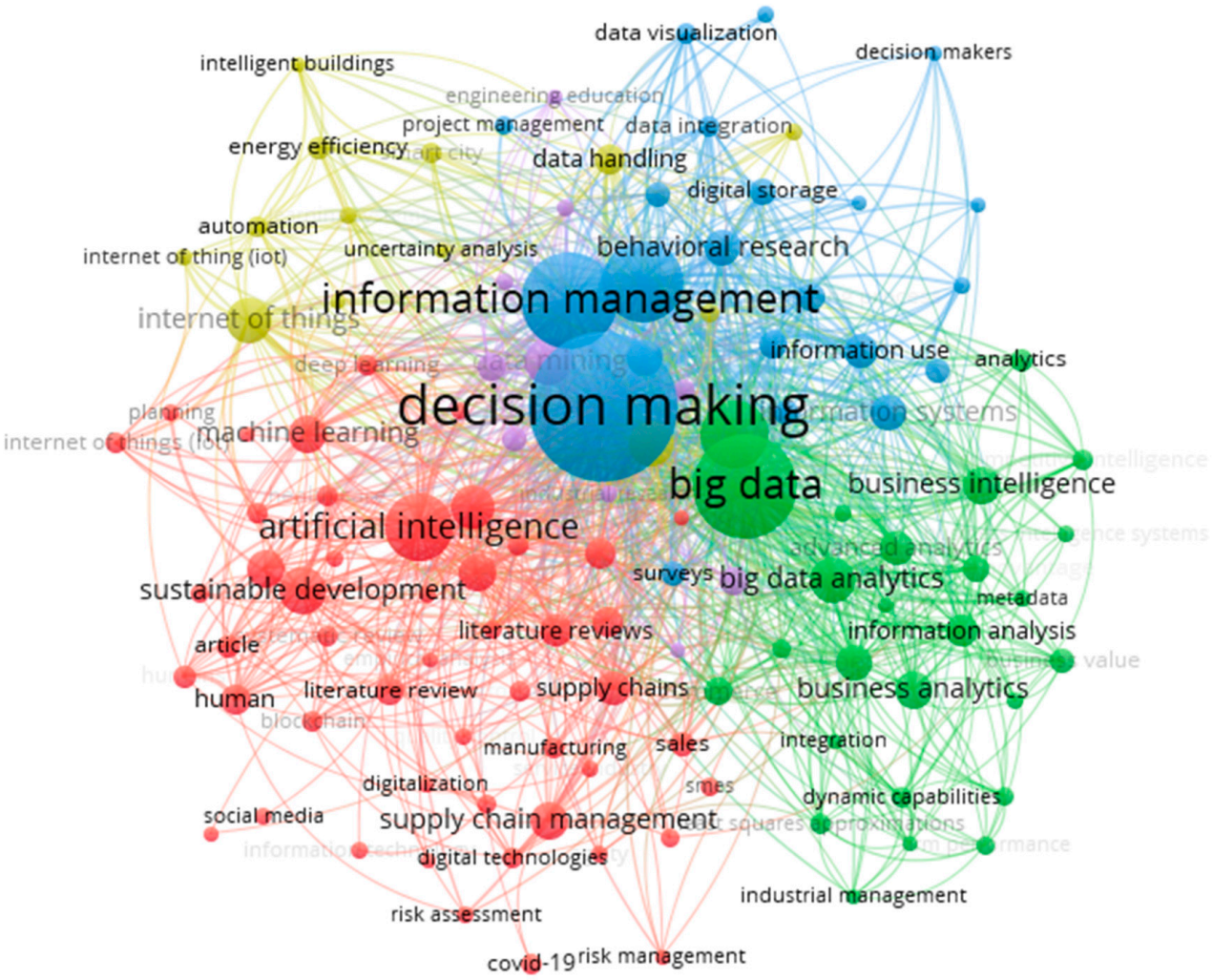

Figure 9. Network visualization—co-occurrence of author keywords.

In contrast, the yellow and red clusters draw attention to the new trends in the information management field, which are the Internet of Things and artificial intelligence, respectively. Additionally, the purple cluster emphasizes how closely information management and the decision-making process are related to the Knowledge-Based System (KBS). KBS is a type of artificial intelligence that aims to synthesize the expertise of human experts to aid in decision-making. The fact that these systems depend on human CEOs gives them the name "expert systems".

Although big data analytics has a strong linkage to information management and improvement, the operational research and decision-making of an organization and bibliometric analysis of the studied field indicate new research paths in the domain [66,67]. Figure 8, which presents the thematic map of authors' keywords, describes the above. This figure illustrates the research themes obtained from the conceptual structure of the documents included in the Bibliometrix analysis. The map is divided into four quadrants, and each quadrant represents a different research theme regarding the studied research topic. In addition, the clusters' sizes highlight the proportion of the number of keywords. The thematic map uses two dimensions: density and centrality. The dimension of density illustrates the degree of the development of each theme, as measured by the internal linkages between the authors' keywords. The second dimension, the centrality, stipulates the relevance of each theme, as measured by the external linkages between the authors' keywords. Furthermore, the map presents four themes: (i) the motor themes, shown in the quadrant in the upper-right position and characterized by both high density and centrality, are the themes that are most developed in the literature, (ii) the basic themes, shown in the quadrant in the lower-right position and defined by high centrality but low density, are the themes that are not yet well developed, (iii) the niche themes, shown in the quadrant that is positioned in the upper-left of the map and characterized by high density and low centrality, are the themes that are well developed and very specialized but are marginal in the overall studied field, and (iv) the emerging themes, which are positioned in the bottom-left of the map and are characterized by low centrality and density [68].

The basic themes of the thematic map presented in Figure 10 indicate emerging technologies like big data analytics and artificial intelligence, which play a crucial role in the decision-making process of companies. However, uncertain factors, such as the COVID-19 pandemic, have enhanced the role of big data analytics. The COVID-19 pandemic has obliged many businesses to transform their operational systems by crossing to a new environment dominated by different procedures and rules. Moreover, the contribution of big data analytics in the management of e-business complaints is noteworthy, which helps an organization improve its operational efficiency and productivity. Consumer complaint behavior and management have been studied in different forms in the literature, but e-complaint business management has not been thoroughly studied. Following the role of the e-complaint and its importance for businesses, it is crucial to highlight the relationship between e-complaints, which are based on big data analytics, and SMEs. Gaining insights into client behavior that would not be attainable using conventional data analysis techniques is one of the main advantages of big data. Large data sets can be swiftly analyzed using big data technology, allowing for the discovery of trends and patterns that smaller data sets would not be able to reveal. SMEs may then utilize this knowledge to enhance their goods and services and better serve their clients. SMEs may also leverage big data to improve marketing campaigns, better target consumers, and provide customized customer experiences. The above can also be confirmed by the thematic map, as the e-complaint factor is dominated by the other niche themes.

Furthermore, to fully examine the research problem, we proceeded with the content analysis by developing a number of maps based on the usage of keywords plus terms. Based on the principles of Bibliometrix, keywords plus terms are categorized in the metadata that can help to perform content analysis [69]. Keywords plus are generated automatically by the index keywords from the names of the referenced articles. In addition, keywords plus terms should be applied more than once and are sorted from multi-word phrases to single terms [69,70]. Additionally, these words enhance the retrieval of titles or keywords that are typically used. For the purpose of the current research thematic map, the thematic evolution and research trends maps have been developed based on the above word type. Figure 11 presents the thematic map based on keywords plus terms. As described above, the thematic map consisted of four quadrants with each of them illustrating a different theme (niche, emerging, motor, and basic themes). Figure 11 highlights predictive analytics, as a branch of analytics that can contribute to information management. Predictive ana-

lytics uses real-time and historical data mining, among other methods, to forecast events and assist corporations and other organizations in decision-making processes [71]. Even though predictive analytics are crucial, it was discovered that bibliographies combining predictive analytics and information management are rare. By linking predictive analytics and information management, businesses can achieve not only the ability to manipulate data for analysis, but also the ability to learn to communicate their analysis and results to decision-makers, become leaders in using data, and facilitate the decision-making process. Furthermore, emerging themes illustrate that the neural network is an important factor for information management. The neural network is a technique used in artificial intelligence which instructs computers to analyze data in a manner modeled after the human brain [72,73]. Deep learning is a type of machine learning that employs linked nodes or neurons in a layered structure that resembles the human brain.

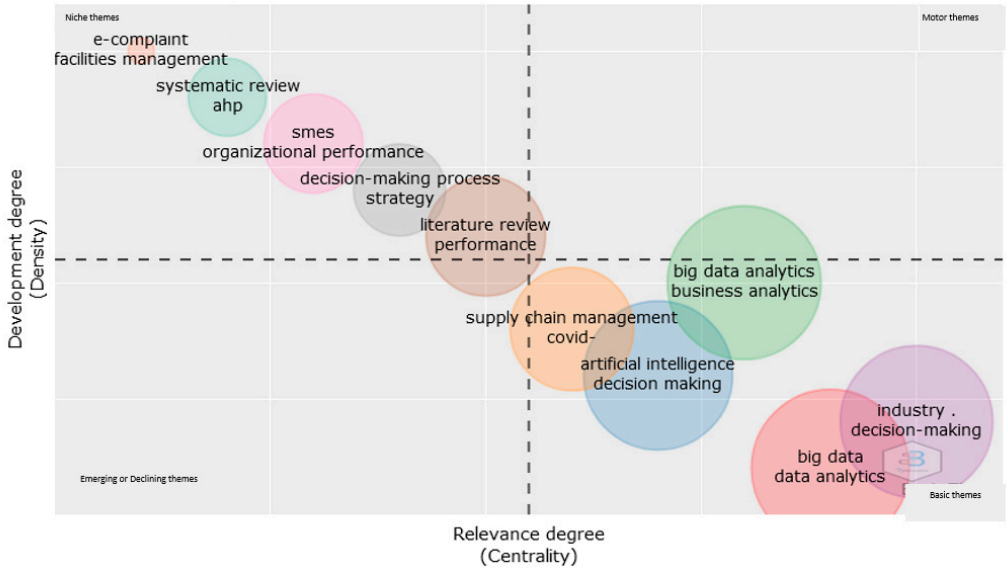

Figure 10. Thematic map based on authors' keywords.

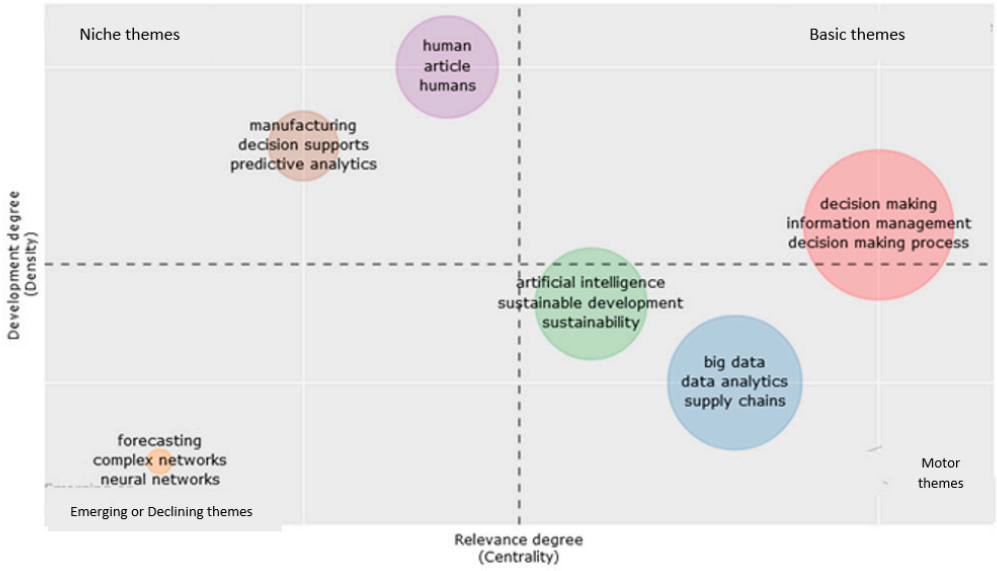

Figure 11. Thematic map based on keywords plus terms.

Moreover, the research field of multi-criteria decision-making (MCDM) is of particular relevance to big data analytics and information management. Figure 12 presents the

thematic evolution map based on keywords plus terms and illustrates the importance of big data analytics and information management in the multi-criteria decision-making process. Complex information management is a critical component of modern decision-making. Nowadays real-world situations require a variety of data sets, some exact or objective and others unclear or subjective. To simulate complicated commercial or engineering processes, a variety of statistical and non-statistical decision-making strategies have been offered in the literature. Multiple-criteria decision-making (MCDM) procedures are among those that have recently gained enormous popularity and widespread use and can be facilitated by the contribution of big data analytics and information management.

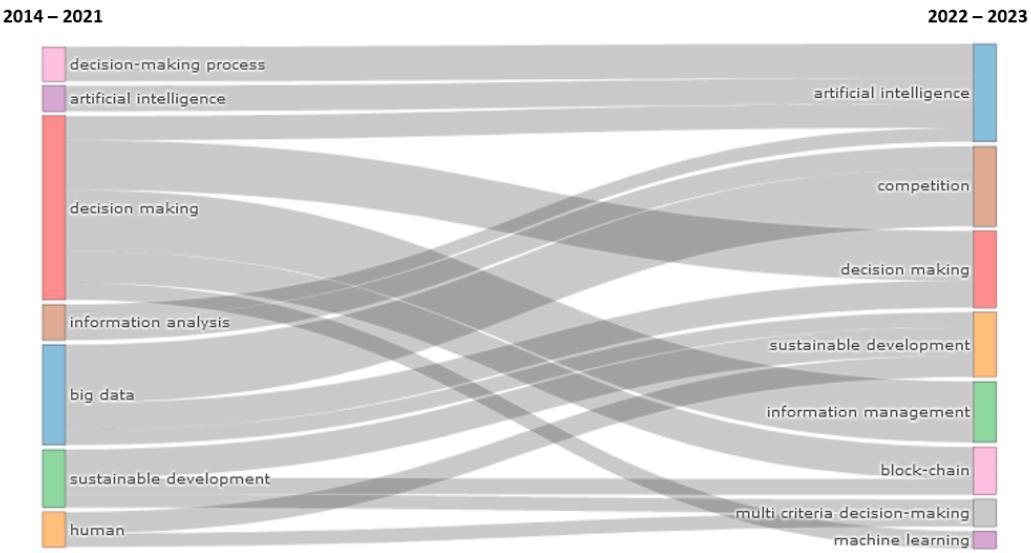

Figure 12. Thematic evolution map based on keywords plus terms.

Instead, scholars have noticed the importance of big data analytics in the domain of information management, which leads to operational efficiency and decision-making process; there is limited research on the contribution of other emerging technologies such as artificial intelligence [74]. Additionally, academics have not yet looked at the contribution of developing technologies to achieving a lasting competitive advantage. Along these lines, this bibliometric research emphasizes how important the aforementioned phrases are in incorporating new emerging technologies into enterprises' information management systems. The Internet of Things, blockchain, and other technologies, when combined with big data analytics, may provide an agile decision-making process and a long-lasting competitive advantage, according to a factorial study using the Multiple Correspondence Analysis (MCA) approach (Figure 13) [75]. In terms of the MCA method, this is a grid that combines co-word analysis (Document Word) with the keywords mapped out on a two-dimensional map. According to the following dimensions: (i) the frequency of each keyword and (ii) the joint reference of the keywords in each recovered document, the MCA approach categorizes the keywords of the original retrieved articles. The results of the MCA approach are interpreted in terms of the locations of the points and the distribution of those points along each dimension. Therefore, the closer the terms are depicted on the Conceptual Structure Map, the more similar they are in their distribution.

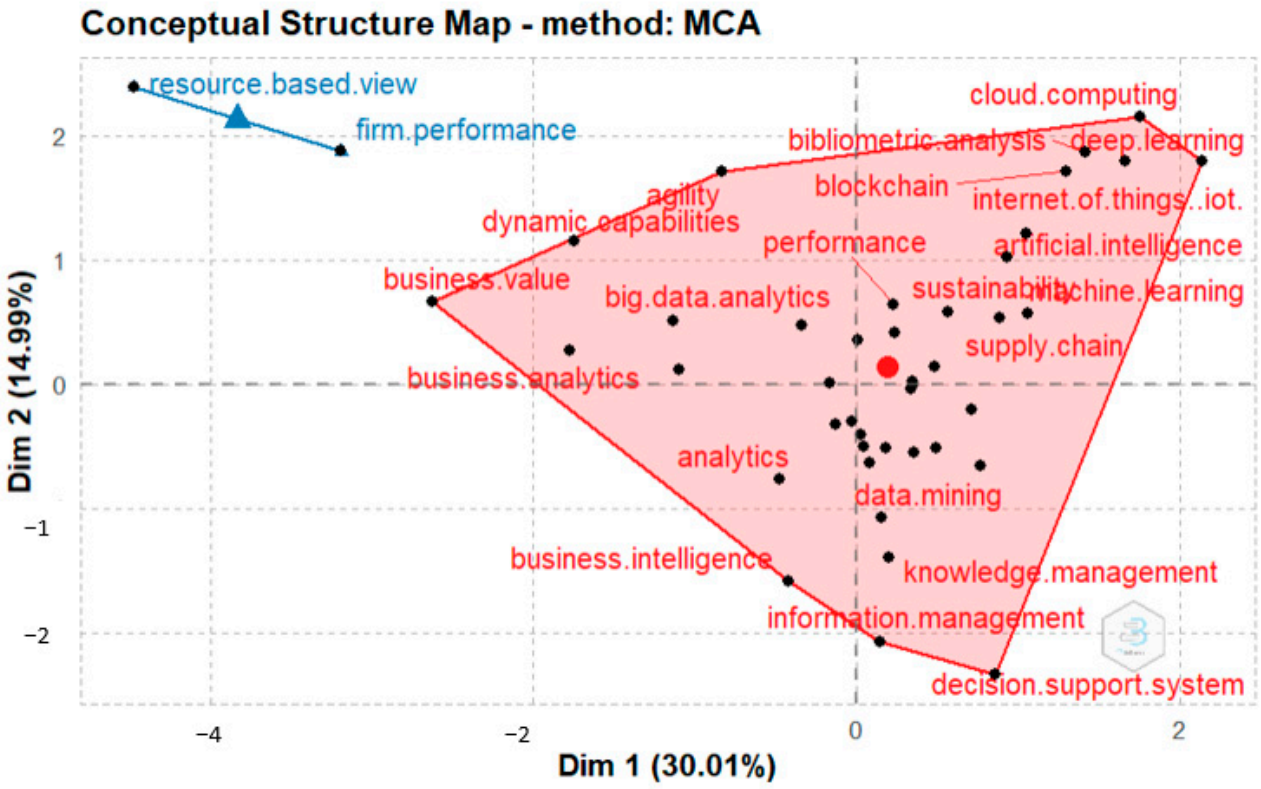

Figure 13. Factorial analysis based on the MCA method.

The cluster in red color highlights the strong connection between emerging technologies (cloud computing, deep learning, Internet of Things, blockchain, and artificial intelligence) and information management. Both can contribute to the facilitation of the decision-making process of businesses and help them achieve sustainable competitive advantage, increase their value, and adopt agile management practices. The above can be achieved in many ways. Tracking employees' efficiency and productivity can be integrated into the multiple advantages that the combination of information management and emerging technologies can offer. Adopting both can help businesses guide the human resource department to hire someone new or find ways to boost the existing workforce's confidence and make them more proactive and productive within the company. Moreover, the integration of technology and information management systems can contribute to the detection of illegal practices in the workforce, such as fraud, money laundering, corruption, and bribery. However, businesses should concentrate their efforts on two key areas where agility may make a significant impact, rather than trying to be "more agile." Access to networks comes first. Prior to COVID-19, a sufficient number of employees were connecting to the network using their own devices. This has become the norm now. Researchers have found that fraudsters are targeting home gadgets more than ever before in an effort to break into corporate networks. All businesses that have a substantial number of remote employees ought to make this one of their top priorities. IT teams can simply implement the proper network controls with the aid of a more adaptable cybersecurity architecture, which can also guarantee that such controls are continuously and automatically updated even in the face of never-before-seen threats. If used properly, it may assist in establishing a foundation where employees can securely log in from any place using any device, giving IT staff peace of mind.

On the other side, the blue cluster illustrates the resource-based view as a fundamental managerial framework applied to determine the strategic resources an organization can exploit to accomplish a sustainable competitive advantage. Furthermore, the resource-based view theory provides a valuable way for academics and researchers of the studied field to consider how Information System Management can be related to the strategy

and performance of a business. In addition, this theory provides direction on how to differentiate among various types of information systems, such as emerging technologies and information systems, and how to study their separate influences on performance.

5. Discussion and Conclusions

Information is the new "oil". This statement is frequently used by experts to convey the significance of digital information to the corporate sector [76]. However, 'water', the resource we all rely on for our existence and well-being, is a better metaphor for the crucial function of data. In the modern economy, everyone has access to data, but, as with water, this depends on their capacity to access it, comprehend how it flows, and accept the source's reliability. Water becomes polluted and worthless if it is not handled properly. People suffer when water access is restricted, therefore data breaches, misuse, and access management are significant concerns. The same is true for how data is now organized [77,78].

Organizations in the modern business world, which is defined by its digitization, are required to handle a massive volume of data from many data sources in a timely, effective, and qualitative manner [79]. Any business information system, including those used by customers, production, warehouses, sales, suppliers, website users, or even social media platforms, may be used to gather this information [13]. Executives and analyst specialists should have a productive approach to organize and evaluate the millions of transactions that come from various databases each month. Businesses may now use specialized information systems thanks to new technologies, which also make it simpler to write reports, perform complex data analysis, and obtain information more quickly [80]. A significant part in the processing of a huge volume of data is played by information management. Information management techniques are a collection of technologies and analytical methods that are intended to analyze the available data and extract meaningful information from it in order to help corporate decision-making processes. A company may also learn, perceive circumstances and occurrences, forecast trends and future events, plan, and develop thanks to information management [81,82]. The collected data is transformed into knowledge that management may utilize to take the proper actions that will result in the definition and accomplishment of company objectives.

Information management relates to all enterprises and has an impact on all organizational activities. Information management systems, namely, have an impact on a company's personnel as well as its clients or suppliers. However, efficient user usage of information management systems is the only way for them to benefit the company [74,83]. Performance of organizations is not impacted by just having greater access to data; rather, the difference is in how they handle the data. However, a variety of approaches based on cutting-edge technology, from big data analytics to artificial intelligence, have greatly enhanced the overall process of data while also enhancing the accuracy of customer-specific data [84]. Consequently, this might provide companies with the assurance that the data they have access to will be pertinent to their clients' needs. The aforementioned can serve as a roadmap for businesses to help them make better operational decisions.

The findings of the bibliometric analysis indicated the crucial role of big data analytics in the transformation of the research domain of information management. Integrating such emerging technologies in the field of information management can offer organizations a couple of benefits, such as collecting data regarding their customers, like demographic and psychographic data, which are related to their preferences, purchasing habits, and the amount they consume. Especially, for the SMEs big data may be used by them to enhance their operations. Businesses may utilize big data, for instance, to streamline operations, spot inefficiencies or waste, and enhance decision-making. Big data may also assist SMEs in having a better understanding of their target markets and clientele. The competitiveness of SMEs may then be increased by using this knowledge to make more educated business decisions. Big data offers small and medium-sized businesses a wide range of chances to enhance their operations and more successfully compete in the modern market. Although

big data technologies may initially appear intimidating, SMEs may rapidly pick them up and put them to great use.

It is noteworthy that the current study's findings emphasize the role of predictive analytics, as a branch of analytics that can contribute to information management and big data analytics. Predictive analytics uses real-time and historical data mining, among other methods, to forecast events and assist corporations and other organizations in decision-making processes. Even though predictive analytics are crucial, it was discovered that bibliographies which combine predictive analytics and information management are rare. By linking predictive analytics and information management, businesses can achieve not only the ability to manipulate data for analysis, but also the ability to learn to communicate their analysis and results to decision-makers, become leaders in using data, and facilitate the decision-making process. Furthermore, the results of the current analysis demonstrate that big data analytics play a role in capturing client concerns through e-complaint. By managing, processing, and providing data analyses of the complaint, the service e-complaint automates the manual procedure and offers transparency [85]. Additionally, the ability of online complaints adds to: (i) improving customer satisfaction, (ii) enhancing customer communication, (iii) improving policies and processes, and (iv) improving company image [86]. The above information may also help firms stand out from the competition, giving them a competitive advantage and empowering them to make business decisions that will optimize their earnings. To sustain a company's competitive edge, however, and to significantly increase an organization's operational efficiency, big data analytics must be integrated into the systems of information management [87]. The investigation of technological developments in the online complaint procedure, as well as their contribution to the assurance of transparency and the prevention of any fraud occurrence, might be suggested as a topic for future research based on the current findings.

Nevertheless, the past two years (since the COVID-19 pandemic started) can be characterized as years of building information management [6]. To promote future economic growth, businesses are continuously attempting to regain some of their prior normalcy and to increase their operational effectiveness. Thus, in addition to big data analytics, the results of the current bibliometric analysis demonstrate that the technological advancements of artificial intelligence, machine learning, Block-chain, and the Internet of Things are significant tools and can assist executives in making rational decisions [81,88]. Artificial intelligence is likely going to be utilized more by businesses in the future since it provides applications in many business fields that aim to provide employees and management with the best judgments. One illustration is the use of artificial intelligence in the field of supply chain management [9,89]. Information management is necessary for a variety of jobs in this industry so that choices may be made quickly. One of the most crucial aspects of supply chain management (SCM) is supply chain planning (SCP), which addresses the scheduling of production, demand, and sales.

Managers must be able to monitor and access all data in order to make choices since supply chains change quickly and business demands are always changing [12]. Hence, a company has to have trustworthy tools available to it in order to create successful plans and make wise judgments. Supply chain decision-makers may dramatically improve their selections by utilizing AI. A large number of data sets are analyzed by AI algorithms, and the results are then presented to management automatically. Additionally, as AI programs examine previous data and offer pre-made recommendations, firms may effectively estimate the demand for their items. One of a company's most important tasks is demand forecasting since a deficit in one area may lower sales and increase turnover. Nevertheless, flaws can negatively impact how customers perceive a company [90]. AI offers useful algorithms that forecast trends. In spite of this, artificial intelligence (AI) can forecast demand patterns based on a variety of factors, including weather, seasonality, holidays, real-time sales and any restrictions that the business may impose. Therefore, future studies should examine how big data analytics and artificial intelligence work together to enhance operational research and decision-making processes. [91].

Further, Figure 14 offers a number of interesting ideas for subsequent investigation. Information technology, according to a sizable proportion of researchers in the scientific field of decision-making, may help businesses be more agile in their decision-making processes. Additionally, agility enables firms to react quickly to shifting market situations while facilitating internal and external communication. As the real time to notice and respond to attacks increases, so do the frequency and intensity of the cyberattack phenomena. Businesses must create IT solutions that might enhance cyber response skills, such as cyber agility, in order to handle the aforementioned concerns. The fact that cyberattacks happen instantly and have equally instantaneous and destructive impacts makes this element vital. Therefore, a suggestion for future study may be to look at how companies' agility in cyberspace affects the effective security and safeguarding of their essential information. Additionally, no matter the size of the business, the rising frequency of cyberattacks increases the complexity of cyber security. Businesses have direct access to various data sources and regularly evaluate a vast amount of data. However, they are unable to adequately evaluate, utilise, and assure the security of this data. Because it allows for fast analysis and storage, which increases the danger of leakage, traditional data storage and analysis methodologies have been found to be ineffective by organizations. In order to enhance the technologies related to cyber security, it is required to adopt a new method of storing and analyzing the data. Businesses can immediately and affordably handle and analyze a large volume of data with the aid of big data analytics. Big data analytics enhances the diagnostic and automated data analysis required to produce insights and respond to difficult security problems by using analytical techniques including data/text mining, machine learning, and pattern matching. In general, massive data analysis methods provide a substantial contribution to stopping harmful conduct. Therefore, in future study, the analysis of big data analytics' contribution to better cybersecurity might be expanded upon.

Finally, we may note at least three theoretical contributions to this work. In this paper, we outline another advantage of enhancing IM skills and orientation, which adds to the body of IM research. By dynamically selecting and managing critical knowledge that is both internal and external to the company, these abilities may optimize the benefits of BDA on firm performance while lowering the risks associated with big data management. The proposed business model's ability to strike a balance between cyber security agility and digital transformation might serve as the second theoretical contribution. To maintain balance, one must be aware of the possibility of an attack and use integrated network security policy management to lessen the likelihood of a compromise. Recognizing the advantages and disadvantages of digital transformation initiatives is one aspect of this. The third theoretical contribution refers to the importance of the three significant capabilities, and the beneficial links between them are addressed in this study, which may add to the body of knowledge on dynamic capabilities. Prior research supporting the idea that information management, big data analytics, agility, and business performance are positively correlated may be used to supplement this.

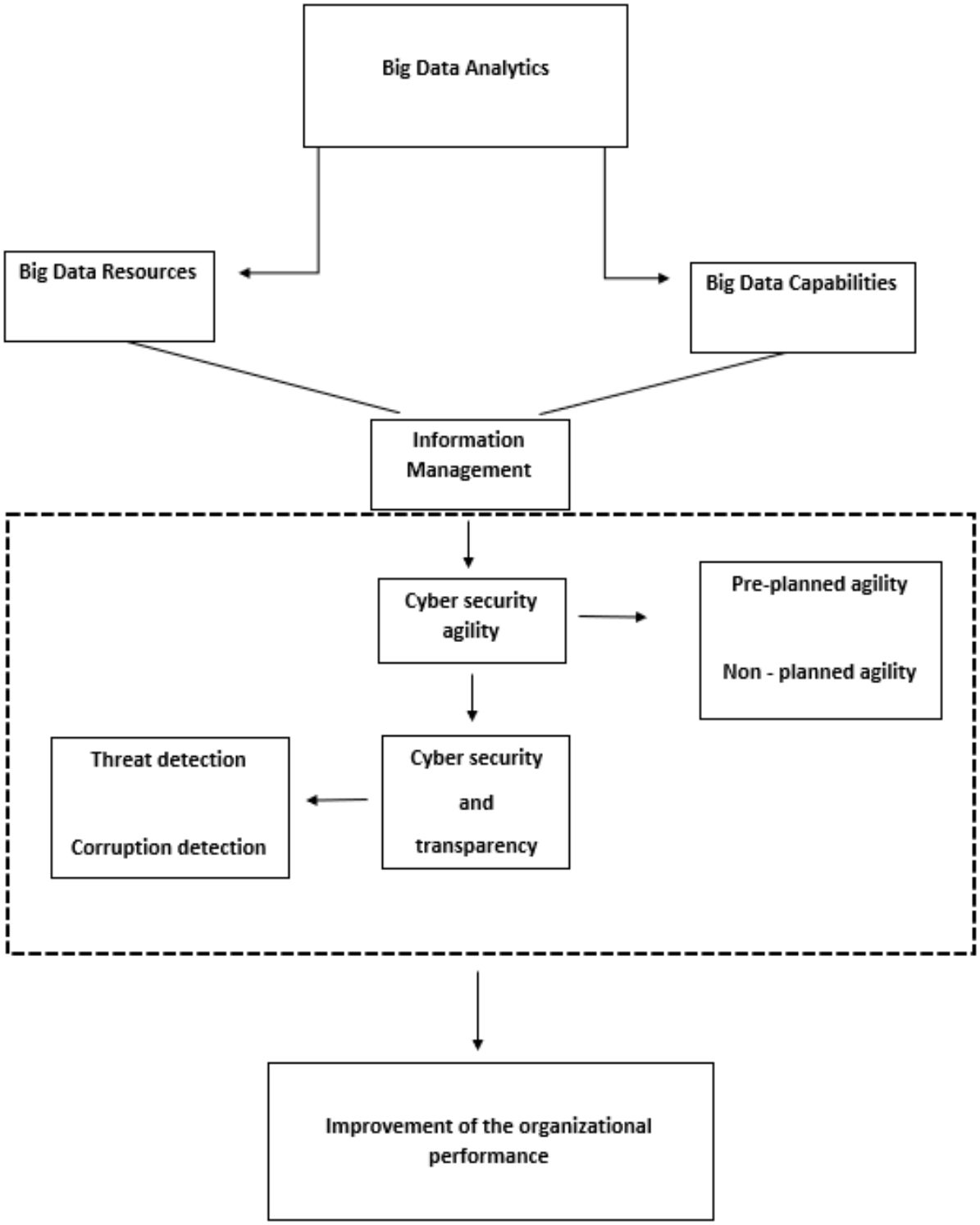

Figure 14. Proposed business model.

Author Contributions: Conceptualization, K.R., I.P. and A.G.; Data curation, K.R., I.P. and A.G.; Formal analysis, K.R.; Investigation, K.R., A.G. and E.G.; Methodology, K.R. and A.G.; Project Administration, K.R., A.G. and I.P.; Resources, K.R. and A.G.; Software, E.G.; Supervision, C.Z.; Validation, C.Z. and A.G.; Writing—original draft, K.R., I.P., A.G., E.G. and C.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Tang, J.; Zhang, S.X.; Lin, S. To reopen or not to reopen? How entrepreneurial alertness influences small business reopening after the COVID-19 lockdown. *J. Bus. Ventur. Insights* **2021**, *16*, e00275. [CrossRef]
2. Nebolsina, E. The impact of the Covid-19 pandemic on the business interruption insurance demand in the United States. *Heliyon* **2021**, *7*, e08357. [CrossRef] [PubMed]
3. Zarghami, S.A. A reflection on the impact of the COVID-19 pandemic on Australian businesses: Toward a taxonomy of vulnerabilities. *Int. J. Disaster Risk Reduct.* **2021**, *64*, 102496. [CrossRef] [PubMed]
4. Kettinger, W.J.; Ryoo, S.Y.; Marchand, D.A. We're engaged! Following the path to a successful information management capability. *J. Strat. Inf. Syst.* **2021**, *30*, 101681. [CrossRef]
5. Huang, P.Y.; Niu, B.; Pan, S.L. Platform-based customer agility: An integrated framework of information management structure, capability, and culture. *Int. J. Inf. Manag.* **2021**, *59*, 102346. [CrossRef]
6. Manandhar, R.; Siebeneck, L.K. Information management and the return-entry process: Examining information needs, sources, and strategies after Superstorm Sandy. *Int. J. Disaster Risk Reduct.* **2021**, *53*, 102015. [CrossRef]
7. Sharma, A.; Rana, N.P.; Nunkoo, R. Fifty years of information management research: A conceptual structure analysis using structural topic modeling. *Int. J. Inf. Manag.* **2021**, *58*, 102316. [CrossRef]
8. Omar, Y.M.; Minoufekr, M.; Plapper, P. Business analytics in manufacturing: Current trends, challenges and pathway to market leadership. *Oper. Res. Perspect.* **2019**, *6*, 100127. [CrossRef]
9. Donaldson, D.A. Digital from farm to fork: Infrastructures of quality and control in food supply chains. *J. Rural. Stud.* **2021**, *91*, 228–235. [CrossRef]
10. Óskarsdóttir, M.; Bravo, C.; Sarraute, C.; Vanthienen, J.; Baesens, B. The value of big data for credit scoring: Enhancing financial inclusion using mobile phone data and social network analytics. *Appl. Soft Comput. J.* **2019**, *74*, 26–39. [CrossRef]
11. Doumpos, M.; Zopounidis, C.; Gounopoulos, D.; Platanakis, E.; Zhang, W. Operational research and artificial intelligence methods in banking. *Eur. J. Oper. Res.* **2023**, *306*, 1–16. [CrossRef]
12. Koot, M.; Mes MR, K.; Iacob, M.E. A systematic literature review of supply chain decision making supported by the Internet of Things and Big Data Analytics. *Comput. Ind. Eng.* **2021**, *154*, 107076. [CrossRef]
13. Nespeca, V.; Comes, T.; Meesters, K.; Brazier, F. Towards coordinated self-organization: An actor-centered framework for the design of disaster management information systems. *Int. J. Disaster Risk Reduct.* **2020**, *51*, 101887. [CrossRef]
14. Ardito, L.; Scuotto, V.; Del Giudice, M.; Petruzzelli, A.M. A bibliometric analysis of research on Big Data analytics for business and management. *Manag. Decis.* **2019**, *57*, 1993–2009. [CrossRef]
15. Ding, Y.; Wu, Z.; Tan, Z.; Jiang, X. Research and application of security baseline in business information system. *Procedia Comput. Sci.* **2021**, *183*, 630–635. [CrossRef]
16. Jiang, X.; Ding, Y.; Ma, X.; Li, X. Compliance analysis of business information system under classified protection 2.0 of cybersecurity. *Procedia Comput. Sci.* **2021**, *183*, 87–93. [CrossRef]
17. Trigo, A.; Belfo, F.; Estébanez, R.P. Accounting Information Systems: Evolving towards a Business Process Oriented Accounting. *Procedia Comput. Sci.* **2016**, *100*, 987–994. [CrossRef]
18. Ponisciakova, O.; Gogolova, M.; Ivankova, K. The Use of Accounting Information System for the Management of Business Costs. *Procedia Econ. Financ.* **2015**, *26*, 418–422. [CrossRef]
19. Azevedo, J.; Duarte, J.; Santos, M.F. Implementing a business intelligence cost accounting solution in a healthcare setting. *Procedia Comput. Sci.* **2021**, *198*, 329–334. [CrossRef]
20. Anaya, L.; Qutaishat, F. ERP systems drive businesses towards growth and sustainability. *Procedia Comput. Sci.* **2022**, *204*, 854–861. [CrossRef]
21. Molina-Castillo, F.-J.; Rodríguez, R.; López-Nicolas, C.; Bouwman, H. The role of ERP in business model innovation: Impetus or impediment. *Digit. Bus.* **2022**, *2*, 100024. [CrossRef]
22. Coşkun, E.; Gezici, B.; Aydos, M.; Tarhan, A.K.; Garousi, V. ERP failure: A systematic mapping of the literature. *Data Knowl. Eng.* **2022**, *142*, 102090. [CrossRef]
23. Bernroider EW, N.; Wong CW, Y.; Lai, K.H. From dynamic capabilities to ERP enabled business improvements: The mediating effect of the implementation project. *Int. J. Proj. Manag.* **2014**, *32*, 350–362. [CrossRef]
24. Hagel, J. Bringing analytics to life. *J. Account.* **2015**, *219*, 24. Available online: https://www.journalofaccountancy.com/issues/2015/feb/big-data-analytics-management-accounting.html (accessed on 2 July 2022).
25. Ahmed, R.; Shaheen, S.; Philbin, S.P. The role of big data analytics and decision-making in achieving project success. *J. Eng. Technol. Manag. JET-M* **2022**, *65*, 101697. [CrossRef]
26. Li, L.; Lin, J.; Ouyang, Y.; Luo, X. Evaluating the impact of big data analytics usage on the decision-making quality of organizations. *Technol. Forecast. Soc. Chang.* **2022**, *175*, 121355. [CrossRef]
27. Barton, D.; Court, D. Making advanced analytics work for you. *Harv. Bus. Rev.* **2012**, *90*, 78–83.
28. Shah, S.; Horne, A.; Capella, J. Good Data Won't Guarantee Good Decisions. *Harv. Bus. Rev.* **2012**, *90*, 23–25.

29. Li, C.; Chen, Y.; Shang, Y. A review of industrial big data for decision making in intelligent manufacturing. *Eng. Sci. Technol. Int. J.* **2022**, *29*, 101021. [CrossRef]
30. Ulrich, P.; Becker, W.; Fibitz, A.; Reitelshöfer, E.; Schuhknecht, F. Data Analytics Systems and SME type—A Design Science Approach. *Procedia Comput. Sci.* **2018**, *126*, 1162–1170. [CrossRef]
31. Brunnschweiler, C.; Edjekumhene, I.; Lujala, P. Does information matter? Transparency and demand for accountability in Ghana's natural resource revenue management. *Ecol. Econ.* **2021**, *181*, 106903. [CrossRef]
32. Do, H.; Budhwar, P.; Shipton, H.; Nguyen, H.D.; Nguyen, B. Building organizational resilience, innovation through resource-based management initiatives, organizational learning and environmental dynamism. *J. Bus. Res.* **2022**, *141*, 808–821. [CrossRef]
33. Ma, S.; Ding, W.; Liu, Y.; Ren, S.; Yang, H. Digital twin and big data-driven sustainable smart manufacturing based on information management systems for energy-intensive industries. *Appl. Energy* **2022**, *326*, 119986. [CrossRef]
34. Wang, B.; Wang, Y.; Yan, F.; Zhao, W. Safety intelligence toward safety management in a big-data environment: A general model and its application in urban safety management. *Safety Sci.* **2022**, *154*, 105840. [CrossRef]
35. Aria, M.; Cuccurullo, C. Bibliometrix: An R-tool for comprehensive science mapping analysis. *J. Informetr.* **2017**, *11*, 959–975. [CrossRef]
36. Tamala, J.K.; Maramag, E.I.; Simeon, K.A.; Ignacio, J.J. A bibliometric analysis of sustainable oil and gas production research using VOSviewer. *Clean. Eng. Technol.* **2022**, *7*, 100437. [CrossRef]
37. Niknejad, N.; Ismail, W.; Bahari, M.; Hendradi, R.; Salleh, A.Z. Mapping the research trends on blockchain technology in food and agriculture industry: A bibliometric analysis. *Environ. Technol. Innov.* **2021**, *21*, 101272. [CrossRef]
38. Huber, J.C. The underlying process generating Lotka's Law and the statistics of exceedances. *Inf. Process. Manag.* **1998**, *34*, 471–487. [CrossRef]
39. Kumar, S.; Sharma, P.; Garg, K.C. Lotka's law and institutional productivity. *Inf. Process. Manag.* **1998**, *34*, 775–783. [CrossRef]
40. Egghe, L. Consequences of Lotka's law in the case of fractional counting of authorship and of first author counts. *Math. Comput. Model.* **1993**, *18*, 63–77. [CrossRef]
41. Amodio, P.; Brugnano, L.; Scarselli, F. Implementation of the PaperRank and AuthorRank indices in the Scopus database. *J. Informetr.* **2021**, *15*, 101206. [CrossRef]
42. Marcucci, G.; Ciarapica, F.; Poler, R.; Sanchis, R. A bibliometric analysis of the emerging trends in silver economy. *IFAC-Pap.* **2021**, *54*, 936–941. [CrossRef]
43. Chen, H.; Jin, Q.; Wang, X.; Xiong, F. Profiling academic-industrial collaborations in bibliometric-enhanced topic networks: A case study on digitalization research. *Technol. Forecast. Soc. Chang.* **2022**, *175*, 121402. [CrossRef]
44. Sivarajah, U.; Kamal, M.M.; Irani, Z.; Weerakkody, V. Critical analysis of Big Data challenges and analytical methods. *J. Bus. Res.* **2017**, *70*, 263–286. [CrossRef]
45. Akter, S.; Wamba, S.F. Big data analytics in E-commerce: A systematic review and agenda for future research. *Electron. Mark.* **2016**, *26*, 173–194. [CrossRef]
46. Ng, I.C.L.; Wakenshaw, S.Y.L. The Internet-of-Things: Review and research directions. *Int. J. Res. Mark.* **2017**, *34*, 3–21. [CrossRef]
47. Côrte-Real, N.; Oliveira, T.; Ruivo, P. Assessing business value of Big Data Analytics in European firms. *J. Bus. Res.* **2017**, *70*, 379–390. [CrossRef]
48. Mikalef, P.; Krogstie, J.; Pappas, I.O.; Pavlou, P. Exploring the relationship between big data analytics capability and competitive performance: The mediating roles of dynamic and operational capabilities. *Inf. Manag.* **2020**, *57*, 103169. [CrossRef]
49. Lezoche, M.; Panetto, H.; Kacprzyk, J.; Hernandez, J.E.; Díaz, M.M.E.A. Agri-food 4.0: A survey of the supply chains and technologies for the future agriculture. *Comput. Ind.* **2020**, *117*, 103187. [CrossRef]
50. Holsapple, C.; Lee-Post, A.; Pakath, R. A unified foundation for business analytics. *Decis. Support Syst.* **2014**, *64*, 130–141. [CrossRef]
51. Mikalef, P.; Boura, M.; Lekakos, G.; Krogstie, J. Big Data Analytics Capabilities and Innovation: The Mediating Role of Dynamic Capabilities and Moderating Effect of the Environment. *Br. J. Manag.* **2019**, *30*, 272–298. [CrossRef]
52. Mikalef, P.; Boura, M.; Lekakos, G.; Krogstie, J. Big data analytics and firm performance: Findings from a mixed-method approach. *J. Bus. Res.* **2019**, *98*, 261–276. [CrossRef]
53. Müller, O.; Fay, M.; vom Brocke, J. The Effect of Big Data and Analytics on Firm Performance: An Econometric Analysis Considering Industry Characteristics. *J. Manag. Inf. Syst.* **2018**, *35*, 488–509. [CrossRef]
54. Pan, Y.; Zhang, L. Roles of artificial intelligence in construction engineering and management: A critical review and future trends. *Autom. Constr.* **2021**, *122*, 103517. [CrossRef]
55. Moeuf, A.; Lamouri, S.; Pellerin, R.; Tamayo-Giraldo, S.; Tobon-Valencia, E.; Eburdy, R. Identification of critical success factors, risks and opportunities of Industry 4.0 in SMEs. *Int. J. Prod. Res.* **2020**, *58*, 1384–1400. [CrossRef]
56. Chen, Y. Industrial information integration—A literature review 2006–2015. *J. Ind. Inf. Integr.* **2016**, *2*, 30–64. [CrossRef]
57. Mortenson, M.J.; Doherty, N.F.; Robinson, S. Operational research from Taylorism to Terabytes: A research agenda for the analytics age. *Eur. J. Oper. Res.* **2015**, *241*, 583–595. [CrossRef]
58. Trieu, V.H. Getting value from Business Intelligence systems: A review and research agenda. *Decis. Support Syst.* **2017**, *93*, 111–124. [CrossRef]
59. Zhang, Y.; Ren, S.; Liu, Y.; Sakao, T.; Huisingh, D. A framework for Big Data driven product lifecycle management. *J. Clean. Prod.* **2017**, *159*, 229–240. [CrossRef]

60. Popovič, A.; Hackney, R.; Tassabehji, R.; Castelli, M. The impact of big data analytics on firms' high value business performance. *Inf. Syst. Front.* **2018**, *20*, 209–222. [CrossRef]
61. Saldanha TJ, V.; Mithas, S.; Krishnan, M.S. Leveraging Customer Involvement for Fueling Innovation: The Role of Relational and Analytical Information Processing Capabilities. *MIS Q.* **2017**, *41*, 367–396. [CrossRef]
62. Lăzăroiu, G.; Neguriţă, O.; Grecu, I.; Grecu, G.; Mitran, P.C. Consumers' Decision-Making Process on Social Commerce Platforms: Online Trust, Perceived Risk, and Purchase Intentions. *Front. Psychol.* **2020**, *11*, 890. [CrossRef] [PubMed]
63. Lai, Y.; Sun, H.; Ren, J. Understanding the determinants of big data analytics (BDA) adoption in logistics and supply chain management: An empirical investigation. *Int. J. Logist. Manag.* **2018**, *29*, 676–703. [CrossRef]
64. Oraee, M.; Hosseini, M.R.; Papadonikolaki, E.; Palliyaguru, R.; Arashpour, M. Collaboration in BIM-based construction networks: A bibliometric-qualitative literature review. *Int. J. Proj. Manag.* **2017**, *35*, 1288–1301. [CrossRef]
65. Sinha, A.; Priyadarshi, P.; Bhushan, M.; Debbarma, D. Worldwide trends in the scientific production of literature on traceability in food safety: A bibliometric analysis. *Artif. Intell. Agric.* **2021**, *5*, 252–261. [CrossRef]
66. Mühl, D.D.; de Oliveira, L. A bibliometric and thematic approach to agriculture 4.0. *Heliyon* **2022**, *8*, e09369. [CrossRef]
67. Kim, H.; So, K.K.F. Two decades of customer experience research in hospitality and tourism: A bibliometric analysis and thematic content analysis. *Int. J. Hosp. Manag.* **2022**, *100*, 103082. [CrossRef]
68. Ampese, L.C.; Sganzerla, W.G.; Di Domenico Ziero, H.; Mudhoo, A.; Martins, G.; Forster-Carneiro, T. Research progress, trends, and updates on anaerobic digestion technology: A bibliometric analysis. *J. Clean. Prod.* **2022**, *331*, 130004. [CrossRef]
69. Valderrama-Zurián, J.C.; García-Zorita, C.; Marugán-Lázaro, S.; Sanz-Casado, E. Comparison of MeSH terms and KeyWords Plus terms for more accurate classification in medical research fields. A case study in cannabis research. *Inf. Process. Manag.* **2021**, *58*, 102658. [CrossRef]
70. Lu, W.; Liu, Z.; Huang, Y.; Bu, Y.; Li, X.; Cheng, Q. How do authors select keywords? A preliminary study of author keyword selection behavior. *J. Informetr.* **2020**, *14*, 101066. [CrossRef]
71. Karimanzira, D.; Rauschenbach, T. Enhancing aquaponics management with IoT-based Predictive Analytics for efficient information utilization. *Inf. Process. Agric.* **2019**, *6*, 375–385. [CrossRef]
72. Park, G.; Song, M. Predicting performances in business processes using deep neural networks. *Decis. Support Syst.* **2020**, *129*, 113191. [CrossRef]
73. Tkáč, M.; Verner, R. Artificial neural networks in business: Two decades of research. *Appl. Soft Comput. J.* **2016**, *38*, 788–804. [CrossRef]
74. Shamim, S.; Zeng, J.; Khan, Z.; Zia, N.U. Big data analytics capability and decision making performance in emerging market firms: The role of contractual and relational governance mechanisms. *Technol. Forecast. Soc. Chang.* **2020**, *161*, 120315. [CrossRef]
75. Boakye, E.A.; Zhao, H.; Ahia, B.N.K. Emerging research on blockchain technology in finance; a conveyed evidence of bibliometric-based evaluations. *J. High Technol. Manag. Res.* **2022**, *33*, 100437. [CrossRef]
76. Papi, F.G.; Hübner, J.F.; de Brito, M. A Blockchain integration to support transactions of assets in multi-agent systems. *Eng. Appl. Artif. Intell.* **2022**, *107*, 104534. [CrossRef]
77. Perdana, A.; Lee, H.H.; Koh, S.K.; Arisandi, D. Data analytics in small and mid-size enterprises: Enablers and inhibitors for business value and firm performance. *Int. J. Account. Inf. Syst.* **2022**, *44*, 100547. [CrossRef]
78. Koltai, T.; Tamás, A. Performance evaluation of teams in business simulation games with weight restricted data envelopment analysis models. *Int. J. Manag. Educ.* **2022**, *20*, 100688. [CrossRef]
79. Hadjielias, E.; Christofi, M.; Christou, P.; Hadjielia Drotarova, M. Digitalization, agility, and customer value in tourism. *Technol. Forecast. Soc. Chang.* **2022**, *175*, 121334. [CrossRef]
80. Vroon, T.; Teunissen, E.; Drent, M.; Negro, S.O.; van Sark, W.G.J.H.M. Escaping the niche market: An innovation system analysis of the Dutch building integrated photovoltaics (BIPV) sector. *Renew. Sustain. Energy Rev.* **2022**, *155*, 111912. [CrossRef]
81. Bui, Q.-T.; Lo, F.-Y. Technology multinational enterprises from emerging markets: Competitive interplay of international entry timing decisions. *Sustain. Technol. Entrep.* **2022**, *1*, 100019. [CrossRef]
82. Lee, C.K.M.; Ng KK, H.; Jiao, R.J.; Yang, Z. Editorial Notes: Emerging intelligent automation and optimisation methods for adaptive decision making. *Adv. Eng. Inform.* **2022**, *51*, 101500. [CrossRef]
83. Alwis SDe Hou, Z.; Zhang, Y.; Na, M.H.; Ofoghi, B.; Sajjanhar, A. A survey on smart farming data, applications and techniques. *Comput. Ind.* **2022**, *138*, 103624. [CrossRef]
84. Cottu, P.; Ramsey, S.D.; Solà-Morales, O.; Spears, P.A.; Taylor, L. The emerging role of real-world data in advanced breast cancer therapy: Recommendations for collaborative decision-making. *Breast* **2022**, *61*, 118–122. [CrossRef] [PubMed]
85. Stevens, J.L.; Spaid, B.I.; Breazeale, M.; Esmark Jones, C.L. Timeliness, transparency, and trust: A framework for managing online customer complaints. *Bus. Horiz.* **2018**, *61*, 375–384. [CrossRef]
86. Dyussembayeva, S.; Viglia, G.; Nieto-Garcia, M.; Invernizzi, A.C. It makes me feel vulnerable! The impact of public self-disclosure on online complaint behavior. *Int. J. Hosp. Manag.* **2020**, *88*, 102512. [CrossRef]
87. Hutzinger, C.; Weitzl, W.J. Co-creation of online service recoveries and its effects on complaint bystanders. *J. Bus. Res.* **2021**, *130*, 525–538. [CrossRef]
88. Wu, J.; Wood, G.; Chen, X.; Meyer, M.; Liu, Z. Strategic ambidexterity and innovation in Chinese multinational vs. indigenous firms: The role of managerial capability. *Int. Bus. Rev.* **2020**, *29*, 101652. [CrossRef]

89. Ardito, L.; Messeni Petruzzelli, A.; Dezi, L.; Castellano, S. The influence of inbound open innovation on ambidexterity performance: Does it pay to source knowledge from supply chain stakeholders? *J. Bus. Res.* **2020**, *119*, 321–329. [CrossRef]
90. Sangeetha, M.; Hoti, A.; Bansal, R.; Faez Hasan, M.; Gajjar, K.; Srivastava, K. Facilitating artificial intelligence supply chain analytics through finance management during the pandemic crises. *Mater. Today Proc.* **2021**, *56*, 2092–2095. [CrossRef]
91. Mediavilla, M.A.; Dietrich, F.; Palm, D. Review and analysis of artificial intelligence methods for demand forecasting in supply chain management. *Procedia CIRP* **2022**, *107*, 1126–1131. [CrossRef]