A Bibliometric Analysis of Prominent Themes in Management Information Systems

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Abstract

This study does a bibliometric analysis to identify important themes in the academic literature on Management Information Systems (MIS) and to investigate how these subjects have evolved over time. Vosviewer and R Studio were utilized as analytic tools. On July 6, 2023, a search for "topic" with the term "Management Information Systems" yielded 2585 items for the period 1970–2023 in this bibliometric analysis. This analysis uses the Web of Science database to find pertinent bibliometric research studies. Studies carried out between 1970 and 2023 (till June) were included in the study's search on the Web of Science database. The findings highlight some important main ideas and sub-themes in the MIS discipline. Also looked at was how these motifs evolved and altered throughout time. This study offers a place to start when assessing broad trends in MIS research and pinpointing potential future difficulties. Researchers and practitioners can use this information to find and close gaps in the literature. As a result, the important topics and trends in the MIS literature are better understood thanks to this bibliometric research. The analyses also demonstrate how specific themes have changed over time and how these problems may serve as a basis for future study.

Keywords: Management Information Systems, Bibliometric Analysis, Co-Citation Analysis, Data Visualization, Research Trends.

Article Type: Research Article

Yönetim Bilişim Sistemlerinde Öne Çıkan Temaların Bibliyometrik Analizi

Öz

Bu çalışma, Yönetim Bilişim Sistemleri (YBS) ile ilgili akademik literatürdeki önemli temaları belirlemek ve bu konuların zaman içinde nasıl geliştiğini araştırmak için bibliyometrik bir analiz yapmaktadır. Analitik araçlar olarak Vosviewer ve R Studio kullanılmıştır. 6 Temmuz 2023 tarihinde "Yönetim Bilişim Sistemleri" terimi ile "konu" araması yapıldığında, bu bibliyometrik analizde 1970-2023 dönemi için 2585 öğe ortaya çıkmıştır. Bu analiz, ilgili bibliyometrik araştırma çalışmalarını bulmak için Web of Science veri tabanını kullanmaktadır. Çalışmanın Web of Science veri tabanındaki aramasına 1970 ile 2023 yılları arasında (Haziran ayına kadar) yapılan çalışmalar dahil edilmiştir. Bulgular, YBS disiplinindeki bazı önemli ana fikirleri ve alt temaları vurgulamaktadır. Ayrıca bu motiflerin zaman içinde nasıl geliştiği ve değiştiği de incelenmiştir. Bu çalışma, YBS araştırmalarındaki geniş eğilimleri değerlendirirken ve gelecekteki potansiyel zorlukları belirlerken bir başlangıç noktası sunmaktadır. Araştırmacılar ve uygulayıcılar bu bilgileri literatürdeki boşlukları bulmak ve kapatmak için kullanabilirler. Sonuç olarak, bu bibliyometrik araştırma sayesinde YBS literatüründeki önemli konular ve eğilimler daha iyi anlaşılmaktadır. Analizler ayrıca belirli temaların zaman içinde nasıl değiştiğini ve bu sorunların gelecekteki çalışmalar için nasıl bir temel oluşturabileceğini göstermektedir.

Anahtar Kelimeler: Yönetim Bilişim Sistemleri, Bibliyometrik Analiz, Ortak Atıf Analizi, Veri Görselleştirme, Araştırma Trendleri.

Makale Türü: Araştırma Makalesi

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1. INTRODUCTION

Most contemporary businesses, organizations, and institutions rely heavily on technology to run their everyday operations. Because of technological developments and the usage of automated equipment, tasks are completed more quickly, better, and efficiently. This has increased the productivity of operations that use data. Information systems (IS) grew into a critical component of how effectively a corporation works with the growth of computer technology. An information system comprises interconnected components that manage information collection, processing, storage, and sharing. information is gathered, processed, saved, and distributed to help management by assisting organizational control and decision-making. Systems for gathering, processing, analyzing, obtaining, and disseminating information are known as management information systems. These systems are essential to management function, process, and decision-making. The planning, organizing, and managing software that is used to acquire and store information conveniently is also a part of the management information system (El-Ebiary et al., 2016).

Institutions may be required to make hasty decisions without enough information. This may put strain on levels of decision-making that change quickly and involve greater risk. In this situation, information has developed into a crucial element and resource for managing a company, especially for making decisions. For businesses to monitor, manage, and handle any difficulties that may arise in their operations, they need well-designed information systems. Businesses anticipate that data will help them make decisions in the future. MIS is regarded as a practical and specialized field that centers on the utilization of various forms of information technology across society, corporate entities, groups, and individuals, encompassing strategic, managerial, and operational contexts. MIS operates within an interdisciplinary framework that influences or is influenced by a variety of fields, either directly or indirectly. The dynamic content of MIS, which continually evolves through its interactions with diverse fields, primarily encompasses elements from cognitive psychology, computer science, economics, management, operations research, organizational philosophy, and engineering principles (Ozkose et al., 2022).

The MIS, a structured, multidimensional, and automated information system, is responsible for collecting, maintaining, and transferring essential information to support company management operations (Alawamleh et al., 2021). Organizations are able to plan, manage, and control the activities for which they are accountable quickly and efficiently because to MIS. MIS functions as a structured system that employs systematic protocols to furnish management with data-derived information, sourced from both internal and external outlets, spanning all tiers and departments. There isn't a single, agreed-upon definition of MIS. It is naturally challenging to pinpoint the precise boundaries of the area of MIS because it is connected to so many various industries, including business, computer science, and the health sector (Ozkose et al., 2022).

Holsapple (2008) notes that by assessing the information in the field and examining its intellectual core, it is possible to determine how the MIS field has formed its identity. The most significant conclusion to draw from this is to periodically unveil the picture of the literature. Bibliometric studies play a vital role in identifying specific subjects and grasping the composition of researchers within that particular field. Researchers can learn about new advancements in the literature and the work of other well-known experts in the subject thanks to these studies. Researchers can also learn about important publications that are outstanding in particular domains as well as the conversation subjects in those journals. In the discipline of MIS, bibliometrics and related techniques have been used since the early 1980s. Statistics regarding the articles are typically included in these investigation (Damar et al., 2021). However, Ozkose and Gencer (2017) used bibliometric mapping to thoroughly research the MIS sector among 1980 and 2015.

The research questions and hypotheses for this study are listed below:

Research Questions:

- What important themes and subtopics exist in the academic literature on Management Information Systems (MIS)?

- Does this study show how these themes have developed and changed over time?

- How can the identification of major themes and sub-themes in MIS research contribute to the identification of future challenges?

Hypotheses:

- H1: The MIS literature shows the emergence of different themes and sub-themes over time.

- H2: Specific themes have evolved and changed within the historical range of MIS research.

- H3: This bibliometric analysis can help identify important themes that can guide future work for researchers and practitioners in the MIS field.

- H4: The evolution of themes in the MIS literature contributes to the identification of future research opportunities and challenges.

2. LITERATURE REVIEW

In this section of the study, the literature on MIS is analyzed, and some of the related bibliometric studies are given. Management Information Systems (MIS) remains a relatively young academic discipline, shaped by its unique history and traditions (Culnan & Swanson, 1986). It is primarily concerned with the strategic, managerial, and operational application of various information technologies at the societal, organizational, and individual levels. MIS draws from a diverse range of disciplines, encompassing computer science, behavioral science, decision science, cognitive psychology, operations management, organization theory, and engineering (Katerattanakul et al., 2006). Over the years, MIS researchers have examined the field's past, present, and future development. In the 1980s, MIS research frameworks emerged, with MIS conceptualized as "a computer-based organizational information system that provides support for management activities and functions" (Ives et al., 1980). Author co-citation analysis was employed to study the advancement of MIS research (Culnan, 1987). MIS gained formal recognition as a discipline in the 1990s, with the development of a keyword classification scheme for MIS literature (Barki et al., 1993). Despite being in existence for more than three decades, MIS has yet to establish a distinct identity as a reference discipline, largely due to the ever-changing research directions and technological innovations. Research trends in MIS have been examined, revealing a primary focus on aspects of information system (IS) usage and IS resource management. However, the field is maturing, with an increasing emphasis on rigorous research approaches, including mathematical models and laboratory experiments (Palvia et al., 2007). The academic identity of MIS is revealed through two key intellectual cores: the IT Artifact and IS theme. Recent scholars have also begun to explore literature presented at conferences. The MIS field has been shaping its identity through scientometric perspectives in key MIS conferences held globally, regionally, and nationally, signifying the evolution of collaborative research and academic output, leading to academic maturity and a commitment to various academic meetings (Mohanty & Sahoo, 2016). The impact of MIS has been shown to be highly significant in a study that assessed the mutual and shared effects of MIS (Mohanty, 2014). Moreover, Merigo et al. (2018) conducted a review of the 50th anniversary of IS, focusing on the publication and citation counts of journals using graphical analysis rather than thematic analysis. Similarly, La Paz et al. (2020) reviewed the 25th IS Journal anniversary using an ontological review and focusing on research types rather than themes, while Culnan's (1987)

presentation of MIS Quarterly followed an intellectual structure. Other studies, such as Hu et al. (2002), examined the holdings of IS journals in university libraries and listed the number of journals each university offered in relation to MIS degrees. Universities were categorized based on the highest degree they offered, with individual journal titles ranked according to the overall number of university libraries that subscribed to them. These titles served as publication outlets for MIS, but provided no information about the scope of materials used for research production.

However, Seo and Han (1997) analyzed MIS researchers, research themes, methodology, and intellectual structure to examine general research patterns in the field of MIS. The study identifies the themes of MIS research, prominent journals, and influential researchers by using methods such as analyzing the topics of academic journal articles, citation analysis, and author co-citation analysis. As a result of these analyses, it was found that the prominent journals in the field of MIS are "MIS Quarterly," "Management Science," and "Communications of ACM," and researchers such as Ives, DeSanctis, Ginzberg, Lucas, Rockart, and Davis are important names. MIS research in Korea is centered around themes such as information systems management, DSS/GDSS strategic information systems, and artificial intelligence applications. This study represents a bibliometric analysis to understand the general research patterns and themes in the MIS field, which can help researchers and practitioners identify gaps in the literature and guide future studies.

Lin et al. (2016) reviewed articles published in the top ten journals to examine contributions to information systems and management information systems (MIS) in electronic commerce literature. This bibliometric study examined the existing literature on information systems, MIS, and international business. It analyzed a sample of 853 articles published in ten leading management and business journals between 1991 and 2014. The results provide a global overview of the field, identifying the most influential studies in the field, the intellectual links between authors and published articles, and the major research traditions or themes explored in information systems and MIS studies. Structural and longitudinal analyses show changes in the intellectual structure of the field over time. The study concludes by discussing the accumulated knowledge and providing recommendations for future research paths.

Ozkose and Gencer (2017) conducted a study to comprehensively analyze the field of management information systems (MIS) using bibliometric mapping. A total of 222 journals included in the Science Citation Index Expanded (SCI-E) and Social Science Index (SSCI) selected from the Web of Science and Scopus databases were identified. In the selection of journals, expert opinions were consulted for a better interpretation of the field. After the expert opinions, 24 journals were selected, and analyses were conducted on these journals. Firstly, a total of 20,497 English articles were collected from the Web of Science (WoS) Core Collection in these journals, covering the period 1980–2015. After the text mining process, influential institutions, authors, and countries were graphically represented by statistical analyses using BibExcel. In addition, the annual evolution of the published articles is visually presented, and the trend analysis of these articles is interpreted. In addition, the most cited articles are also included. Then, using VosViewer, the most associated terms in this field were identified by association analysis through abstracts and keywords. The terms and their clusters were visualized on a graph, and density maps were used. Graphs and density maps were interpreted in detail.

Alfawareh et al. (2021) conducted a study to examine the trends of management information systems (MIS) research between 2017 and 2021 and to compare the contributions of this research based on different countries and authors. In particular, this study presents a bibliometric analysis highlighting key themes in MIS over the last five years. The analysis highlights influential leading MIS journals, authors, contributing countries, source types, supporting institutions, document languages, and subject areas. Data were selected from the Web of Science and Scopus databases based on defined search terms

related to MIS. Microsoft Excel 2016 was used to summarize bibliometric characteristics, the number of publications, subject areas, and country contributions. Based on the search results, a total of 3624 articles were included. The results showed that most of the articles were published in journals and conferences, mostly in the English language. It also indicated that research in the field of MIS is largely conducted in the fields of computer, engineering, medical, and management sciences, with China providing the largest article contribution. "Journal of Physics" and "International Conference on Information Systems Development" were the journals with the highest number of publications, while the European Commission, the National Natural Science Foundation of China, and the National Science Foundation were the most supporting organizations. The results provide a global overview of the MIS field, identifying the most impactful studies and the main research traditions or themes explored in MIS studies. Structural analyses showed changes in the MIS field over time. The study concluded with recommendations for future research and accumulated knowledge.

Ozkose et al. (2022) considered the discipline of management information systems (MIS) to have an interdisciplinary nature that is evolving and changing with the influence of other fields. In this context, they conducted an analysis of 25,304 articles published in the Scopus database from 2016 to 2021. Performance analysis, which is part of bibliometric analysis, was then used to measure the research productivity and impact of authors, institutions, countries, and journals. In this way, the most influential authors, institutions, countries, and journals in the discipline were identified. Then, the articles were grouped into 15 categories, and the topic was analyzed by modeling. These categories were analyzed annually, and more detailed results were obtained. This study has revealed the baselines of the MIS field and provided a guide for researchers on the topics they can focus on in the future.

In summary, fundamental literature and research themes in online reviews of MIS are still lacking, and as such, this study reviews recent publications in this dynamically expanding field, as evidenced by the fact that the majority of the works were published in the past five years. Finally, this work presents an innovative thematic evolution chart and analyzes network structure dimensions, providing deeper insights into the field's development and status.

3. BIBLIOMETRIC ANALYSIS

In the recent times, there has been a surge in the adoption of bibliometric analysis. The rise of bibliometric methodologies, the availability of research databases such as Scopus and Web of Science, the expanding utilization of bibliometric approaches spanning various disciplines, along with the practicality and user-friendliness of bibliometric tools like Gephi, Leximancer, and Vosviewer, collectively contribute to this trend (Donthu et al., 2021). Bibliometric analysis involves quantitatively evaluating research that has been documented in the scientific literature pertaining to a specific subject. These analyses often examine articles created by a certain author or institution on a specific subject during a specific time period. This kind of analysis is used to spot broad patterns in the literature, popular subjects, influential organizations or writers in a certain field, and works that are often mentioned (Hood and Wilson, 2001). Bibliometric analyses may reveal some unexpected results. For instance, it can be discovered that a certain person or group has done the majority of the work in an area, or that a lot of work has been done on a specific issue but very little of it is referenced. Such data may be helpful in identifying the fields that require more research (Aksnes, 2003). Additionally, bibliometric analyses may be utilized to assess a university's or research institution's success. For instance, it is possible to ascertain the importance of a university in a specific discipline, the most prominent researchers, or the most well-liked academic subjects there (Abramo et al., 2014). Results from bibliometric analyses are frequently trustworthy and unbiased since they frequently draw from huge databases. This kind of analysis can therefore be a useful tool for comprehending and analyzing the literature (Van Raan, 2005). Bibliometric analyses do have certain restrictions, though. For instance, the quantity of citations is

frequently employed as a measure of a work's quality, although it is not necessarily reliable. Additionally, because bibliometric analyses often only include research located in certain databases, they could not contain all published works (Hicks et al., 2015).

Bibliometric analysis is used by academics for a number of purposes, such as identifying novel trends in the performance of articles and journals, patterns of cooperation, and research components, as well as studying the intellectual underpinnings of a certain subject within the body of literature. Large-scale (performance analysis, etc.), subjective (thematic analysis, etc.), knowledge-based methodologies, and processes are utilized to generate the data that form the core of bibliometric analysis. By carefully evaluating huge volumes of unstructured data, bibliometric analysis can be valuable in unraveling and documenting the corpus of scientific knowledge as well as the subtle evolution of established fields. Therefore, properly carried out bibliometric research can create solid foundations for expanding a subject in fresh and important ways (Donthu et al., 2021).

Given the interdisciplinary nature of management information systems (MIS) and the extensive research conducted in this field, possessing a comprehensive understanding of the subject and discerning current trends in the literature is of utmost importance. This necessitates employing bibliometric analysis methods within this domain. In their study, Ozkose et al. (2022) focused on MIS-related publications in the Scopus database. Our research, however, is limited to publications in the Web of Science database that specifically address MIS as a subject. Additionally, the co-citation and bibliographic coupling analyses are not included in this paper. In contrast, in addition to expanding on the findings of Ozkose et al. (2022), our work also takes into account co-citation and bibliographic coupling studies. We anticipate that our study will add something worthwhile to the body of knowledge already available as a consequence.

The objective of this research is to address the existing knowledge void by conducting a comprehensive examination of the volume and quality of research in the field of management information systems within a specified timeframe. A search for articles published between 2015 and 2023 was conducted using the keyword 'Management Information Systems' in the Web of Science database, up until June. Network analysis of the collected data was performed using Vosviewer and R applications. The initial section of the article presents descriptive data, including yearly scientific output, leading nations in terms of productivity, total country citations, national collaborations, most productive nations and authors, as well as essential study-related information. The subsequent section presents analyses involving document co-occurrence, bibliographic correlations, and co-citation patterns. Descriptive statistics were handled by the R software's bibliometric package, while the second section was handled by the VOSviewer tool. This investigation facilitated the identification of current trends and significant topics within the MIS field.

4. METHODOLOGY AND DATA COLLECTION

The approach used in this bibliometric analysis was developed by Ruiz-Real (2018). This includes: (1) supplying the database, (2) choosing the search criteria, keywords, and time zones, (3) exporting the entire results, (4) analyzing the data, and (5) outlining the results. By choosing the "subject" with the keyword "Management Information Systems" on 07/06/2023, 2585 results were found for the study between 1970 and 2023. 1583 articles, 821 papers, 4 books, 68 book reviews, 85 book chapters, 81 review articles, and 15 early access articles were discovered in accordance with these findings. Bibliometric research often makes use of the Web of Science and Scopus databases. In this study, the Web of Science database was utilized to identify relevant papers.

Bibliometric analyzes can be performed using a range of software that allows analysis and visualization of a wide range of datasets. One of these software is VOSviewer (Van Eck and Waltman,

2010) which is often used for visualization and analysis of large text and reference datasets. Another popular tool is CiteSpace, which provides analysis and visualization of scientific publications and citations (Chen, 2006).

HistCite typically tracks the evolution of citations and handles the chronological component of bibliometric analyses (Garfield et al., 2003). In bibliometric analysis, Bibexcel, another program made to find themes, trends, and patterns in scientific writings, is crucial (Persson et al., 2009).

Extensive searches and assessments are conducted within the Scopus and Web of Science databases to locate citations for scientific papers. These databases enable the scrutiny and depiction of publications and citations within a specific field, along with the examination and graphical representation of the articles themselves (Falagas et al., 2008; Kulkarni et al., 2009). For the purposes of this investigation, the Web of Science database was employed to generate descriptive statistics. While each software has its advantages and limitations and is commonly employed in the relevant research, network analysis in this study was carried out using Vosviewer and R. In this context, initial emphasis is placed on furnishing descriptive details. The section on descriptive statistics shows the annual production of scientific knowledge, the most productive nations, the number of citations each nation has gotten, the most productive journals and authors, the best articles per citation, and significant research information. The subsequent segment encompasses the exploration of keyword co-occurrence, bibliographic coupling, and co-citation. Descriptive statistics were computed using the bibliometric package within the R program. Software called VOSviewer was employed to conduct the analyses in the second section.

5. ANALYSIS RESULTS

The R program's bibliometric package was employed to collect descriptive information, encompassing metrics such as yearly scientific output, leading contributor nations, cumulative citations by country, top-performing journals and authors, and articles with the highest citation rates. This section presents the outcomes. Furthermore, outcomes of the Keyword Co-Occurrence Analysis, Bibliographic Coupling, and Co-Citation Analysis executed via the VOSviewer software are also displayed.

5.1. Descriptive Statistics

The search term 'Management Information Systems' was employed to query the Web of Science database for this investigation, yielding a total of 2585 papers. This corpus comprises diverse formats including 4 books, 68 book reviews, 85 book chapters, 81 review articles, 15 early access articles, etc., totaling 1583 articles and 821 papers. The findings from the search unveiled that the earliest documented research dates back to 1970. Table 1 contains basic details regarding the studies that have been published.

Table 1. Basic Information

Basic Information About Studies	Time Range	1970-2023
	Resources (Magazines, Books, etc.)	1559
	Documents	2585
	Document Average Age	16,2
	Average Number of Citations per Document	15,43
	Annual Average Number of Citations Per Document	1,191
	References	64758
Document Types	Article	1583
	Paper	821
	Book	4
	Book Review	68
	Book Chapter	85

	Review Article	81
	Early Access Article	15
Document Content	Keyword Plus (ID)	1965
	Author's Keyword (DE)	5569
Authors	Authors	6229
	Author Views	7177
	Authors of Single-Author Documents	651
Authors Collaboration	Documents per author	0,415
	Co-Authors Per Document	2,78
	International Co-Authorities	14,04

### 5.1.1. Annual Scientific Production

Figure 1 illustrates the annual publication count of research studies. The data for this visualization was acquired using the Bibliometric package within the R program. The first research was carried out in 1970, according to the results of the search employing the chosen keyword. Since this time, there have generally been more research published. The number of studies rose to 102 in 2010. In 2020 there were 116 studies, while in 2022 there were 100 studies. In the end, 35 investigations were completed by June 2023. Studies in this area have, generally speaking, grown in recent years. Furthermore, 6229 writers in total contributed to works in this subject. There were 64,758 citations to research in this area overall. There were 15.43 citations on average per study. The studies' average age is 16.2. This demonstrates that there have been more research done in this area recently. Only 651 of the 2585 papers that were evaluated were single-name articles, too. This result demonstrates that the writers worked together cooperatively throughout the project.
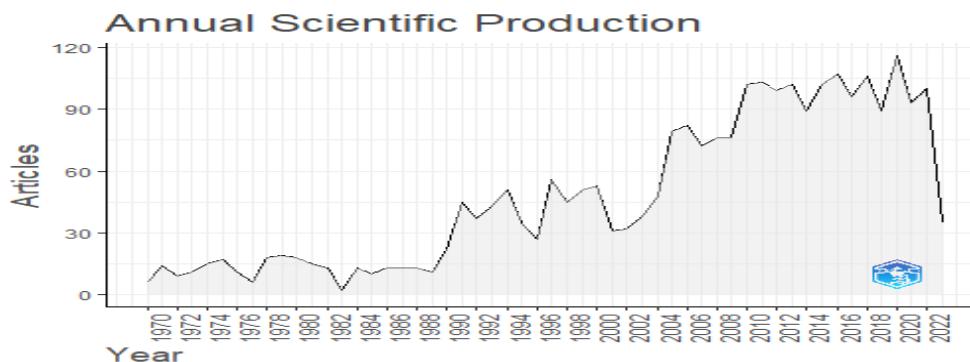
Figure 1. Annual Scientific Production

5.1.2. Most Productive Countries

Figure 2 presents the leading 15 nations in terms of research productivity. These metrics were compiled utilizing the Bibliometric package of the R program. As a result, it was discovered that the USA was responsible for the majority of the research. There have been 661 research on this topic published in the USA overall. The USA is the source of 29.61% of the studies in this topic. 588 of these studies are single-country publications, compared to 73 multi-country articles. The USA collaborated with several nations in 11.04% of its efforts. Following the United States in that order were China, the United Kingdom, Germany, Australia, Canada, Spain, the Netherlands, Poland, Indonesia, India, South Africa, Brazil, Greece, and Turkey.
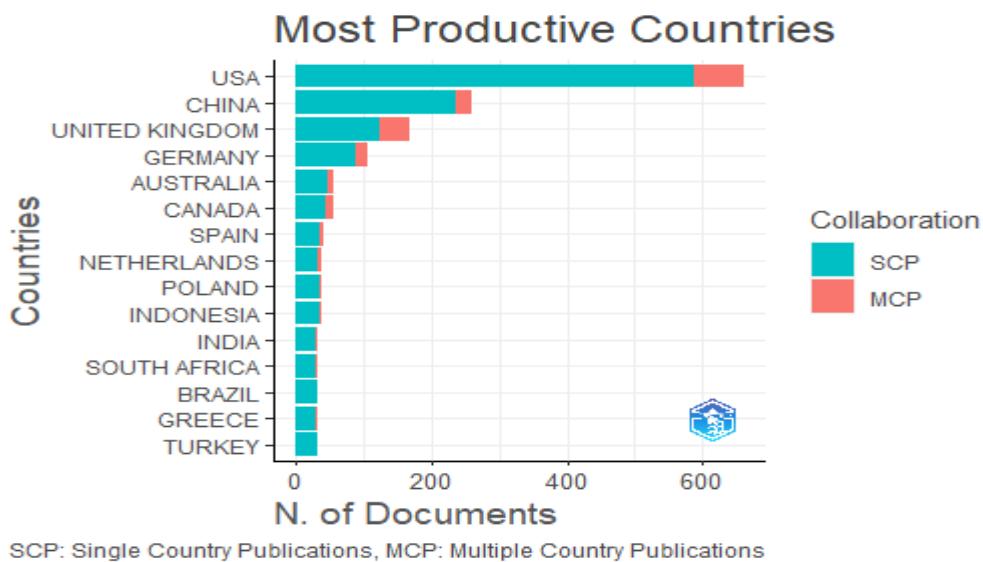
Figure 2. Most Productive Countries

5.1.3. Total Citations Per Country

The ten nations with the most citations are detailed in Table 2. The R program's Bibliometric package was used to get this data. It follows that the USA is the nation that is most frequently referenced. 14880 references in all were sent to the USA. There are typically 22.51 references to the United States in each study. Switzerland obtained 64.75 citations per research, ranking it as the nation with the most citations (Table 2).

Table 2. Total Citations per Country

Rank	Country	Total Citations	Average Article Citations
1	USA	14880	22,51
2	GERMANY	4649	44,27
3	IRAN	4161	24,62
4	CHINA	1912	7,35
5	AUSTRALIA	1403	25,50
6	CANADA	1336	24,29
7	SWITZERLAND	1036	64,75
8	NETNERLANDS	815	20,89
9	ISRAEL	525	58,33
10	SPAIN	502	11,95

5.1.4. Most Prolific Journals and Authors

Table 3 outlines the journals that have published the highest quantity of papers. This data was gathered through utilization of the Bibliometric package within the R program. The journal "Information & Management" published the most research when the term "management information systems" was searched in the Web of Science database. Since 1970, this magazine has published a total of 34 papers. The "MIS Quarterly" journal comes in second, though. This journal has published 32 papers. Then, in order, "Computers and Electronics in Agriculture" had 25 studies, "Journal of Computer Information Systems" had 23, "Decisions Sciences" had 19, and "Communications of The Association for Information Systems" had 18 studies, each as well as 15 studies each in "Industrial Management & Data Systems", "Internatioanal Journal of Information Systems", "BMC Health Services Research", and "Interfaces."

Table 3. Most Prolific Journals

Rank	Journals	Total Articles	Rank	Journals	Total Articles
1	Information & Management	34	6	Communications of The Association For Information Systems	18
2	MIS Quarterly	32	7	Industrial Management & Data Systems	17
3	Computers and Electronics In Agriculture	25	8	Internatioanal Journal of Information Systems	17
4	Journal of Computer Information Systems	23	9	BMC Health Services Research	15
5	Decisions Sciences	19	10	Interfaces	15

Table 4 lists the writers who have published the most on the subject. The R program's Bibliometric package was used to collect this data. According to this data, Hernes, M. has contributed the most research since 1970, with 11 studies. Koumpis, A., and Zhang, P. 9 then took part in the study. With six investigations each, Torkzadeh, G., and Eom, S., followed these writers. Finally, 5 papers were submitted by Galletta, D. F., Edelhauser, E. V., Vichova, K., Wetherbe, and Dijkhuizen, A. A.

Table 4. Most Prolific Writers

Rank	Authors	Total Articles	Rank	Authors	Total Articles
1	Hernes, M	11	6	Galletta, D. F	5
2	Koumpis, A	9	7	Edelhauser, E. V	5
3	Zhang, P	9	8	Vichova, K	5
4	Torkzadeh, G	6	9	Wetherbe, J	5
5	Eom, S	6	10	Dijkhuizen, A. A	5

5.1.5. Top Articles Per Citation

Table 5 lists the information of the most frequently mentioned papers on the topic. The R program's Bibliometric package was used to collect this data. The most often mentioned work in the relevant topic, according to the table, is Hair et al. (2014). A total of 3655 references were made to this work. An average of 365,50 citations have been made every year since its publication. Table 5 provides comprehensive data on other investigations.

Table 5. Top Articles Per Citation

Rank	Authors	Year	Journals	Total Citation	Total Citation Per Year
1	Hair, J.F. et al.	2014	European Business Review	3655	365,50
2	Eppler, M. J. and Mengis, J.	2004	Information Society	894	44,70
3	Rowley, J.	2007	Journal of Information Science	679	39,94
4	Vessey, I.	1991	Decision Sciences	627	19
5	Webster, J. and Martocchio, J. J.	1992	MIS Quarterly	570	17,81
6	Gorry, G. A. and Morton, M. S. S.	1971	Sloan Management Review	503	9,49
7	Hair, J. F. et al.	2019	European Journal of Marketing	472	94,40

| 8	Mason, R.O. and Mitroff, I.	1973	Management Science Series a-Theory	420	8,24
9	Sewell, G. and Wilkinson. B.	1992	Omega-International Journal of Management Science	389	12,16
10	Gorla, N. et al.	2010	Journal of Strategic Information Systems	375	26,79

5.2. VOSviewer Analysis

This section furnishes insights derived from the Keyword Co-Occurrence Analysis, Bibliographic Coupling, and Co-Citation Analysis conducted using the VOSviewer software.

5.2.1. Keyword Co-Occurence Analysis

The simultaneous presence of two or more keywords in a given text is referred to as keyword co-occurrence. This often proves beneficial for comprehending challenges, advancements, and connections within a specific subject area in the realm of scientific literature (Callon et al., 1991). The exploration of emerging and evolving themes within a particular field can be facilitated through keyword co-occurrence analysis. The breadth and emphasis of study in an area may be determined extremely effectively using this. It aids in identifying important and developing problems in a certain field (van Eck and Waltman, 2011). Analysis of keyword co-occurrences may also be used to find links and correlations within a field of study. Understanding the structure and dynamics of research in an area greatly benefits from knowing how frequently certain topics are connected to one another (Coulter et al., 1998). Bibliometric software is typically used for this kind of study. These programs are frequently employed in extensive bibliometric investigations because they have the capacity to analyze and visualize massive datasets (Van Eck and Waltman, 2010).

In our study, there are altogether 5569 keywords. At least 59 keywords appeared at least ten times. The research resulted in the discovery of 59 items overall, 8 clusters, and 315 linkages. Each cluster's keywords are supposed to be closely related to one another and to be less connected to other clusters (Xu et.al., 2018). The first cluster (Red) has 15 items. Artificial intelligence, Covid-19, data quality, design, health information systems, health management information systems, healthcare, hmis, implementation, information, innovation, management, survey, and technology are some of them. 13 items are in the second cluster (Green). These encompass topics such as performance, research, supply chain management, sustainability, e-commerce, management information system, management information systems (MIS), integration, management information system, and information technology. The third cluster (Blue) has 13 items. These include e-learning, education, enterprise resource planning, farm management information systems, higher education, ict, internet of things, and mis. This category additionally covers subjects like big data, business intelligence, cloud computing, data mining, and data mining. The fourth cluster (Yellow) has seven items. These include knowledge management, simulation, developing nations, integrated management information systems, erp, knowledge management, and user satisfaction. The fifth cluster (Brown) has 5 items. These encompass management information system, framework, assessment, and decision support system. The sixth cluster (Pink) consists of 3 items. These include decision assistance systems, bibliometrics, and citation analysis. The seventh set, Orange, has 2 items. Project management information systems and project management are these. Information management makes up the only item in the eighth and final cluster (white). Figure 3 displays an analysis of keyword co-occurrences.
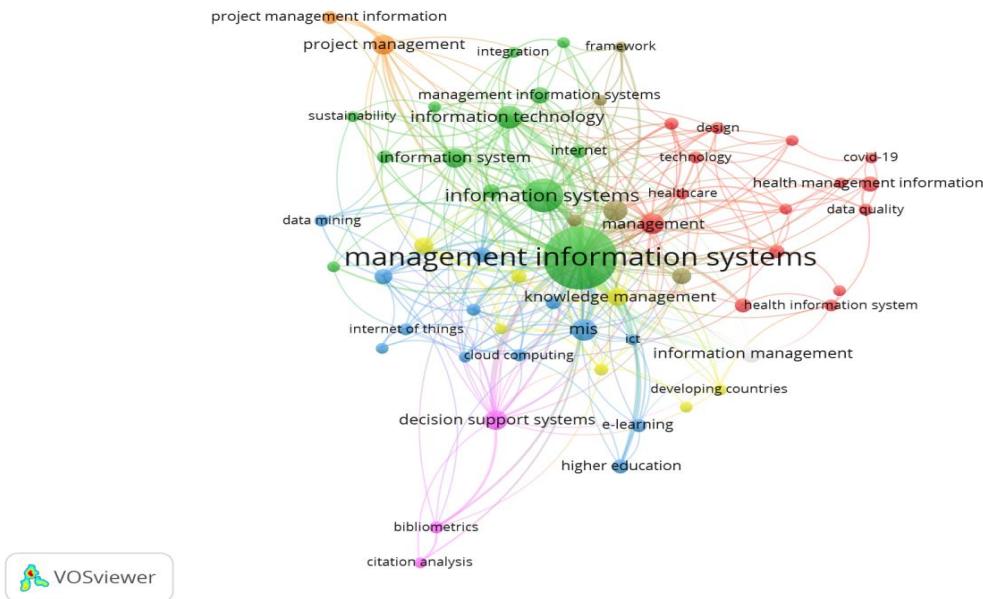
Figure 3. Keyword Co-Occurence Analysis

5.2.2. Bibliographic Coupling and Co-Citation Analysis

The simultaneous utilization of bibliographic coupling and co-citation analysis becomes a valuable asset in studying scientific literature. Both approaches aid in comprehending a certain scientific field's history and development. A bibliographic link happens when the same works are cited in two different texts. This can suggest a connection between the papers and suggest that they deal with related issues. This makes it possible to spot similarities and differences across papers (Kessler, 1963). Understanding the organization of a given scientific topic and the connections between papers is aided by bibliographic linkage analysis (Small and Griffith, 1974). Co-Citation Analysis, on the other hand, is utilized when two documents are cited concurrently in one document. This suggests that the two texts could cover the same or a related subject (Small, 1973). Co-Citation Analysis helps in comprehending the linkages and interactions between different subfields within a discipline. The program VOSviewer may be used as a tool that combines co-citation analysis with bibliographic linkage. It is simpler to comprehend the fundamental organization of a scientific area and the relationships between the documents and themes inside it when these analyses are combined (Van Eck and Waltman, 2010).

Both bibliographic matching and co-citation analysis are covered in this section. The VOSviewer application was used to perform a bibliographic matching study. The outcomes are displayed in Figure 4. Nodes (circles) are used to symbolize articles that are identifiable by the initial author's last name. Node position and color are employed to cluster articles related by citations, while node size corresponds to the weight of the articles. The bibliographic link analysis consisted of 242 items, 13 clusters, 3055 linkages, and a total of 6277 link strengths. This information is supported by the data presented in Figure 4, which depicts 13 clusters.
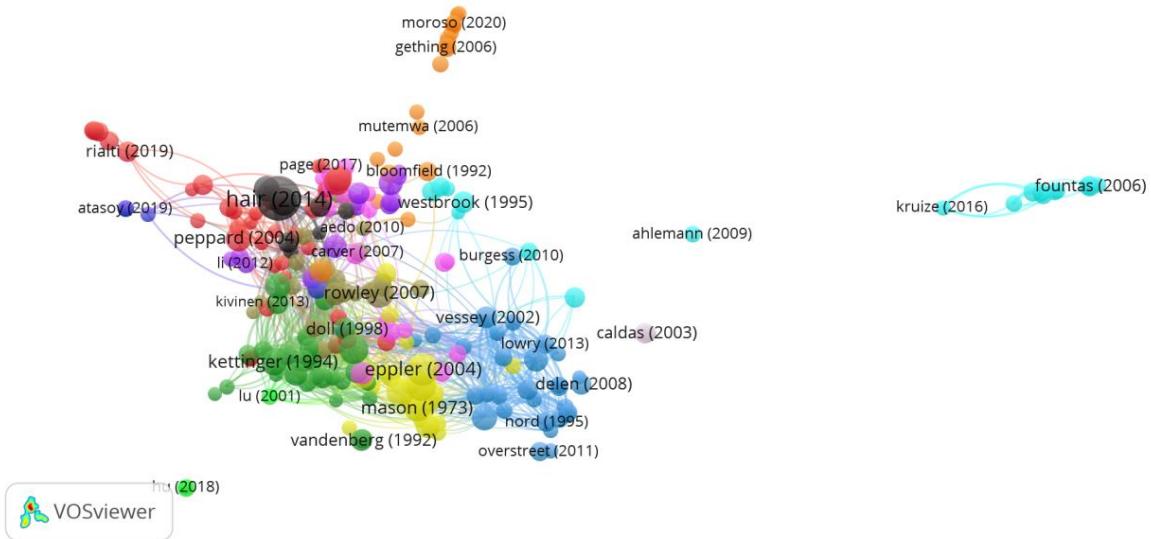
Figure 4. Bibliographic Coupling

- Cluster 1 (red): research involving mathematical modeling, system evaluation tools, and system analysis.

- Cluster 2 (Dark Green): Studies examining the effects of the information system success model

- Cluster 3 (Blue): Literature reviews on the development and current status of management information systems.

- Cluster 4 (Yellow): Structural measurement issues, conceptual frameworks, and strategic planning in the field of management information systems

- Cluster 5 (Brown): Studies examining multi-agency disaster management information systems for public safety and measuring the impact of information management processes

- Cluster 6 (Pink): Research examining the impact on public administration, e-government, and digital transformation

- Cluster 7 (Orange): Studies on health management and digital health

- Cluster 8 (Turquoise): Research examining the application of information systems in agriculture.

- Cluster 9 (Purple): Information systems performance measurement studies

- Cluster 10 (Black): Research focusing on structural equation modelling.

- Cluster 11 (Dark Blue): Studies examining the effects of information systems in healthcare organisations.

- Cluster 12 (Light Green): Research on software integration, maintenance management information systems and new applications.

- Cluster 13 (Light Pink): Studies examining construction management information systems.

Findings stemming from co-citation analysis indicate that the nature of co-citation investigations could exhibit variations influenced by the temporal progression and academic advancements within the field (Ardito et al., 2019). The link between the works of the writers who used the same study is depicted

in Figure 5. Studies having more than 25 citations make up the figure. 24 points and 4 clusters make up the figure.
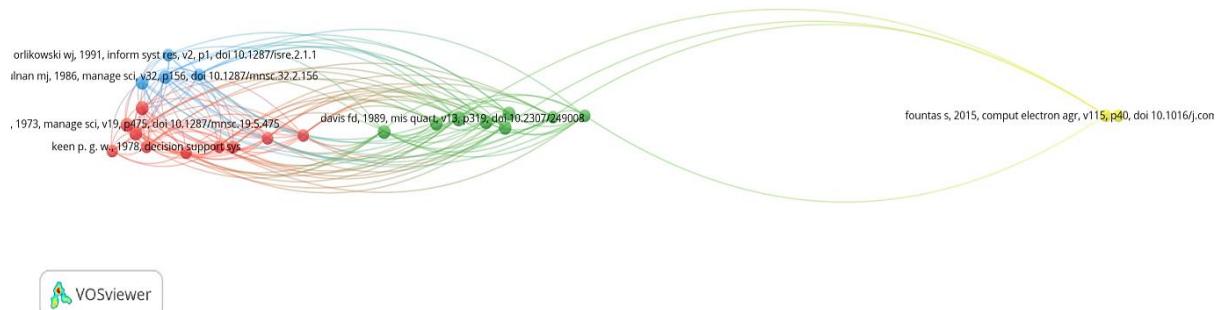
Figure 5. Co-Citation Analysis

Studies in the first cluster (red) include theoretical and applied methods for understanding the achievements, designs, and outcomes of MIS and related systems. Authors such as Ives, DeSanctis, Ginzberg, Lucas, Rockart, and Davis have made significant contributions to these topics. This research has focused specifically on the factors that influence the success or failure of particular MIS instances and has examined system architecture, user satisfaction, and the broader concept of success. They also investigate the impact of user involvement on information systems design, providing a conceptual framework that maps previous research. Therefore, the main objective of these studies is to examine various factors for evaluating, analyzing, and improving the success of MIS and to investigate the impact of these factors on the design, implementation, user satisfaction, and overall success of MIS.

Studies in the second cluster (green) includes theoretical frameworks and studies that examine the adoption, effectiveness, and outcomes of information technologies and systems. These studies aim to gain a deeper understanding of the more effective and successful use of information technologies. Issues such as user acceptance, system effectiveness, the technology acceptance model, and the impact of information systems are frequently investigated. Studies such as Ajzen's (1991) intention theory, Davis et al.'s (1989) studies on computer acceptance, Delone and McLean's (1992, 2003) IS Success Model, Fornell and Larcker's (1981) structural equation models, and Venkatesh and Davis' (2000) TAM extensions are included in this cluster. These studies contribute to a better understanding of the adoption, impact, and success of information technologies and systems.

Studies in the third cluster (blue) focus on the progress of Management Information Systems (MIS) research, its intellectual foundations, and the diversity of academic studies. These studies explore the interdisciplinary nature of MIS, research paradigms, and comprehensive analyses of academic work in the field. Culnan's (1986) work uses author co-citation analysis to illustrate the conceptual growth of ideas in MIS research and introduces emerging mapping to track new areas of research. Culnan and Swanson's (1986) study explores how MIS emerged as an independent research discipline supported by computer science, management science, and organizational science. These reviews aim to reveal the intellectual structure of MIS research, unravel its research traditions, and reveal its role in academic debate.

Studies in the fourth and final cluster (yellow) focus on Farm Management Information Systems (FMIS) and provide a comprehensive review on the functionality, applications and development of these systems. A study by Fountas et al. (2015) examines the academic and industrial use of FMIS and focuses on core system designs, application areas, acceptance status, and profitability of precision agriculture. The research addresses 141 foreign software packages categorized into 11 processes for commercial solutions. Furthermore, another study by Sorensen et al. (2010) examines the limitations and decision-making processes of a Farm Information Management System (FMIS) and builds a conceptual model for developing an effective FMIS to suit the changing needs of farmers. Both studies emphasize the importance of understanding and improving the potential benefits of FMIS for farmers, its functioning,

and patterns of use. These studies reveal that Farm Management Information Systems (FMIS) have an important theme.

6. EVALUATION OF FINDINGS

The study's findings revealed the following. The earliest instance of "Management Information Systems" study can be found in 1970, after which there has been a steady increase in the quantity of studies, particularly after 1990. In 2010, there were 102 studies; by 2020, there were 116; and by 2022, there were 100. Up till June 2023, this field has contributed 35 new studies. There were 6229 unique writers who together contributed to this field of study. All papers in this field earned a total of 64,758 citations, and it was found that each article received an average of 15.43 citations. The studies' average age was determined to be 16.2 years old. These statistics demonstrate how the research sector has become more well-known and influential in recent years. Furthermore, only 651 of the 2585 papers that were examined had only one author. This demonstrates that writers in this field of study frequently collaborate.

Out of a total of 661 research articles, the United States stands as the leading contributor to MIS studies. With a share of 29.61%, the USA accounts for the largest portion of research in this domain. Notably, 73 of these studies are collaborative efforts involving multiple nations, constituting 11.04% of the USA's article count. This underscores the USA's propensity for collaborative research endeavors. Following the USA in terms of prolific content generation are China, the United Kingdom, Germany, Australia, Canada, Spain, the Netherlands, Poland, Indonesia, India, South Africa, Brazil, Greece, and Turkey, in descending order of content dissemination.

Accumulating a total of 14,880 citations, the USA holds the forefront as the most frequently cited nation in the Studies. On average, each study garners 22.51 citations from the United States. Notably, Switzerland emerges with distinction in terms of citation density per study. Boasting an average of 64.75 citations per research, Switzerland outshines other nations in terms of overall citation impact. This highlights the elevated influence and significance of research originating from Switzerland compared to that of other countries.

Another study finding shows that "Information & Management" is the journal with the most publications. Since 1970, this publication has released a total of 34 papers. According to the data, this journal is the most influential and active one in the MIS sector.

On the other hand, it has been shown that Hernes, M., with 11 research, has made the most advancements in this subject since 1970. Koumpis, A., and Zhang, P., with 9 studies, came next. With 6 investigations each, Torkzadeh, G., and Eom, S., followed these writers. Also contributing 5 research each were Galletta, D. F., Edelhauser, E. V., Vichova, K., Wetherbe, and Dijkhuizen. These statistics show that M. Hernes is the most active author in the MIS discipline. The most referenced study in the subject of MIS, according to an evaluation of works' citation counts, is Hair, et al. (2014). Eppler and Mengis' (2004) paper, which received 894 citations and an average of 44.70 each year, came in second.

However, it was found that a total of 5569 keywords were utilized in the MIS research after analyzing the keywords used in those studies. There are 59 terms that have been found to repeat at least 10 times. These have been divided into 8 clusters, with the similar ones being grouped together. The most researched areas in the field of MIS in this direction are:

• Artificial intelligence, COVID-19, health information systems and technology (Cluster One)

• Decision support systems, e-commerce, information systems and sustainability (Second Cluster)

• Big data, cloud computing, e-learning and Internet of Things (IoT) (Third Cluster)

• Decision making, developing countries and integrated management information systems (Fourth Cluster)

• Decision support system, framework and management information system evaluations (Fifth Cluster)

• Bibliometrics and citation analysis (Sixth Cluster)

• Project management (Seventh Cluster)

• Knowledge management (Eighth Cluster)

These keywords and subject clusters demonstrate the most important issues in the field of MIS as well as their connections.

However, using 242 items, 13 clusters, 3055 linkages, and 6277 total link strengths, a bibliographic link analysis was carried out. The research revealed a number of distinct clusters on several themes. Each cluster often focuses on a particular subject or field of study. According on the findings of the bibliographic linkage analysis, further research is required on the following subjects for future study:

• Evolution and status of management information systems: More comprehensive analyzes and examinations can be made in this area. Studies can be conducted on the historical development, current status and future trends of management information systems.

• Success of management information systems: Further research could examine factors affecting information systems success, performance measurement and evaluation. New models and approaches can be developed in this area.

• Health management and digital health: More research can be done on the impact of information systems in the health sector, health management and digital health. Topics such as the use of new technologies, data analytics and the digital transformation of health services can come to the fore in this area.

• Agriculture and information systems: More studies can be done on the use and impact of information systems in the agricultural sector. Topics such as the functionality of farm management information systems, the adoption process and agricultural data analytics may need further investigation in this area.

• Performance measurement: More research can be done on performance measurement, particularly in areas such as taxation, small and medium enterprises, accounting information systems and information technology control weaknesses. New measurement models and methods can be developed in this area.

• Construction management information systems: More research can be conducted on the use and impact of information systems in the construction industry. Particular attention can be given to issues such as the management of construction projects, document management and digitization of construction processes.

These estimations highlight problems that the MIS field needs to investigate more. However, the advancement of the subject, technology advancements, and societal demands will influence future research objectives and paths.

The study uses co-citation analysis to demonstrate how the citations made to a study might alter depending on developments in the field and over time. Studies with at least 25 citations were analyzed, and there were 4 clusters and a total of 24 points. This approach can assist us in comprehending the relative importance of various authors and research in a subject and the influence that each study has on it. It is anticipated that research concentrating on measuring, assessing, and improving the performance of MIS will continue in light of the analysis's findings. In this domain, more complete models, techniques, and tools may be created. To comprehend the aspects influencing the design, implementation, user happiness, and overall effectiveness of MISs, more study may be done. To learn more about how information technology and information systems are used, influence, and success, research may still be done. In this domain, more elaborate theoretical and empirical models may be created. It is possible to perform studies on the adoption procedures, user behavior, and organizational consequences of new technology. On the other hand, research can still improve our knowledge of MIS's philosophical foundation and the course of its evolution in the academic literature. It is possible to do study in this field on the development of MIS, research traditions, and its place in academic literature. The amount of information in the topic may be enhanced with further analysis and synthesis research. Last but not least, research into Farm Management Information Systems (FMIS) is anticipated to

continue and advance. The functionality, applications, adoption process, and commercial/academic solutions of FMISs may all be further studied. It may be designed to create and assess FMIS using fresh ideas. In conclusion, future developments in MIS may involve additional study, the creation of thorough models and techniques, and a greater comprehension of real-world applications. A greater knowledge of the development of MIS and its function in academic literature may be at the forefront, as well as issues like the adoption of new technologies, more investigation of user happiness and success measures, and more.

In addition to the above given details, operations research stands out as the most discussed issue when current developments in MIS-related research topics are taken into account. This subject was covered in each of the pertinent studies' four quarters. "Risk assessment and management," "Technology acceptance," "Decision support systems," and "Smart system technologies" come after "Operation Research." "Technology Acceptance" ranks first in the slope when the subjects are analyzed according to years and slope values, indicating that the research in this area is advancing. On the other hand, following 2019, "Performance improvement" began to take center stage. In addition to this, "Decision making", "Health services", and "Company performance" challenges stand out in 2021. The implications and uses of cutting-edge digital technologies (digital business model innovation, gamification, Internet of Things, big data analytics) in many industries are primarily being studied in 2022 and 2023. These studies, which are inspired by a variety of fields including management, information systems, education, farm management, finance, and international commerce, look at the effects of using cutting-edge technology as well as prospective future study areas. They also sought to design successful techniques, remove conceptual ambiguities, and develop future research roadmaps.

7. CONCLUSION AND SUGGESTIONS

Future studies could further investigate the issues described above. For example, the key elements of digital business model innovation may need to be more precisely defined. More work could be done on online engagement tactics in gamification and look at applications across many industries. More research could be done on the impact of cutting-edge technologies such as the Internet of Things, blockchain, and big data analytics on global trade. It is possible to look further into the implications and potential application areas of the use of big data in financial decision-making processes. More extensive research could be conducted to learn more about the total impact of these cutting-edge technologies on businesses and sectors.

However, the trajectory of MIS points to a continuous trajectory of expansion and development in the coming years. Insights from these findings predict that the architecture of management information systems will undoubtedly evolve to incorporate new technological advances, but that their fundamental attributes will persist across the continuum of time. Areas that involve and utilize technology, such as knowledge management, data mining, and technology adoption, exemplify this evolution. This also contributes to the conceptualization of a system that increases the use of data and provides a more appropriate framework for distilling insights from voluminous data streams. MIS's most important concerns, encompassing performance improvement, sustainable growth, supply chain orchestration, informed decision-making, and organizational effectiveness, all derive significant benefits from the use of sensitive data. The future success of MIS depends on its ability to skillfully combine data and technology to evolve into a versatile, context-adaptive system.

We can say that your results and evaluation provide a general understanding of the academic literature in the field examined. Let us evaluate your results according to your research questions and hypotheses given below:

Research Questions and Results:

Which important themes and subtopics are found in the academic literature in the field of "Management Information Systems (MIS)"?

Conclusion: Different important themes and subtopics have been identified in the academic literature in the reviewed field. These themes are: artificial intelligence, COVID-19, health information systems and technology; decision support systems, e-commerce, information systems and sustainability; big data, cloud computing, e-learning and Internet of Things (IoT); decision making, developing

countries and integrated management information systems; decision support system, framework and management information system evaluations; bibliometrics and citation analysis; project management; knowledge management.

Does this study show how themes in MIS research have developed and changed over time?

Conclusion: Yes, this study shows how themes in MIS research have evolved and changed over time. The research provides information on this by examining the evolution and change of these themes.

How can the identification of important themes contribute to the identification of future challenges for researchers and practitioners in the MIS field?

Conclusion: This study's identification of important themes can contribute to identifying the direction of future work for researchers and practitioners in the MIS field. The analysed themes can be used as a guide to identify future study opportunities and challenges.

Hypotheses and Conclusions:

H1: MIS literature shows the emergence of different themes and sub-themes over time.

Conclusion: This hypothesis was confirmed. The study shows that the MIS literature shows the emergence of different themes and sub-themes over time.

H2: Specific themes have evolved across the date range of MIS research.

Conclusion: This hypothesis was confirmed. The study shows that certain themes have evolved over time.

H3: This bibliometric analysis can guide future work for researchers and practitioners in the MIS field.

Conclusion: This hypothesis was confirmed. The study can contribute to the identification of important themes that can guide future work for researchers and practitioners in the MIS field.

H4: The evolution of themes contributes to identifying future research opportunities and challenges in the MIS literature.

Conclusion: This hypothesis was confirmed. The study shows that the evolution of themes contributes to identifying future research opportunities and challenges in the MIS literature.

As a result, the research questions and hypotheses of your study are validated and it appears to be an important resource in identifying future research directions in the field of MIS.

Ethical Statement

During the writing and publication of this study, the rules of research and publication ethics were complied with, and no falsification was made in the data obtained for the study. Ethics committee approval is not required for the study.

Contribution Rate Declaration

All of the authors of the study contributed to all processes, from writing the study to drafting the manuscript, and read and approved the final version.

Conflict Statement

This study did not lead to any individual, institutional, or organizational conflict of interest.

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Extended Abstract
A Bibliometric Analysis of Prominent Themes in Management Information Systems

This paper presents an extensive bibliometric analysis of the Management Information Systems (MIS) field, covering the period from 1970 to 2023. The study aims to explore and understand the evolving themes within the MIS literature, employing advanced analytical tools such as Vosviewer and R Studio for data visualization and analysis. The primary focus is on identifying key themes, their progression over time, and the interaction between these themes, with the overarching goal of providing insights into the future directions of MIS research. The methodology involves comprehensive data collection from the Web of Science database, focusing on documents related to MIS. A dataset of 2585 documents, including articles, conference papers, books, and reviews, was compiled. This broad dataset enables a wide-ranging view of the MIS field, covering a diverse array of topics and research areas. Key aspects of the analysis include evaluating annual scientific production, identifying the most productive countries in MIS research, assessing total citations per country, determining the most prolific journals and authors, and analyzing the top articles in terms of citations.

The findings reveal a significant growth in MIS research, especially post-1990, reflecting the increasing importance of information systems in organizational contexts. The United States is the leading country in both the volume of research produced and the number of citations received, indicating its central role in shaping the MIS field. The journal "Information and Management" is identified as a primary publication venue, and Hernes M. is a notable contributor. Keyword analysis uncovers primary research areas such as artificial intelligence, the impact of COVID-19 on information systems, health information systems, e-commerce, big data, and cloud computing. These themes illustrate the field's evolution and point towards future research directions.

An integral part of the study is the use of bibliographic coupling and co-citation analysis via VOSviewer. These methods categorize the research into thematic clusters, representing various domains within MIS. These clusters include the evolution and status of MIS as a discipline, methodologies for measuring success, the integration of MIS in health management, advancements in digital health, and its role in agriculture. These thematic clusters highlight the need for further research in comprehensive system analyses, the development of new models, performance measurement techniques, and the impact of information systems in different sectors.

In the academic field of management information systems (MIS), this study identifies a range of significant themes and subtopics. These include artificial intelligence, the impact of COVID-19 on health information systems and technology, decision support systems, e-commerce, sustainability in information systems, big data, cloud computing, e-learning, and the Internet of Things (IoT). Also highlighted are themes such as decision making, the role of MIS in developing countries, integrated management information systems, evaluations of decision support and management information systems, bibliometrics, citation analysis, project management, and knowledge management. This comprehensive identification of themes and subtopics provides a detailed overview of the current state of MIS research.

The study confirms several hypotheses, demonstrating the dynamic nature of the MIS literature over time. It shows that different themes and sub-themes have emerged and evolved, marking the progress and shifts in focus within MIS research. This evolution is not only evident in the broadening of topics covered but also in the depth and complexity of the subjects explored. The research confirms that this bibliometric analysis can effectively guide future work for both researchers and practitioners in the MIS field. The identified themes and their evolution offer valuable insights into future research opportunities and challenges, making the study a critical resource for guiding future research directions in MIS.

Furthermore, the research delves into the collaborative aspect of MIS research, showing significant international collaboration, which reflects the global nature of the field. For academics, the analysis offers a comprehensive overview of the field's evolution, providing insights into extensively researched areas and identifying opportunities for future investigation. For practitioners, the findings emphasize the necessity of staying updated with evolving MIS trends to ensure effective implementation and management of information systems within organizations. In conclusion, this bibliometric analysis of MIS offers a detailed perspective on the development and trajectory of the field. It highlights the dynamic, interdisciplinary, and global nature of MIS research, underscoring its significance in today's technologically driven environment. Serving as a foundational resource for scholars and practitioners, the study guides future research and practice in the diverse and continually evolving field of management information systems.