

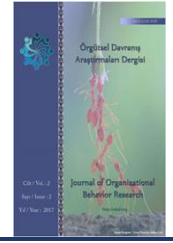


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A SYSTEMATIC REVIEW OF ARTIFICIAL INTELLIGENCE AND KNOWLEDGE MANAGEMENT USING BIBLIOMETRIC ANALYSIS

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ABSTRACT

The process of knowledge management encompasses knowledge creation, knowledge assessment, knowledge presentation, knowledge sharing, and knowledge application. With the advent of information technology and artificial intelligence (AI) in the 21st century, knowledge management has grown increasingly advanced and intricate. This research examines the current state and landscape of scientific output in AI within knowledge management, offering insights for future developmental and innovative research. The study population comprises scientific articles published in the Web of Science (WoS) database.

Moreover, the Vos Viewer software has been employed for the bibliometric analysis of these articles. The study's findings reveal that the United States has exhibited the highest scientific productivity and international collaboration in this domain. An analysis of frequently employed keywords by authors indicates that concepts such as management, decision-making, systems, big data, innovation, performance, modeling, quality, expertise systems, networks, and machine learning are intricately linked with AI and knowledge management. This suggests a substantial potential for addressing these topics in-depth. Furthermore, this article furnishes recommendations for future research endeavors. By offering a comprehensive assessment of research on AI in knowledge management through bibliometric analysis and visualization of interconnections, this paper assists authors in their appraisal of this burgeoning field.

Keywords: Artificial Intelligence, Knowledge Management, Bibliometrics, Web of Science

INTRODUCTION

Artificial intelligence (AI), a highly advanced field in computer science and engineering, has undergone significant and remarkable development in recent decades, resulting in substantial changes across various domains (Smith, 2010). This rapid advancement of AI has profoundly influenced technology and computer science, with significant implications for knowledge management (Johnson, 2015). Given the intrinsic connection between AI and knowledge management, recent advances in AI have paved the way for fundamental changes in approaches and methods for managing knowledge within organizations (Sanzogni et al., 2017).

Both AI and knowledge management are inherently linked to the process of knowledge acquisition and learning. Therefore, recent advancements in AI offer new perspectives for transforming knowledge management within organizations (Sanzogni et al., 2017). The impact of technology and information on knowledge management is profound, prompting many

successful managers to actively seek alignment between their organization's knowledge management practices and technological advancements. In this context, the widespread utilization of AI and expert systems has facilitated various scientific, industrial, educational, and other domains, making tasks more manageable (Sanzogni et al., 2017).

In the twentieth century, AI has become a cornerstone of knowledge management due to its role in acquiring advanced information, development, dissemination, and effective utilization within businesses (Alhashmi et al., 2019). AI and machine learning are integral components of organizational studies and industrial networks, recognized as essential business tools (Chen Z. et al., 2018; Taherdoost, H., 2022). AI and blockchain have transformed how organizations collect, create, disseminate, and utilize information (Qi G et al., 2021; Taherdoost, H., 2022).

The focus of researchers on AI has led to exponential growth in scientific publications, particularly over the last two decades. Continuous monitoring and analysis of publishing trends in this field are essential for gaining insights into its various dimensions and guiding future research. According to some perspectives (Stewart, 1996), knowledge management is a methodology for generating, preserving, and utilizing the extensive knowledge resources organizations benefit from in their daily activities. Another viewpoint describes knowledge management as a set of processes involving intelligent interactions and technical tools, such as information technology and decision support systems, in knowledge generation, sharing, and utilization (Leibowitz and Volkakis, 1996). Knowledge management is integral to organizational resource management (Brown, 2018). Organizations can collect, store, transfer, and leverage their internal knowledge as a strategic asset by applying knowledge management principles. Employing scientific methods to understand the knowledge domain will benefit research (Benckendorff and Zehrer, 2013). Substantial progress has been made in this research field in some instances.

For instance 2019, Rajascara and colleagues conducted a bibliometric analysis of knowledge management literature. This study scrutinized various aspects, including the number of articles, authors, glossaries, and topics. In 2018, Lopez et al. undertook a systematic review of knowledge management literature and presented a network analysis of subject structures and ongoing research in this field. In 2017, Gesinto et al. delved into the bibliometric analysis of knowledge management and intellectual capital literature. In 2018, Saritas and collaborators addressed bibliometric analysis of knowledge management literature and the creation of knowledge-based value.

In the present article, cognitive techniques and tools have been employed to extract a map detailing the impact of AI on *knowledge management*. Our focus has been on articles published in the *Web of Science (WOS)* database, one of the most reputable and comprehensive scientific databases. This endeavor aims to provide insights into the research topic of AI based on the latest publications, particularly in the field of *knowledge management*. It introduces a collection of articles containing knowledge, concepts, and various thematic domains, laying the groundwork for identifying new research areas in *knowledge management*.

Research Method:

This research belongs to the category of *descriptive-analytical research*. The research population encompasses all ISI researchers worldwide in *AI* and *knowledge management* who are indexed in the *Thomson Reuters* database. The *ISI Institute*, renowned for its emphasis on scientific



evaluation and publishing, was established in 1960 by *Eugene Garfield* (although it existed under a different name before that). *ISI* was acquired by *Thomson Corporation* in 1992 and was subsequently known as *Thomson ISI*. In 2002, *Thomson Corporation* merged with *Reuters*, forming *Thomson Reuters Corporation*. *WoS* is a component of *Thomson Reuters*, encompassing approximately 45 languages and over 12,000 journals, boasting the highest impact factors dating back to 1900. This database offers bibliographic database services. Its specialized domain lies in *citation indexing* and *statistical analysis*, rendering it one of the most esteemed international information databases for *scientometric studies*. It enjoys widespread acceptance and frequent utilization for the analysis of scientific publications, with many of the most significant *bibliometric studies* relying on this information repository (Bihl et al., 2006; Schield et al., 2006; Kim & McMillan, 2008; Narayan et al., 2008; Fescharek & Yusnir, 2012; Schaltger et al., 2013; Nannen et al., 2018).

Bibliometric analysis represents an effective method for quantifying scientific publications through statistical techniques (Zhang et al., 2015). This method constitutes a standard systematic analytical tool across various fields, aiming to assess the state of research and trends in a specific subject and identify future research directions to guide researchers (Fu et al., 2010). The present research involves a literature review utilizing *bibliometric analysis techniques*. *Bibliometric analysis* is often deployed to appraise scientific research through quantitative examinations of research publications. Grounded in the assumption that scientific discoveries and research outcomes primarily disseminate through international scientific journals, *bibliometric analyses* empower researchers to peruse and cite these publications. By employing *bibliometric analyses*, one can extract quantitative characteristics and performance indicators of research and gauge the relationships among researchers and research areas (Katarina et al., 2014).

Mapping the scientific landscape represents a pivotal research area within *bibliometric studies*. Its objective is to discern and visually depict the relationships within a dynamic and ever-changing scientific knowledge system. In *science mapping*, the focal point lies in observing a scientific field and delineating its research domains. *Data retrieval, processing, extraction, visualization, analysis, and the depiction of the network* comprise the principal steps in the workflow of *science mapping* (Kobayashi et al., 2011).

To obtain the records for this research, a search was conducted in the core collection of the *WoS* database on July 13, 2023, without imposing any time restrictions.

Search Formula:

TOPIC: ("Artificial Intelligence") AND TOPIC: ("Knowledge Management")

In this article, data have been retrieved from the *WoS* scientific database. 321 *AI* and Knowledge Management articles were collected by searching in the "Title, Abstract, Keywords" section of the *WoS* scientific database.

Results:

Based on the retrieved data, the conducted research method, and the available tools, the results of the cognitive analysis of *AI* and *Knowledge Management* from several perspectives:

Based on the subject categorization of *WoS*, Figure 1 displays the top 10 subject areas of the retrieved articles in terms of frequency. This table shows that 23.67% of the articles (76) are authored in the management field, followed by the subject area of *AI* in *Computer Science*, which accounts for 18.06% (58).





Figure 1 ~ Number of Published Articles in the Field of AI and Knowledge Management by Subject Area

The number of published articles is a significant indicator for measuring the development trends within a research field or domain. In the realm of "Knowledge Management and AI," as indexed in the WOS database, there are 321 articles, and the publication dynamics within this domain span from 1991 to 2023. The highest number of articles, totaling 55 publications (17%), was observed in 2022.

The inaugural article in this subject area, indexed in ISI, was published in 1991 under the title "Enhancing the Scientific Process with AI – Forest Science Applications" in the journal "AI Applications." The publication trend of scholarly output within the specified time frame can be observed in the following graph. According to the published graph, there has been a consistent upward growth trend in this research domain since 2017, with the most significant positive growth observed in 2022.

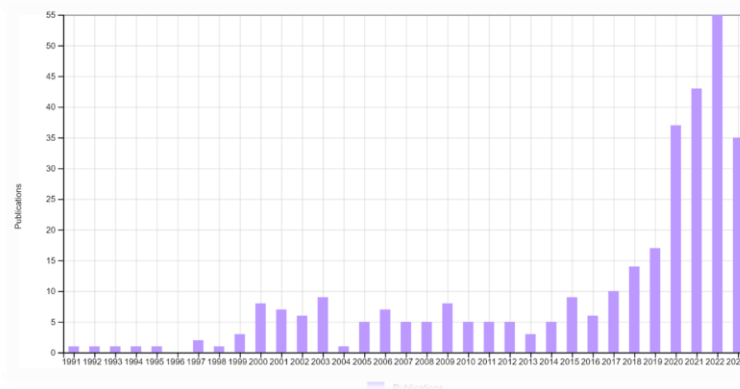


Figure 2 - Number of Published Articles by Year in the Fields of AI and Knowledge Management: Repetition of Keywords and Evolution Trend Over the Years

Keywords hold significant importance as they serve as the fundamental concepts through which authors communicate with their audience, enabling readers to discern the central content of an article. This research delves into the analysis and classification of keywords to elucidate prevalent topics and research trends. Authors of the scientific publications under scrutiny in this study employed 1681 keywords extracted from article titles, with 113 recurring at least four times. The frequently recurring keywords are highlighted within enclosed circles, while smaller circles denote less frequent appearances. The most frequently recurring keywords have been organized into six clusters, each distinguished by a unique color corresponding to co-occurrence patterns. Each cluster has been assigned an appropriate title based on its prevalent keywords. The outcomes of the lexical analysis are showcased in the diagram below. The size of the circles signifies the frequency of keyword occurrences; for instance, larger circles indicate more frequent utilization of the respective keyword in article titles related to the domains of AI and knowledge management. Meanwhile, the thickness of the connecting lines signifies a stronger relationship and interdependence among the associated keywords. Shorter distances between keywords indicate a more pronounced correlation between terminologies.

The establishment of terminology dependencies is rooted in quantifying how often terminologies appear together in the titles and abstracts of articles. Various colors have been employed to distinguish the different clusters. The vocabulary mapping presented in Figure 3 illustrates the clustering of AI and knowledge management terminologies. In this figure, six distinct clusters are discernible. As depicted in the figure, all clusters display a high level of interconnectedness, underscoring the robust relationships and dependencies among AI and knowledge management topics. It is possible to assign a label to each cluster by analyzing its prevalent terminologies.

Blue Cluster: Artificial Intelligence (AI)

Red Cluster: Knowledge Management

Yellow Cluster: Big Data

Green Cluster: Innovation

Turquoise Cluster: Systems

Purple Cluster: Technology

The most important terms within these clusters include:

Blue Cluster: AI, Algorithm, Machine Learning, Classification, Support Systems, Neural Networks, Simulation.



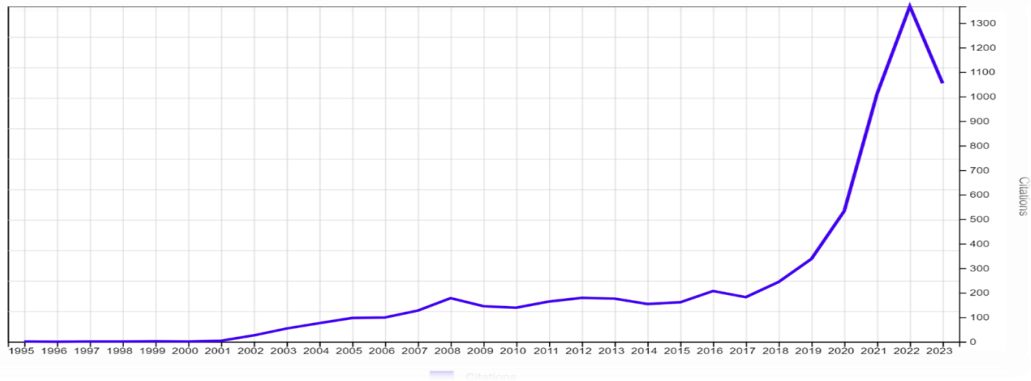


Figure 6 - Trend of Citations to Articles in the Field of AI and Knowledge Management: According to the published chart, the trend of citations has shown a consistent upward growth from 2001 to 2022. Although there were fluctuations between 2008 and 2017, substantial and noticeable upward growth has been evident since 2017. Table 1 presents the top 10 articles with the highest number of citations.

Table 1 - Articles with the Highest Citations in the Field of AI and Knowledge Management

Title of the Article	Authors	Journal Name	Publication Year	Total Number of Citations Received	Average Citations Received per Year
Artificial intelligence for decision making in the era of Big Data – evolution, challenges, and research agenda	Duan, Yanqing; Edwards, John S.; Dwivedi, Yogesh K.	INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT	2019	619	123/8
Knowledge management technologies and applications – a literature review from 1995 to 2002	Liao, SH	EXPERT SYSTEMS WITH APPLICATIONS	2003	280	13/33



Artificial intelligence and business models in the sustainable development goals perspective: A systematic literature review	Di Vaio, Assunta; Palladino, Rosa, Hassan, Rohail; Escobar, Octavio	JOURNAL OF BUSINESS RESEARCH	2020	198	49/5
Knowledge warehouse: an architectural integration of knowledge management, decision support, artificial intelligence, and data warehousing	Nemati, HR; Steiger, DM; Iyer, LS; Herschel, RT	DECISION SUPPORT SYSTEMS	2002	197	8/95
Designing and building real environmental decision support systems	Poch, M; Comas, J; Rodríguez-Roda, I; SánchezMarrè, M; Cortés, U	ENVIRONMENTAL MODELLING & SOFTWARE	2004	177	8/85
Knowledge management and its link to artificial intelligence	Liebowitz, J	EXPERT SYSTEMS WITH APPLICATIONS	2001	170	7/39
Perspectives of Environmental Informatics and Systems Analysis	Huang, G. H.; Chang, N. B .	JOURNAL OF ENVIRONMENTAL INFORMATICS	2003	161	7/67
Artificial cognition for social human-robot	Lemaignan, Severin; Warnier, Mathieu;	ARTIFICIAL INTELLIGENCE	2017	159	22/71



interaction: An implementation	Sisbot, E. Akin; Clodic, Aurelie; Alami, Rachid				
Impacts of increasing volume of digital forensic data: A survey and future research challenges	Quick, Darren; Choo, Kim-Kwang Raymond	DIGITAL INVESTIGATION	2014	146	14/6
A survey of design rationale systems: Approaches, representation, capture and retrieval	Regli, WC; Hu, X; Atwood, M; Sun, W	ENGINEERING WITH COMPUTERS	2000	142	5/92

"AI for Decision Making in the Era of Big Data – Evolution, Challenges, and Research Agenda" is the most cited article, with 619 citations. It was written by Mr. Yanqing Duan, Mr. John S. Edwards, and Mr. Yogesh K. Dwivedi in 2019 and published in the "International Journal of Information Management".

Top Authors:

Among the 1,113 authors whose scientific productions were retrieved, 41 authors have published at least 2 articles. The top 10 authors in the world, based on the number of publications and the citation level, are listed in the following figure.

Table 3 - Authors with the Highest Citation Counts in the Field of Artificial Intelligence and Knowledge Management			Table 2 - Authors with the Most Scholarly Documents in the Field of Artificial Intelligence and Knowledge Management		
The top 10 authors in the world in terms of the number of citations by age			Top 10 authors by age		
Author Name	Number of citations	Age number	Author Name	Age number	Number of citations
Liao, sh	401	3	wang, w. m.	4	8
Rodríguez roda, i	203	2	Iebow, Francesco	3	98
Liebowitz, j	192	3	cerchione, Roberto	3	24
comas, j	189	2	iebow, c. f.	3	7

cortés, u	189	2	gacanin, haris	3	42
poch, m	189	2	Liao, sh	3	401
paschen, Jeannette	186	2	Liebowitz, j	3	192
Gupta, shivam	122	2	abbas, Akhtar	2	16
wang, meng	63	2	Ahmad, Shakil	2	16
Mitri, m	45	2	Ansari, Muhammad	2	8

Network Analysis of Co-Authorship

In co-authorship networks, authors who have collaborated on the authorship of at least two articles are represented (Figure 7). Each node symbolizes an author, and each connecting edge represents the collaboration of two authors corresponding to two nodes in the authorship of an article. The thickness of each edge indicates the frequency of collaboration between two authors, and the size of each node represents the frequency of collaboration of the author corresponding to that node with other authors in article co-authorship.

Based on this analysis, it can be observed that each author has collaborated with several others in authoring papers. According to the co-authorship network, it is evident that robust collaboration among authors has not yet reached its full potential. Further collaboration among researchers in this field is necessary to generate rich and influential research articles.

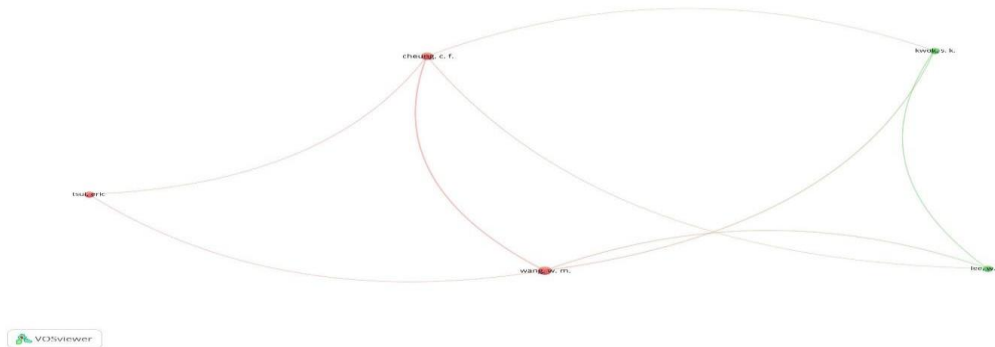


Figure 7 - Collaborative Authorship Network among Authors in AI and Knowledge Management who have co-authored at least 2 papers.

Top Countries:

Based on authors' affiliation in publishing articles (according to the organization of authors), 73 countries have played a role in publishing articles, with 49 countries having published a minimum of 2 articles. The majority of these articles, 65 in total, have been published in the United States. Following the United States, China has secured the second rank. The subsequent countries include England, France, Spain, Australia, Italy, India, Canada, and Germany.

Table 5 - Top Countries in Terms of the Number of Citations to AI and Knowledge Management Documents			Table 4 - Top Countries in Terms of the Number of AI and Knowledge Management Documents Produced		
Top 10 Countries by Number of Citations			Top 10 Countries by Number of Documents		
Country Name	Number of Citations	Number of Documents	Country Name	Number of Documents	Number of Citations
USA	1777	65	USA	65	1777
England	1480	28	peoples r china	50	678
France	693	24	England	28	1480
peoples r china	678	50	France	24	693
Wales	641	3	Spain	23	515
Spain	515	23	Australia	22	444
Italy	493	20	Italy	20	493
Taiwan	479	11	India	16	155
Canada	464	13	Canada	13	464
Australia	444	22	Germany	13	75

As seen in Table 4, the United States of America ranks first with 1777 scientific citations, followed by the United Kingdom with 1480, France with 693, and China with 678 in subsequent positions. Figure 8 illustrates the trend of the analysis of relationships between countries based on the year. The figure demonstrates that countries such as Iran, Saudi Arabia, the United Arab Emirates, Cyprus, South Korea, Malaysia, Mexico, Indonesia, Croatia, and emerging countries in this research field are included in the analysis.

The larger circle indicates more documents produced by the respective country, and the connections between countries are shown using connecting lines. The thicker the connecting line, the stronger the relationship between the two countries and the proximity of the circles to each other indicates a stronger connection between the two countries.

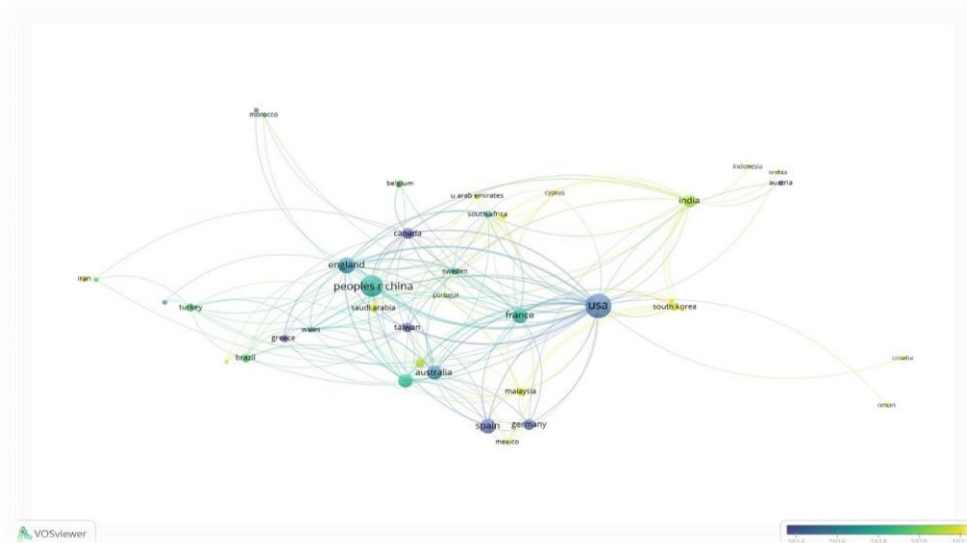


Figure 8 ~ Analytical Trends in International Relations in the Field of *AI* and Knowledge Management Based on the Year

Top Journals:

The table below (Table 6) displays 10 journals with the highest scientific production. Of 207 journals, 25 meet the minimum requirement of having at least 3 documents per journal. Table 6 presents 68 articles out of a total of 321 articles that have been published, and the primary subject area of these journals is knowledge management systems. Furthermore, the journal "Expert Systems with Applications" holds the highest share of publishing articles.




Table 6 - 10 Journals with the Highest Scientific Production in the Field of *AI* and Knowledge Management

Top Journals		
Journal Name	Number of Documents	Number of Citations
expert systems with applications	15	884
knowledge management research practice	11	70
applied sciences-basel	8	29
journal of knowledge management	8	75
knowledge-based systems	5	168
Kybernetes	5	29
Sustainability	5	88
Information	4	18
journal of intelligent manufacturing	4	133
automation in construction	3	104

Conclusion:

This research aims to provide a comprehensive overview of the status of artificial intelligence (AI) in knowledge management at the global level using bibliometric analysis. Considering the publication of results in ISI journals, the findings indicate an upward trend in article production, with the most significant growth occurring in 2022, totaling 55 articles. Concerning the number of citations, the most cited article is "AI for Decision Making in the Era of Big Data: Evolution, Challenges, and Research Agenda," published in the "International Journal of Information Management" in 2019. Additionally, the journal "Expert Systems with Applications" exhibits the highest production in this field with 15 documents, while Mr. Wang W. M. has the highest number of documents, totaling 4. Furthermore, the United States, with 65 articles, China, with 50, and the United Kingdom, with 28 documents, rank highest in article production.

Regarding keywords, it is noteworthy that in recent years, the role of AI tools such as machine learning, neural networks, and blockchain in knowledge management and knowledge dissemination has become increasingly evident. Moreover, based on the analysis above, topics such as "deep learning," "knowledge graphs," "digital twins," "social media," and "sustainability" emerge as emerging subjects that warrant exploration in future research. Additionally, countries such as Iran, Saudi Arabia, the United Arab Emirates, Cyprus, South Korea, Malaysia, Mexico, Indonesia, and Croatia are considered emerging players in this field of research.



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Ethical statements : We will conduct ourselves with integrity, fidelity, and honesty. We will openly take responsibility for our actions.

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