Examining the Influence of AI Chatbots on Semantic Web-Based Global Information Management in Various Industries

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ABSTRACT

This article presents a comprehensive analysis of the application and effect of ChatGPT, an advanced AI chatbot model, on global information management across various industries such as healthcare, industry, education, and more. Leveraging a dataset obtained from the Scopus database encompassing research papers from 2022 to 2023, this study investigates the influence of ChatGPT by examining publisher impact, authorship patterns based on Lotka's Law, country-specific scientific production, and keyword distribution. The analysis sheds light on prominent publishers, prolific authors, geographic distribution of research contributions, and prevailing research themes. By understanding the impact of ChatGPT in these sectors, this research contributes to the advancement of knowledge and facilitates informed decision-making regarding the responsible and effective utilization of artificial intelligence (AI) chatbot technologies in global information management.

KEYWORDS

AI Chatbots, ChatGPT, Global Information Management, Publisher Impact, Sector Analysis

INTRODUCTION

The advancement of digital technologies has significantly impacted global information management across various sectors. Businesses and industries have experienced notable benefits from the increasing digital evolution, leading to enhanced operational efficiency, innovative management strategies, and improved market positioning (Sinaga et al., 2019). The evolution of digital technologies has also influenced societal culture, consumption patterns, and saving behaviors, with the introduction of smart devices, online platforms, and social media platforms reshaping societal norms (Grigorescu, 2023). The empowerment of digital technologies has played a crucial role in driving the evolution of

enterprise green strategies through factors such as managerial perception, competitive capabilities, data utilization, and digital marketing (He et al., 2022; Hu et al., 2022).

Furthermore, the profound impact of digital technologies on businesses is evident, with rapid advancements affecting various operational aspects and strategic approaches (Veldhoven & Vanthienen, 2022). The integration of digital technologies, artificial intelligence (AI), and connectivity has brought about a significant transformation in society's socioeconomic landscape (Hilbert, 2020; Almomani et al., 2022). The adoption of digital technologies in industries such as manufacturing has been instrumental in promoting resource-efficient practices and enhancing industrial capabilities (Shang & Zhang, 2022). The digital transformation of the National Basketball Association serves as a prime example of how incorporating digital technologies can lead to increased revenue, global branding, and strategic business evolution (Santomier et al., 2023; Li et al., 2022).

Moreover, the evolution of digital technologies has spurred disruptive innovation across sectors, showcasing the transformative power of digital tools and technologies (Zhang et al., 2022). The shift toward digital transformation has not only enhanced business management practices but also triggered social and cultural changes beyond technological advancements (Negro, 2022). Organizational responses to market dynamics have been influenced by the evolution of digital technologies, prompting changes in trade, industry practices, and information technology approaches (Farzi, 2022; Brdesee et al., 2022).

The concept of digital twins and bionics exemplifies the advanced stages of digital technology evolution, highlighting collaborative simulations and virtual commissioning as key technologies driving design and manufacturing integration (Li et al., 2021). Digital health technologies have emerged as a solution to address healthcare challenges, particularly in cardiovascular care and research (Zwack et al., 2023; Pan et al., 2022). The potential applications of digital twin technology across various industrial sectors underscore the transformative impact of digital innovations on infrastructure, aerospace, and automotive industries (Chakraborty & Adhikari, 2021). AI chatbots use semantic web technologies to enhance global information management by incorporating advanced capabilities in understanding and processing data. The integration of semantic web technologies, such as knowledge graphs, ontologies, and linked data, enables AI chatbots to access and interpret information in a structured and meaningful way (Sermet & Demir, 2021; Sharma et al., 2022). By using semantic web technologies, AI chatbots can enhance their ability to comprehend user queries, extract relevant information from diverse sources, and provide accurate responses based on contextual understanding.

The use of semantic web technologies in AI chatbots facilitates the creation of a knowledge base that organizes information in a structured format, allowing for efficient retrieval and use of data (Gkinko & Elbanna, 2022; Almomani et al., 2024). This structured approach enables chatbots to deliver more personalized and contextually relevant responses to users, thereby enhancing the overall user experience and information delivery process. Additionally, semantic web technologies enable AI chatbots to establish relationships between different pieces of information, leading to a more comprehensive understanding of user queries and preferences.

Moreover, the incorporation of semantic web technologies in AI chatbots supports the development of intelligent conversational agents that can engage in more sophisticated interactions with users. By leveraging ontologies and semantic reasoning, chatbots can infer implicit user intents, disambiguate ambiguous queries, and provide more accurate and context-aware responses. This enhanced conversational capability contributes to improved information management by ensuring that users receive relevant and precise information tailored to their needs.

Furthermore, semantic web technologies empower AI chatbots to access and integrate information from diverse sources, including structured databases, unstructured text, and multimedia content (Sermet & Demir, 2021; Chaklader et al., 2023). This capability enables chatbots to offer comprehensive and multidimensional responses to user queries, drawing insights from a wide range of data sources. By leveraging semantic web technologies, AI chatbots can enhance the efficiency and effectiveness of information retrieval and dissemination, ultimately contributing to more robust global information management practices.

RESEARCH GAP

Research on the synergy between AI chatbots, the semantic web, and information management has made significant strides, but several gaps remain to be addressed. One key research gap lies in understanding the effectiveness of AI chatbots in leveraging semantic web technologies to enhance information management practices. Although research on the individual components, such as AI chatbots and the semantic web, exists, more comprehensive studies that explore how the integration of these technologies can optimize information retrieval, knowledge organization, and user interaction within diverse information management contexts are needed (Zhang et al., 2020; Mishra et al., 2023). Another research gap pertains to the impact of AI chatbots and semantic web technologies on customer service efficiency in various sectors, including commercial banks. Studies have highlighted the potential benefits of AI chatbots in improving customer service, but research that specifically examines how the use of semantic web technologies can further enhance the efficiency and effectiveness of AI chatbots in addressing customer queries and providing personalized services is needed (Andrade & Tumelero, 2022; Chui et al., 2023).

Furthermore, there is a research gap in understanding the successful implementation of chatbots in businesses from a business-to-business (B2B) customer experience perspective. Although some studies have explored the adoption of chatbots in business settings, more in-depth investigations that analyze the challenges, opportunities, and best practices associated with deploying chatbots to enhance B2B customer interactions and information management processes are needed (Kaushal & Yadav, 2023; Gaurav et al., 2023).

Additionally, research is needed to explore the attitudes and knowledge of different user groups, such as medical students, toward AI chatbots and the semantic web in specific domains (for example, healthcare). Understanding user perceptions and acceptance of AI chatbots in specialized contexts can provide valuable insights into the design and implementation of chatbot systems that effectively support information management and decision-making processes (Moldt et al., 2023; Jain et al., 2022).

Moreover, there is a gap in research focusing on the role of entity, interactivity, and experiential perceptions in chatbot persuasion. Investigating how these factors influence user engagement and information retrieval through AI chatbots can contribute to enhancing the design and functionality of chatbot systems for improved information management outcomes (Ischen et al., 2020).

Existing research has shed light on the individual components of AI chatbots, the semantic web, and information management, but more comprehensive studies that bridge the gaps in understanding how the integration of these technologies can optimize information processing, user interactions, and decision-making processes across various domains is necessary.

In this context, this paper aims to provide a comprehensive analysis of the impact of ChatGPT on global information management across various sectors. The findings of this study can contribute to the existing body of knowledge, inform decision-making processes, and promote responsible and effective use of AI chatbot technologies. By harnessing the potential of ChatGPT and understanding its implications in different sectors, we can enhance information management practices, improve user experiences, and foster innovation on a global scale.

RESEARCH METHODOLOGY

In this section we outline the methodology employed to analyze the impact of ChatGPT on global information management. We used a dataset obtained from the Scopus database, which comprises research papers published between 2022 and 2023.

Data Collection

We chose the Scopus database as the primary source for collecting relevant research papers. The search query used a combination of keywords, such as ChatGPT, AI chatbots, global information

management, and other related terms. We exported the dataset, ensuring the inclusion of papers from a diverse range of sectors, such as healthcare, industry, and education.

The Dataset

The collected dataset contains information on research papers, including the title, author names, publication year, source (journal/conference), citations, and keywords. It covers a specific timeframe (2022–2023) to capture recent research trends and developments.

Variable Analysis

We analyzed the following variables:

- Publisher impact: We assessed the influence and impact of publishers by analyzing the distribution and citation counts of papers published by different publishers.
- Authorship patterns: We applied Lotka's law to investigate the distribution of authors based on the number of documents they have written, aiming to identify prolific authors and collaboration patterns.
- Country-specific scientific production: We analyzed the dataset to determine the distribution of research contributions across different countries, providing insights into the global landscape of ChatGPT research.
- Keyword distribution: We conducted a keyword analysis to identify prevalent research themes and topics related to ChatGPT in global information management.

Research Questions

For our research we used the following questions:

- RQ1: What are the distribution and impact of publishers in research related to ChatGPT and its effect on global information management?
- RQ2: What are the authorship patterns and collaboration networks within the research on ChatGPT in global information management?
- RQ3: How does the scientific production of different countries contribute to the field of ChatGPT and global information management?
- RQ4: What are the prevalent research themes and topics related to ChatGPT in global information management across various sectors?
- RQ5: How do these research trends and patterns contribute to our understanding of the application and effect of ChatGPT on global information management?

Hypotheses

For this paper we used the following hypotheses:

- H1: There will be variations in publisher impact within the research on ChatGPT, with certain publishers exhibiting higher citation counts and influence compared with others.
- H2: According to Lotka's Law, a small group of prolific authors will contribute to a significant proportion of research on ChatGPT, whereas the majority of authors will contribute only a single document.
- H3: The scientific production related to ChatGPT and global information management will vary across countries, with certain countries having a higher frequency of research contributions.
- H4: The prevalent research themes related to ChatGPT in global information management will include artificial intelligence, chatbots, machine learning, ethics, and specific sector-related topics, such as healthcare, industry, and education.

- H5: The analysis of publisher impact, authorship patterns, country-specific scientific production, and keyword distribution will collectively enhance our understanding of the application and effect of ChatGPT on global information management, providing insights for future research and practical implementation.

Data Analysis

We processed and analyzed the collected dataset using statistical techniques and text mining approaches. Descriptive statistics, such as frequencies and proportions, were computed to summarize the data. We employed visualization techniques, such as charts and graphs, to present the findings effectively.

Ethical Considerations

We considered ethical considerations, including data privacy and confidentiality, throughout the research process. The study adhered to ethical guidelines and respected the intellectual property rights of the authors and publishers.

RESULTS AND DISCUSSION

Figure 1 presents the dataset obtained from the Scopus database for the years 2022 to 2023, including a total of 796 documents from 492 different sources, such as journals, books, and conferences. The average age of the publications is very recent, with an average of 0.00377 years from publication, indicating that the data represent current research trends. The average number of citations per document is 2.737, while the average citations per year per document is 2.692, suggesting that the research in this dataset has garnered moderate attention within a short period. The documents encompass various types, including articles, conference papers, editorials, letters, reviews, and more. The dataset comprises a diverse range of topics, as evident from the 1,836 keywords plus (ID) and 1,277 author's keywords extracted from the documents.

In terms of authorship, there are 2,088 authors associated with the documents, and they collectively appear 2,437 times. Among these authors, 228 have authored single-authored documents, and 1,860 have contributed to multi-authored documents. The dataset reflects a collaborative research environment, with a collaboration index of 3.48, indicating a relatively high level of collaboration among authors. Overall, this dataset presents a snapshot of recent research related to global information management. It showcases the diverse nature of publications, the involvement of multiple authors,
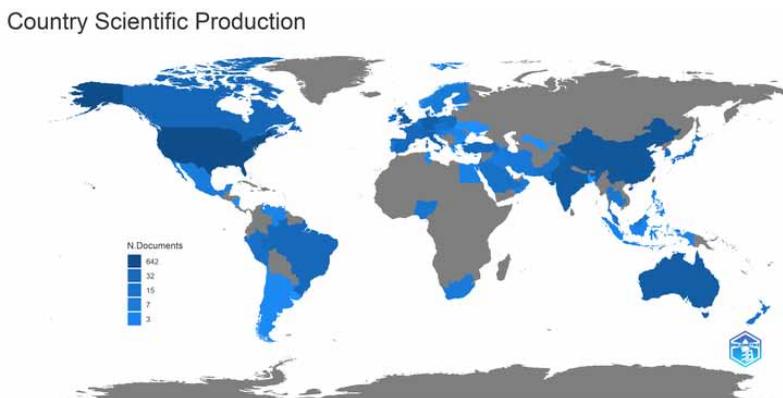
Figure 1. Main information

Figure 2. Author productivity through Lotka's Law

and the growing interest in topics related to information management across various sectors. Further analysis of this dataset can provide valuable insights into the applications and impact of information management by ChatGPT in sectors such as healthcare, industry. Further analysis can also highlight emerging trends and potential research gaps.

Analysis of Authors

Figure 2 presents information about the number of authors associated with different numbers of documents, following Lotka's law. Lotka's Law is a bibliometric principle that states the relationship between the number of authors and the frequency of their publications. The figure displays the distribution of authors based on the number of documents they have written.

According to the data, most authors (89.9%) have written only one document. This finding aligns with Lotka's law, which suggests that the number of authors decreases as the number of documents written increases. The proportions of authors decrease steadily as the number of documents written per author increases. For example, around 7% of authors have written two documents, 1.5% have written three documents, and so on. As the number of documents per author increases, the proportion of authors decreases significantly.

This distribution pattern supports the observation that a small percentage of authors contribute to a large proportion of the total documents. It highlights the presence of a core group of prolific authors who consistently publish multiple documents, while the majority of authors contribute only a single document.

Lotka's law has been observed in various fields and helps to explain the concentration of scholarly output among a small number of authors. It also underscores the importance of recognizing and supporting the work of prolific authors who make substantial contributions to their respective fields. This distribution pattern implies the unequal distribution of scholarly output among authors and emphasizes the significant contributions made by a smaller group of prolific authors. Understanding Lotka's law can aid in evaluating authorship patterns, identifying influential researchers, and gaining insights into the dynamics of scholarly publishing.

Analysis of Country

Figure 3 presents the scientific production of different countries based on their frequency of appearance in the dataset. The countries with the highest scientific production are as follows:

- USA: The United States leads the list with 642 occurrences. This high scientific production is expected because the United States is home to numerous prestigious universities and research institutions and has a robust research funding environment.

Figure 3. Country scientific production
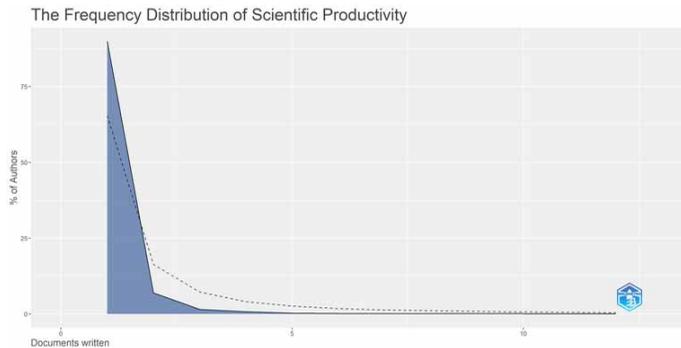
- China: China follows closely with 221 occurrences, indicating its growing prominence in scientific research. China has been investing heavily in research and development, leading to significant advancements across various fields.
- UK: The United Kingdom ranks third with 145 occurrences, showcasing its longstanding tradition of excellence in scientific research and contributions to various disciplines.
- India: India stands out with 141 occurrences, reflecting its increasing emphasis on scientific research and development, driven by a large pool of talented researchers and a rapidly growing scientific community.
- Australia: Australia demonstrates a notable scientific production with 131 occurrences. The country's well-established research infrastructure, strong academic institutions, and favorable research funding have contributed to its significant scientific contributions.

The data also highlight the scientific production of other countries, such as Germany, Italy, Switzerland, Canada, Brazil, France, Spain, Israel, Singapore, Turkey, Japan, Denmark, Poland, the Netherlands, and South Korea. Although these countries' frequencies are relatively lower, they still signify their active engagement in scientific research and their contributions to various fields. This information underscores the global nature of scientific research and highlights the contributions of different countries. It reflects the distribution of scientific production across diverse regions, with certain countries leading in terms of quantity and impact. Collaborations and knowledge exchange among these countries can foster further advancements and drive innovation on a global scale. The above information helps in understanding the scientific output of different regions and can help identify research trends, foster international collaborations, and promote the exchange of knowledge for the benefit of global scientific advancement.

Analysis of Publication Source

Figure 4 provides information on the impact of different publishers across two years: 2022 and 2023. Specifically, it focuses on five publications: Annals of Biomedical Engineering, Nature, Library Hi Tech News, Aesthetic Plastic Surgery, and CEUR Workshop Proceedings.

In 2022, Annals of Biomedical Engineering did not have any documented impact, whereas Nature had two instances of impact, Library Hi Tech News had none, and both Aesthetic Plastic Surgery and CEUR Workshop Proceedings had no recorded impact. In 2023, Annals of Biomedical Engineering experienced a significant increase in impact with 45 instances, indicating a rise in the recognition and citation of publications from this journal. Nature also saw an increase, with 20 instances of impact, further solidifying its influential position. Library Hi Tech News received 13 instances of impact, suggesting a growing appreciation for the publications in this domain. Aesthetic Plastic Surgery and

Figure 4. Source impact
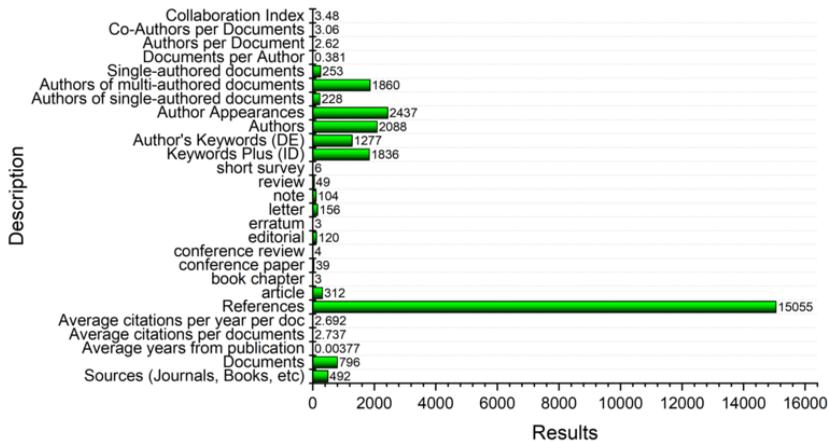
CEUR Workshop Proceedings both showed moderate impact with eight instances each, reflecting a level of recognition for their respective publications. The data showcase the varying impact and influence of these publications over time. Annals of Biomedical Engineering and Nature emerged as the most impactful publications in 2023, with notable increases compared with the previous year. This finding could be attributed to the quality and relevance of the research published in these journals, which resonated with the academic community and attracted citations. Library Hi Tech News, Aesthetic Plastic Surgery, and CEUR Workshop Proceedings also displayed impact, although to a lesser extent.

The findings suggest that researchers and scholars in the field should consider the reputation and impact of publishers when selecting outlets for their work. Journals such as Annals of Biomedical Engineering and Nature, with their significant impact, provide researchers with a platform to reach a broader audience and potentially contribute to the advancement of their respective fields. Understanding the influence of publishers can assist in identifying key sources for literature reviews, keeping abreast of important developments, and assessing the overall scholarly impact of publications.

Analysis of Trending Topics

The distribution of keywords, shown in Figure 5, within the dataset offers valuable insights into the predominant focus of research and discussions. At the forefront is the keyword ChatGPT, which appears most frequently, indicating the significant attention and interest surrounding this particular AI-based chatbot model developed by OpenAI. Researchers and practitioners are evidently exploring the capabilities and applications of ChatGPT in various contexts, showcasing its potential impact on global information management. The dataset also highlights the prominence of broader concepts, such as the keywords artificial intelligence and AI, with relatively high frequencies of 211 and 49, respectively. This finding underscores the widespread interest in AI-related research, with a particular emphasis on the advancements and implications of artificial intelligence in various sectors. It reflects the recognition of AI as a transformative technology that can revolutionize information management practices.

Additionally, the presence of keywords, such as chatbot, machine learning, large language models, and natural language processing, further reinforces the focus on intelligent conversational systems and the underlying technologies that drive them. Chatbots, in particular, have gained substantial attention owing to their ability to automate and enhance communication in diverse domains. Keywords such as education and ethics indicate the recognition of important considerations related to the implementation of AI technologies, including their impact on learning environments and the ethical implications associated with their use.

Figure 5. Keyword distribution
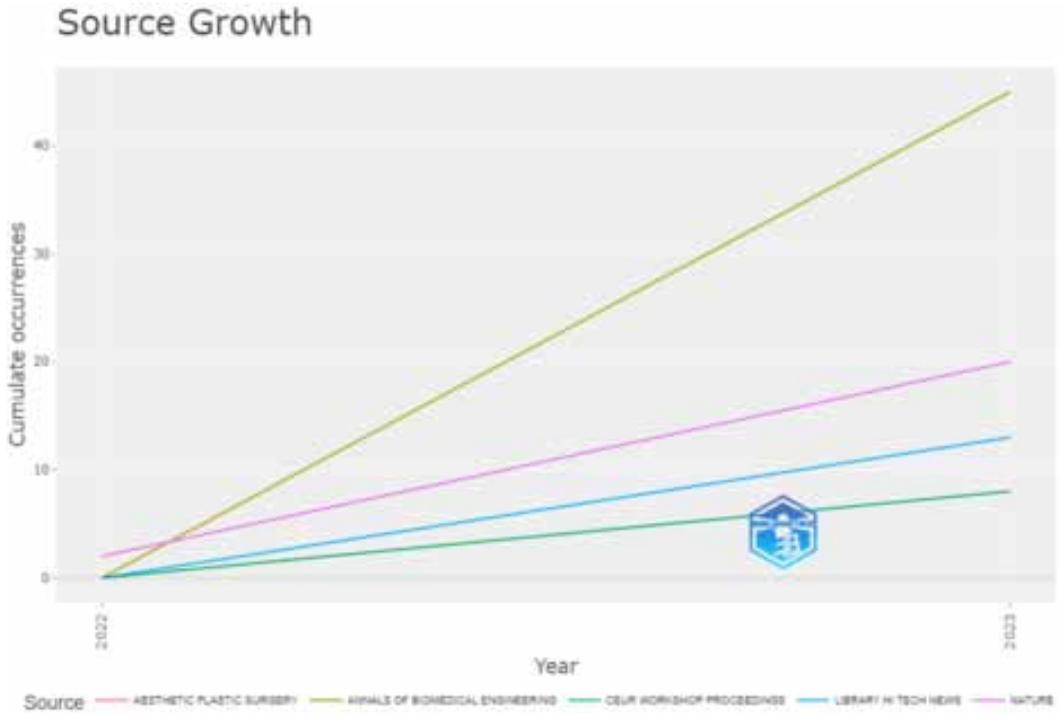
The keyword distribution signifies the active research and discourse surrounding ChatGPT, artificial intelligence, machine learning, and natural language processing. These keywords reflect the growing interest in AI-driven conversational systems and their potential to revolutionize global information management practices across various sectors. Understanding these keyword trends can provide researchers, practitioners, and stakeholders with valuable insights into the prevailing areas of focus and can guide further exploration and advancements in the field of information management.

Analysis of Published Documents

Table 1 presents the most globally cited documents along with their respective DOIs, total citations, citations per year (TC per year), and normalized TC values. The top cited documents are as follows:

- Thorp, H. H. (2023). Science: This document has a total of 130 citations, with an average of 130 citations per year. The normalized TC value is 48.951, indicating its high impact and consistent citation rate.
- Stokel-Walker, C. (2023). Nature: With 112 total citations and a TC per year of 112.0, this paper demonstrates significant recognition within the scientific community. Its normalized TC value is 42.173.
- Van Dis, E. A. M. (2023). Nature: This document has 92 citations, with a TC per year of 92.0 and a normalized TC value of 34.642, suggesting its substantial influence.
- Else, H. (2023). Nature: This paper has 73 citations, a TC per Year of 73.0, and a normalized TC value of 27.488, demonstrating its influence in the field.

Table 1. Highly cited papers

Paper	DOI	Total citations	TC per year	Normalized TC
Thorp (2023)	https://doi.org/10.1126/science.adg7879	130	130	48.951
Stokel-Walker & Van Noorden (2023)	https://doi.org/10.1038/d41586-023-00107-z	112	112	42.173
van Dis et al. (2023)	https://doi.org/10.1038/d41586-023-00288-7	92	92	34.642
Editorial (2023), Nature	https://doi.org/10.1038/d41586-023-00191-1	77	77	28.994
Else (2023)	https://doi.org/10.1038/d41586-023-00056-7	73	73	27.488
Shen et al. (2023)	https://doi.org/10.1148/RADIOL.230163	60	60	22.593
Stokel-Walker (2022)	https://doi.org/10.1038/d41586-022-04397-7	53	26.5	2.178
Gilson et al. (2023)	https://doi.org/10.2196/45312	49	49	18.451
Stokel-Walker & Van Noorden (2023)	https://doi.org/10.1038/d41586-023-00340-6	48	48	18.074
Liebrenz et al. (2023)	https://doi.org/10.1016/S2589-7500(23)00019-5	43	43	16.191
Dwivedi et al. (2023)	https://doi.org/10.1016/j.ijinfomgt.2023.1026	4242	42	15.815
Biswas (2023)	https://doi.org/10.1148/RADIOL.223312	41	41	15.438
Patel & Lam (2023)	https://doi.org/10.1016/S2589-7500(23)00021-3	39	39	14.685
Pavlik (2023)	https://doi.org/10.1177/10776958221149577	39	39	14.685
Kasneci et al. (2023)	https://doi.org/10.1016/j.lindif.2023.102274	35	35	13.179
Salvagno et al. (2023)	https://doi.org/10.1186/s13054-023-04380-2	32	32	12.049
Sallam (2023)	https://doi.org/10.3390/healthcare11060887	30	30	11.296
Gordijn & Have (2023)	https://doi.org/10.1007/s11019-023-10136-0	28	28	10.543
Wang et al. (2023)	https://doi.org/10.1109/JAS.2023.123486	25	25	9.414
Lund & Wang (2023)	https://doi.org/10.1108/LHTN-01-2023-0009	24	24	9.037

The dataset also includes other highly cited papers from various disciplines, such as radiology, medical education, information management, and healthcare.

From the data, it is evident that the most globally cited documents come from prestigious journals such as Science and Nature, indicating their reputation and impact on the scientific community. These papers are contributing to the advancement of knowledge across diverse fields. Additionally, the high citation rates reflect the significance and relevance of the research presented in these documents.

Researchers and scholars can refer to these highly cited papers to gain insights into influential studies and current trends in their respective fields. Furthermore, analyzing the citations and impact of these papers can provide valuable information about the direction of research and the areas that attract significant attention within global information management and related sectors.

CONCLUSION

This paper has provided a comprehensive analysis of the impact of ChatGPT on global information management across various industries. Through an examination of the dataset obtained from the

Scopus database, several key findings have emerged. First, the study revealed the dominance of specific publishers in disseminating research related to ChatGPT, underscoring the importance of reputable outlets for scholarly work. Additionally, Lotka's law demonstrated that a majority of authors contribute only one document, but a core group of prolific authors is driving research in this field. Moreover, the analysis of country-specific scientific production highlighted the global nature of ChatGPT research, with countries such as the United States, China, and the UK leading in terms of frequency of publications. Last, the keyword distribution shed light on the primary research themes, with a focus on ChatGPT, artificial intelligence, chatbots, and ethics.

This research contributes to the understanding of ChatGPT's impact on global information management by providing insights into publisher influence, authorship patterns, country-specific contributions, and prevailing research themes. The findings have implications for researchers, practitioners, and policymakers alike. Understanding the landscape of ChatGPT research can inform decisions regarding collaboration opportunities, identifying influential sources, and addressing ethical considerations associated with AI chatbot technologies. By harnessing the potential of ChatGPT effectively and responsibly, stakeholders can leverage its capabilities to enhance information management practices across sectors such as healthcare, industry, education, and beyond. Continued exploration and research in this area will be crucial to keep pace with the evolving landscape of AI and its impact on global information management.

CONFLICTS OF INTEREST

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PROCESS DATES

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