Digital Archives Management in the Public Sector: A Bibliometric Study

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Notes	ABSTRACT
  	This study examined development trends in digital archives management within government agencies using a bibliometric approach, covering the period from 2001 to 2023. The bibliometric approach was applied to examine publication patterns from 170 articles sourced from the Scopus database, filtered based on specific criteria. The analysis integrates qualitative and quantitative assessments to identify influential works and emerging themes in the field. The study revealed a notable growth in scholarly interest, with publications increasing from 10 in 2022 to 17 in 2023. The United States emerged as the leading contributor in both publication output and citation impact. Among journals, Government Information Quarterly (355 citations), The Electronic Library (144 citations), and Records Management Journal (180 citations) were identified as highly influential. Keyword network analysis highlighted key research directions centered on leveraging technology for digital archives management. Dominant themes included "records management," "e-government," and "blockchain," reflecting a focus on optimizing archival practices and ensuring secure, interoperable systems. Future research should explore integrating blockchain with e-government frameworks to enhance records management security and developing interoperable electronic archive systems. The study underscores the importance of a collaborative, multidisciplinary approach involving archivists, technologists, and policymakers to foster innovation and address challenges in digital archives management. **Keywords:** Archives management; digital archives; bibliometric

1. INTRODUCTION

Digitalization has revolutionized all sectors, including government operations. In government organizations, digitalization aims to enhance service effectiveness and efficiency (Singh & Slack, 2022). A key aspect of this transformation is the shift from manual to digital-based archive management (Yuspiani et al., 2021). Digitizing archives is essential for better management, as archives hold crucial information that must be preserved and improved through effective management (Tintswalo et al., 2022). Moreover, manual archive management needs more storage space, poses risks of damage, requires a large workforce, and involves lengthy retrieval times (Salmin, 2019).

At the same time, inadequate archive management can lead to significant losses for various stakeholders and may even have legal repercussions. For instance, archives may suffer damage, fall into unauthorized hands, or get lost (Yani & Syafiin, 2021). Consequently, archives might be handled carelessly, such as being misplaced or improperly maintained, which could lead to future problems (Sugiyamta et al., 2022). Therefore, the government must be adaptive and responsive in addressing the issues of manual archive management. In this era of technological disruption and the Industrial Revolution 4.0, it is crucial that government administration, including archive management, evolves accordingly. Archives play a vital role in providing information to leaders for decision-making and policy formulation. Thus, a robust system and efficient working procedures are necessary to ensure that information is presented quickly, comprehensively, and accurately (Ermawaty, 2013). In other words, archives serve as proof of accountability in societal, national, and state affairs and must be managed properly to ensure their integrity and security (Juliati & Lamingthon, 2021). In addition to digitizing archives, digital archiving also has new approaches to creating and managing digital assets called digital curation. Digital curation centers on "maintaining and adding value to a trusted body of digital information for current and future use." Even the challenge between digital archives management and digital curation requires more complex systems as well as competent human resources (Poole, 2016; Yakel, 2007).

Digitization in archives is closely linked to digitalization. Digitization is the starting point of the archive digitalization process because the concept of digitization is a process of transforming analog data into a digital form before the public sector finally carries out the process of digitalizing archives in full meaning from the creation of the document until the document is finished in digital form as an attempt to support the paperless effort (Nabela et al., 2020). Digitalization in government involves utilizing technology and digital data to transform business processes from traditional methods to digital systems (Crawford et al., 2020; Opute et al., 2020). The application of cloud computing in archive management reduces the costs associated with managing archives for government operations (Mukred et al., 2022). Additionally, technology enhances the speed of work processes, decreases reliance on paper, and improves the security of managed archives (Nandini & Girisha, 2021). The use of electronic media in archive management is commonly referred to as an electronic filing system that relies on computers. Computers can convert conventional archives into digital formats or create entirely new electronic archives (Rifauddin, 2016). Therefore, the digital data derived from digitization becomes a fundamental component of this process. Ultimately, digitalization aims to accelerate development and enhance public services (Erfa, 2021).

Previous studies have explored the digitalization of archives. For instance, public institutions in South Africa face two primary challenges in managing digital archives. First, despite numerous legislative and regulatory frameworks intended to address digital archives management issues, these frameworks often fail to address the functional equivalence between digital and physical archives. Second, there is a challenge in differentiating between original and copy recordings (Ngoepe & Katuu, 2015). Similarly, research on the Kenyan government in 2007 focused on automating all land records and transactions by developing and implementing a land information management system based on big data technology, which effectively manages a broad range of data on land ownership and transactions (Kwanya, 2014). Additionally, research on archive management in Indonesia has developed a model based on eight educational standards to enhance school accountability. This research highlights the importance of the Electronic Record Management System (ERMS) in supporting school accountability (Oktarina et al., 2023).

There have been other studies using a bibliometric approach to explore archive-related topics. Some research aims to analyze the evolution of digital archive topics to address various management issues and risks associated with digital archives (Wibowo & Adriani Salim, 2022). However, previous research has not addressed the development trends in archive digitalization within government agencies through bibliometric analysis to examine trends in studies on archive digitalization (Aswin et al., 2022).

The aim of this article is to describe in a comprehensive manner the research trends in the development of archive digitalization in the public sector between the period 2001-2023 as part of looking at the process of digital transformation in the public sector, especially in archive management.

2. METHODS

This study employed a bibliometric method to explore the research landscape of digital archives management. The bibliometric method applies statistical and mathematical techniques to analyze the publication patterns of articles and journals on a specific topic. It involves qualitative and quantitative studies of scientific literature to determine which papers have the most impact on a certain field of study (Godin, 2006). Furthermore, this approach seeks to explain how research subjects have evolved by looking at the number and variety of studies (Tupan, 2020).

The article data was retrieved from the Scopus database using specific search terms: ("records management" OR "archives management" OR "archival management") AND ("government" OR "public sector" OR "administrat*" OR "civic") AND "digital," applied across the title, abstract, and keywords. The search was conducted in two stages. Initially, 196 documents were identified. In the second stage, the results were refined to include only publications from 2001 to 2023, written in English, and classified as research articles, conference proceedings, review articles, or book chapters. This filtering process resulted in a final dataset comprising 170 articles. The data was then saved in CSV format and analyzed using VOSviewer 1.19 software. VOSviewer is a tool designed to visualize networks of scientific publications based on data from scientific databases. It enables users to visualize citation, co-citation, and co-word analysis in intuitive graphs and charts. Moreover, it will facilitate network

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analysis, and the identification of patterns, and relationships among scientific publications, including authors, countries, affiliations, and publishers (Van Eck & Waltman, 2010).
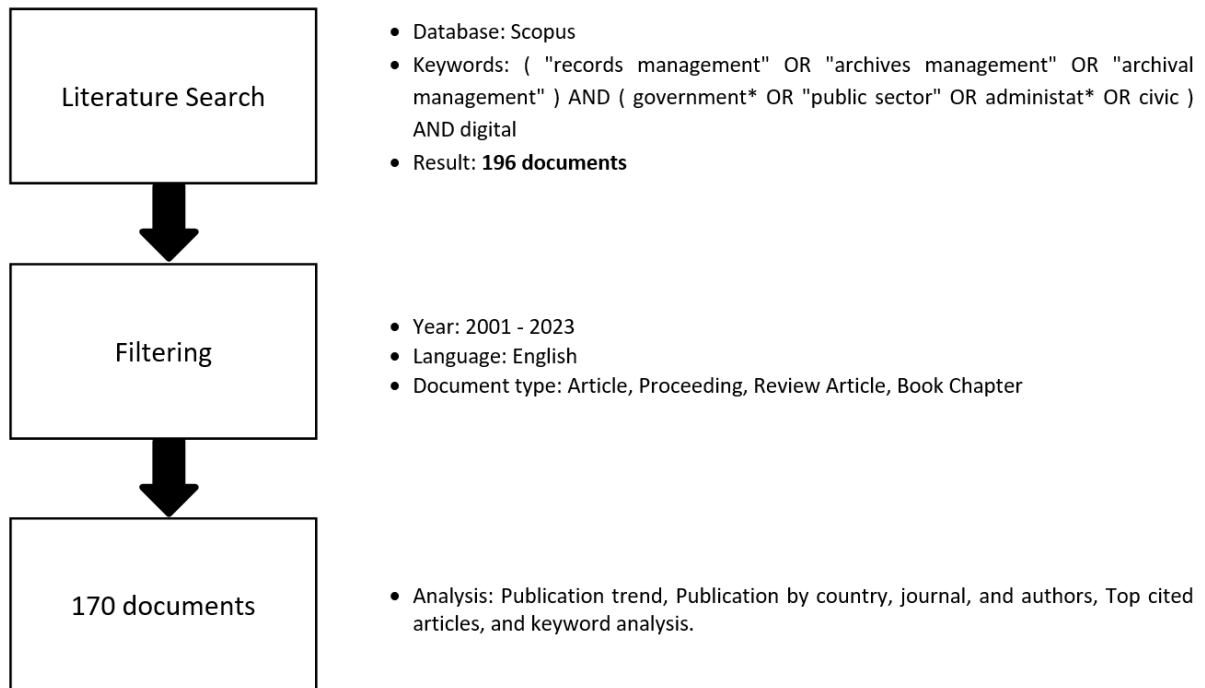
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┌─────────────────────┐     • Database: Scopus
│                     │     • Keywords: ( "records management" OR "archives management" OR "archival
│  Literature Search  │       management" ) AND ( government* OR "public sector" OR administat* OR civic )
│                     │       AND digital
└─────────────────────┘     • Result: 196 documents
          │
          ▼
┌─────────────────────┐     • Year: 2001 - 2023
│                     │     • Language: English
│      Filtering      │     • Document type: Article, Proceeding, Review Article, Book Chapter
│                     │
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┌─────────────────────┐
│                     │     • Analysis: Publication trend, Publication by country, journal, and authors, Top cited
│    170 documents    │       articles, and keyword analysis.
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Figure 1. Stages of literature search

3. RESULTS AND DISCUSSION

Publication Trend

In the past two decades (2001-2023), research on digital records management and digital archives management in government, public sector, administration, or civic contexts has resulted in 196 Scopus-indexed documents (including research articles, proceedings, review articles, and book chapters). The highest number of publications was in 2023, with 16 documents, while the lowest was in 2001 and 2006 (one document). It indicates a substantial increase in publications, rising from 10 in 2022 to 17 in 2023.
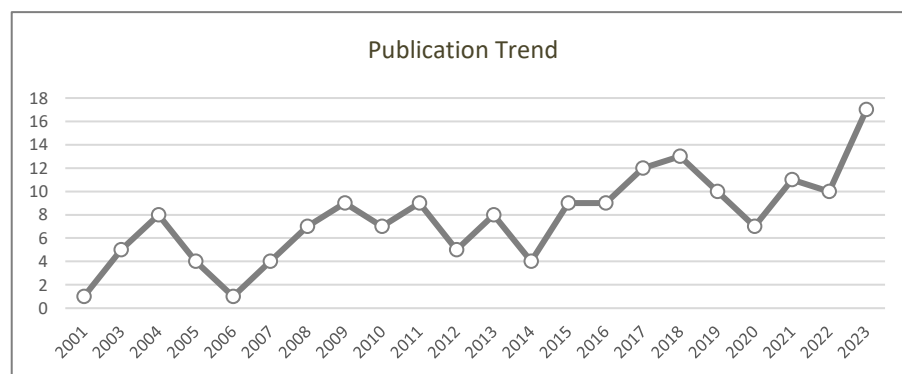
Source: Processed by Authors (2024)

Figure 2. Publication trend

Publications by Country

From the literature spanning 2001 to 2023, the United States leads among the top ten countries in terms of both the number of publications and citations (Table 1). Thirty-four publications from the U.S. have accumulated a total of 446 citations, highlighting its dominant role in digital archives management research. The rankings of other countries differ depending on whether the focus is on publication volume or citation count. In terms of publications, India, Australia, China, and South Africa rank second to fifth, while the United Kingdom, Canada, Sweden, Estonia, and Malaysia occupy sixth to tenth positions. For citation counts, Australia, India, the United Kingdom, Estonia, South Africa, Canada, Malaysia, and China are ranked second to ninth, while Sweden comes in tenth with seven papers cited 22 times.

Additionally, in terms of international collaboration, seven countries have partnered on publications related to "digital archives management." As shown in Figure 3, The United States is central to this network. It collaborates with China, the United Kingdom, Canada, Taiwan, and India. India and Australia also engage in research collaboration within this field.

Table 1. Publication by country

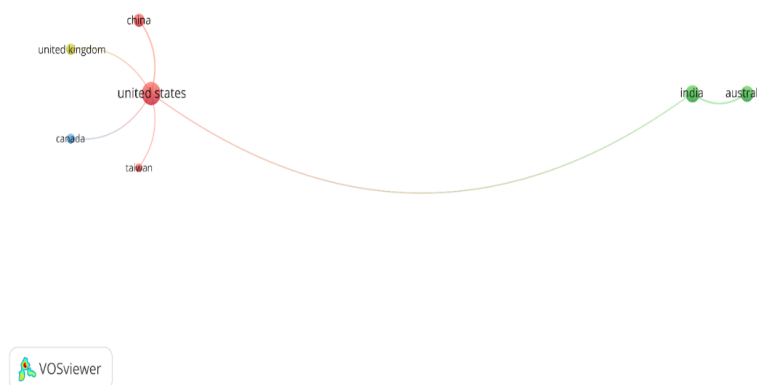| No.	Country	Document (D)	Citation (C)	C/D
1.	United States	34	446	13.12
2.	India	20	71	3.55
3.	Australia	17	143	8.41
4.	China	12	23	1.92
5.	South Africa	9	49	5.44
6.	United Kingdom	8	55	6.88
7.	Canada	7	31	4.43
8.	Swedia	7	22	3.14
9.	Estonia	6	51	8.50
10.	Malaysia	5	26	5.20

Source: Processed by Authors' (2024)

Figure 3. International collaboration networks

Publications by Journals

The top ten journals in this field include prominent titles such as Records Management Journal, ACM International Conference Proceedings, and Lecture Notes in Computer Science.

Among these ten journals, 57 documents have been published out of a total of 196 collected documents, while the remaining 139 documents are distributed across various other journals. This substantial number of documents indicates the significance and relevance of the topic across a broad range of research contexts.

In terms of citations, Government Information Quarterly leads with 355 citations, the Electronic Library with 144 citations, and the Records Management Journal with 180 citations. High citation counts suggest that articles published in these journals are highly regarded and influential within the academic community.

Notably, the citation-to-publication ratio is highest for Government Information Quarterly, with a ratio of 118.33, for the Electronic Library 28.80, and for Studies in Health Technology and Information 24. This ratio provides valuable insight into the relative impact of articles published in these journals and helps researchers assess the importance of the journals.

Table 2. Publications by journals

No.	Publication	Document (D)	Citation (C)	C/D
1.	Records Management Journal	22	180	8.18
2.	ACM International Conference Proceeding	6	26	4.33
3.	Lecture Notes in Computer Science	6	8	1.33
4.	Electronic Library	5	144	28.80
5.	Archival Science	4	32	8.00
6.	Final Program and Proceeding of Archiving Conference	4	8	2.00
7.	Government Information Quarterly	3	355	118.33
8.	Archivaria	3	5	1.67
9.	Studies in Health Technology and Information	2	48	24.00
10.	ASLIB Proceeding	2	32	16.00

Source: Authors' elaboration

Most Productive Authors

The analysis of the Most Productive Authors, as shown in Table 3, identifies the top ten authors in the field of archives. Meanwhile, the topic of archives has not yet gained widespread popularity, as evidenced by the relatively low number of publications by these leading authors. For instance, Ingrid Papple, the most prolific author, has produced only five works on digital archives. Mpho Ngoepe and Ingmar Pappel, ranked second and third respectively, have each authored four articles, while Dian Indrayani Jambari and Bardo Fraunholz, in fourth and fifth place, have each published three articles on digital archives.

The authors' countries of origin are diverse, spanning Asia, Europe, Australia, and Africa. Ingrid Pappel and Ingmar Pappel, who are ranked first and third, are from Estonia; Mpho Ngoepe, in second place, is from South Africa; Dian Indrayani Jambari is from Malaysia; and Bardo Fraunholz is from Australia. Comparing these authors to the top ten countries with the highest number of archive-related publications, there is representation from both Australia and South Africa among the top five authors. Notably, all top five authors are affiliated with academic institutions, indicating that research on digital archives remains primarily within the academic domain rather than extending into practical consulting fields.

Regarding expertise, only Mpho Ngoepe has a background specifically in archives and is engaged with themes related to archives, record management, literature, and language. The other four authors have varied expertise, including digital transformation, information society, information systems, information technology, and project management.

Table 3. Most productive authors

No.	Author(s)	Document (D)	Citation (C)	C/D
1.	Pappel, Ingrid	5	50	10
2.	Ngoepe. Mpho	4	31	7.75
3.	Pappel, Ingmar	4	49	12.25
4.	Jambari, Dian Indrayani	3	17	5.66
5.	Fraunholz, Bardo	3	24	8
6.	Swatman, Paula M.C.	3	24	8
7.	Fan, Guanyan	2	0	0
8.	Li, Siyi	2	0	0
9.	Palonen, Osmo	2	0	0
10.	Kettani, Driss	2	1	0.5

Source: Processed by Authors (2024)

Top Cited Articles

The most-cited article, titled "Transparency and Technological Change: Ensuring Equal and Sustained Public Access to Government Information," published in 2010, has gathered 315 citations at the time of this review. This paper examines President Barack Obama's administration efforts to enhance transparency and information access in government institutions through internet access and e-government strategies (Jaeger & Bertot, 2010). The second most-cited paper, with 63 citations, is "E-Government and Records Management: An Assessment Tool for E-Records Readiness in Government." It explores the challenges faced by digital archives management in Africa due to inadequate systems and procedures (Mnjama & Wamukoya, 2007a). The third most-cited article, with 41 citations, is "A Patient Agent to Manage Blockchains for Remote Patient Monitoring." This paper emphasizes the importance of developing a mindset for digital archives management through sustainable training, infrastructure, and frameworks, particularly within Nigerian universities (Asogwa, 2013).

Table 4. Top cited articles

No.	Author	Title	Publication	Number of citations
1.	Jaeger P.T.; Bertot J.C. (2010)	Transparency and technological change: Ensuring equal and sustained public access to government information	Government Information Quarterly	315
2.	Mnjama N.; Wamukoya J. (2007)	E-government and records management: An assessment tool for e-records readiness in government	Electronic Library	63
3.	Uddin M.A.; Stranier A.; Gondal I.; Balasubramanian V. (2018)	A patient agent to manage blockchains for remote patient monitoring	Studies in Health Technology and Informatics	41
4.	Asogwa B.E. (2013)	The readiness of universities in managing electronic records a study of three federal universities in Nigeria	Electronic Library	41
5.	Mistry C.; Thakker U.; Gupta R.; Obaidat	MedBlock: An AI-enabled and Blockchain-driven Medical Healthcare System for	IEEE International Conference on	33

	M.S.; Tanwar S.; Kumar N.; Rodrigues J.J.P.C. (2021)	COVID-19	Communications	
6.	Iwhiwhu E.B. (2005)	Management of records in Nigerian universities: Problems and prospects	Electronic Library	26
7.	Dorner D.G. (2009)	Public sector readiness for digital preservation in New Zealand: The rate of adoption of an innovation in records management practices	Government Information Quarterly	22
8.	Mosweu T.L.; Kenosi L. (2018)	Implementation of the Court Records Management System in the delivery of justice at the Gaborone Magisterial District, Botswana	Records Management Journal	20
9.	Griffin A. (2004)	Records Management Capacity Assessment System (RMCAS)	Archival Science	19
10.	Pappel I.; Pappel I.; Saarmann M. (2012)	Digital records keeping to information governance in Estonian local governments	International Conference on Information Society, i-Society 2012	19

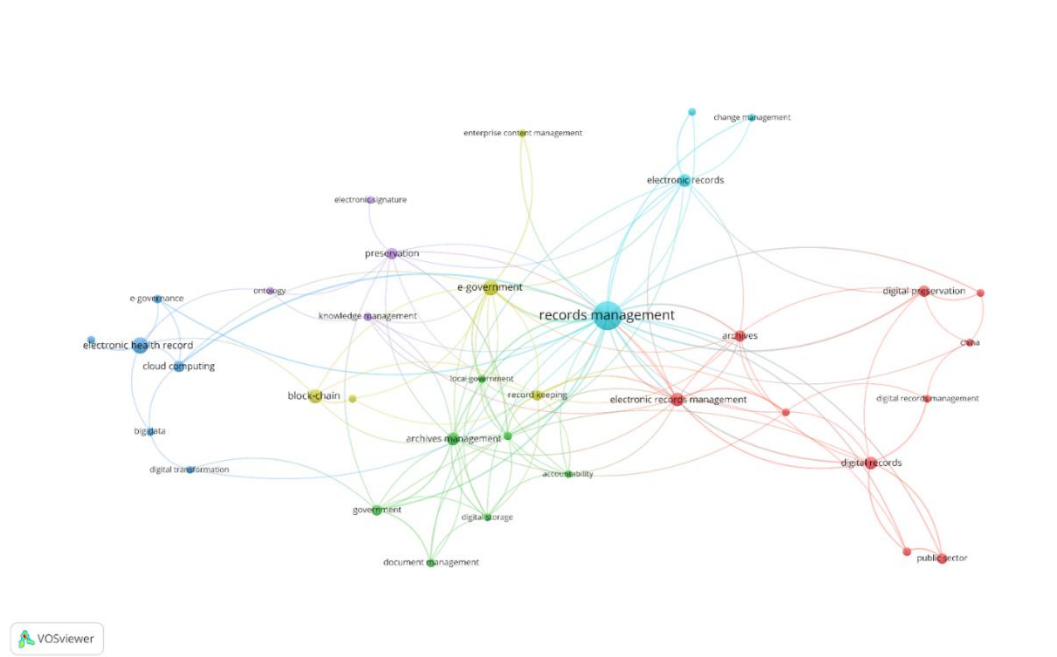Source: Authors' elaboration

Most Frequent Keywords

Figure 4. Keyword network in the research theme of digital archives management in the public sector

Table 5. Most frequent keywords

No.	Keywords	Frequency
1.	Records Management	30
2.	E-Government	12
3.	Blockchain	11
4.	Electronic records management	9
5.	Archives management	9
6.	Digital records	8
7.	Electronic records	8

8.	Digital preservation	8
9.	Preservation	7
10.	Archives	7
11.	Cloud computing	7
12.	Record keeping	6

Source: Authors' elaboration

In a study on digital archives management in the public sector, Table 5 highlights the most frequently occurring keywords. The top three keywords are "Records Management" (30), "E-Government" (12), and "Blockchain" (11). These keywords collectively reflect the primary research focus on developing methods and best practices for systematic and efficient archive management, ensuring data organization and accountability throughout the archive lifecycle. The term E-Government Integration draws the digitalization efforts in the government sector that aimed at enhancing efficiency, transparency, and public engagement through information and communication technology (An, 2009; Henriksen Hagen, 2023). Amid digital transformation, blockchain technology is emerging as a promising solution for improving security and transparency in digital archives management (Koulizakis & Loukis, 2020). The connection between these keywords indicates that effective records management in the digital era requires the adoption of e-government technologies and blockchain to maintain data integrity and validity, resulting in a more transparent, efficient, and reliable system for managing digital archives.

Additionally, keyword network analysis has identified seven key clusters, offering insights into the dominant research themes and potential areas for further study in digital archives management within the public sector. These clusters reveal that research is heavily influenced by advancements in digital technologies. Prominent themes include digital archives management, accountability in archive management, the use of big data and cloud computing technologies, innovations in records management through blockchain and e-government, as well as electronic document preservation and knowledge management. Clusters marked with red nodes emphasize digital records management in public sector organizations, frequently featuring keywords like digital records, electronic records management, and digital preservation.

This research addresses concerns related to data security, accessibility, and reliability of digital archives. Furthermore, the themes of big data technology, data mining, and cloud computing are represented by blue clusters, reflecting a significant interest in leveraging these technologies to enhance information management efficiency. Other clusters highlight technological innovations such as blockchain in records management and e-government system implementations. It indicates a focus on improving transparency and security in archive management. Similarly, electronic document preservation and knowledge management are key areas of interest, suggesting ongoing research efforts to ensure the long-term maintenance of electronic archives and effective knowledge management practices.

Between 2001 and 2023, the number of scientific publications on digital archives management has shown an overall upward trend. Notable increases in publications occurred in the years 2002, 2003, 2004, 2007, 2008, 2009, 2011, 2013, 2015, 2016, 2017, 2018, 2021, and 2023—14 times in total. Conversely, a downward trend was observed in 2005, 2006, 2010, 2012, 2014, 2019, and 2020—7 times in total. The upward trend in publications on digital archives management has been 67 percent more frequent than the downward trend. The periods of decline were typically short-lived, lasting no more than two consecutive years, with subsequent increases observed in the following years.

The rise in publications may be attributed to various factors, such as the growing need to adapt to advancements in digital technology and societal development. In the digital age, effective management of digital archives, especially in the public sector, requires adaptation to technological changes and the evolution of the archivist profession (Harries, 2009; Kallberg, 2012). The digital era has increased the demand for instant access to information, minimizing delays, complex procedures, and resource expenditure. Consequently, archive management professionals must embrace new technologies to maintain relevance, efficiency, and effectiveness (Reed, 2010). Moreover, the cultural shift from manual to digital methods has spurred an increase in research on digital archives management, particularly in the public sector. This research provides valuable insights for organizations considering digital archive implementation (Gregory, 2005). So, the key studies highlighting these trends include Transparency and Technological Change: Ensuring Equal and Sustained Public Access to Government Information, which addresses increased transparency and public access; and E-Government and Records: An Assessment Tool for E-Records Readiness in Government. It examines challenges in adapting digital archives. Otherwise, a Patient Agent to Manage Blockchains for Remote Patient Monitoring explores attitudes toward digital access (Mnjama & Wamukoya, 2007b; Jaeger & Bertot, 2010; Uddin et al., 2018).

A digital-based archive management system offers several benefits, including improved efficiency, higher process quality, better regulatory compliance, enhanced information access, and support for remote access. These advantages contribute to increased productivity and employee satisfaction. Technical reliability in managing different types of archives and trust in stored data are crucial factors, along with cost considerations (especially as noted in 2005). However, research indicates that many public sector organizations are not adequately prepared for digital archive management, often lacking necessary staff training and resource allocation for cultural changes (Shepherd, 2006). Effective training in digital archives management is essential for a smooth transition from paper-based systems, requiring executive support, clear communication, and an understanding of the training's benefits (Wilkins et al., 2009). This situation highlights the potential for further research in digital archives management. On top of that, the leading authors in digital archives management publications come from a variety of fields beyond archival expertise, including digital transformation, information society, information systems, information technology, and project management, which contributes to the growing trends in publication.

According to the analysis, the top three countries with the highest number of publications on "digital archives management" are the United States, India, and Australia. The United States leads significantly in this field, contributing 34 articles and receiving 446 citations. This prominence is unsurprising given the U.S.'s pivotal role in the development of digital preservation and archiving. Since 1934, the U.S. has had the National Archives and Records Administration (NARA), which is tasked with identifying, protecting, preserving, and publishing historically significant records from all branches of the Federal Government (Horsley & DeVorsey, 2018). NARA continues to advance archive management policies as part of the transition to a digital government.

India ranks second, producing more than half the number of publications compared to the U.S., with 20 articles and 71 citations. India has two main state archive organizations: the National Archives of India (NAI) and the Delhi Archives Department (DA). Since 1998, they have employed best practices and new technologies for the acquisition and preservation of archives, including preventive, curative, and restorative measures to safeguard and extend the lifespan of archival records (Ahmad & Sharma, 2021).

Australia ranks third in the list, having published 17 articles that have garnered a total of 143 citations. Since the implementation of the Archives Act in 1983, Australia has focused on its National Archives, establishing the National Archives of Australia as the official authority for archival and record-keeping for the Australian Government. The National Archives has been engaged in digital preservation efforts for over twenty years, with a project starting in the late 2000s aimed at developing methods to preserve digital records and ensure their long-term accessibility (Wilson, 2005). Besides, the National Library of Australia has prepared a statement on digital archive preservation, supported by its policy that integrates archive preservation planning with digitalization strategies (Hapsari & Ariyani, 2019). As digitalization becomes a major focus globally, countries recognize the importance of preserving digital archives for future benefits. This awareness has led to significant research and publications on the topic in these nations.

Regarding highly cited articles, the digitalization of government institutions is seen as a way to increase transparency and public access to government information. This shift is driven by the need for government work to meet community needs, enhancing accountability and ensuring that performance results are communicated effectively. Therefore, policies and rules must align with public needs (Han Hui & Juan Jing, 2010; Petrakaki, 2018). In that sense, the development and skills of human resources are crucial for successful digital transformation and optimal implementation.

Likewise, keyword network analysis reveals several promising research directions in the field of digital archives and information management within the public sector. Key terms such as "records management", "e-government", and "blockchain" suggest a strong emphasis on leveraging technology to enhance digital archives management. Future research could explore integrating blockchain technology with e-government systems to develop more secure and transparent records management solutions. Additionally, studies could focus on improving the interoperability of electronic archive management systems with various technology platforms to ensure data remains accessible and authentic over time.

Broader keywords like digital preservation, archives management, and electronic records management highlight the need for more effective digital preservation strategies. Research could be directed towards developing new methods for the long-term maintenance of electronic documents and addressing challenges posed by rapidly evolving technologies that impact data accessibility. Comparative studies of best practices in different countries could also be valuable in identifying widely adopted solutions for managing digital archives in the public sector. A collaborative, multidisciplinary approach involving technicians, archivists, and policymakers may lead to significant innovations and improvements in digital archives management practices.

4. CONCLUSION

Bibliometric analysis of digital archives management from 2001 to 2023 does show a significant trend. The 67% increase in digital archive publications compared to the downward trend indicates that there is an increasing need for efficient and effective information management. This is in line with the adaptation to the advancement of digital technology and the demands of a developing society. Some of our findings include effective support from management and clear internal communication are crucial for successfully transitioning to digital archiving. Research focused on digital archives management in the public sector aims to develop more secure and transparent records management solutions and enhance interoperability between

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electronic archive systems and various technology platforms. This is essential for maintaining data authenticity and accessibility for the long term.

In terms of the number of publications, the United States, India, and Australia make the highest contribution to "digital archives management," and the role of organizations in managing archives is a major factor in these three countries. Government institutions are pivotal in advancing digital preservation and archiving, and they continually innovate to address country-specific challenges. An international comparative study of best practices in digital archives management can offer valuable insights for public sector improvements. Moreover, the United States as the most productive country takes the role of the center of collaboration among countries such as China, the UK, Canada, Taiwan and India. Collaboration among technicians, archivists, and policymakers is vital for driving innovation in digital archives management.

Acknowledgment

Authors' contributions

All authors contributed equally to the paper.

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