Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan
Vol. 12, No. 1, June 2026
http://ejournal.undip.ac.id/index.php/lpustaka

Research Article
Received: 18 November 2025, Revised: 09 December 2025, Accepted: 22 June 2026, Online: 30 June 2026

From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives

Fairus Faqih[1)*], Hendro Margono[2)]
[1)2)]*Department of Master of Information and Library Science, Universitas Airlangga, Surabaya, Indonesia*
[1)]fairus.faqih-2025@fisip.unair.ac.id, [2)]hendro.margono@fisip.unair.ac.id

Abstract
Background: Digitization has reshaped management across library science. Over the past decade, libraries have adopted digital co-creation, AI, and automation to enhance access and services. Yet the shift from preservation-oriented to collaboration-centered approaches in digital archives remains underexplored.
Objective: To map the thematic evolution of digital innovation in library management (2011-2025) and assess shifts from preservation frameworks toward collaborative, participatory, and AI-assisted approaches.
Methods: A bibliometric analysis of 263 Scopus-indexed articles (2011-2025) was conducted using the Bibliometrix R package and Biblioshiny. Performance analysis, science mapping, and thematic evolution were applied, comparing two periods (2011-2021; 2022-2025).
Results: Scholarly output increased notably after 2019. Three core clusters were identified: digital technologies, digital libraries, and humanities. Recent work highlights collaboration, blockchain-based management, AI-driven curation, and participatory archiving. Emerging topics include language processing, digital library services, and large language models.
Conclusion: Digital innovation in library management has moved from a preservation-centric to a collaboration-oriented paradigm. The study clarifies this transformation and informs the design of tools, policies, and collaborative frameworks. Libraries should strengthen competencies in participatory digital preservation and AI integration to support future-ready information management.

Keywords: *Bibliometric; digital library; digital innovation; library science*

INTRODUCTION

Over the past decade, digital transformation has fundamentally reshaped library management, extending beyond the digitization of collections toward the integration of intelligent technologies, collaborative infrastructures, and user-centered services. Academic and research libraries increasingly employ artificial intelligence (AI), cloud computing, digital repositories, and interoperable information systems to improve resource discovery, preservation, and knowledge sharing (Ardyawin et al., 2025; Okunlaya et al., 2022). Consequently, digital innovation is no longer viewed solely as a technological intervention but as a strategic process that transforms organizational workflows, service delivery, and stakeholder participation.

Within this transformation, digital archives occupy a central position because they simultaneously function as cultural memory repositories and technological infrastructures

* Corresponding Author

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962

supporting long-term access to digital resources. Traditionally, digital archive management emphasized preservation principles through standardized frameworks such as the Open Archival Information System (OAIS), preservation metadata standards (PREMIS), format migration, and redundant storage mechanisms to ensure authenticity, integrity, and accessibility of digital objects over time (Consultative Committee for Space Data Systems [CCSDS], 2012; Lavoie, 2014). These preservation-oriented approaches have remained fundamental to digital stewardship for more than two decades.

Recent technological developments, however, have expanded the scope of digital archive management beyond preservation. Libraries increasingly adopt collaborative digital infrastructures incorporating artificial intelligence, machine learning, blockchain, linked data, and participatory metadata creation to enhance digital curation, automate archival workflows, and facilitate community engagement (Messeri & Crockett, 2024; Okunlaya et al., 2022). Rather than functioning solely as custodians of digital collections, libraries are progressively becoming collaborative platforms in which librarians, researchers, and users jointly create, enrich, and manage digital knowledge resources.

The emergence of participatory digital archiving also reflects broader changes in digital scholarship and open science. Community-based metadata enrichment, crowdsourced transcription, collaborative digital humanities projects, and decentralized preservation infrastructures have redefined the relationships between institutions and users (Ridge, 2014; Theimer, 2011). Consequently, digital preservation is increasingly understood not merely as a technical activity but as a socio-technical process integrating technological innovation, institutional governance, and public participation.

Despite this rapid development, existing literature primarily examines individual technologies or evaluates specific digital library services. Recent systematic literature reviews have documented the growing implementation of AI, digital platforms, and intelligent library services, particularly during the post-pandemic period (Ardyawin et al., 2025). Nevertheless, these reviews provide only limited understanding of how the intellectual structure of digital archive research has evolved over time, especially regarding the transition from preservation-oriented paradigms toward collaboration-centered approaches.

This limitation highlights the need for a longitudinal perspective capable of tracing thematic changes across the field. Unlike systematic literature reviews that synthesize research findings, bibliometric analysis enables researchers to identify publication trends, conceptual structures, collaboration networks, and thematic evolution through quantitative mapping of scientific literature (Aria & Cuccurullo, 2017; Donthu et al., 2021). Such an approach is particularly appropriate for revealing how scholarly attention has shifted from technical preservation issues—including metadata standards, authenticity, and repository management—to emerging topics such as participatory archiving, AI-assisted curation, blockchain-based preservation, and large language models.

Accordingly, this study conducts a bibliometric analysis of digital innovation in library archives using 263 Scopus-indexed publications published between 2011 and 2025. The

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

E-ISSN: 2540-9638, ISSN: 2302-4666.
doi: http://doi.org/10.14710/lenpust.v12i1.78962

selected period captures both the early development of digital preservation research and the subsequent acceleration of collaborative and AI-driven innovations following 2022. The analysis compares two temporal periods (2011–2021 and 2022–2025) to identify thematic continuity, emerging research fronts, and shifts in the intellectual structure of digital archive scholarship.

This study contributes to the literature in four important ways. First, it provides a longitudinal bibliometric overview of research on digital innovation in library archives over fifteen years. Second, it identifies the thematic evolution from preservation-centered to collaboration-oriented research. Third, it maps the intellectual, conceptual, and collaborative structures that shape the field through science mapping techniques. Finally, it offers practical implications for libraries seeking to develop future-ready digital archive management strategies that integrate technological innovation, participatory governance, and artificial intelligence.

LITERATURE REVIEW

Digital transformation has significantly reshaped how libraries manage, preserve, and provide access to information resources. Initially, digital archives were primarily developed to ensure the long-term preservation of digital collections through standardized metadata, repository systems, and preservation frameworks. The primary objective was to maintain the authenticity, integrity, and accessibility of digital materials despite rapid technological change. As digital collections continue to expand, libraries have increasingly recognized that digital archives should not only function as preservation systems but also as platforms that support efficient information management and wider public access.

Recent technological developments have accelerated this transformation. Libraries increasingly adopt artificial intelligence (AI), cloud computing, blockchain, automation, and advanced digital platforms to improve collection management, metadata generation, retrieval, and user services. These technologies have shifted the role of digital archives from passive repositories toward interactive and collaborative environments where librarians, researchers, and users actively contribute to the creation, organization, and dissemination of knowledge. Consequently, contemporary digital archives emphasize collaboration, interoperability, and user participation alongside traditional preservation functions, reflecting broader changes in digital library services.

To understand how this transformation has evolved, bibliometric analysis has become an increasingly important research approach. Unlike systematic literature reviews that synthesize findings from individual studies, bibliometric analysis examines the structure and development of an entire research field through publication trends, citation relationships, collaboration networks, and keyword co-occurrence. Science mapping techniques further enable researchers to identify dominant research themes, emerging topics, and conceptual changes over time. These methods provide a comprehensive overview of how scholarly knowledge develops and how different research themes become interconnected.

Although previous studies have discussed digital transformation and technological innovation in library services, existing reviews have mainly focused on current applications of

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962

digital technologies and AI. Relatively little attention has been given to the long-term intellectual evolution of digital archive research, particularly the transition from preservation-oriented approaches toward collaboration-centered paradigms. This gap limits understanding of how emerging technologies have reshaped research priorities and conceptual developments in digital archives. Therefore, this study employs bibliometric analysis of Scopus-indexed publications from 2011 to 2025 to map publication trends, thematic evolution, and the changing intellectual structure of digital archive research in libraries. Through this approach, the study provides a comprehensive overview of the field's transition from preservation to collaboration and identifies emerging directions for future research.

METHODS

This study applies a bibliometric and science mapping approach to explore the thematic evolution of digital innovation and archival transformation in library services between 2011 and 2025. Bibliometrics is used as a quantitative lens to capture publication performance, intellectual structure, and the evolution of key concepts from preservation to collaboration. This approach transforms the literature itself into analyzable data, allowing researchers to identify patterns in how knowledge in the field of digital libraries and archives has developed over time.

Bibliometric methods are particularly valuable for analyzing large volumes of academic literature because they quantify relationships between documents, authors, institutions, and keywords (Donthu, Kumar, Mukherjee, & Pandey, 2021). In this study, bibliometrics is employed not merely to count publications but to map co-authorship networks, citation linkages, and keyword co-occurrence patterns, thereby revealing the intellectual trajectory of digital library innovation.

Bibliometric Rationale and Relation to SLR

While Systematic Literature Reviews (SLRs) emphasize content analysis and evidence synthesis, bibliometric analysis focuses on the structure and evolution of knowledge through measurable linkages between publications. SLRs are appropriate for answering focused questions about the effectiveness or quality of specific interventions; bibliometrics, on the other hand, provides a macro-level overview of how an entire research field grows, interacts, and reconfigures itself (Aria & Cuccurullo, 2017).

For this study, bibliometrics was chosen because the main objective is to observe long-term thematic evolution rather than to evaluate the outcomes of specific projects or policies. The approach is well suited to identifying transitions in the intellectual structure of digital library scholarship, from technical preservation concerns to collaborative innovation and AI-driven participation.

Data Source and Search Strategy

The bibliographic data were retrieved from the Scopus database, which is widely regarded as one of the most comprehensive repositories of peer-reviewed literature. Scopus

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

E-ISSN: 2540-9638, ISSN: 2302-4666.
doi: http://doi.org/10.14710/lenpust.v12i1.78962

offers standardized metadata and supports export formats compatible with R-based bibliometric analysis (Donthu et al., 2021).

Data collection was carried out in September 2025 using the search query, which was refined to fit the objectives of this research:

```
TITLE-ABS-KEY (("Digital Technology" OR "Digital Transformation")
AND ("Academic Libraries" OR "Library Service" OR "Library Information Service"
OR "Library System" OR "E Resources"))
AND PUBYEAR > 2010 AND PUBYEAR < 2026
AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp"))
AND LIMIT-TO (LANGUAGE, "English")
```

This Boolean expression targeted publications related to digital technology and innovation in library services while excluding non-library contexts.

The query returned 263 documents indexed in Scopus that met these criteria, comprising both journal articles and conference papers published between 2011 and 2025.

Screening and Data Normalization

As the query itself applied strict filters (document type and language), all 263 records were directly included in the analytical corpus. The cleaning process focused on improving metadata quality without excluding any documents. The steps included:

1. Duplicate detection: Duplicate records (based on DOI and identical titles) were checked; no duplicates were detected after Scopus export verification.
2. Author and affiliation standardization: Variants of author names (e.g., “A. Smith” vs. “Smith, A.”) and institutional names (e.g., “Univ. of Indonesia” vs. “University of Indonesia”) were harmonized using the metaTagNormalization function in *bibliometrix*.
3. Keyword unification: Synonyms, plural/singular forms, and spelling variations were consolidated (e.g., “digital preservation,” “digital archiving,” and “preservation in libraries” were merged under “digital preservation”). A controlled thesaurus was built to maintain consistency.
4. Field alignment: Metadata fields (authors, title, year, keywords, source, and affiliations) were aligned using the convert2df() function in *bibliometrix* to ensure analytical uniformity.

After cleaning and validation, the final dataset consisted of 263 valid records, representing the complete and standardized corpus for subsequent analyses.

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962

Analytical Tools and Workflow

The data were analyzed using R software (version 4.3) with the bibliometrix package and its graphical interface Biblioshiny (Aria & Cuccurullo, 2017). These tools enable an end-to-end workflow, from descriptive statistics to network visualization and thematic evolution mapping, while ensuring analytical reproducibility.

For visualization validation, the open-source software VOSviewer (van Eck & Waltman, 2010) was employed to cross-check clustering accuracy and to generate high-resolution maps.

The analysis proceeded through three main stages:

1. Performance Analysis; assessment of research productivity (annual growth, country output, institutional contribution, source impact, and most-cited documents).
2. Thematic and Evolution Analysis; examination of co-occurrence of keywords and thematic changes over time using thematicMap() and thematicEvolution() functions.
3. Science Mapping; visualization of intellectual and social structures through co-citation, bibliographic coupling, and co-authorship networks.

Performance Analysis

Performance indicators included:

- Annual publication and citation trends from 2011 to 2025.
- Most productive authors, institutions, and countries.
- Journal and conference sources contributing most to the topic.
- Collaboration indices distinguishing single-country and international collaborations.

This stage provides a quantitative overview of global research productivity on digital transformation in library contexts.

Thematic and Evolutionary Analysis

Keyword-based thematic analysis was conducted to explore conceptual linkages and topic maturity. Using biblioNetwork() and thematicMap() functions, the study generated co-occurrence matrices and thematic maps based on author keywords and Keywords Plus. Two sub-periods were established for comparative analysis:

- Period I (2011-2021): representing the phase dominated by *digital preservation*, *OAIS*, *metadata interoperability*, and *digital library systems*.
- Period II (2022-2025): representing the shift toward *collaboration*, *blockchain*, *AI-assisted curation*, and *participatory archiving*.

Thematic positioning was assessed according to centrality (a theme's connectedness to others) and density (internal cohesion), forming four quadrants following Cobo et al. (2011):

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962

1. Motor themes; both central and dense, representing driving forces of the field.
2. Basic themes; central but less developed, forming the field's foundation.
3. Niche themes; internally mature yet peripheral to the main structure.
4. Emerging/declining themes; low centrality and density, indicating topics either emerging or fading.

The thematic evolution analysis compared the two periods using the thematicEvolution() function to trace continuity and divergence of topics. Particular attention was given to the transition from preservation-centric to collaboration-centric clusters, signifying a conceptual shift in digital library research.

Science Mapping

Science mapping was performed to uncover both the intellectual structure and the collaboration network of the field. Three network types were analyzed:

- Co-citation network: identifies seminal works frequently cited together, revealing the theoretical foundations of the field.
- Bibliographic coupling: detects relationships among newer documents sharing similar reference lists.
- Co-authorship network: maps collaboration among authors, institutions, and countries to understand research partnerships and global knowledge flows.

The resulting networks were visualized using *Biblioshiny's* networkPlot() and refined in VOSviewer. Node sizes represent document or citation counts, and link thickness corresponds to the strength of connections (*total link strength*).

Period Segmentation and Comparative Design

Following the study's conceptual logic, the dataset was segmented into two chronological clusters:

1. 2011-2021: the *Preservation Era*, emphasizing standards (OAIS, PREMIS), authenticity, and metadata frameworks.
2. 2022-2025: the *Collaboration Era*, emphasizing user participation, data sharing, AI-enhanced services, and decentralized preservation.

This segmentation enables the comparison of thematic trajectories, highlighting how earlier preservation models evolved into collaborative infrastructures. The *overlay thematic map* visualizes these transitions, showing how themes migrated between quadrants across the two-time frames.

Validation and Triangulation

Three layers of validation were conducted to ensure analytical reliability:

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962

1. Cross-software validation: Network structures generated by *Biblioshiny* were compared with VOSviewer outputs for consistency.
2. Manual verification: A random sample of 30 documents was manually reviewed to confirm keyword categorization and thematic alignment.
3. Literature triangulation: Results were compared with prior systematic reviews (Ardyawin et al., 2025) and synthesis studies (Scopus AI, 2025) to corroborate quantitative findings with qualitative insights.

These measures strengthened the validity of interpretations regarding thematic evolution and conceptual shifts.

Ethical Statement and Limitations

This study relies exclusively on secondary bibliographic data from Scopus, containing no personal or sensitive information. Therefore, ethical approval was not required. All data processing followed open-science standards ensuring transparency and replicability.

Nevertheless, several limitations should be noted:

- Database bias: Scopus overrepresents English-language and Western publications, possibly underestimating contributions from other regions.
- Keyword inconsistency: Author-provided keywords may vary, influencing clustering accuracy.
- Incomplete 2025 coverage: Some publications from 2025 may still be indexed later, leading to partial representation for that year.

These limitations, however, do not affect the comparative validity between the two temporal clusters, as the analysis focuses on relative rather than absolute trends.

Analytical Output

The analytical outputs generated include:

1. Annual publication trend chart (2011-2025).
2. Top contributing countries, institutions, journals, and authors.
3. Co-authorship and co-citation networks.
4. Conceptual structure map using Multiple Correspondence Analysis (MCA).
5. Thematic evolution maps comparing Period I (2011-2021) and Period II (2022-2025).

These outputs provide the empirical foundation for the subsequent Results and Discussion section, which interprets the transition “from preservation to collaboration” in the knowledge domain of digital archives and library transformation.

Research Workflow

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962

The research workflow followed a systematic sequence:

1. Problem formulation based on the literature review.
2. Data retrieval from Scopus using the defined Boolean query.
3. Data cleaning and normalization with *bibliometrix*.
4. Descriptive and network analyses via *Biblioshiny*.
5. Visualization in *Biblioshiny* and VOSviewer.
6. Validation and triangulation with prior reviews and synthesis reports.

Each stage was documented to ensure traceability and adherence to open-science practices

FINDINGS

Publication Trends (2011-2025)

Across fifteen years (2011-2025), scholarship on digital innovation in library services shows a marked upward trajectory. The dataset comprises 263 documents retrieved from Scopus under the predefined Boolean query. The trajectory steepens after 2019, with publications in 2019 representing ~5.7% of total identified records and climbing to ~19.3% by 2025. This pattern indicates an inflection coinciding with accelerated platform integration, post-pandemic digitization strategies, and the mainstreaming of AI-assisted services in libraries.

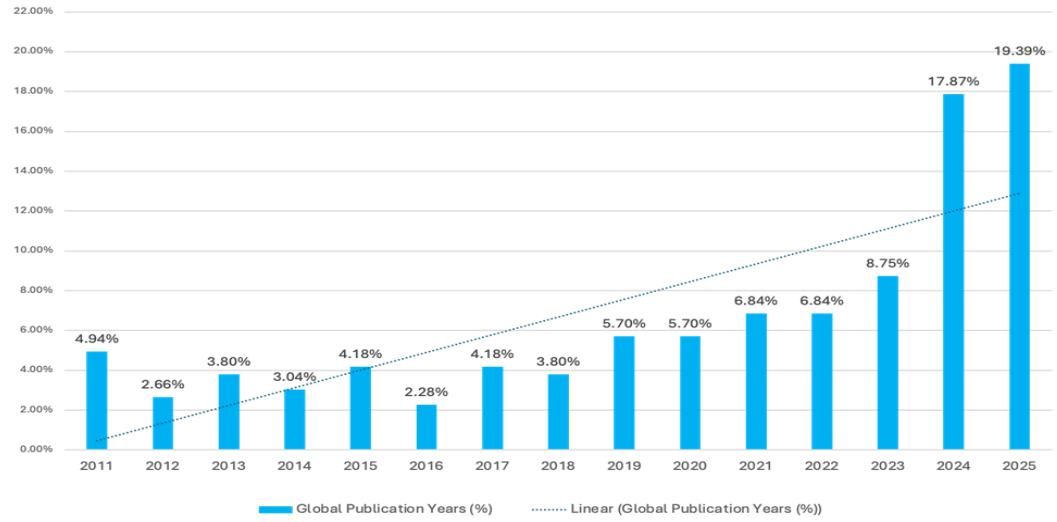

Figure 1. Annual publication trend of research on digital innovation in library services from 2011 to 2025.

Countries' Output and Dynamics

Geographically, China leads output with ~95 documents over 2011–2025, followed by India and Italy (each ~50). This distribution suggests a widening global footprint of digital-library scholarship beyond traditional Anglophone centers and likely reflects strategic national

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

E-ISSN: 2540-9638, ISSN: 2302-4666.
doi: http://doi.org/10.14710/lenpust.v12i1.78962

investments in digital transformation, repository development, and data-driven services in higher education systems. The top-10 country ranking (as depicted in the original charts) underscores a sustained contribution from Asia and Europe to the field's growth.

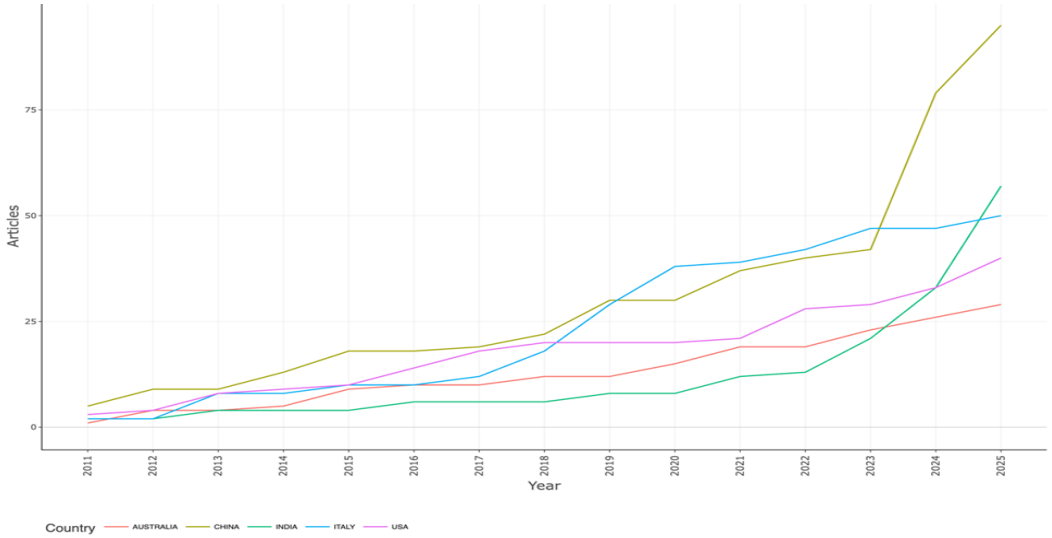

Figure 2. Top ten countries contributing to digital innovation in library services research.

Sources and Venues

The document source analysis highlights seven leading venues. Library Philosophy and Practice display the highest cumulative occurrence (~7 per period), with Lecture Notes in Computer Science (LNCS) close behind, indicating a notable presence of conference-oriented dissemination alongside journal outputs. Two outlets show a rapid recent escalation: *The Journal of Academic Librarianship* and *Library Hi Tech News*, signaling increased appetite for evaluative and practice-driven studies of digital innovation in academic libraries. For accuracy and neutrality, we report these venues as credible and relevant rather than assigning quartile labels across the board.

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962

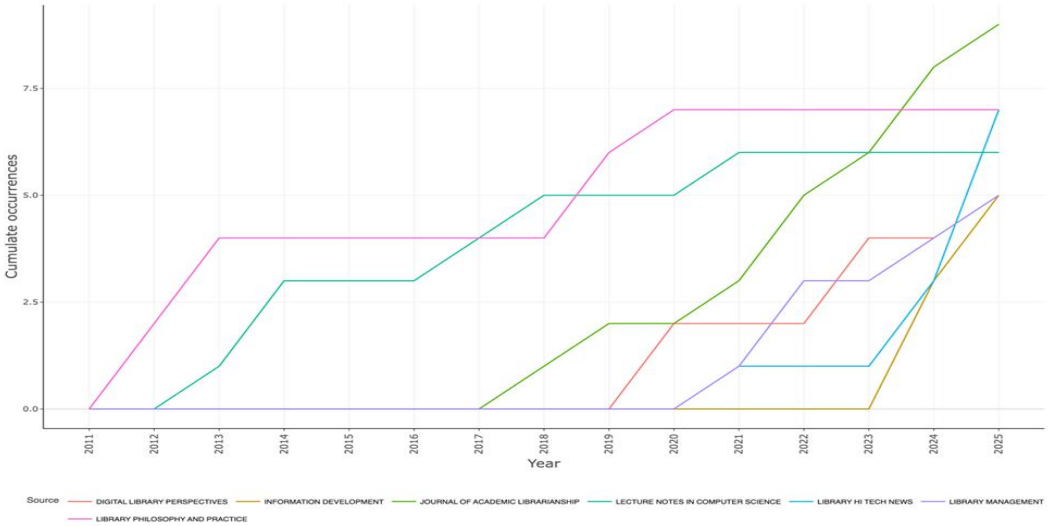

Figure 3. Leading publication sources in digital innovation in library services research.

Highly Cited Documents, Authors, and Institutions

The citation landscape concentrates between 2013 and 2025, with the most-cited documents including work by Okunlaya et al. (2022) on AI applications in library services. On the institutional side, Alma Mater Studiorum, Università di Bologna appears as a top contributor, followed by University of South Africa and Nanjing University, reflecting a mixture of European, African, and Asian leadership in digital library innovation. These patterns align with the field's dual character: technical development on the one hand and service-oriented evaluation on the other.

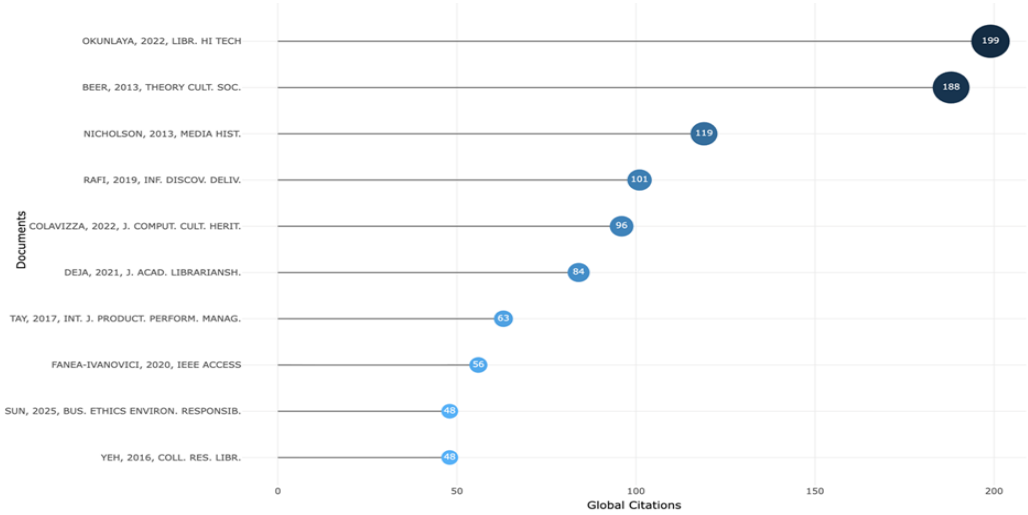

Figure 4. Top Cited Publications in Digital Innovation in Library Services Research.

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962

From the ten identified authors/researchers, the relevant affiliations are as follows:

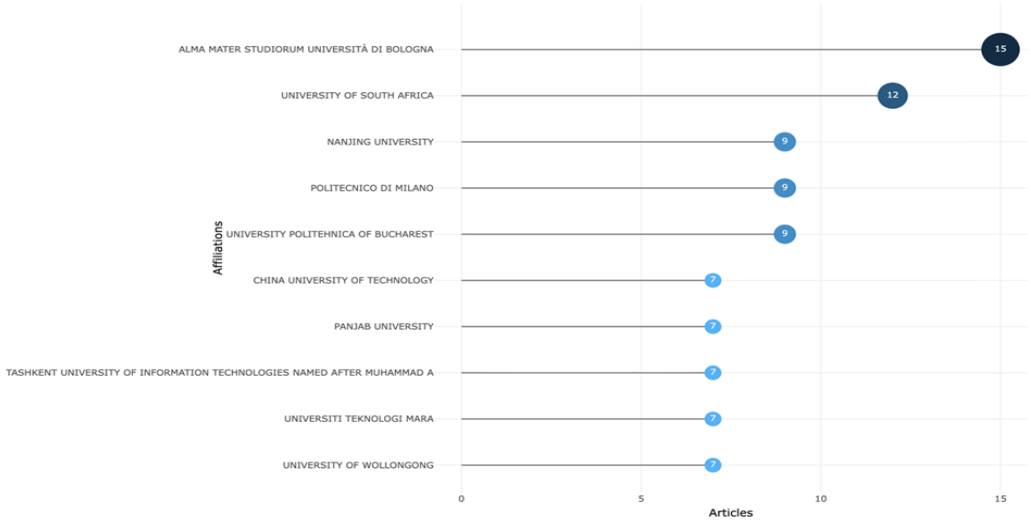

Figure 5. Top contributing institutions in digital innovation in library services research.

From the graph, Alma Mater Studiorum from University of Bologna emerges as the institution with the highest number of publications related to the topic Digital Innovation in Library Services, followed by the University of South Africa, Nanjing University, and so on.

Networking, Overlay, and Density

The bibliometric findings reveal ten popular keywords related to the topic *Digital Innovation in Library Services*, including "digital libraries," "digital technologies," "digital transformation," and so forth. This indicates that these keywords represent the most common phrases in studies on digital innovation in library services. On the other hand, the variation of keywords concentrated on digitization-related phrases highlights the emphasis on digital aspects in library services, such as AI, hybrid recommender systems, digital archiving, integration of third-party resources with university library systems, and so on. The illustration of the most frequently occurring keywords is as follows:

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

E-ISSN: 2540-9638, ISSN: 2302-4666.
doi: http://doi.org/10.14710/lenpust.v12i1.78962

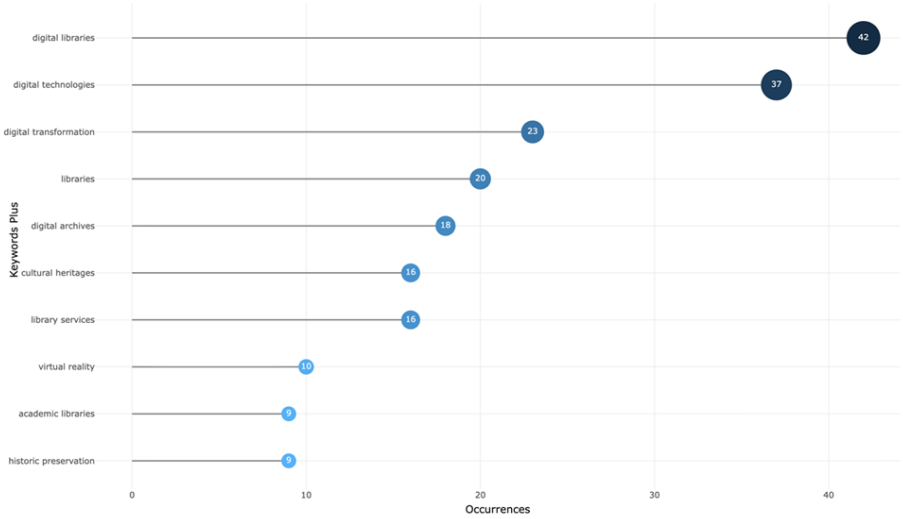

Figure 6. Keyword co-occurrence network illustrating the conceptual structure of digital innovation in library services.

Meanwhile, over the period from 2011 to 2025, the keywords “digital libraries” and “digital archives” have appeared since 2011. This indicates that the discourse on digital transformation in the context of library services has been a dynamic and evolving topic in line with the advancement of information technology. As illustrated in the graph below, these two keywords have shown a significant escalation since 2019.

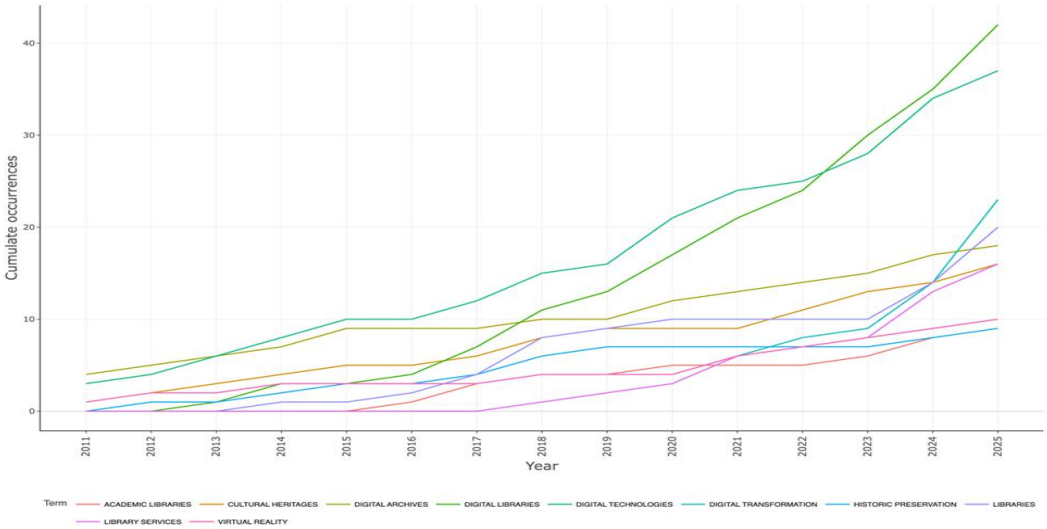

Figure 7. Overlay visualization showing the temporal evolution of research topics (2011–2025).

Meanwhile, based on the frequency of emerging topics, “digital libraries” is among the most frequently used topics during the period from 2020 to 2024. The table below presents the eleven topics with the highest frequencies, representing research on digital innovation in library services.

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

E-ISSN: 2540-9638, ISSN: 2302-4666.
doi: http://doi.org/10.14710/lenpust.v12i1.78962

TABLE 1.
Frequency and Year Distribution of Emerging Keywords in Digital Innovation in Library Services

item	Freq.	Year_q1	Year_med	Year_q3
digital archives	8	2021	2022	2024
e-learning	6	2020	2022	2023
virtual reality	6	2021	2022	2024
digital libraries	31	2021	2023	2024
digital technologies	22	2020	2023	2024
cultural heritages	8	2022	2023	2024
digital transformation	22	2022	2024	2025
library services	15	2021	2024	2024
libraries	12	2024	2024	2025
artificial intelligence	6	2021	2025	2025
learning systems	5	2024	2025	2025

Meanwhile, to measure the clustering of each topic within the network of relevant research keywords, a co-occurrence network analysis was conducted, with the findings presented as follows:

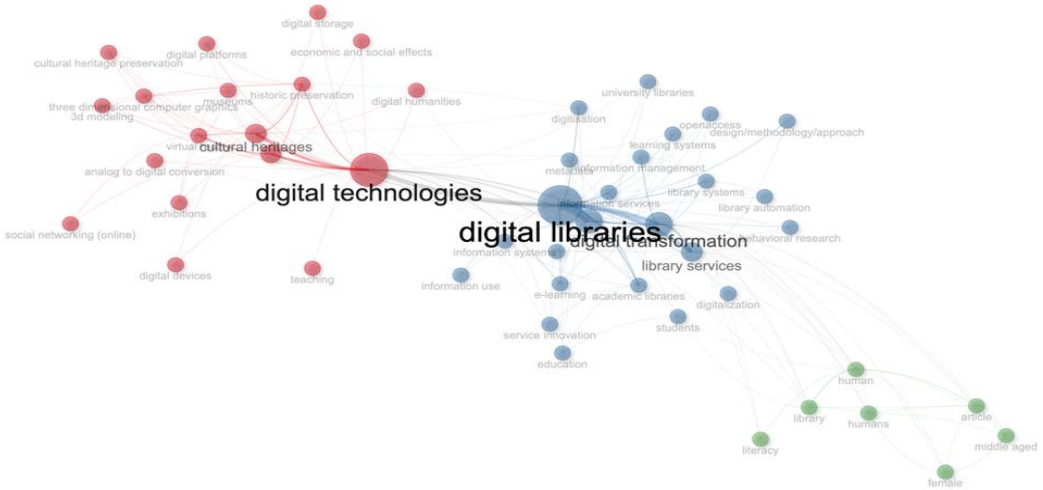

Figure 8. Keyword Co-occurrence Network Showing the Conceptual Structure of Digital Innovation in Library Services.

It was identified that there are three main clusters among all document keywords related to the topic of digital innovation in library services, namely Cluster 1 (*digital technologies*),

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962

Cluster 2 (*digital libraries*), and Cluster 3 (*humanities*). Upon closer examination, Cluster 1 consists of keywords closely associated with tech-centric themes such as *digital devices*, *digital platforms*, and others. These topics contribute to the broader discourse of digitization, although they are not specifically focused on library research.

Meanwhile, Cluster 2 shows the correlation of the digital library topic with relevant keywords such as *library services*, *academic libraries*, and *library systems*. This indicates that *digital libraries* are composed of keywords that specifically represent research on digital innovation in library services. Cluster 3, on the other hand, essentially serves as a supporting network for the *digital libraries* cluster, including supporting keywords such as *literacy*, *library*, and *article*.

On the other hand, to observe the trend or scope of research ranging from the most popular to the least explored topics, a density analysis was conducted as follows:

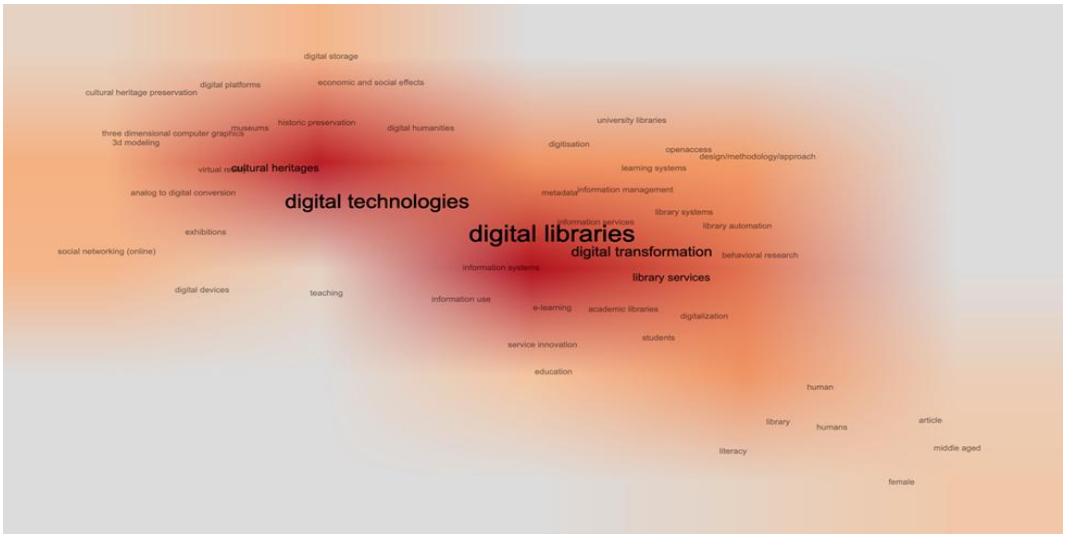

Figure 9. Density visualization highlighting research hotspots in digital innovation in library services.

Based on the density analysis, within the *digital libraries* cluster there are topics with relatively low occurrence, i.e., areas that are rarely explored, such as “library automation,” “open access,” and “service innovation.” This identification thus indicates which topics should be prioritized for future research in the context of digital innovation in library services.

DISCUSSION

Thematic Evolution Analysis

The next section presents a Thematic Evolution analysis, which traces shifts in research focus within the topic of Digital Innovation in Library Services. Thematic evolution categorizes research themes based on their centrality and density, allowing the identification of motor themes, basic themes, emerging or declining themes, and niche themes that collectively illustrate the conceptual development of a research field (Cobo et al., 2011; Donthu et al., 2021).

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962

As discussed earlier, publications related to digital innovation intensified around 2022, coinciding with the rapid adoption of artificial intelligence and advanced digital technologies in library environments. Accordingly, 2022 is used as the cutoff period separating the earlier stage of digital transformation from the more recent phase characterized by intelligent and AI-enabled library services. The final results are illustrated in the following graph:

Thematic Evolution 2011-2022

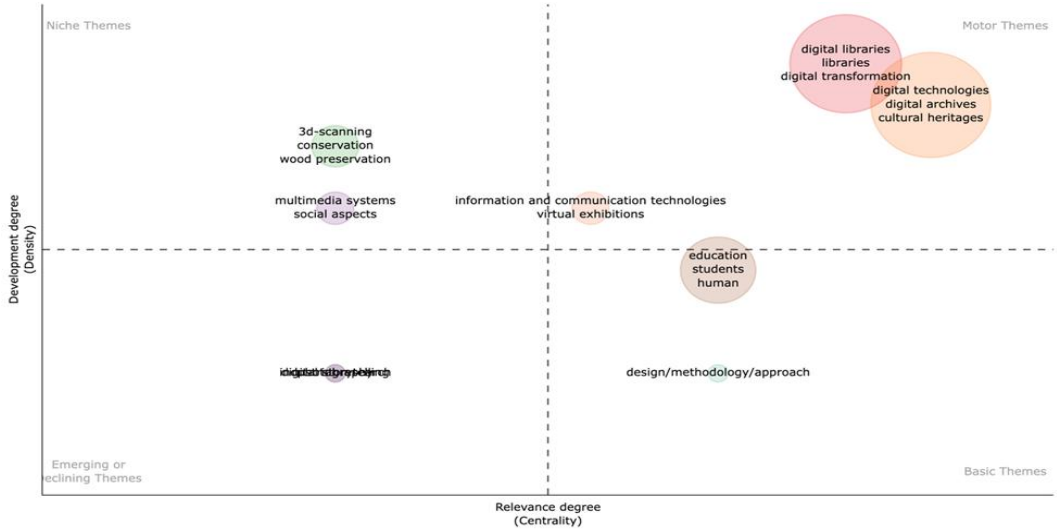

Figure 10. Thematic map for the period 2011–2022.

The quadrant above represents the categorization of thematic evolution during the 2011–2022 period, which shows that research on Digital Innovation in Library Services had not yet demonstrated the emergence of substantial new themes beyond the fundamental and widely adopted topics, particularly digital transformation and digital archives. This finding suggests that research during this period remained focused on establishing digital infrastructures, repository development, metadata management, and preservation-oriented services rather than exploring intelligent technologies. Recent reviews similarly indicate that the early phase of digital transformation in libraries was largely driven by collection digitization, digital preservation, and improvements in information accessibility before expanding toward AI-enabled services and intelligent library systems (Mallikarjuna, 2024; Perera & Premarathne, 2024).

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962

Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan
Vol. 12, No. 1, June 2026
http://ejournal.undip.ac.id/index.php/lpustaka

Meanwhile, in the subsequent period of 2022–2025, the thematic landscape changes considerably, as illustrated below.

Thematic Evolution 2022-2025

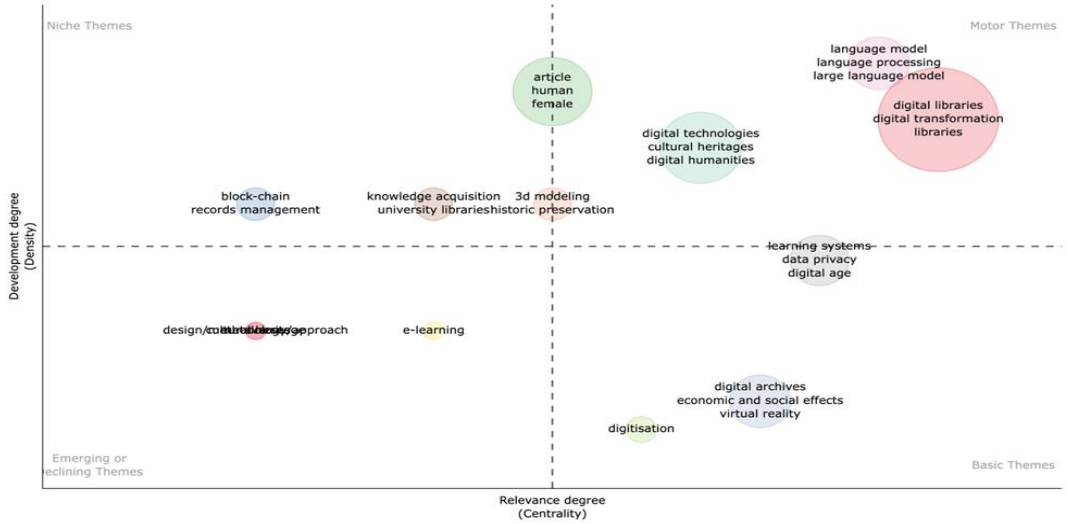

Figure 11. Thematic map for the period 2022–2025.

During the 2022–2025 period, several new and intriguing themes have emerged, including blockchain applications in library management systems and the use of three-dimensional (3D) modeling. These findings illustrate how the post-2022 period represents a convergence point for increasingly dynamic discussions on digital innovation in libraries. The emergence of these themes indicates that research has expanded beyond conventional digitization toward intelligent, interoperable, and data-driven library ecosystems. Recent studies similarly report that academic libraries are increasingly integrating artificial intelligence, machine learning, predictive analytics, and intelligent automation to improve resource discovery, user engagement, decision-making processes, and operational efficiency (Mallikarjuna, 2024; Singh & Satpathy, 2025).

At the same time, themes such as e-learning have experienced a decline in publication frequency. Rather than indicating a reduction in scholarly interest, this trend may reflect the maturation of e-learning as an established research domain. As digital transformation has evolved, many discussions previously centered on e-learning have become incorporated into broader topics such as AI-supported learning environments, digital transformation strategies, and intelligent library services. Consequently, the independent visibility of e-learning within thematic mapping has gradually decreased despite its continued relevance (Perera & Premarathne, 2024).

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

E-ISSN: 2540-9638, ISSN: 2302-4666.
doi: http://doi.org/10.14710/lenpust.v12i1.78962

On the other hand, digital libraries and digital transformation remain foundational research themes during this period. Their continued presence as basic themes demonstrates that recent innovations continue to build upon these concepts as the intellectual foundation of the field rather than replacing them. Emerging technologies such as blockchain, AI, and intelligent information systems therefore complement existing digital library infrastructures while extending their functionality to support more adaptive, collaborative, and data-driven services (Mallikarjuna, 2024).

Interestingly, the direction of research on digital innovation in libraries has also expanded toward advanced computational technologies, as reflected in the emergence of language processing and large language models. The growing prominence of these themes reflects increasing interest in applying generative artificial intelligence to library services, including information retrieval, metadata generation, digital curation, automated cataloguing, and personalized user assistance. Recent systematic reviews similarly identify natural language processing, AI-powered chatbots, AI literacy, and intelligent recommendation systems as among the fastest-growing research directions in library and information science, highlighting the transformation of libraries into intelligent knowledge platforms capable of supporting more efficient and user-centered services (Perera & Premarathne, 2024; Singh & Satpathy, 2025).

Overall, the findings of this thematic evolution analysis demonstrate that Digital Innovation in Library Services represents a highly dynamic research field that continues to evolve alongside advances in information technology. While digital preservation and digital transformation remain the conceptual foundation of the discipline, recent research increasingly emphasizes artificial intelligence, blockchain, intelligent information systems, language processing, recommendation systems, and collaborative digital infrastructures. These findings are consistent with recent systematic reviews, which conclude that the future development of academic libraries depends not only on technological infrastructure but also on librarians' AI competencies, ethical governance, organizational readiness, and user-centered digital innovation (Mallikarjuna, 2024; Perera & Premarathne, 2024; Singh & Satpathy, 2025).

CONCLUSIONS

The bibliometric analysis conducted in this study successfully mapped the evolution of research on digital innovation and archival transformation in library services over the 2011–2025 period. The findings indicate that the scholarly discourse has progressively shifted from preservation-oriented frameworks, emphasizing authenticity, metadata standards, and digital continuity, toward collaboration-centered paradigms that integrate artificial intelligence, blockchain, and participatory archiving.

This transition signifies a conceptual and practical redefinition of how libraries manage and curate digital resources, moving from technical preservation to socio-technical collaboration that involves users, creators, and institutions as co-stewards of digital heritage. The results also highlight that emerging themes such as language processing, large language models, and digital library services are increasingly central to current research, reflecting the growing influence of AI and data-driven methods in library management.

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

The significance of this study lies in providing an empirical foundation for understanding how digital transformation reconfigures the intellectual structure of library science. The findings offer theoretical insights into the convergence of preservation and collaboration, while practically guiding library professionals in adopting participatory and intelligent management models.

Future research is encouraged to expand bibliometric horizons beyond Scopus-based datasets, incorporate qualitative meta-synthesis to enrich contextual interpretation, and explore policy-level implications of collaborative digital archiving, particularly regarding ethical stewardship, user participation, and sustainable infrastructure for digital libraries.

AUTHOR CONTRIBUTIONS

[Fairus Faqih]: Conceptualization, methodology design, data collection, formal analysis, and writing, original draft preparation, review, and editing. [Hendro Margono]: Conceptualization, software operation (Bibliometrix/Biblioshiny), data validation, visualization, and writing, review and editing.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this article.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to the Magister of Library and Information Science Program for its academic guidance and support throughout this research. The authors also extend appreciation to colleagues who provided insightful feedback and technical assistance during the data collection and analysis process. Finally, the authors acknowledge the editorial team and reviewers of Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan for their valuable comments and constructive suggestions that have improved this article.

REFERENCES

Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Ardyawin, I., Sugihartati, R., & Danugroho, A. (2025). The Role of Digital Technology in Transforming Academic Library Services: A Systematic Literature Review. *New Review*

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

E-ISSN: 2540-9638, ISSN: 2302-4666.
doi: http://doi.org/10.14710/lenpust.v12i1.78962

of Academic Librarianship, *31*(4), 466–486. https://doi.org/10.1080/13614533.2025.2524806

Consultative Committee for Space Data Systems. (2012). Reference model for an Open Archival Information System (OAIS) (CCSDS 650.0-M-2). CCSDS.

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011). Science mapping software tools: Review, analysis, and cooperative study among tools. Journal of the American Society for *Information Science and Technology*, *62*(7), 1382–1402. https://doi.org/10.1002/asi.21525

Donthu, N., Kumar, S., Mukherjee, D., & Pandey, N. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070

Lavoie, B. (2014). The Open Archival Information System (OAIS) Reference Model: Introductory guide (2nd ed.). *Digital Preservation Coalition*. https://www.dpconline.org/docs/technology-watch-reports/1359-dpctw14-02/file

Mallikarjuna, C. (2024). Integrating artificial intelligence in academic libraries: An analysis. *DESIDOC Journal of Library & Information Technology*, *44*(2), 124–129. https://doi.org/10.14429/djlit.44.2.18958

Messeri, L., & Crockett, M. J. (2024). Artificial intelligence and illusions of understanding in scientific research. *Nature*. https://doi.org/10.1038/d41586-024-01546-2

Okunlaya RO, Syed Abdullah N, Alias RA (2022), "Artificial intelligence (AI) library services innovative conceptual framework for the digital transformation of university education". *Library Hi Tech*, *40*(6), 1869–1892. https://doi.org/10.1108/LHT-07-2021-0242

Perera, K., & Premarathne, K. (2024). Application of artificial intelligence for library services: A systematic literature review. *Journal of the University Librarians Association of Sri Lanka*, *27*(2), 257–284. https://doi.org/10.4038/jula.v27i2.8089

Ridge, M. (Ed.). (2014). Crowdsourcing our cultural heritage. Ashgate.

Singh, R., & Satpathy, S. (2025). Adoption of artificial intelligence in academic libraries: A systematic review of current practices, challenges, and research opportunities. South African *Journal of Libraries and Information Science*, *91*(1). https://www.researchgate.net/publication/398571178_Adoption_of_artificial_intelligence_in_academic_libraries_A_systematic_review_of_current_practices_challenges_and_research_opportunities

Theimer, K. (2011). A different kind of web: New connections between archives and our users. *The American Archivist*, *74*(1), 58–82. https://www.academia.edu/143167787/KATE_THEIMER_ed_A_Different_Kind_of_Web_New_Connections_Between_Archives_and_Our_Users

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

E-ISSN: 2540-9638, ISSN: 2302-4666.
doi: http://doi.org/10.14710/lenpust.v12i1.78962

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Cite this article: Faqih, F., & Margono, H. (2026). From Preservation to Collaboration: A Bibliometric Study of the Transformation of Library Digital Archives. *Lentera Pustaka: Jurnal Kajian Ilmu Perpustakaan, Informasi dan Kearsipan*, *12*(1), 174-195. http://doi.org/10.14710/lenpust.v12i1.78962

doi: http://doi.org/10.14710/lenpust.v12i1.78962