



# The Digital Odyssey: Mapping Science and Research in Digital Libraries (1984-2023)

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**Abstract.** The digital library has evolved significantly, shaping an ever-changing environment for the growth of science and research. This study aims to conduct comprehensive analysis of the published research on digital libraries, providing an overview of digital libraries' research trajectory, and generate nuanced keyword-grouping through systemic analysis. Employing quantitative methods and bibliometric techniques, we analyze 1642 journal articles spanning 1984-2023 from the Scopus database. Core papers on education were initially collected, forming the basis for a keyword co-occurrence network. We then examined changes in network density and identified the development of core topics within the digital libraries field. Our findings reveal that the United States, United Kingdom and India are the top three countries publishing digital libraries-related publications. The International Journal on Digital Libraries, D-LIB Magazine and Science and technology Libraries emerge as the leading sources with the highest publications number. Notably, Nicholas is identified as a prolific author, while the most influential authors are Frantzi, Katerina T., Ananiadou, Sophia & Mima, Hideki. Co-occurrence network analysis identifies five keywords grouping related to digital libraries: academic libraries, metadata, information services, education and e-learning, and collection development.

**Keywords:** Bibliometrics, Digital Libraries, Mapping Science.

## 1 Introduction

Interest in digital libraries has surged since the 1990s. The term "digital library" itself was first popularized through the NSF/DARPA/NASA Digital Libraries Initiative project in 1994 [1], a research and development project to create, use and evaluate large-scale digital libraries. Shaped by diverse scientific disciplines, digital libraries took on varying conceptions. In the Library and Information Science (LIS) context, digital libraries emerged as a response to limitations inherent in conventional libraries [2]. The advent of new technologies has transformed the creation, access, and use of

information. Digital libraries distinguish themselves by comprising digital resources like e-books, e-journals, images, video, and audio, in contrast to physical collections found in conventional libraries. Furthermore, digital libraries offer remote accessibility, independent of location and time, contingent on an internet connection. In contrast, conventional libraries necessitate in-person visits during operational hours. Effectively transitioning from conventional to digital libraries requires comprehensive policy formulation addressing infrastructure, technology, human resources, cooperation, and partnerships for a successful transformation. This section must present theories or concepts too (select ones in line with the focus of analysis) and/or research type to be used. Note that citation or adoption from references, such as textbooks/e-books, journals, scientific works (thesis or dissertation) should become a priority. On the other hand, secondary data, such as sources from the media and/or self-citation must be adopted according to previous studies. The secondary data must not exceed 10 per cent of the total references.

Numerous research articles on digital libraries are featured in Scopus-indexed journals, including *International Journal on Digital Libraries*, *D-LIB Magazine*, *Science and Technology Libraries*, *Library Review*, and *International Information*. In addition to journals, various proceedings such as *Proceedings of the University Library at a New Stage of Social Communications Development*, *Conference Proceedings Open Access*, *Latvijas Nacionālās Bibliotēkas Zinātniskie Raksti*, *IATUL Proceedings*, and *Proceedings of the ACM International Conference on Digital Libraries* contribute significantly to the scientific discourse on digital libraries. Noteworthy book series like *Intelligent Systems Reference Library*, *Lecture Notes in Control and Information Sciences*, and *Advances in Librarianship* consistently publish relevant works in the field.

The abundance of literature in digital libraries necessitates an examination of their overall impact and productivity. Bibliometric studies play a crucial role in understanding topics across various disciplines, offering quantitative insights into publication data, citations, authors, and trends, a particular field of science. The increasing prevalence of bibliometric analyses is evident [3], [4], in diverse scientific fields, including economics, which explores financial inclusion [5], education, focusing on the learning landscape in higher education [6], and the health sector, investigating scientific outcomes related to adolescent social anxiety and its connection with psychoeducational variables [7]. This study is pivotal, providing relevant, efficient, and reliable information for the advancement of scientific disciplines [8], [9], [10].

Numerous bibliometric studies on digital library research have been conducted, with recent investigations shedding light on critical facets of the field. Ali et al (2023), delved into electronic libraries, digital libraries, and online libraries from 1971 to 2020, consolidating documents indexed on the Web of Science [11], [12]. Their research identifies digital libraries as the predominant topic, with proceedings papers being the

most prevalent document type, primarily published in English. Another noteworthy study by Borgohain explores global trends in digital libraries, drawing insights from the Scopus database [8]. This research offers a comprehensive overview of research directions in the domain, spanning the past, present, and future, revealing digital libraries as inclusive spaces for library researchers and experts in geo-informatics, bioinformatics, chemistry, physics, and mathematics. Additionally, Aslam et al explored digital and online resources in higher education academic libraries, uncovering their significant impact on library services in higher education [8]. In a study by Ahmad et al., the expansion and characteristics of literature on digital libraries were explored [13]. Analyzing over 4,206 documents from 2002 to 2016 sourced from Web of Science, the study investigated annual productivity, citations, most cited articles, prolific authors, top journals, institutional productivity, and country contributions. Findings indicate substantial development in digital library research productivity within the LIS field over the last 15 years, with notable deviations. These collective studies contribute to our understanding of the evolving landscape and implications of digital libraries.

To date, no research has delved into science mapping analysis of digital libraries within the subject area of Libraries and Information Science. Previous bibliometric studies on digital libraries encompassed various subject areas, but this study specifically draws from scientific journals within Library and Information Science—a notable research gap. By focusing on specific sources in this subject area, our research aims to illuminate the practices and processes of digital library development in the LIS field. This contribution provides a comprehensive overview of the field's evolution, encompassing past, present, and future, serving as a valuable reference for researchers exploring digital libraries.

## 2 Methods

This study aims to create a comprehensive bibliometric map of scientific studies on digital libraries, utilizing the esteemed Scopus database [14], [15]. Our focus includes performance analysis and science mapping to illuminate key trends and contributions in the field.

## 2.1 Defining Keywords Search

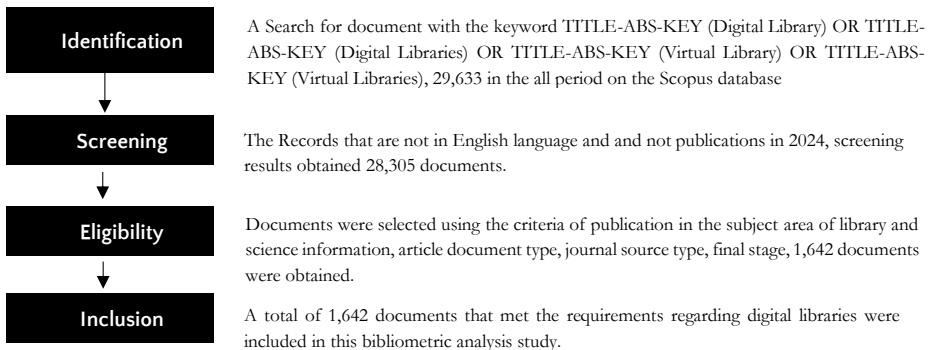
This study exclusively utilizes data from the Scopus database. Employing a trial-and-error approach, we developed the search strategy: TITLE-ABS-KEY (Digital Libraries) OR TITLE-ABS-KEY (Digital Library) OR TITLE-ABS-KEY (Virtual Libraries) OR TITLE-ABS-KEY (Virtual Library).

## 2.2 Initial Search Results

The search yielded 29,633 documents from various sources and types, including Conference papers, Articles, Reviews, Book chapters, and more. This comprehensive approach covered all subject areas, languages, and publication stages, providing diverse and unbiased results without time range constraints.

## 2.3 Refining the Search Results

Specific criteria were set to acquire relevant documents: 1) the title must contain predefined keywords, the document should be an article from a journal with final stage status; 2) it must belong to the library and information science subject area; 3) be written in English, and 4) published until 2023. The systematic document selection involves four steps: identification, screening, eligibility, and inclusion.



**Fig 1.** Steps in refining the search result of bibliometric

As illustrated, we acquire 1,642 articles that met requirement and hence extracted from social sciences, sub-subject library and information science, with article document type, final stage, English language, and publication until 2023.

## **2.4 Compiling the Initial Data Statistics**

Documents meeting criteria serve as research data, sourced from the Scopus database in *Comma Separated Values (CSV)* and *Research Information System (RIS)* formats. Both include essential article details—citation information, bibliographical information, abstracts, and keywords.

## **2.5 Data Analysis**

Data analysis utilized Biblioshiny and VOSviewer software for enhanced readability, offering valuable insights into network metrics and clustering [16]. Further analyses were conducted in Microsoft Excel using .csv files extracted from Scopus.

# **3 Results And Discussion**

Analyzing 1,642 studies from 1984 to 2023, this research evaluates performance based on year, country, journal, and influential authors. The findings section also presents science mapping, exploring research themes, trends, and the distribution of result clusters.

## **3.1 Distribution Analysis of Digital Library Research**

The trend of publication volume by year reveals a notable surge occurred in 1996, peaking in 2004 with 127 publications. Post-2004, publication numbers fluctuated, reaching a 13.44% decline in 2023, marking the lowest count since 1996.

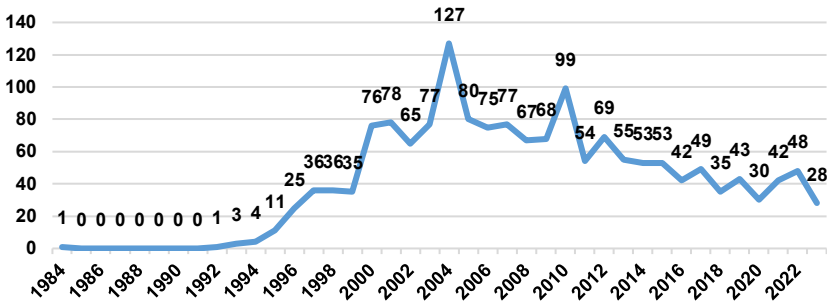


Figure 2. Distribution of the number of publications by year

Research publications on digital libraries span 87 countries. Table 1 and Figure 3 present data on the top 10 countries contributing to digital library publications. The United States leads with 777 (47.3%) journal articles, followed by the United Kingdom with 146 (8.9%) and India with 101 (6.2%) journal articles in the field.

Table 1. Number and percentage of digital libraries publications by authors’ country affiliation

Rank	Country	Number of Journal Articles	Percentage of Total Number of Journal Articles
1	United States	777	47.3
2	United Kingdom	146	8.9
3	India	101	6.2
4	Germany	60	3.7
5	Canada	55	3.3
6	Italy	55	3.3
7	China	45	2.7
8	Australia	43	2.6
9	Netherlands	32	1.9
10	Greece	31	1.9

### 3.2 Most Productive and Cited Journals

International Journal on Digital Libraries (n=198), D-LIB Magazine (n=150), and Science and Technology Libraries (n=28) top the list of the sources with the highest

publication counts. The significance of the International Journal on Digital Libraries in digital library research is evident from its leading position in Figure 4.

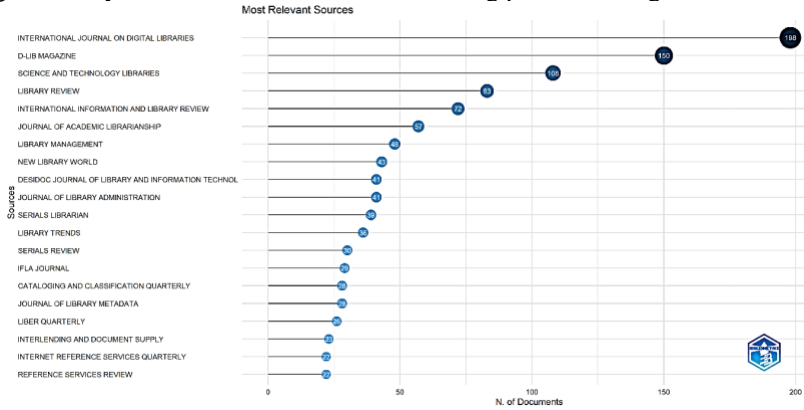


Fig 3. Sources with the highest number of publications in terms on digital libraries

On the most influential journals based on citations, The International Journal on Digital Libraries (n=4092), D-LIB Magazine (n=2280), and Journal of Academic Librarianship (n=179) emerge as the most cited hence presumably the most impactful journals in the field.

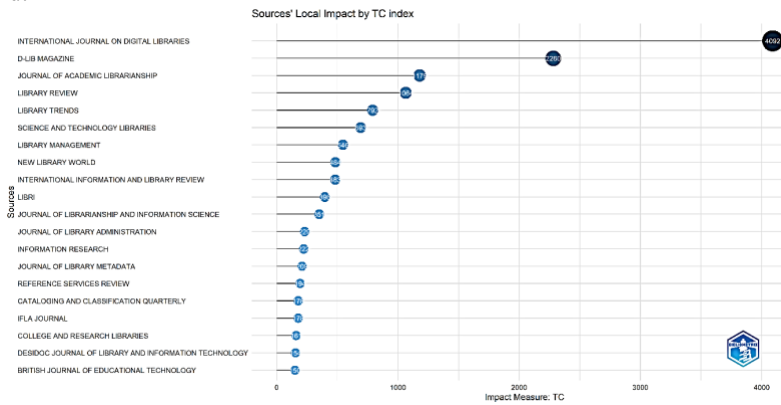


Fig 4. Most cited journals by research on digital libraries

**Table 2.** Most cited journals by research on digital libraries

<b>Rank</b>	<b>Title of Journal</b>	<b>H index</b>	<b>G index</b>	<b>M index</b>	<b>TC</b>	<b>NP</b>	<b>PY_start</b>
1	International Journal on Digital Libraries	29	58	1.036	4092	198	1997
2	D-Lib Magazine	25	40	1	2280	150	2000
3	Journal of Academic Librarianship	19	32	0.655	1179	57	1996
4	Library Review	18	29	0.621	1064	83	1996
5	Library Trends	15	27	0.469	792	36	1993
6	Science and Technology Libraries	15	20	0.556	693	108	1998
7	New Library World	14	20	0.438	484	43	1993
8	International Information and Library Review	13	18	0.52	483	72	2000
9	Library Management	13	22	0.448	546	48	1996
10	Journal of Library Administration	10	13	0.385	229	41	1999

Still on the count of citations, the International Journal on Digital Libraries serves as the most productive and influential journal, indicating the quality of its articles. Additionally, Bradford's Law assesses journal productivity over a specific period [17]. Figure 6 illustrates the core distribution of digital library-related publications following Bradford's Law. The findings in Figure 6 complement Figure 4, illustrating the ranking of sources with the highest publication counts. Notably, International Journal on Digital Libraries, D-LIB Magazine, Science and Technology Libraries, Library Review, and International Information constitute the core group of journals in this domain.



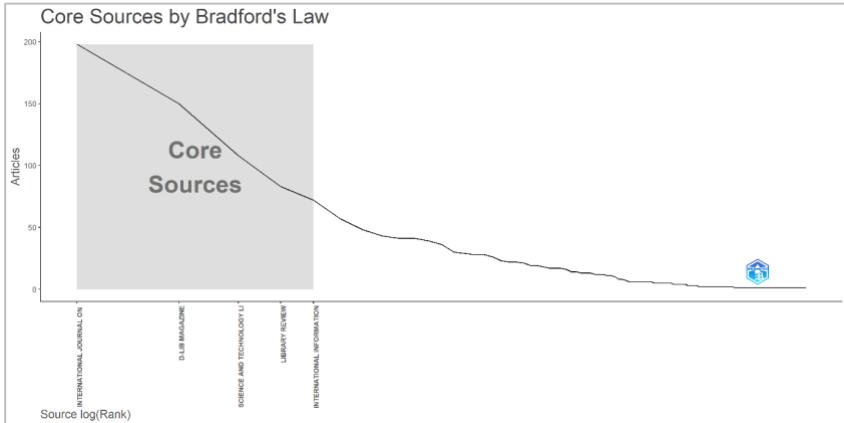


Fig 5. Most cited journals by research on digital libraries

### 3.3 Most Productive Cited Authors

To gauge author productivity, the number of publications is considered, while author influence is reflected through the number of citations. Figure 7 highlights authors with the highest productivity, focusing on those who have published a minimum of 5 articles.

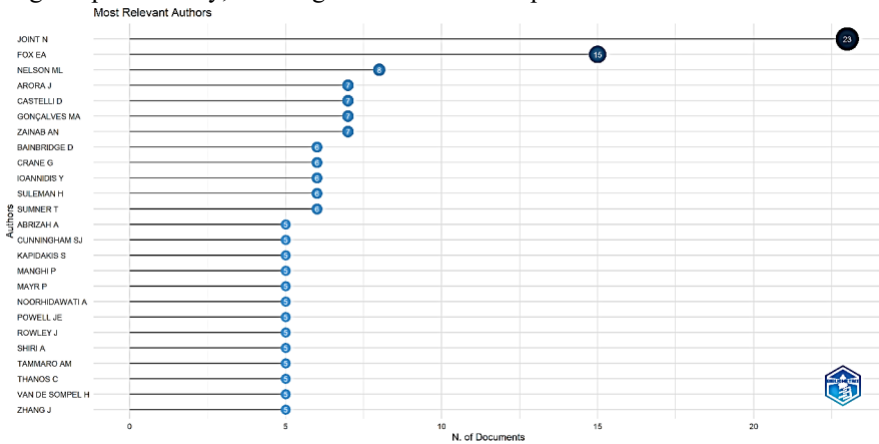


Fig 6. Most productive authors

Among the 2,984 authors identified on the publications selected in this research, Figure 7 highlights the most productive authors, publishing a minimum of 5 journal articles. Topping the list is Nicholas Joint from the University of Strathclyde, Glasgow,

United Kingdom, with 23 journal articles on digital libraries. In terms of influence, Frantzi, Katerina T. (University of the Aegean, Greece), Ananiadou, Sophia (The University of Manchester, UK), and Mima, Hideki (The University of Tokyo, Japan) lead with the influential publication "Automatic recognition of multi-word terms: The C-value/NC-value method," cited 644 times in Scopus. Their study explores vital elements for digital libraries [18]. In the second position, Mundur, Padmavathi V. (University of Maryland, USA), Rao, Yong (College of Engineering and Information Technology, Baltimore, USA), and Yesha, Yelena (University of Miami, USA) hold prominence with the publication "Keyframe-based video summarization using Delaunay clustering," cited 649 times. Their research proposes a video summarization technique using Delaunay clusters, enhancing summary quality and reducing redundancy for improved searchability in digital repositories [19].

**Table 3.** Most influential authors

Rank	Authors	Title	Journal	Citations
1	Frantzi, K., Ananiadou, S., Mima, H.	Automatic recognition of multi-word terms: The C-value/NC-value method	International Journal on Digital Libraries, 3(2), pp. 115–130	644
2	Mundur, P., Rao, Y., Yesha, Y.	Keyframe-based video summarization using Delaunay clustering	International Journal on Digital Libraries, 6(2), pp. 219–232	270
3	Macgregor, G., McCulloch, E.	Collaborative tagging as a knowledge organisation and resource discovery tool	Library Review, 55(5), pp. 291–300	208
4	Baldonado, M., Chang, C.-C.K., Gravano, L., Paepcke, A.	The Stanford Digital Library metadata architectur	International Journal on Digital Libraries, 1(2), pp. 108–121	190
5	Smith, M., Bass, M., McClellan, G., ...Stuve, D., Walker, J.H.	DSpace: An open-source dynamic digital repository	D-Lib Magazine, 9(1)	180
6	Saracevic, T.	Digital library evaluation: Toward an evolution of concepts	Library Trends, 49(2), pp. 350–369	154
7	Borgman, C.L., Wallis, J.C., Enyedy, N.	Little science confronts the data deluge: Habitat ecology, embedded sensor networks, and digital libraries	International Journal on Digital Libraries, 7(1-2), pp. 17–30	149

Rank	Authors	Title	Journal	Citations
8	Lagoze, C., Payette, S., Shin, E., Wilper, C.	Fedora: An architecture for complex objects and their relationships	International Journal on Digital Libraries, 6(2), pp. 124–138	145
9	Choi, Y., Rasmussen, E.	What Qualifications and Skills are Important for Digital Librarian Positions in Academic Libraries? A Job Advertisement Analysis	Journal of Academic Librarianship, 35(5), pp. 457–467	141
10	Bryant, J., Matthews, G., Walton, G.	Academic libraries and social and learning space: A case study of Loughborough university library, UK	Journal of Librarianship and Information Science, 41(1), pp. 7–18	129

### 3.4 The keywords analysis and digital libraries trend topics

On the digital libraries' keywords and topics, a network visual is produced to represent the keyword network identified by authors (Figure 7). Employing VOSviewer, larger circle sizes denote higher keyword frequencies [16], [20]. Similar colors group related keywords, with lines indicating connections [21], [22]. The minimum keyword occurrence was set at 12, resulting in 65 keywords meeting this threshold out of 3,714. These keywords are categorized into groups based on their co-occurrence and the strength of their relationships.

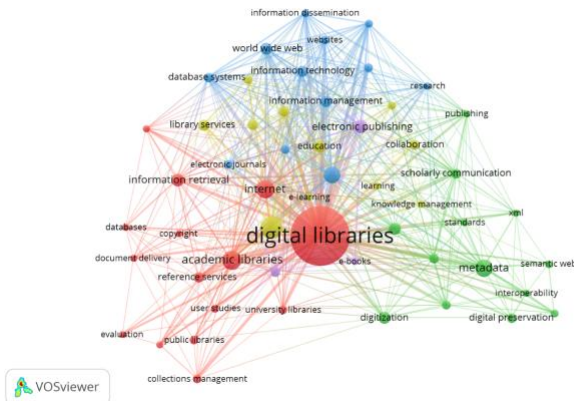
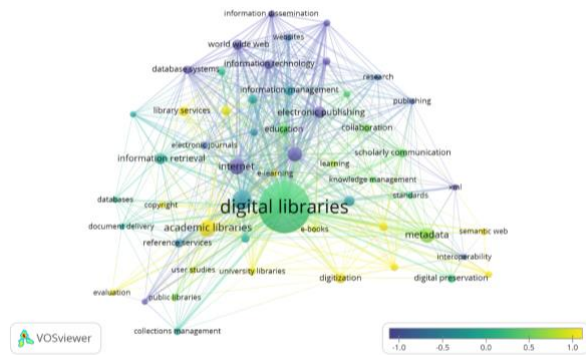


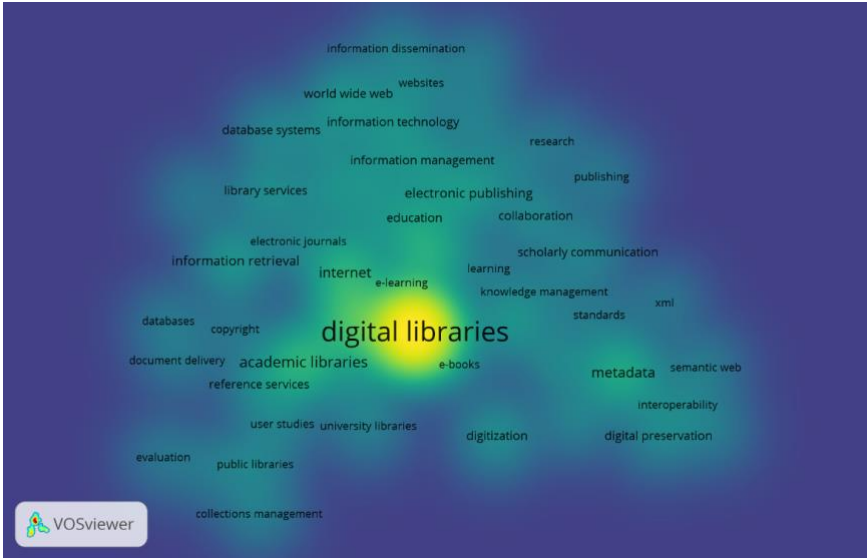
Fig 7. Keyword clustering generated in VOSviewer

Clusters were identified based on keyword occurrences. Cluster 1, represented in red, focuses on academic libraries (Extensible Markup Language) and includes reference service, user studies, document delivery, copyright, databases, information retrieval, search engine, library users, public libraries, and evaluation. Cluster 2, depicted in green, centers on metadata and comprises open access, electronic resources, semantic web, interoperability, linked data, digital preservation, digitization, institutional repositories, XML, and standards. Cluster 3, in blue, revolves around information services and encompasses electronic publishing, electronic journals, information management, research, online searching, database systems, world wide web, websites, information dissemination, and societies and institutions. Cluster 4, in yellow, pertains to Education and E-learning, covering information literacy, students, library services, collaboration, and distance education. Finally, Cluster 5, presented in purple, focuses on collection development and includes e-books and electronic publishing. After mapping through network visualization, we proceed to cluster research trends by year of publication. Figure 8, derived from Overlay visualization, serves as a reference for identifying and detecting the state of the art in digital library research.



**Fig 8.** Overlay visualization map of keywords' co-occurrence

In this visualization, node colors represent historical traces of research. For instance, the keyword 'metadata' is depicted with a green node, indicating its usage by researchers, though it isn't the newest keyword. Similarly, 'internet' and 'electronic publishing' have purple nodes, suggesting they have been extensively discussed alongside the digital library keyword over time. In contrast, the keyword 'semantic web' appears yellow and is distant from the digital library keyword, implying it is a topic that has emerged recently and has not been widely discussed until the last few years.



**Fig 9.** Density visualization map of keywords' co-occurrence

The subsequent analysis involves density visualization with the assistance of VOSviewer. As depicted in Figure 8, certain areas exhibit higher density at one node compared to others. Saturation levels, indicated in yellow, signify extensively researched topics. Notably, keywords like 'internet,' 'e-learning,' and 'academic libraries' are frequently associated with digital libraries. Conversely, nodes marked with darker colors and situated away from the brightest ones, such as "semantic web," "information dissemination," "library service," and "evaluation," represent less-explored topics in digital libraries. This suggests ample opportunities for further research, indicating that these areas remain broad and warrant in-depth investigation.

### 3.5 Discussion

To the author's knowledge, no standardized guidelines exist for conducting keyword analysis in bibliometric studies [23]. We experimented with different configurations to generate logically interpretable keyword groupings. With a minimum occurrence threshold of 12, out of 3,714 keywords, 65 met the criteria. The following provides a summary of key findings from each cluster.

#### Academic Libraries

Digital portals play a crucial role for academic libraries by facilitating access to diverse information sources. These encompass research databases, library catalogues, e-books,

e-journals, and other digital collections. Digital resources may include full-text equivalents of printed materials, collections exclusively available in digital formats, or digital representations of physical collections.

Academic libraries are undergoing substantial transformations due to advancements in technology, providing readers with convenient and rapid access to information from any location. This contrasts with traditional media like books and newspapers, which necessitate specific times and places for access. The increasing prevalence of online learning has further altered information access and learning methods. Digital libraries play a pivotal role in delivering library materials as adaptable learning resources, aligning with the evolving landscape of education and information accessibility [11], [12], [24].

The underlying motive behind this paradigm shift is the conviction that digital libraries can offer superior academic services compared to traditional approaches [25], [26]. Academic libraries must facilitate access to diverse digital information sources, including e-books, scholarly articles, databases, and other online learning materials [27]. Additionally, they should provide resources supporting distance learning, such as SPOC and MOOCs [28], and cater to research needs with tools like scientific databases, data analysis, and reference services [29], [30]. Emphasizing information literacy is also crucial, empowering users to utilize information effectively and responsibly [11], [12], [31].

### **Metadata**

Metadata plays a pivotal role in digital libraries, impacting the distribution, maintenance, and preservation of digital assets [32]. The choice of a metadata scheme is crucial, influencing the ability to manage digital resources effectively. Standardizing metadata practices is essential for ensuring comprehensibility across diverse systems, promoting interoperability in digital libraries, akin to traditional libraries [33]. In the digital realm, interoperability facilitates seamless collaboration and information sharing among different systems, while metadata furnishes the requisite information for achieving interoperability. Therefore, the standardization of metadata is paramount for enhancing interoperability and amplifying the value of metadata.

The Semantic Web operates as an extensive knowledge network, interlinking data from diverse sources [34], [35]. Integrating metadata with the Semantic Web promises enhanced and more effective information discovery in digital libraries. This synergy unlocks boundless possibilities [36], positioning digital libraries as crucial gateways to a smarter and more accessible era of information.

### **Information Services**

Digital libraries drive librarian innovation, prompting adaptive solutions aligned with library requirements. Information services hold a pivotal role in assisting users in finding and utilizing necessary information. Through the delivery of high-quality

information services, digital libraries empower users to fulfill their information needs effectively.

The latest global trend, as reported by *wearesocial.com* (2023), indicates that 57.8% of internet users primarily seek information online. This underscores the digital era's transformative impact on information-seeking behavior. As the main information source, libraries must adapt to these shifts to remain relevant. Functional and user-centric information services, aligned with technological advancements like open-source content, social networks, and artificial intelligence, are essential for libraries. The development of new services should align with user needs, including user awareness of available information sources (Ifijeh & Yusuf, 2020) and the ability to independently find information that suits their requirements [37], [38], [39].

## 4 Conclusion

The digital era has significantly transformed education, and libraries, as crucial information resource centers, play a pivotal role in this shift. Digital libraries are not merely alternatives; they have evolved into indispensable tools for enhancing educational quality in the digital age [40], [41]. The core concept revolves around granting access to an extensive array of information and knowledge across diverse sources, disciplines, languages, and formats. This democratizes learning by enabling individuals to discover and utilize pertinent and trustworthy materials aligned with their educational objectives, unrestricted by location, time, or device.

In the realm of e-learning, libraries, functioning as vital information resource centers, play a pivotal role in content provision [42], [43], [44]. Content holds paramount importance in e-learning contexts [45], and libraries contribute by offering access to their digital collections, encompassing e-books, e-journals, e-repositories, videos, and other digital resources. Librarians, serving as information managers, must comprehend the learning requirements. Hence, collaborative efforts between learning managers and librarians become imperative for precisely identifying and addressing these educational needs.

In addition, digital libraries can foster digital literacy [46], [47], which is the ability to understand, use and create information safely, responsibly and ethically. Digital literacy is not only a skill, but also a culture that needs to be cultivated in an e-learning environment. By improving digital literacy, it enables learners to access various sources of information and knowledge online, find information relevant to their needs and enrich their learning and understanding of various topics.

Collection development is a continual endeavor involving the curation and maintenance of library materials tailored to users' needs. In the digital library context, this encompasses the selection, acquisition, and administration of digital information

sources [48], spanning e-books, e-journals, videos, and more. This process requires a nuanced approach, involving comprehension of users' information requirements, meticulous evaluation and selection of digital resources, and effective management to ensure perpetual relevance and accessibility. Collection development significantly influences a digital library's success, hinging on the caliber and pertinence of its digital collections [49], [50].

In digital libraries, collection development transcends the mere digitization of physical books; it demands intricate considerations like acquisition methods and management strategies [51]. Overcoming challenges in selecting, acquiring, and managing digital resources, while harnessing emerging technologies, is paramount. Through judicious collection development policies and technology integration, digital libraries can evolve into vital hubs, offering broader public access to information and knowledge.

## References

- [1] W. B. Seales and C. Y. Chapman, "From stone to silicon: technical advances in epigraphy," *International Journal on Digital Libraries*, pp. 1–10.
- [2] M. A. Sanjeev, S. Khademizadeh, T. Arumugam, and D. K. Tripathi, "Generation Z and intention to use the digital library: does personality matter?," *The Electronic Library*, vol. 40, no. 1/2, pp. 18–37.
- [3] M. K. Linnenluecke, M. Marrone, and A. K. Singh, "Conducting systematic literature reviews and bibliometric analyses," *Australian Journal of Management*, vol. 45, no. 2, pp. 175–194.
- [4] D. Mukherjee, W. M. Lim, S. Kumar, and N. Donthu, "Guidelines for advancing theory and practice through bibliometric research," *J Bus Res*, vol. 148, pp. 101–115.
- [5] M. Ghosh, "Financial inclusion studies bibliometric analysis: Projecting a sustainable future," *Sustainable Futures*, vol. 100160.
- [6] G. Rullyana, R. Susilana, and M. Emilzoli, "Tren Global Microlearning di Pendidikan Tinggi: Analisis Bibliometrik (2013–2023)," *E-Tech: Jurnal Ilmiah Teknologi Pendidikan*, vol. 11, no. 2, pp. 1–15.
- [7] D. J. Urbán, A. M. Greca, J. M. García-Fernández, and C. J. Ingles, "A bibliometric analysis on adolescent social anxiety and psychoeducational variables in Web of Science 2002–2021," *J Gen Psychol*, vol. 151, no. 1, pp. 1–20.
- [8] D. J. Borgohain, S. Zakaria, and M. Kumar Verma, "Cluster analysis and network visualization of global research on digital libraries during 2016–2020: A bibliometric mapping," *Sci Technol Libr (New York, NY)*, vol. 41, no. 3, pp. 266–287.



- [9] M. A. Selvavinayagam, M. Muthu, and E. Boopalan, "Scientometrics, techniques, sources and their key points to analysis of LIS research: An overview," *International Journal of Science and Technology*, vol. 8, no. 1, pp. 10–19.
- [10] M. Wijewickrema, "A bibliometric study on library and information science and information systems literature during 2010–2019," *Library Hi Tech*, vol. 41, no. 2, pp. 595–621.
- [11] H. W. Ali, N. Q. Mehmood, S. Z. Mahfooz, and I. Ali, "Usability evaluation of online digital libraries of educational institutions," *World Journal of Advanced Engineering Technology and Sciences*, vol. 8, no. 2, pp. 183–188.
- [12] N. Ali, M. Shoaib, and K. Syed, "Steady ship: Digital, online, and e-libraries (1971–2020)," *J Inf Sci*, vol. 49, no. 5, pp. 1187–1201.
- [13] K. Ahmad, Z. Jian Ming, and M. Rafi, "Assessing the digital library research output: bibliometric analysis from 2002 to 2016," *The Electronic Library*, vol. 36, no. 4, pp. 696–704.
- [14] J. Baas, M. Schotten, A. Plume, G. Côté, and R. Karimi, "Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies," *Quantitative science studies*, vol. 1, no. 1, pp. 377–386.
- [15] R. Prancutè, "Web of Science (WoS) and Scopus: The titans of bibliographic information in today's academic world," *Publications*, vol. 9, no. 1, pp. 1–59.
- [16] N. J. Eck and L. Waltman, "VOSviewer manual," *Leiden: Univeriteit Leiden*, vol. 1, no. 1, pp. 1–53.
- [17] S. Kalita, "Research productivity of Library and Information Science in India during 2010-2019: A Scientometric Study," *Library Philosophy and Practice (E-Journal)*, vol. 6729, pp. 1–28.
- [18] K. Frantzi, S. Ananiadou, and H. Mima, "Automatic recognition of multi-word terms: the c-value/nc-value method," *International journal on digital libraries*, vol. 3, pp. 115–130.
- [19] P. Mundur, Y. Rao, and Y. Yesha, "Keyframe-based video summarization using delaunay clustering," *International journal on digital libraries*, vol. 6, pp. 219–232.
- [20] D. Wong, "VOSviewer," *Technical Services Quarterly*, vol. 35, no. 2, pp. 219–220.
- [21] H. Xie, Y. Zhang, Z. Wu, and T. Lv, "A bibliometric analysis on land degradation: Current status, development, and future directions," *Land (Basel)*, vol. 9, no. 1, pp. 1–37.
- [22] Y. Yu *et al.*, "A bibliometric analysis using VOSviewer of publications on COVID-19," *Ann Transl Med*, vol. 8, no. 13, pp. 1–11.

- [23] R. Wilden, M. A. Akaka, I. O. Karpen, and J. Hohberger, "The evolution and prospects of service-dominant logic: An investigation of past, present, and future research," *J Serv Res*, vol. 20, no. 4, pp. 345–361.
- [24] K. Martzoukou, "Academic libraries in COVID-19: a renewed mission for digital literacy," *Library management*, vol. 42, no. 4/5, pp. 266–276.
- [25] A. Llewellyn, "Innovations in learning and teaching in academic libraries: A literature review," *New Review of Academic Librarianship*, vol. 25, no. 2–4, pp. 129–149.
- [26] G. Farid, N. F. Warraich, S. Iftikhar, D. Mehta, and X. Wang, "Digital information security management," *Digit Libr Perspect*, vol. 36, no. 4, pp. 351–363.
- [27] K. Ismayilov, N. Ismayilov, and V. Mammadova, "Library information services in academic libraries of Azerbaijan: a comparative study," *Library Management*, vol. 40, no. 6/7, pp. 461–477.
- [28] E. Acheampong and F. G. Agyemang, "Enhancing academic library services provision in the distance learning environment with mobile technologies," *The Journal of Academic Librarianship*, vol. 47, no. 1, p. 102279.
- [29] G. Haddow and J. Mamtora, "Research support in Australian academic libraries: services, resources, and relationships," *New Review of Academic Librarianship*, vol. 23, no. 2–3, pp. 89–109.
- [30] L. Si, Y. Zeng, S. Guo, and X. Zhuang, "Investigation and analysis of research support services in academic libraries," *The Electronic Library*, vol. 37, no. 2, pp. 281–301.
- [31] D. Stebbing, J. Shelley, M. Warnes, and C. McMaster, "What Academics Really Think about Information Literacy," *Journal of information literacy*, vol. 13, no. 1, pp. 21–44.
- [32] R. Groenewald and A. Breytenbach, "The use of metadata and preservation methods for continuous access to digital data," *The Electronic Library*, vol. 29, no. 2, pp. 236–248.
- [33] R. C. Amorim, J. A. Castro, J. Silva, and C. Ribeiro, "A comparison of research data management platforms: architecture, flexible metadata and interoperability," *Univers Access Inf Soc*, vol. 16, pp. 851–862.
- [34] S. A. Khan and R. Bhatti, "Use of Semantic Web & Ontology-based Applications for Future Semantic Digital Libraries (FSDL)," in *International Conference on Information Management & Libraries (ICIML)*, Conducted by the Institute of Information Management on, pp. 10–13.
- [35] Z. Mirhoseini and M. Dastaran, "Semantic Solutions for Digital Libraries Emphasizing on Semantic Web Standards and Technologies," *Journal of Knowledge Studies*, vol. 12, no. 44, pp. 81–98.

- [36] A. A. Anwar, "A survey of semantic web (Web 3.0), its applications, challenges, future and its relation with Internet of things (IoT)," in *Web Intelligence*, No. Preprint., IOS Press, pp. 1–30.
- [37] G. Ifijeh and F. Yusuf, "Covid–19 pandemic and the future of Nigeria's university system: The quest for libraries' relevance," *The Journal of Academic Librarianship*, vol. 46, no. 6, p. 102226.
- [38] S. Paor and B. Heravi, "Information literacy and fake news: How the field of librarianship can help combat the epidemic of fake news," *The Journal of Academic Librarianship*, vol. 46, no. 5, p. 102218.
- [39] J. Zhou, "The role of libraries in distance learning during COVID-19," *Information Development*, vol. 38, no. 2, pp. 227–238.
- [40] A. Haleem, M. Javaid, M. A. Qadri, and R. Suman, "Understanding the role of digital technologies in education: A review," *Sustainable Operations and Computers*, vol. 3, pp. 275–285.
- [41] H. Silvana, G. Rullyana, S. Agustina, and A. Ardiansah, "E-libwork web portal design as a digital learning resources," *Edulib*, vol. 11, no. 1, pp. 65–75.
- [42] R. C. Johan, M. R. Sutisna, G. Rullyana, and A. Ardiansah, "Developing online learning communities," in *Borderless Education as a Challenge in the 5.0 Society*, CRC Press, pp. 145–153.
- [43] K. H. Lau, T. Lam, B. H. Kam, M. Nkhoma, J. Richardson, and S. Thomas, "The role of textbook learning resources in e-learning: A taxonomic study," *Comput Educ*, vol. 118, pp. 10–24.
- [44] C. Pinho, M. Franco, and L. Mendes, "Exploring the conditions of success in e-libraries in the higher education context through the lens of the social learning theory," *Information & Management*, vol. 57, no. 4, p. 103208.
- [45] R. Susilana, L. Dewi, G. Rullyana, A. Hadiapurwa, and N. Khaerunnisa, "Can microlearning strategy assist students' online learning," *Jurnal Cakrawala Pendidikan*, vol. 41, no. 2, pp. 437–451.
- [46] G. Hallam, A. Thomas, and B. Beach, "Creating a connected future through information and digital literacy: strategic directions at the University of Queensland Library," *Journal of the Australian Library and Information Association*, vol. 67, no. 1, pp. 42–54.
- [47] M. Rafi, Z. JianMing, and K. Ahmad, "Technology integration for students' information and digital literacy education in academic libraries," *Inf Discov Deliv*, vol. 47, no. 4, pp. 203–217.
- [48] J. Wang, "Digital collection development and sharing on a national scale: A case study of the Digital Library Promotion Project," *New Library World*, vol. 117, no. 11/12, pp. 678–687.

- [49] A. R. Abdul Rahman and S. Mohezar, "Ensuring continued use of a digital library: a qualitative approach," *The Electronic Library*, vol. 38, no. 3, pp. 513–530.
- [50] N. Soltani-Nejad, F. Taheri-Azad, N. Zarei-Maram, and M. K. Saberi, "Developing a model to identify the antecedents and consequences of user satisfaction with digital libraries," *Aslib Journal of Information Management*, vol. 72, no. 6, pp. 979–997.
- [51] L. Benny, "Selection and acquisition of e-resources in academic libraries: Challenges," *International Journal of digital library services*, vol. 5, no. 2, pp. 124–137.

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