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# Recent Trends in Digital Library Publications : A Scientometric Analysis

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## Abstract

The study seeks to illustrate the most current trends in digital library research via the use of scientometrics. The study of scientific networks is important in many scientific domains. A social network with many nodes and connections serves as the foundation for scientific network research. Nodes include authors, publications, and journals, while linkages include citations, cocitations, and coauthorship. Data was collected from the Scopus abstracting and citation database for the period of ten years from 2012 to 2021. The most relevant 1957 documents were chosen from the collection, and selected documents were analyzed using Biblioshiny and VOSviewer. The research showed that digital library productivity is rising annually, the United States of America dominates the production of scholarly production on digital libraries, and research is increasingly focused on digital resource and digital collection development. However, artificial intelligence, deep learning, machine learning, big data, and other related areas of study have emerged as the most recent research trends in digital library research. The outcomes of this study will aid digital library research by providing up-to-date and reliable research information.

**Keywords:** Digital library, Scientometrics, Vosviewer, Biblioshiny, Research trend

## 1. Introduction

It is essential to provide outstanding service in order to maintain usage and to develop a strong academic communication network that illuminates major value propositions to libraries. Services offered and marketing support for library services provide value to library. Librarians have always provided a wide range of services to library patrons. The whole notion of library and library services has altered to fit the digital world as a result of the advent of ICT. In order to

improve the quality of academics, research, and development, librarians have begun to utilise technology to deliver tailored services in digital format. Libraries have re-defined themselves in the digital world to meet the requirements of Generation Z, who were born digital. The advent of the digital library has ushered in a new age in library operations and service delivery, allowing it to effectively match the diverse information demands of its patrons while also keeping pace with the times. One of the best ways to keep up with the ever-changing digital world is by using an agile strategy that enables libraries to quickly change and deliver new services. Sharing resources and services have become easier since the rise of digital libraries (Roopa, 2015). Also, it gave more attention and encouragement for experimenting with new and transformative ideas and innovative practices. The concepts of digital library are embraced across globe amongst all libraries. Even, users have been able to expand their knowledge from their convenient location for betterment of self and society.

Many libraries are now considering a "concierge" approach that emphasizes personalized service (Bhui & Sahoo, 2018)). In order to better serve their users and turn the library into a smart library, librarians may take advantage of the present study and training opportunities given by specialists in the field, such as conferences, seminars, or workshops. Consequently, this article is intended to demonstrate the latest digital library trends and to suggest possible study avenues in the field.

### ***Objectives:***

The study has followed the objectives similar to the Dhawan, Gupta and Ritu Gupta and represented as it is

- To study the growth rate of research output in digital library research, global publication share and global citation share.
- To study the international collaborative publications, and share of leading collaborating partner countries
- To study research output by broad subject areas
- To study the publication productivity and citation impact of top 10 most productive authors, countries and sources (Dhawan et al., 2017)

### ***Scope***

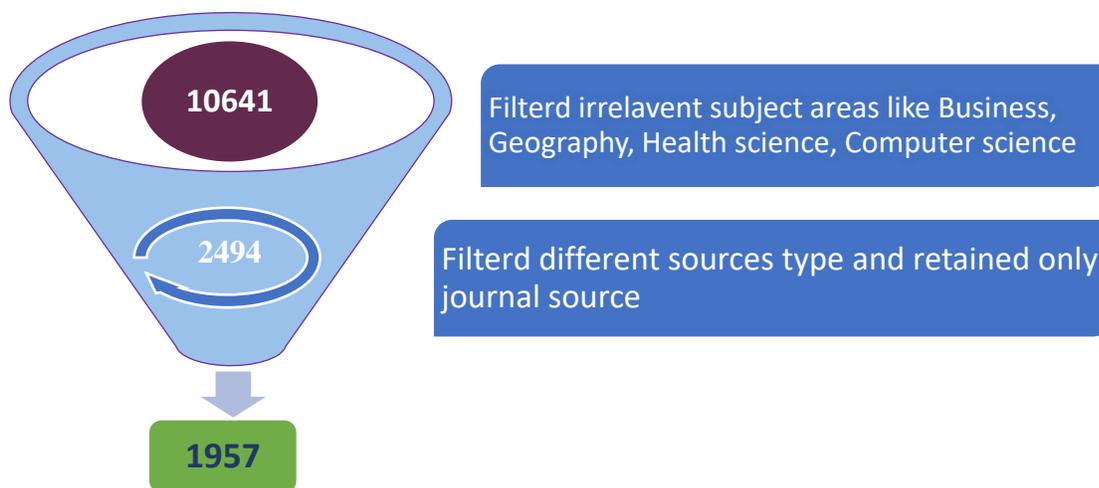
All the journal publication indexed in Scopus (a biggest abstracting and citation database) with the keyword digital library is considered for the study.

### ***Limitation***

The data for the scientometrics study was collected from a single abstracting and citation database, which, excludes the publishing information of several local journals from consideration due to its inclusion policy.

### ***Methodology***

The scientometric approach is employed in this study of scholarly publications relating to "Digital library" as shown in Figure 1. Finalizing significant keywords is the first step in retrieving scientific publications related to a particular subject. The keyword digital library was decided to use to retrieve precise and accurate documents. After the finalizing the domain-specific keyword. Scopus abstracting and citation database was used for the searching documents. In the keyword field, the term digital+library was used, and the date range was limited to ten years, from 2012 to 2021. After filtering the documents, a total of 1957 documents were selected for scientometric analysis. The data was analysed using Vosviewer and Biblioshiny, and the findings are expressed in tables, graphs, and network diagrams.



**Figure 1: Document Collection Process**

## **2. Review of related literature**

Various articles have been published in the area of digital library, among them a few highly significant articles are been reviewed to summarize the ideas of existing knowledge. ZhiPing (2014) conducted a comprehensive analysis of the benefits of data mining technology in university library work, detailed how data mining technology is used to deliver individualized services, and highlighted how data mining is used to expand college library services. He found that data mining technology might be utilized to increase the quality of information services, increase public awareness of the services, and also increase the efficiency and quality of library services. Malik & Mahmood (2013) observed the prevailing status of ICT infrastructure required for presenting efficient Digital Reference Service (DRS) in the university libraries of Punjab. The outcomes shows that the ICT infrastructure required for contriving and executing an efficient DRS in libraries is better but requires some more improvement. They identified that many libraries also possess general as well as reference collection in electronic format and a few libraries have initiated DRS while most of them are still applying head on channel for reference communications. Further Stejskal & Hajek (2015) analyzed the effectiveness of the digital services Their results shows that greater benefits are associated with digital services with remote access in comparison with on-site services, specifically, the highest value library services found were “Searching the catalogue” and “E-book downloading”, which were used most frequently. The highest unit benefits were connected with “Using a PC” and “E-book downloading”. Further they recommended to examine the transferability of the described methodology, in public library services. Wasim (2017) investigated existing storage solutions for long-term massive data preservation in digital libraries. The research finds that present storage technology cannot preserve massive data in digital libraries for lengthy periods. They can't meet all storage needs or reduce digital library costs. The report also highlights the need for ongoing innovation and development in existing storage technologies to reduce the effect of storage scarcity on digital libraries and enable upcoming storage technologies to progress and take over. Author cautioned on using existing storage technologies, as he felt digital libraries would suffer from information loss.

Tripathi (2018) explored numerous difficulties connected to long-term preservation in a digital context. Concerning the preservation of digital items. The entire scenario for long-term

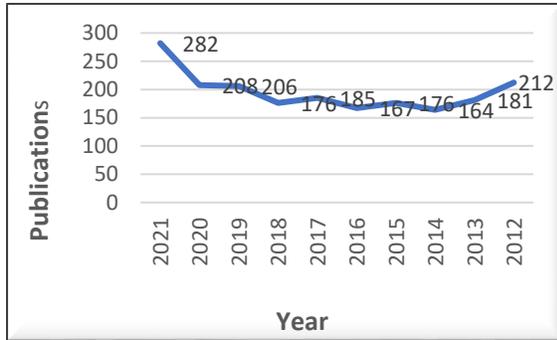
preservation of an asset includes digital storage, quality monitoring, and risk preparation. To deal with difficulties of long-term preservation of an asset, many strategies have been proposed that may be utilized to create an organization's policy. A combination of conventional and digital methods is recommended to guarantee long-term preservation. It contains numerous checklists for long-term digital preservation. Huaiyuan, Zhao (2020) proposed ways to test university archive management expertise. Data collecting issues at colleges and universities including neglect, poor investment, software issues, a lack of archive websites, and a lack of expertise to preserve data. In light of these issues, actions may be done to create an information management database, educate technical personnel, develop software, and raise awareness. This research focuses solid solutions for solving challenges in university database administration. Singh (2018) examined the novel activities, techniques, and technology that are being employed in the digitization and establishment of digital libraries. It outlines many critical elements and the precise plans necessary for the process, as well as offering advice and direction to working librarians and information scientists.

### **3 Analysis and Discussion**

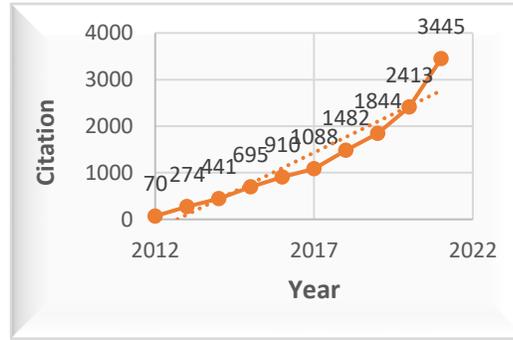
#### ***Periodic Growth of Publications in Library Consortia Research***

A total of 1957 relevant published articles on digital library were retrieved from the Scopus for the period of ten years from 2012 to 2021. Figure 2 shows increasing trend in annual publication rate, however, the growth is undulating. During 2021 the publication rate is increased by 35% than the previous year but the growth rate in the publication did not rise to the great extent as it can be observed in the figure 2, during 2012 the publication was 212 which increased to 282 publications in 2021. The year 2021 is the most productive year which shows the importance of digital library in the current period.

The number of citations increased from 70 in 2012 to 3445 in 2021, demonstrating a strong upward trend in digital library research (Figure 3). The citation rate was highest in 2021.



**Figure 2: Annual Publication Trend**



**Figure 3: Annual Citation Trend**

***Perspectives on the Most Productive Authors and country***

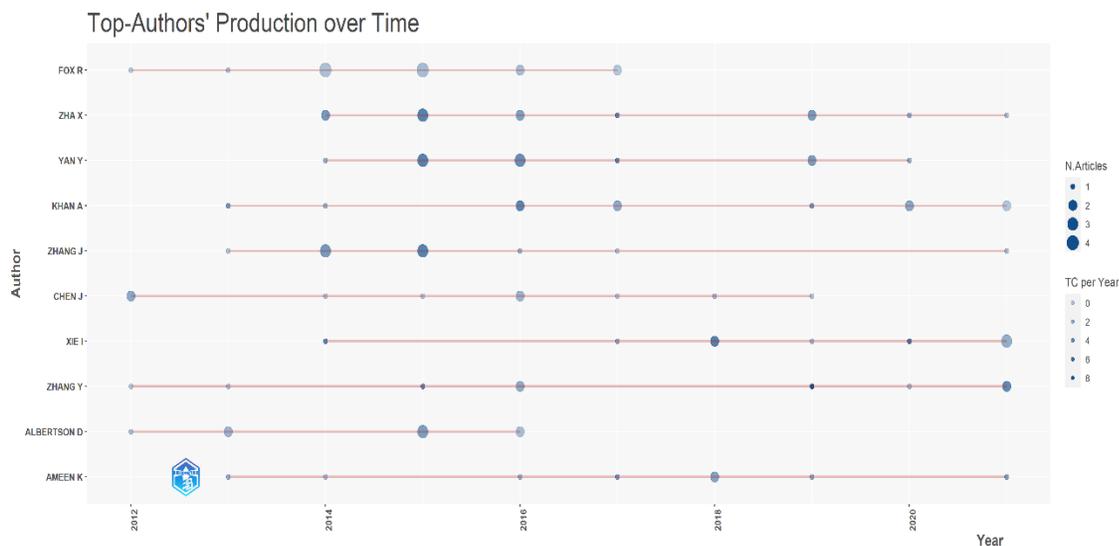
The authorship attribute is an important element in scientometrics as intellectual content is created by authors to spread their research. The study revealed that 3988 authors were linked to the digital library publications throughout the study period, while few of them worked prominently with a larger number of publications. The most notable of these authors are presented in Table 1. Zha, X (12 Publications) from China has published a greater number of publications than other authors. Most of the authors have published only one publications, indicating a limited scope for continuous research in the area of digital library, however, the majority of the top authors are continuously involved in research (Figure 4). It was observed that, there is vast difference between top productive authors and authors who have received highest number of citations.

**Table 1: Author’s Productivity in Digital Library Research**

Element	h_index	g_index	TC*	NP*
Fox R	3	3	15	15
Zha X	8	11	122	12
Yan Y	8	10	117	11
Khan A	6	9	108	9
Xie I	5	8	92	8
Zhang Y	4	8	89	8

Element	h_index	g_index	TC*	NP*
Zhang J	6	8	73	8
Ameen K	5	8	71	8
Albertson D	4	6	40	8
Chen J	4	5	35	7

\*NP= No, of Publication \*TC=Total Citation



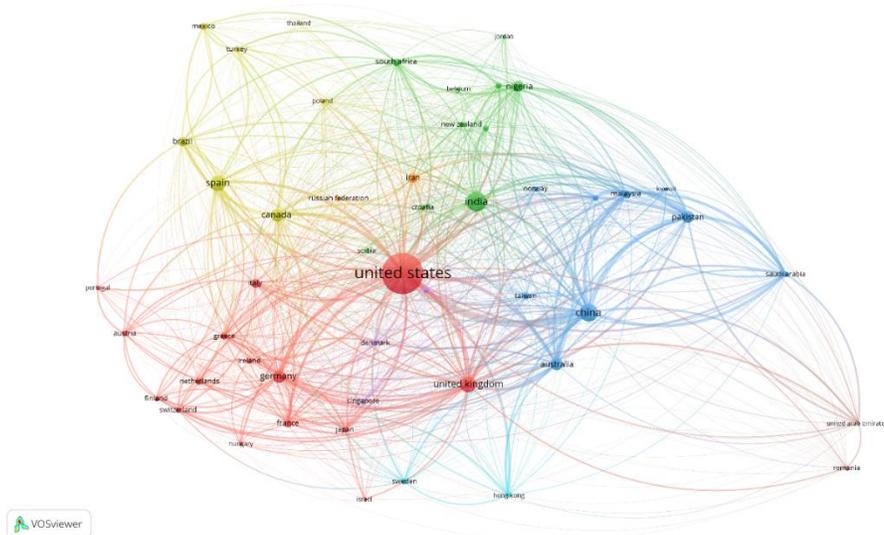
**Figure 4: Top authors production overtime**

In Table 2, the countries are ranked by their productivity. USA is ranked first in terms of productivity and citation received followed by China. India is ranked third in the list with 97 publications. USA's share in production is 25% to the global publication in digital library, however, their multiple citation is only 4.91%. Many countries single citation ratio is higher than that of the multiple citation ratio. Average citation rate of Italy found to be greater among the top ranked counties. To increase the quality and impact of its research results, collaboration is the best option thus we find collaboration between authors within and outside the countries. USA collaborated with India, China, Spain and United Kingdom and India collaborated with China, United Kingdom, USA, Australia, Nigeria, Pakistan these countries have been the top collaborators. Further, it was found that the major portion of the citation belong to single citation publications and lesser number of publications belong to multiple citation publications.

**Table 2: Country's Productivity in Digital Library Research**

Country	No. of Publication	Total Citations	Average Article Citations	SCP	MCP	MCP_Ratio
USA	489	3134	6.409	465	24	0.0491
China	100	1198	11.98	81	19	0.19
India	97	397	4.093	93	4	0.0412
United Kingdom	66	562	8.515	55	11	0.1667
Australia	43	716	16.651	36	7	0.1628
Pakistan	41	261	6.366	35	6	0.1463
Germany	38	494	13	33	5	0.1316
Spain	36	186	5.167	33	3	0.0833
Canada	30	447	14.9	25	5	0.1667
Italy	19	584	30.737	18	1	0.0526

*\*SCP= Single Citation Publication \*MCP=Multiple Citation Publication*



**Figure 5: Collaboration Among Different Countries**

*Perspectives on the Most Productive Source*

The most productive journals were analysed using biblioshiny and results were presented in the Table 3. Among the 303 sources which published digital library related publications, the greater number of articles were published in Library philosophy and practice journal and ranked number one in publishing digital library research articles (135 articles) followed by Digital library perspectives and Library hi-tech. However, their h-index found to be low compared to the that of other journal which published lesser number of articles.

**Table 3: Most Productive Source in Digital Library**

Sources	H-index	Articles
Library philosophy and practice	6	135
Digital library perspectives	9	88
Library hi tech	11	77
Electronic library	15	73
Journal of chemical information and modeling	20	64
International journal on digital libraries	8	42
Journal of the association for information science and technology	12	37
Proceedings of the association for information science and technology	12	37
Journal of documentation	8	35
Technical services quarterly	Not available	35

### ***Research Focus Areas in Digital Library Research***

The increase in the number of publications and citation on digital library may be related to the latest trend in the research where, scholars have adopted latest computing technology such as artificial intelligence, deep learning, machine learning etc. this innovation promotes the use of digital library and helps to offer specialized services at any time and location. Thus, this study helps researcher to adopt latest computing technology for improving digital library services and also development of strategies for better management of digital library and further helps in recognizing the progress of technology to the rise of scientific dissemination and updating of

knowledge. However, studies on this subject were also found in digital resources and digital collection and services as may articles were published related to this theme. Some studies have made a mention of digital preservation, digital born collections, digital preservation, open access and its implications, legal rights related to digital preservation etc. (Table 4)

**Table 4: Most used keywords by Authors in digital Library**

Year	Keyword	Year	Keyword
2012	Collections management	2017	Academic libraries
	Digital rights management		Collaboration
	Digital storage		Digital archives
	Educational resources		Digital humanities
	Google books		Digital preservation
	GsdI		Institutional repository
2013	Copyright law		Linked data
	Digital curation		Open access
	Digital documents		Semantic web
	Learning		Social media
	Outreach	2018	Archives
	Semantics		Digital divide
	Wikipedia		Digital scholarship
	Information literacy		
2014	Citation analysis	Public libraries	
	Collection development	University libraries	
	Data curation	2019	Academic library
	Data management		Digital environment
	Databases		Digital inclusion
	Dspace		Digital library services
	E-books		Digital literacy
	Information services		E-learning
	Information systems		Ict
	Information technology		Library services
	Research libraries	2020	Artificial intelligence
Web 2.0	Big data		
2015	Cloud computing		Digital information
	Copyright		Digital resources
	Digital content		Digital skills
	Digital publishing		Digital transformation
	Electronic resources	2021	Authorship pattern
	Information access		Bibliometric analysis
	Internet		Deep learning
	Open source software		Machine learning
	Repositories		

	User experience		National digital library of india
	User studies		Social networking sites
2016	Digital collections		Virtual services
	Digital repositories		Bigdata
	Digitization		
	Information management		
	Information retrieval		
	Knowledge management		
	Metadata		

#### 4. Conclusion

The process of providing digital content requires careful preparation, thorough analysis, and well-informed decisions. The ultimate purpose of every library is to satisfy the informational requirements of all who approach the library. There are a number of benefits of having a digital library in place, including the ability to provide new and creative library services for the users, as well as ensuring long-term preservation. Appropriately equipping library programmers with tools for application development, adding digital content, and figuring out the best way to create an electronic document management system that meets the needs of users. Articles on digital libraries have grown tremendously throughout the years. More articles have been written in the library philosophy and practice journal and Scientific Production of USA has made the greatest contribution to global research. The greatest number of works by Chinese authors may be found in the digital library's scientific literature. Artificial Intelligence, deep learning, machine learning, and other cutting-edge computer technologies have been the focus of recent studies.

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