INFORMATIO
JOURNAL OF LIBRARY AND INFORMATION SCIENCE
ISSN 2775-0043 (Online) journal.informatio@unpad.ac.id https://jurnal.unpad.ac.id/informatio
JOURNAL INFORMATIO

Bibliometric analysis: Trends research application of information technology in university libraries

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Received: July 2025; Accepted: September 2025; Published: September 2025

Abstract

Background: Technological developments are keeping pace with the increasingly complex needs of society. For example, in university libraries, academics demand information technology to effectively support learning and research activities.
Purpose: To analyze publication development, country distribution, the most productive authors, and publication theme trends based on the co-occurrence of keywords related to the research topic.
Methods: This study uses quantitative analysis with bibliometric data from the Scopus database and the VOSviewer application.
Results: This study shows an increase in publications related to the topic of information technology application in university libraries in 2021. This was influenced by the COVID-19 pandemic, which necessitated information technology-based online services to meet the needs of the academic community. However, publications declined again in 2025 as the research focus shifted to AI and other emerging issues, aligning with current trends. The country with the highest contribution was China, and the most productive author, Chen, Y., also came from China. This can be attributed to the Chinese government's push to accelerate the digitization of higher education. The most frequently discussed keywords were 'information technology,' 'university libraries,' and 'libraries.' Meanwhile, 'smart libraries' was one of the least researched keywords.
Conclusion: This study concludes that developing information technology in university libraries is important for creating more efficient, effective, sustainable, and up-to-date services. Future research could analyze similar keywords using different databases or explore rarely researched keywords to obtain more diverse results.

Keywords:
Bibliometric
Information technology
University library

How to cite this article:
Ramadani, T. A. & Erwina, W. (2025). Bibliometric analysis: Trends research application of information technology in university libraries. Informatio: Journal of Library and Information Science. Vol.5 No.3. 321-336 DOI: https://doi.org/10.24198/inf.v5i3.65182

INTRODUCTION

The volume of information exchanged in the current information age is massive. According to statistics released by Statista (2024), every day, 347.3 million emails are sent and received, thousands of news articles on various issues are published, 500 million tweets are posted, and 95 million images and videos are shared on Instagram. The sheer volume of information uploaded daily aligns with the rapid advancement of information technology, leading to an increasing diversity in media used for information dissemination. This is consistent with data from the Central Statistics Agency (2024), which indicates that out of Indonesia's population of 281.6 million people, 67.29% own mobile phones. Over the past 10 years, the number of internet users in Indonesia has increased to 69.21% and is projected to continue growing.

In addition to causing an information explosion, the creation of increasingly sophisticated information technology provides various positive benefits. For example, smart devices such as computers, smartphones, and laptops supported by the internet help with learning, work, shopping, socializing, and traveling virtually around the world without leaving one's seat (Ratnaya, 2011). In line with the views of Rufaidah, Erwina, and Yanto (2019), the internet, as a key development in information technology, can transform local communities into global ones and expand access to information, thereby creating a more transparent world.

The development of information technology involves changes in a number of activities, including library operations. According to Law No. 43 of 2007, Article 1, Paragraph (1) concerning Libraries, a library is defined as an institution that manages collections and information services for the purposes of education, research, preservation, and recreation. Libraries are divided into five types: national, public, specialized, academic, and school libraries. One type of library required to implement information technology to meet its users' information needs is the university library.

University libraries are centers of up-to-date and relevant information for the academic community to fulfill the three pillars of higher education. They have a duty to understand and meet the information needs of their users and to house various publications produced by the academic community. Librarians act as facilitators in knowledge management and build relationships with various groups of scientists and library patrons. Meanwhile, information technology plays a crucial role in processing large amounts of data, accelerating the management process and assisting librarians in controlling repetitive tasks, avoiding data duplication, and ensuring that the information produced is more accurate and of higher quality (Aswati, Mulyani, Siagian, & Syah, 2015). Providing information technology that is always updated with the latest technological advancements can enhance the efficiency and effectiveness of the learning process for library users, particularly academic staff.

The requirements for the application of information technology in libraries are contained in Law No. 43 of 2007, Article 5, Paragraph (1), which states that a library must use information and communication

technology in its management and services (Indonesia, 2007). Further elaborated in Article 20, Paragraph (2), it is stated that university libraries must develop integrated information collections and services using information technology to support academic and research activities.

The International Federation of Library Associations and Institutions (IFLA), in its "International Manifesto on Libraries and Lifelong Learning," also states that it is important for libraries to implement information technology to improve access to information resources, support lifelong learning, and provide more efficient services. The ALA (American Library Association) has also established standards emphasizing the importance of technology and information infrastructure in academic libraries (*Standards for Libraries in Higher Education*), including fast internet connections, relevant hardware and software, and secure data storage systems to support the provision of digital information and services, thereby supporting learning, research, collection management, and improving access to information resources (Libraries, 2018).

The importance of applying information technology in libraries also aligns with the increasingly complex information access needs of the academic community, requiring university libraries to adapt so that the information sources offered to users become more diverse (Fahrizandi, 2020). In line with the views of Arvelina et al. (2022), the use of information technology needs to be implemented in university libraries for disseminating high-quality, easily accessible information effectively to its intended users.

Information technology can be applied to various library services. Circulation services can provide user statistics, membership administration, self-service options, and cross-library services. Reference services can offer electronic dictionaries, directories, maps, digital research results, OPAC, and web-conferencing. Journal and periodical services can provide e-journals. Multimedia or audiovisual services can offer media like video cassettes, microfilm, DVDs, and interactive media for users with special needs, such as digital audiobooks, Braille, and virtual references (Info Eyes). Internet and computer station services can include Wi-Fi networks, and security services can include electronic gatekeepers.

Muis and Fedy (2024) mention both positive and negative effects resulting from the implementation of information technology in libraries. The positive effects include lightening librarians' workloads, improving the library's image, facilitating virtual information exchange between libraries, providing convenience for patrons to search for, borrow, and return items, and enabling broader promotion through websites. On the other hand, the negative impacts may include increasing costs due to software purchases, maintenance, and the need for continuous data security upgrades, as well as a dependency on information technology, which may strain the relationship between librarians and users.

Research on the application of information technology in university libraries—in the form of scientific articles, theses, and dissertations—needs to be conducted as a reference for libraries wishing to apply information technology, so

that it can be implemented appropriately, systematically, and strategically. Previous studies have been limited to theoretical and applied research without in-depth exploration. Meanwhile, research should aim to develop existing theories or create new ones relevant to contemporary developments, thereby avoiding redundant research on similar topics. Therefore, research using mapping methods, also known as bibliometrics, is necessary.

Maula et al. (2018) explain that bibliometric analysis is a statistical method that aims to analyze literature and describe trends in the development of knowledge. Kriswanto et al. (2019) mention that bibliometric research is used to evaluate patterns or trends in scientific research. Ananda et al. (2025) also argue that bibliometric studies can provide added value in responding to the challenges of the digital age, where the volume of information is often difficult to manage. Through this method, not only can existing literature be organized, but research gaps can also be identified, guiding future study directions and supporting academics, researchers, and policymakers in decision-making.

Unlike other studies that describe topics through explanations or test variables using numerical formulas, bibliometric analysis produces mappings to help researchers analyze trends, identify under-researched topics, and develop new theories, thus avoiding redundant research. In other words, the mapping from a bibliometric analysis becomes the primary focus before further analysis with other research approaches. Therefore, this bibliometric analysis is important to conduct.

Bibliometric research on this topic has been studied previously. Nabutto (2022) researched the application of information and communication technology (ICT) in libraries between 2011 and 2021 in the Scopus database, yielding 1,186 documents. The results indicated that publication productivity peaked in 2019. The country that contributed the most was Nigeria, the most contributing institution was the University of Nigeria, and the most productive author was Gomez.

Park and Kim (2024) analyzed research trends on information technology and artificial intelligence for libraries from 2011 to 2024 using CiteSpace and VOSviewer. They found that the highest number of publications was in 2022 and that “academic libraries” was the most frequently researched keyword.

Kori and Chhabra (2016) also conducted a bibliometric study on information technology and library publications from 2005 to 2013. Their results showed that the highest number of articles was published in 2012. The United States produced the most publications. Universities were the most common contributing institutions, and the majority of articles were between 1 and 10 pages long.

Although research on this topic has been conducted previously, what distinguishes this study and makes it novel is the more recent research period (2015–2025), so the results are more relevant for policymaking or for conducting further research on topics that have been rarely studied. In addition, the three previous studies did not comprehensively analyze publication theme trends based on keyword co-occurrence; therefore, this study offers more diverse results.

The purpose of this study is to identify the development of scientific article publications, analyze the distribution of countries, analyze the most productive authors, analyze the most frequently used document types, and identify publication theme trends based on keyword co-occurrence.

Based on these objectives, this study not only shows publication trends and dominant contributors but also reveals the most frequently discussed topics and areas that still receive little attention. These results confirm the existence of a research gap, especially in post-pandemic studies focusing on the utilization and sustainability of library information systems. These findings are expected to serve as a basis for further research on new issues, such as the application of artificial intelligence, big data, and the development of smart libraries in higher education.

RESEARCH METHODS

This study uses a quantitative method with bibliometric data analysis. The software used for data analysis includes VOSviewer (version 1.6.20), Biblioshiny, and the analysis tools within the Scopus database (www.scopus.com). According to Eck and Waltman (2022), VOSviewer is free computer software for creating bibliometric visualization maps designed to provide intuitive data visualization, thereby facilitating the understanding of relationships between research elements (Ananda, Rizal, & Rohman, 2025).

This study uses secondary data sourced from the Scopus database. Klapka and Slaby (2018) argue that Scopus is one of the most comprehensive and reliable journal databases because research published in it undergoes a rigorous peer-review process, and its high reputation guarantees the quality of its information (Wibowo & Salim, 2022). Therefore, the researchers decided to conduct further research on this topic using the Scopus database.

Data collection was conducted on February 12, 2025. First, the researchers searched the Scopus database using the keywords “Information Technologies” AND “University Library,” with the search applied to the title, abstract, and keywords. After obtaining the search results, the researchers filtered the data.

The data criteria used were: 1) articles on information technology in university libraries, 2) originating from academic publications such as scientific articles, books, book chapters, conference papers, reviews, and conference reviews, 3) published in the last 10 years (2015 to 2025) to highlight current trends, 4) from disciplines related to information technology and libraries, and 5) written in English. Based on these criteria, 153 documents were obtained. Sources that did not meet the criteria were excluded.

The selected data was then exported in CSV format. The analysis uses data visualization from Scopus and VOSviewer. Scopus has an “Analyze” feature to explore trends based on document type. The results are visualized in bar and pie charts, which were exported in JPEG format. Meanwhile, VOSviewer software was used to map the relationships between keywords (co-occurrence). VOSviewer provides three types of map visualizations: a) Network Visualization, which shows the network

Table 1. Data Source Information

Categories	Special Requirements
Database	Scopus
Search Period	2015-2025
Keywords	*"Technology Information" AND "University Libraries"*
Document Type	*Scientific articles, book, book chapter, conference paper, review,* and *conference review*
Data Extraction	Export with full notes and cited references in CSV format
Sample Size	153

Source: Researcher's processing, 2025

between terms; b) Overlay Visualization, which shows the historical traces of research; and c) Density Visualization, which describes the density of research clusters and can be used to identify less popular research areas. In addition, the data is presented in tabular form using the Biblioshiny application to analyze the frequency distribution of publications by country and the most productive authors.

RESULTS AND DISCUSSION

In the current global era, society demands higher quality modern services, and university libraries are one such area. According to Law No. 43 of 2007 on Libraries, Section Four, Article 24 (3), university libraries must develop library services based on information and communication technology (Indonesia, 2007). This aligns with one of Ranganathan's ideas in "The Five Laws of Library Science," which states that libraries are always evolving, growing, and adapting to change.

Based on the search results in the Scopus database, 153 documents published between 2015 and 2025 were obtained. The factors considered in analyzing research trends on this topic include the development of publications, distribution by country, most productive authors, document types, and co-occurrence of keywords. Given the current abundance of electronic information, bibliometric analysis helps map existing research, facilitating a better understanding of relevant topics.

This bibliometric study focuses on the application of information technology in university libraries over a ten-year period (2015–2025), with its development observed year by year. The objective is not only to present statistical trends but also to identify factors influencing the increase, decrease, or fluctuation in publications on this topic.

The Figure 1 shows the Scopus analysis results related to the development of publications on this topic. Based on Figure 1, the development of publications has fluctuated. In 2015, there were 16 documents, followed by a decline to 11 in 2016 and 6 in 2017. Subsequently, there was a gradual increase to 11 publications in 2018, 18 in 2019, and 20 in 2020. Publication development peaked in 2021 with 23 documents.

The development of publications is related to the COVID-19 pandemic. This was driven by the demand for transformation and utilization of information technology

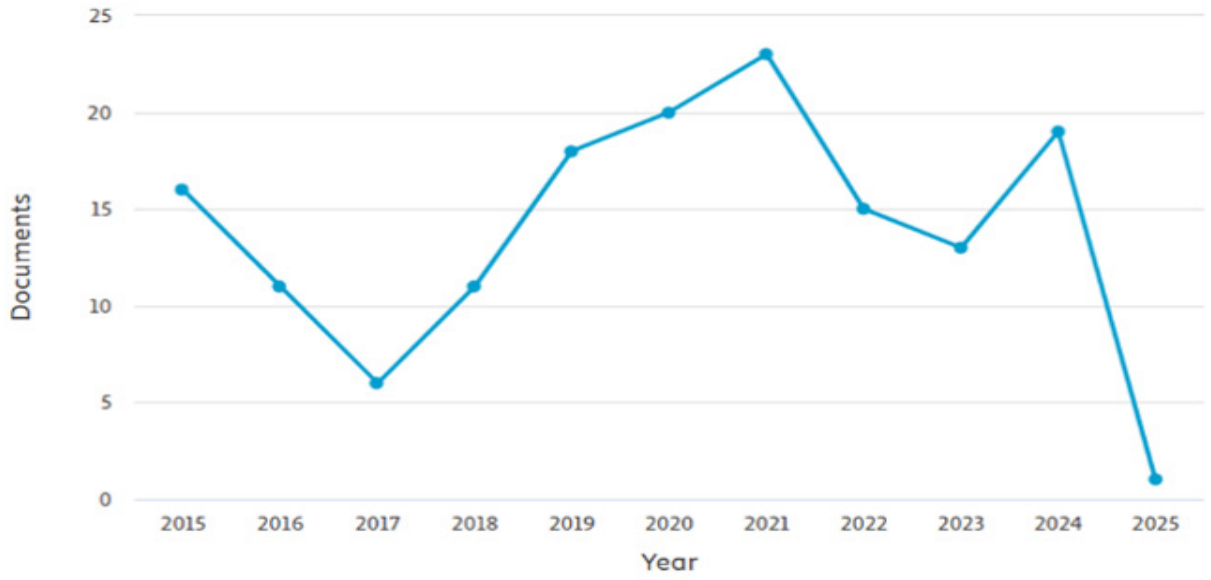

Figure 1. Research Development Chart

Source: Scopus, 2025

in university libraries to meet the teaching and learning needs of the academic community from home. Therefore, research publications increased to discuss solutions and innovations in new information technology that could bridge the needs of the academic community. This is in line with research by Nabutto (2022) and Park and Kim (2024), which showed similar increases in publications during the pandemic years.

The period from 2019 to 2022 was still part of the COVID-19 era, and enthusiasm for creating new information technology continued to increase. Thus, it can be concluded that the development of research publications was influenced by the COVID-19 pandemic.

However, the number of publications then fluctuated, with a decrease to 15 documents in 2022 and 13 in 2023, followed by an increase to 19 in 2024, and then a drastic decline to only 1 publication in 2025. This is due to a shift in research focus. During the pandemic, many researchers studied innovations to deal with the existing conditions. As time went by, the technology began to be utilized. Consequently, after the pandemic, from 2023 onwards, the discussion shifted primarily to maintenance aspects. Research on information technology in university libraries naturally declined, and the research focus has since adjusted to current conditions to produce more relevant results.

Fluctuating research developments can be caused by different research priorities; for example, there may be a trend toward a popular topic, resulting in more research on that phenomenon. Additionally, rapid technological developments can pose research challenges. Ananda (2025) suggests that publication growth can be attributed to increasing academic interest and advances in technology. Furthermore, Lisnarini (2025) explains that a decline in output may result from a shift in research focus. The inconsistent trends present an opportunity for researchers to investigate the causes and explore both frequently and

Table 2. Scientific Publications by Country

Country	Frequency
China	88
USA	48
Nigeria	38
Pakistan	24
India	23

Source: Biblioshiny, 2025

Table 3. Most Productive Authors

Author	Frequency
Chen, Y.	3
Ali, M.Y.	2
Bahader, M.	2
Baryshev, R.A.	2
Bhatti, R.	2

Source: Biblioshiny, 2025

infrequently studied themes.

In addition, research trends can be analyzed through the distribution of publications by country. This analysis identifies which countries contribute the most, reflecting the extent to which information technology has been implemented in their university libraries.

Table 2 shows the distribution of countries that have contributed research on the topic. China ranks first with 88 publications.

The high number of publications from China is attributed to the Chinese government's support for improving the quality of higher education. This is achieved through large research grants, regulations requiring scientific work for graduation, and efforts by Chinese universities to increase their research intensity to improve their world university rankings (Krishna, Zhang, & Jiang, 2025).

This is followed by the USA with 48 documents, Nigeria with 38, Pakistan with 24, and India with 23 publications. A country's initiative in conducting research can be influenced by the dynamics of research development, policy factors, or the need to enhance research productivity. Mapping publications by country serves as a useful reference for other researchers and can assist librarians in studying the implementation process in those countries before applying similar technologies in their own libraries.

Analyzing the most productive authors is also essential in observing research trends. Identifying authors who frequently publish on a subject provides other researchers with valuable references and fosters opportunities for collaboration. Author productivity is measured, among other things, by the number of works published (Mubarok & Istiana, 2022). Below is data on the most prolific authors researching the application of information technology in university libraries:

Based on the data analysis in Table 3, there are five most productive authors researching the topic "Application of Information Technology in University Libraries": Chen, Y., with a total of 3 publications, followed by Ali, Bahader, Baryshev, and Bhatti, each with 2 publications. This analysis is expected to inspire other authors to be more productive in publishing their research findings. Trends in research development, when viewed through author productivity, are often aligned with the dynamics of related research topics and the need for specific research outcomes (Faridan & Lawanda, 2024).

Another factor in trend analysis

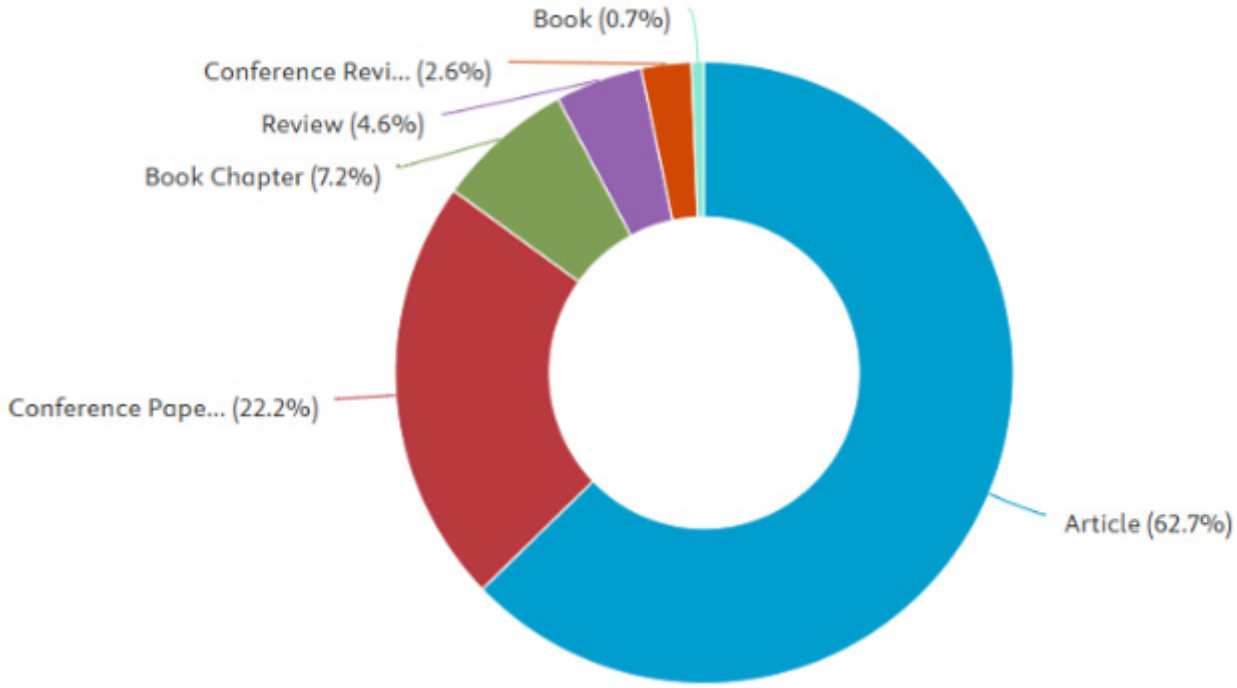

Figure 2. Pie Chart of Research Based on Document Type

Source: Scopus, 2025

involves categorizing research documents by type. This allows researchers to determine which document types are most commonly produced in this research area. Understanding the dominant or underrepresented document types can help future researchers assess the reasons behind such trends. This also aids researchers who may be unsure of which document type to use when studying related topics. Exploring different types of research outputs helps diversify the scholarly landscape.

The Figure 2 is a visualization of research data categorized by document type concerning the application of information technology in university libraries. Based on Figure 2, the types of research documents discussing the "Application of information technology in university libraries" in the 2015–2025 period are very diverse. The majority are published as scientific articles (96 documents), followed by conference papers (34 documents). Other formats include book chapters (11 documents), reviews (7 documents), conference reviews (4 documents), and, least commonly, books (1 document).

The final factor in trend analysis is the co-occurrence of keywords. This method identifies thematic relationships by analyzing the frequency of keywords appearing together in articles on related topics. Co-occurrence analysis employs software tools to visualize the results. In this study, VOSviewer is used as the analysis software, featuring three types of visual maps: network visualization, overlay visualization, and density visualization.

The process involves searching the Scopus database using the keywords "Information technologies" AND "University libraries," then filtering the results based on criteria such as publication dates within the last 10 years (2015 to 2025). The documents are then exported in CSV format and analyzed in the VOSviewer

application by selecting "Create," then "Create a map based on bibliographic data," followed by "Read data from bibliographic database files." The Scopus database is selected, the CSV file is uploaded, and "Co-occurrence analysis" is chosen. Finally, the appropriate visualization maps are selected.

Network visualization displays a number of keywords in each cluster that are interconnected within the network. In this analysis, more similar colors indicate a stronger relationship, and a larger circle size indicates that the topic is more frequently researched. The purpose of network visualization is to analyze the content, patterns, and trends of a collection of documents by measuring the strength of terms and calculating the number of keywords that appear together in the articles being studied (Russell & Rousseau, 2015).

Figure 3 visualizes 4 clusters with 27 keywords related to the research topic. Cluster 1 (Red): Consists of 10 items: artificial intelligence, big data, collaborative filtering, data mining, information services, libraries, library services, smart libraries, university libraries, and university library. Cluster 2 (Green): Consists of 10 items: academic libraries, articles, electronic resources, humans, information services, information technology, libraries, library management, and Pakistan. Cluster 3 (Blue): Consists of 4 items: engineering education, information systems, knowledge management, and students. Cluster 4 (Yellow): Consists of 3 items: digital libraries, information management, and universities. Based on the analysis,

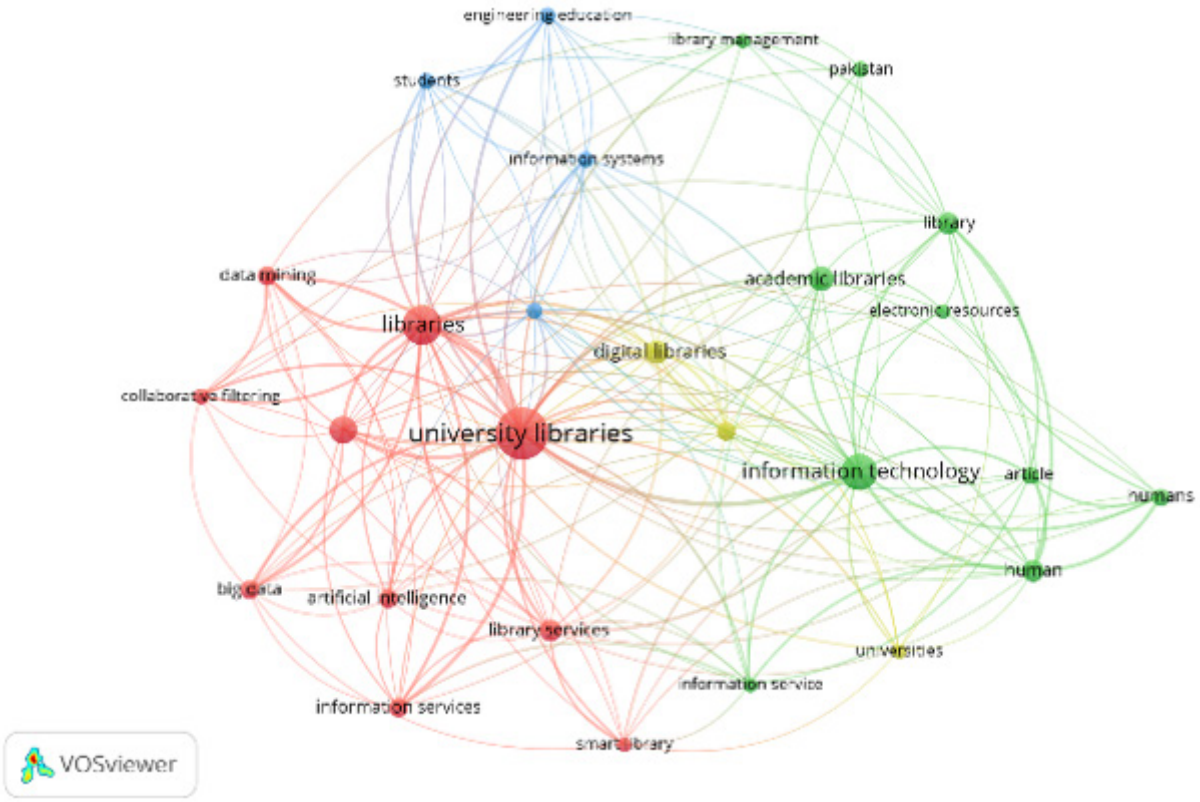

Figure 3. Network Vizualization

Source: VOSviewer, 2025

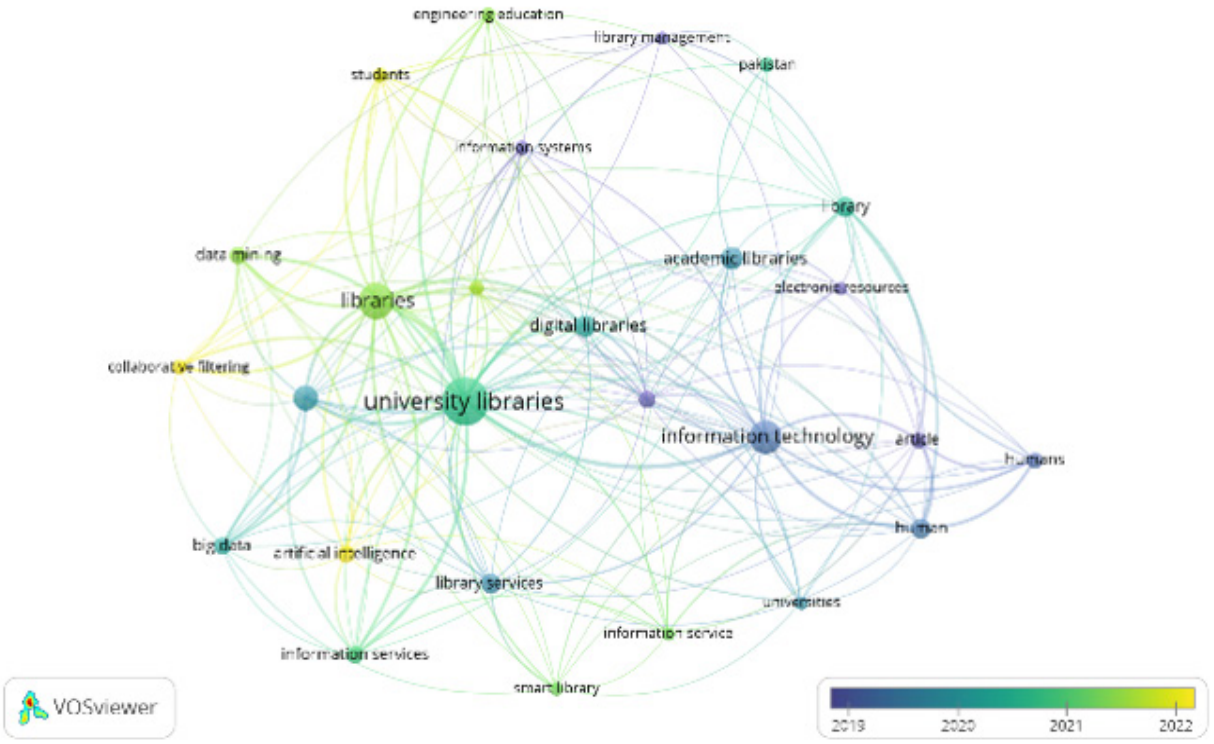

Figure 4. Overlay Vizualization

Source: VOSviewer, 2025

"University Library" is the main keyword most frequently researched and connected to other keywords.

Another form of mapping used to determine the historical traces and development of scientific publications is overlay visualization. Overlay visualization displays research topic trends based on the historical usage of keywords from year to year, indicated by differences in network colors. Prastya et al. (2021) explain that the darker the color of a node, the longer the topic has been discussed, whereas a lighter node indicates a more up-to-date topic. This analysis aims to identify gaps in previous research, thereby achieving novelty in future examinations (Rahman, 2023).

Figure 4 shows the overlay analysis for the research topic over the past 10 years. The keyword "university libraries" is highlighted with a large green circle and is the most frequently researched topic, with the majority of publications occurring in 2021. The keyword "information technology," shown in dark blue, indicates that this keyword was researched earlier than other themes. Meanwhile, the keyword "libraries," shown in yellow, is the newest keyword frequently used in the last 10 years. The publication time range can be seen through the color of each item: dark purple items represent earlier research (2019 and below), green items indicate research published around 2020, and light green to yellow items show the latest publication years (2021–2022).

The final type, density visualization, illustrates the intensity of keyword concentration in a given research area. This analysis also highlights less-explored research areas. Keyword saturation is shown through yellow-colored circles; the larger and brighter the item, the more frequently

Figure 5. Density Vizualization

Sumber: VOSviewer, 2025

it has been studied. Conversely, dimmer colors indicate that the keyword has rarely been used in research (Rahman, 2023). This suggests potential opportunities for future research using those underrepresented keywords (Karim et al., 2021).

The density visualization of information technology application in university libraries provides insight into the focus of this research topic shows in Figure 5. Figure 5 shows that the keyword "university libraries" was the most researched, as indicated by the bright yellow item and the largest circle, followed by the keywords 'libraries' and "information technologies." Meanwhile, the least researched keywords included "universities," "information service," "smart library," "humans," "electronic resources," "Pakistan," "library management," "information systems," and "collaborative filtering."

The limited research on these topics requires other authors to discuss related subjects to broaden the scope and provide diverse solutions to the problems faced by higher education institutions. This can add new perspectives for other libraries, especially university libraries, to apply information technology in all their services. This can help facilitate the fulfillment of users' needs and create satisfaction in utilizing existing services, thereby achieving the library's goal of providing excellent service.

Based on the presented visualizations and analysis, it can be concluded that research on the application of information technology in university libraries continues to evolve in response to the demands of the global era. Despite ongoing developments, there remain gaps that future researchers can address, potentially leading to theoretical advancements and innovations in this field. In line with the opinion of Faridan and Lawanda (2024), bibliometric analysis is expected to benefit researchers in determining research themes, evaluating literature on similar topics, and exploring developments and changes in various fields of science and technology that are useful for future research.

CONCLUSION

This study maps the development of publications related to the application of information technology in university libraries published in the Scopus database between 2015 and 2025. The results reveal that the highest trend in publications occurred in 2021. Afterward, there was a decline due to the effects of the COVID-19 pandemic, resulting in fluctuating development with a shift in focus from general technology issues to more specific concepts related to libraries.

The results confirm that the main themes have been widely discussed, while other issues such as smart libraries, library management, and collaborative systems are still rarely explored. The main contribution of this study is to reveal the research map and provide in-depth insights into global development trends and research directions. Therefore, the results of this study can be used as a reference for academics, researchers, and practitioners to better understand the dynamics of the development of information technology applications in university libraries and their relevance in meeting the needs of the academic community.

The gaps identified in this study can be used as a strategic basis for further study. Future research has the opportunity to expand the scope of the study, utilize more diverse analytical tools, and explore new and marginalized keywords and topics. The limitations of this study lie in its reliance on a single database and analytical tool, so the results are not yet comprehensive. Therefore, further research is recommended to use a broader database and different analytical approaches to produce more comprehensive findings.

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