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# Mapping Global Patterns in Library Technologies in Educational Management: Basis for Digital Literacy and Capacity-Building Programs

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## ABSTRACT

This study mapped global patterns in library technologies within educational management as a basis for designing digital literacy and institutional capacity-building programs. Using a bibliometric research design complemented by thematic content analysis, the study retrieved and analyzed Scopus-indexed scholarly documents published from 2023 to 2025. Bibliometric processing was conducted through Scopus analytics, Biblioshiny, and VOSviewer, while thematic interpretation was used to connect publication patterns with capacity needs. The final dataset comprised 11,797 peer-reviewed documents after PRISMA-guided screening from 12,166 initially identified records. Findings revealed a sharp growth in scholarly production, increasing from 2,600 documents in 2023 to more than 5,000 in 2025. The intellectual structure of the field was dominated by artificial intelligence, generative AI, higher education, and teaching and learning. Research production was concentrated in China and the United States, while institutional productivity was led by Tecnologico de Monterrey. Articles and conference papers formed the largest share of document types, and the field drew strongly from Social Sciences, Computer Science, Engineering, and Decision Sciences. Funding patterns were also concentrated among large national and international sponsors, indicating the continuing influence of resource capacity on research production. The study concludes that library technologies have shifted from support services into strategic assets for educational management. It recommends a Digital Literacy and Capacity-Building Program anchored on technical skills, pedagogical integration, governance, resource mobilization, multidisciplinary collaboration, and equity.

**Keywords**: *bibliometric analysis, digital literacy, educational management, institutional capacity building, library technologies, VOSviewer*

## INTRODUCTION

The contemporary transformation of education has repositioned library technologies as strategic assets for institutional governance, academic delivery, and inclusive access to knowledge. Libraries are no longer limited to the management of printed collections; they now operate as technology-enabled ecosystems that support digital archiving, virtual reference services, institutional repositories, integrated learning platforms, and AI-assisted resource discovery (Asemi et al., 2020; Khan et al., 2023). This shift also redefines the professional role of librarians from custodians of information to facilitators of digital fluency, research support, and data curation.

Educational management has likewise moved toward digitization, data-driven decision-making, and learner-centered delivery. Smart libraries, cloud-based systems, interoperable platforms, and digital repositories support academic collaboration and enable administrators to make evidence-based decisions on resource allocation,

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curriculum support, and institutional planning (Jin et al., 2025; Useche et al., 2022). When library services are embedded into learning management systems and other institutional platforms, they become part of a wider academic infrastructure that connects instruction, research, and governance.

Despite these developments, the global adoption of library technologies remains uneven. High-income and digitally advanced regions often benefit from stable connectivity, policy support, funding, skilled personnel, and access to advanced platforms. In contrast, many institutions in resource-constrained contexts face persistent barriers related to infrastructure, digital skills, funding, and governance (Obande et al., 2024; World Bank, 2022). The digital divide is therefore not only a matter of hardware access but also a matter of capacity, policy, human capital, and sustainable institutional support.

Although prior studies have examined specific library systems, digital repositories, user experiences, and smart library applications, fewer studies have mapped the broader global scholarly landscape of library technologies within educational management. This gap limits the ability of educational leaders, policymakers, and library professionals to understand how research trends, institutional productivity, country participation, subject areas, and funding patterns shape the field. Responding to this need, the present study mapped global research patterns from 2023 to 2025 and used the findings as the basis for a Digital Literacy and Capacity-Building Program for educational management.

## Literature Review

### *Library technologies and educational management*

The literature consistently describes the transition of libraries from passive repositories into active digital knowledge hubs. Integrated Library Systems, discovery tools, digital repositories, and smart library platforms have improved resource accessibility, remote access, and institutional decision-making (Isiaka et al., 2024; Omolayo & Adedoyin, 2020). In higher education, these technologies support flexible learning models, curriculum alignment, student success initiatives, and evidence-based collection development (Kabo, 2025; Sung & Wang, 2025).

Recent discussions also show the growing influence of artificial intelligence, machine learning, cloud platforms, and analytics in library operations. These technologies allow libraries to provide personalized search, automated metadata processing, predictive resource management, and data-informed services (Asemi et al., 2020; Huang et al., 2023). However, their effectiveness depends not only on technical capacity but also on institutional strategy, governance, staff competence, and user readiness.

### *Digital literacy, capacity building, and equity*

Digital literacy is increasingly understood as a multidimensional competence that includes technical use, information evaluation, ethical digital behavior, algorithmic awareness, and the capacity to apply digital tools meaningfully in academic and professional settings (Breen et al., 2022; Garcia, 2023). For librarians and faculty members, digital literacy includes the ability to manage digital resources, support research data management, use discovery platforms, and guide students in responsible information use (Jain, 2023; Lo, 2024).

Capacity building is central to the successful use of library technologies. Institutions that invest in staff development, policy support, infrastructure, resource mobilization, and cross-disciplinary collaboration are better positioned to sustain digital transformation (Buchan et al., 2024; Gerhart & Feng, 2021). In the ASEAN and Philippine contexts, studies and policy reports emphasize the urgency of building library staff competencies, improving digital infrastructure, and aligning digital services with broader educational transformation agendas (ASEAN Foundation, 2024; Buenrostro & Cabbab, 2022; Esposo-Betan & Fresnido, 2022).

### *Challenges in adoption and implementation*

Implementation challenges include limited funding, poor connectivity, lack of technical expertise, weak policy frameworks, fragmented standards, and inadequate institutional planning (Ahmad & Rafiq, 2022; Lagas & Isip, 2023). These barriers are especially visible in institutions where digital projects are implemented as short-term responses rather than sustained strategic initiatives. The literature also warns that advanced technologies such as AI

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may intensify inequality when institutions adopt them without adequate ethical guidelines, training, and data governance (IFLA, 2022; UNESCO, 2023).

Global patterns of adoption reveal that technological innovation is shaped by national funding systems, institutional leadership, research capacity, and collaborative networks (Isono & Prilliadi, 2023; Thangiah et al., 2024). Therefore, the success of library technology integration requires a holistic approach that combines technical training, pedagogy, policy, resource mobilization, collaboration, and equity. These dimensions informed the development of the proposed Digital Literacy and Capacity-Building Program in this study.

## METHODS

### Research Design

This study employed a bibliometric research design complemented by thematic content analysis. Bibliometric analysis was used to examine global scholarly patterns, publication growth, prolific sources, authors, affiliations, countries, document types, subject areas, funding sponsors, and keyword structures. Thematic content analysis was used to interpret the implications of the bibliometric patterns for digital literacy and institutional capacity building.

### Research Locale

The study was global in scope and used Scopus-indexed publications as the research environment. The analysis focused on scholarly literature on library technologies within the context of educational management from 2023 to 2025.

### Sources of Data

The primary source of data was the Scopus database. The search strategy used combinations of terms related to libraries, library technologies, digital libraries, library automation, information systems, ICT, educational technology, learning technology, smart campuses, artificial intelligence, educational management, higher education, school administration, and institutional management. Only peer-reviewed journal articles, conference papers, and review articles relevant to the study were retained.

### Data Gathering Procedure

The initial search identified 12,166 records. Using PRISMA-guided screening, irrelevant document types such as editorials, notes, short surveys, conference reviews, errata, and out-of-scope records were removed. After screening and eligibility assessment, 11,797 documents were included in the bibliometric analysis. Bibliographic records were exported and cleaned by standardizing author names, harmonizing keywords, checking incomplete records, and preparing the dataset for analysis.

Table 1. *Summary of PRISMA-Guided Screening Process*

| Stage | Number / Description |
|---|---|
| Records identified from Scopus database | 12,166 |
| Records screened and assessed for eligibility | 11,797 |
| Editorials excluded | 146 |
| Notes excluded | 91 |
| Short surveys excluded | 63 |
| Conference reviews excluded | 61 |
| Errata excluded | 8 |
| Final records included in bibliometric analysis | 11,797 |

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### Data Analysis

Scopus analytics was used to generate descriptive indicators such as annual publication counts, source productivity, author productivity, affiliation productivity, country distribution, document types, subject areas, and funding sponsors. Biblioshiny was used for interactive bibliometric exploration, while VOSviewer was used to visualize keyword co-occurrence networks and identify thematic clusters. Thematic content analysis was applied to interpret how these bibliometric patterns reflected institutional capacity needs.

### Ethical Consideration

The study used publicly available bibliographic metadata and did not involve human participants, personal interviews, surveys, or private institutional records. Ethical care was observed by reporting bibliometric patterns accurately, avoiding unsupported claims, and using the data only for scholarly analysis and program development.

## RESULTS AND DISCUSSION

### Global research trends

The keyword co-occurrence network showed a research landscape centered on artificial intelligence, generative AI, higher education, education, teaching, and learning. These terms functioned as the most visible nodes in the network, indicating that current research on library technologies in educational management is strongly shaped by the rise of AI-driven educational transformation. The clustering also suggests that studies are not merely technical; they are tied to teaching practice, institutional governance, and learning improvement.

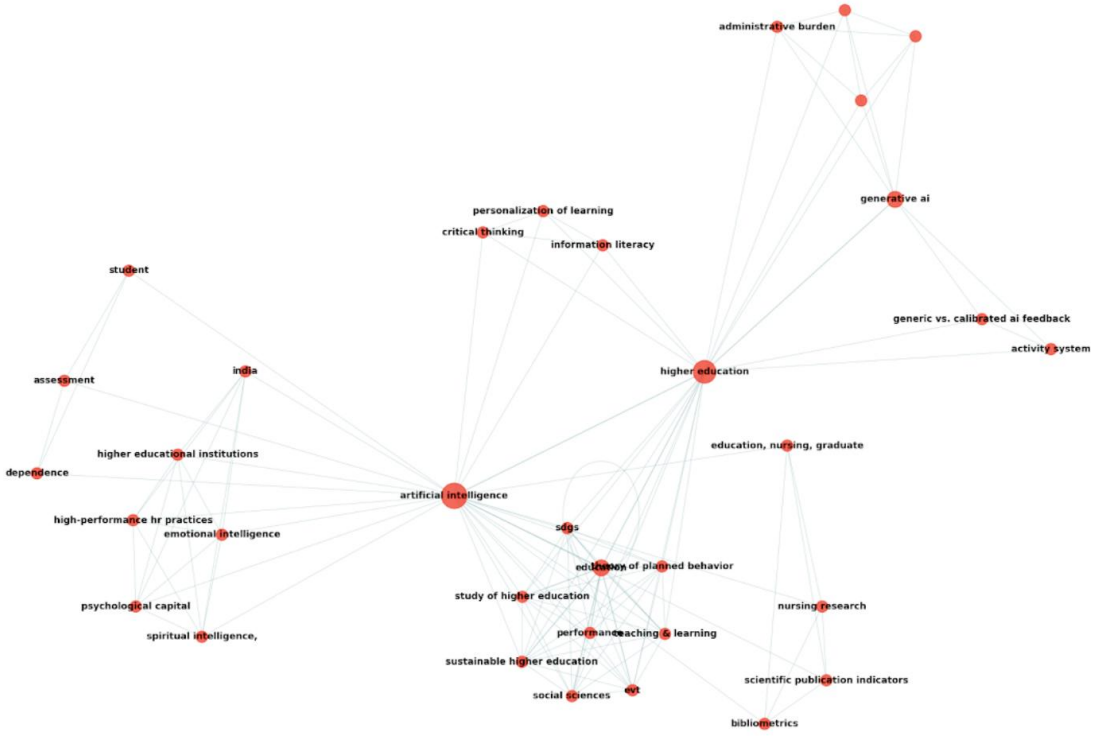


Figure 1. *Global Research Trend Based on Keyword Co-Occurrence Network*

This finding supports recent literature showing that AI and data-driven systems have become central to educational technology and library management (Huang et al., 2023; Lo, 2024). The implication is that digital literacy programs for library technologies must include AI literacy, information evaluation, data ethics, and responsible use of automated discovery tools.

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**Volume and growth of publications**

Publication output increased sharply during the study period. The number of documents rose from 2,600 in 2023 to more than 5,000 in 2025. This growth confirms that library technologies in educational management have become an expanding global research area and that the 2023-2025 timeframe captured a period of rapid scholarly acceleration.

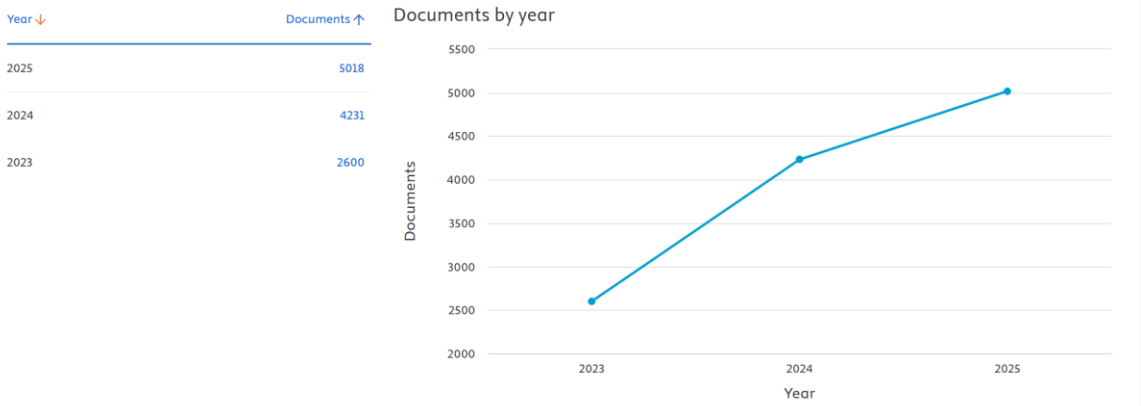


Figure 2. *Documents by Year*

The exponential growth of publications reflects the increasing urgency of digital transformation in educational institutions. From the perspective of Diffusion of Innovations theory, this surge indicates a fast-moving adoption environment in which library technologies are increasingly seen as advantageous and strategically necessary. However, the growth of research also implies a parallel need for institutions to develop the competencies required to use these technologies effectively.

**Source productivity**

The document-per-year-by-source analysis revealed that the intellectual production of the field was concentrated in a small number of publishing venues. Source A contributed the largest number of publications, followed by other secondary sources. This concentration indicates that the knowledge base is shaped by a limited set of platforms, many of which are technology-oriented rather than education-specific.

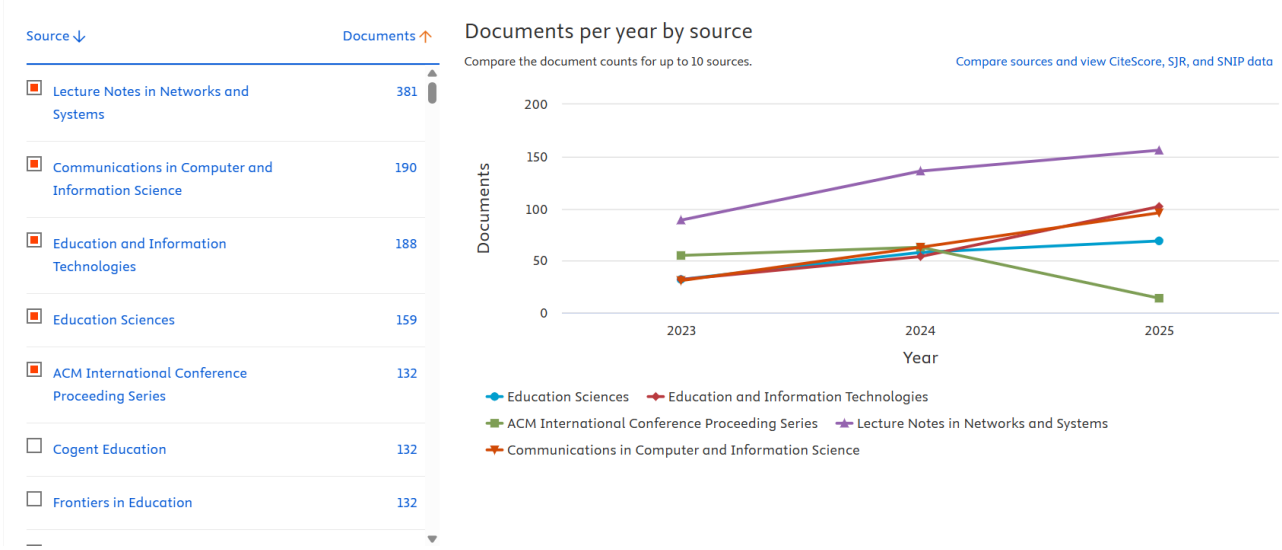


Figure 3. *Documents per Year by Source*

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This pattern suggests the presence of knowledge chokepoints. Institutions seeking to design evidence-based capacity programs should therefore systematically review core sources rather than rely on scattered literature. From a Resource-Based View, access to and interpretation of these sources becomes part of an institution's strategic knowledge capital (Gerhart & Feng, 2021).

## Author productivity

Author productivity was led by a single top contributor, although the overall pattern was decentralized. The remaining authors were widely dispersed, indicating that the field is shaped by a broad and multidisciplinary scholarly community rather than by one dominant authority.


Figure 4. *Documents by Author*

The dispersed authorship pattern confirms the interdisciplinary nature of library technology research. It integrates perspectives from library and information science, educational technology, computer science, decision sciences, management, and policy studies. Consequently, capacity-building programs must not be limited to technical training but should include governance, pedagogy, ethical use, and institutional planning.

## Affiliation productivity

The analysis of documents by affiliation revealed that Tecnologico de Monterrey was the leading institution, producing 259 documents. It was followed by the University of South Africa, University of Johannesburg, Universidad Cesar Vallejo, and Universidad de Salamanca. The large gap between the leading institution and the remaining affiliations demonstrates the uneven distribution of research capacity.

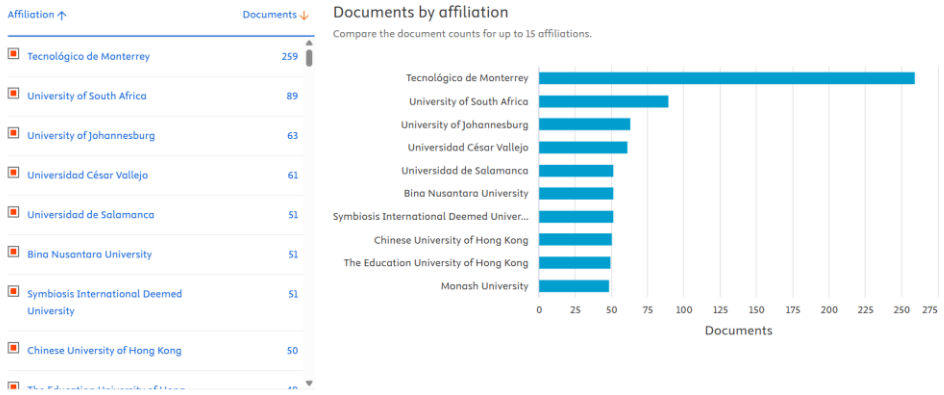


Figure 5. *Documents by Affiliation*

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This result suggests that advanced research on library technologies is concentrated in institutions with stronger infrastructure, funding, human capital, and research systems. The finding reinforces the need for knowledge transfer partnerships between research-leading institutions and institutions with limited capacity.

**Country productivity**

The country distribution showed that China and the United States dominated scholarly production, followed by India and the United Kingdom. This geographic concentration reflects a global imbalance in knowledge production and indicates that research leadership is shaped by national investment, research funding, and technological infrastructure.

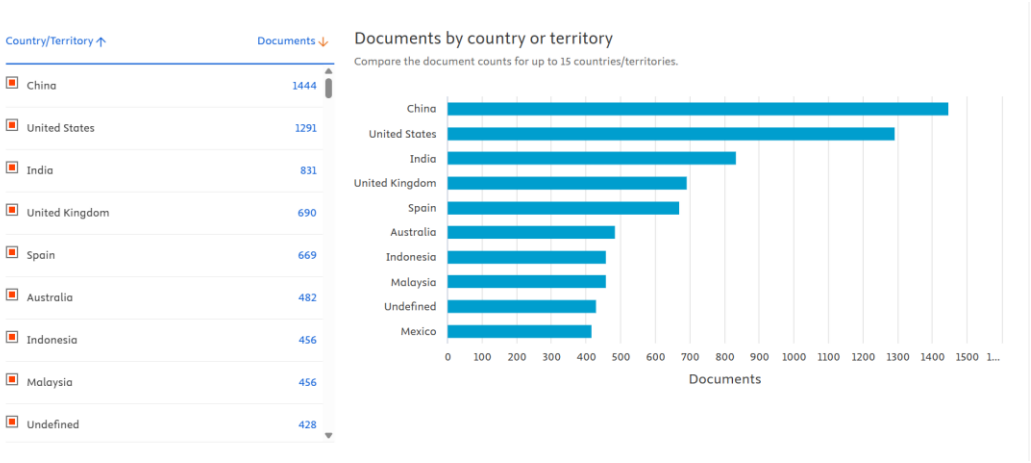


Figure 6. *Documents by Territory*

The result illustrates the continuing digital divide in both technology adoption and knowledge generation. Countries with stronger research infrastructure tend to set the global research agenda, while lower-capacity regions remain underrepresented. This makes international collaboration, open access to knowledge, and capacity development essential for equitable digital transformation.

**Document types**

Articles and conference papers accounted for nearly 80% of the scholarly output. Articles comprised 53.0% of the dataset, while conference papers represented 26.0%. Book chapters and reviews formed smaller proportions.

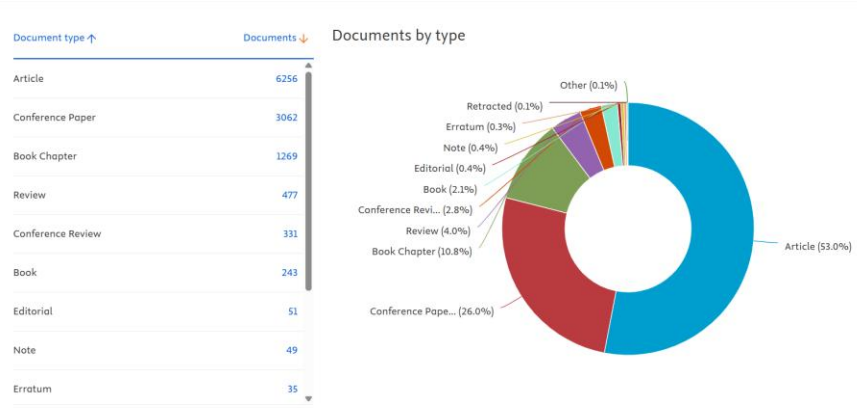


Figure 7. *Documents by Type*

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The dominance of peer-reviewed articles and conference papers indicates that the field has a strong empirical and academic foundation. This supports the use of the dataset as a reliable basis for developing the proposed Digital Literacy and Capacity-Building Program.

**Subject areas**

The subject area distribution confirmed the multidisciplinary structure of the field. Social Sciences contributed the largest share, followed by Computer Science, Engineering, and Decision Sciences. Together, Social Sciences and Computer Science accounted for more than half of the total documents.

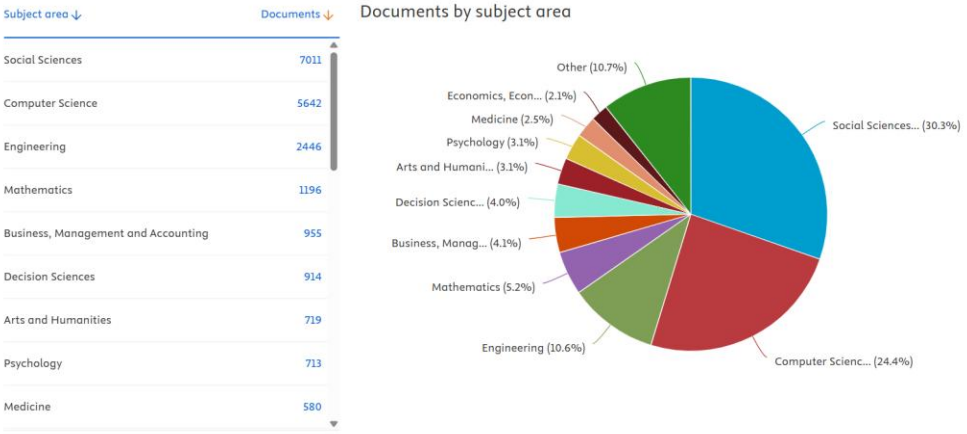


Figure 8. *Documents by Subject Area*

This finding means that library technology adoption is both a technical and social process. Computer Science and Engineering contribute to system design and infrastructure, while Social Sciences and Decision Sciences explain user behavior, management decisions, policy, and organizational readiness. Therefore, the proposed program must combine technical proficiency with pedagogical, managerial, and ethical competencies.

**Funding sponsors**

The analysis of funding sponsors showed that research support was concentrated among a small number of large national and international funding bodies. This pattern indicates that research on library technologies is often driven by strategic national priorities and by the availability of substantial funding resources.

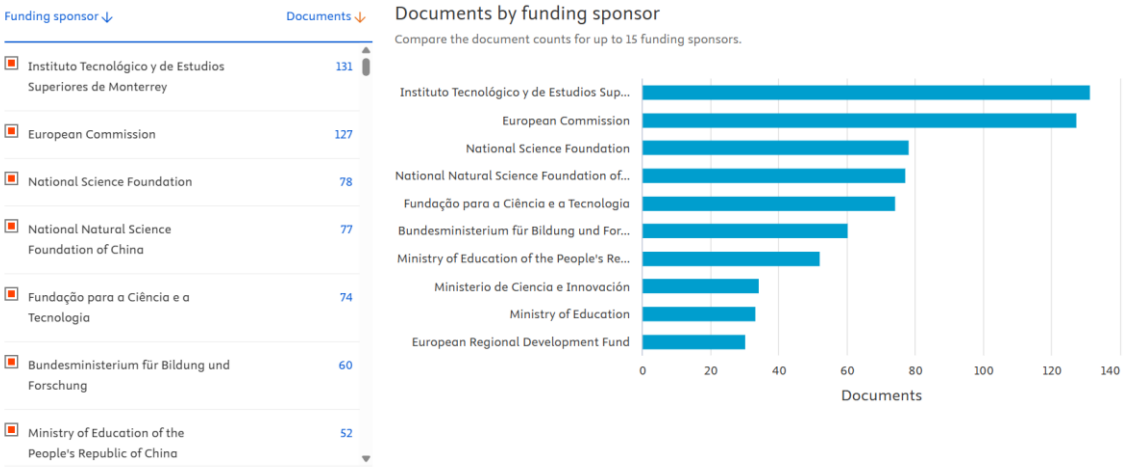


Figure 9. *Documents by Funding Sponsor*

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The concentration of funding has important implications for institutions in resource-constrained settings. Without funding and partnership strategies, institutions with limited budgets may struggle to conduct research, adopt advanced technologies, and sustain digital transformation. For this reason, resource mobilization was included as a major pillar of the proposed program.

**Proposed digital literacy and capacity-building program**

Based on the bibliometric and thematic findings, the study proposed a Digital Literacy and Institutional Capacity-Building Program organized around six interconnected pillars: technical skills development, pedagogical integration, policy and governance, resource mobilization, multidisciplinary collaboration, and equity and inclusion. These pillars respond directly to the observed patterns of rapid technological growth, concentrated knowledge production, geographic disparities, and multidisciplinary requirements.


Figure 10. *Digital Literacy and Institutional Capacity-Building Program*

Table 2. *Plan of Action for the Digital Literacy and Capacity-Building Program*

| Key Finding | Strategy / Activity | Objective | Key Performance Indicator | Persons Involved | Timeframe | Source of Funds |
|---|---|---|---|---|---|---|
| Limited technical proficiency | Training on ILS, repositories, and AI tools | Enhance technical skills | Percentage of staff trained; system utilization rates | Librarians and IT staff | Year 1-2 | Institutional ICT budget; external grants |
| Gaps in pedagogical integration | Faculty workshops and curriculum redesign | Integrate digital literacy in teaching | Number of courses redesigned; student competency scores | Faculty and curriculum developers | Year 1-3 | University budget; partnerships |
| Policy gaps | Develop institutional guidelines | Establish governance frameworks | Approved policies; compliance audits | Administrators and policymakers | Year 1 | Institutional funds |

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| | | | | | | |
|---|---|---|---|---|---|---|
| Funding constraints | Grant writing and partnership development | Mobilize resources | Grants secured; partnerships formed | Resource mobilization office | Year 1-3 | National, international, and private partners |
| Limited collaboration | Cross-disciplinary projects | Foster collaboration | Joint projects; publications | Faculty across disciplines | Year 2-3 | Collaborative grants |
| Digital divide | Equity-focused capacity programs | Promote inclusion | Participation of low-resource institutions | Partner institutions | Year 1-3 | International collaborations |

## CONCLUSION

The study concludes that library technologies in educational management have become a rapidly expanding and strategically important research field. The sharp increase in publications from 2023 to 2025 demonstrates the growing global urgency of digital transformation. Within this growth, artificial intelligence, generative AI, higher education, and teaching and learning emerged as the strongest thematic centers, showing that the field is increasingly concerned with how advanced technologies reshape instructional delivery, academic services, and institutional governance.

The findings also show that knowledge production remains uneven. Research output is concentrated in a limited number of sources, institutions, countries, and funding systems. China and the United States dominate country productivity, while Tecnologico de Monterrey leads institutional productivity. These patterns reveal that the global digital divide extends beyond access to technology and includes disparities in research capacity, funding, institutional infrastructure, and specialized expertise.

Overall, successful adoption of library technologies requires a holistic and multidisciplinary approach. The field draws from Social Sciences, Computer Science, Engineering, and Decision Sciences; therefore, capacity building must combine technical skills, pedagogical integration, policy governance, resource mobilization, collaboration, and equity. The proposed Digital Literacy and Capacity-Building Program provides an evidence-based framework for strengthening institutional readiness and promoting inclusive digital transformation in educational management.

### Recommendations

Educational institutions should prioritize structured digital literacy programs that include AI literacy, information evaluation, responsible use of digital tools, metadata awareness, digital preservation, and the management of library systems. Faculty development should also focus on integrating library technologies into pedagogy, curriculum design, research support, and learner-centered instruction.

Institutional leaders should establish sustainable governance structures for library technologies. These should include policies on digital preservation, intellectual property, data privacy, ethical AI use, interoperability, and long-term system maintenance. Libraries should be included in institutional planning because they serve as strategic partners in research, teaching, and academic decision-making.

Institutions in resource-constrained contexts should strengthen resource mobilization and partnership development. Collaborative arrangements with leading universities, professional library networks, government agencies, international organizations, and private technology partners may support funding, training, infrastructure improvement, and knowledge transfer. Future researchers may expand the study by including additional databases, longer publication periods, and qualitative interviews with library professionals and educational leaders.

## References

Ahmad, R., & Rafiq, M. (2022). Global perspective on digital preservation policy: A systematic review. Journal of Librarianship and Information Science, 55, 859-867. https://doi.org/10.1177/09610006221111572

Asemi, A., Ko, A., & Nowkarizi, M. (2020). Intelligent libraries: A review on expert systems, artificial intelligence, and robot. Library Hi Tech, 39(2), 412-434. https://doi.org/10.1108/lht-02-2020-0038

ASEAN Foundation. (2024). ASEAN Digital Literacy Programme. https://aseanfoundation.org/programme/asean-digital-literacy-programme

Breen, M., Waters, J., & O'Shea, L. (2022). Taking a lead on digital literacy for students: A case study from the library at the University of Limerick. New Review of Academic Librarianship, 29(1), 11-32. https://doi.org/10.1080/13614533.2022.2039243

Buenrostro, J. C., & Cabbab, J. F. (2022). Libraries and digital citizenship. Philippine Journal of Librarianship and Information Studies. https://phjlis.org/index.php/phjlis/article/view/116/70

Buchan, M. C., Bhawra, J., & Katapally, T. R. (2024). Navigating the digital world: Development of an evidence-based digital literacy program and assessment tool for youth. Smart Learning Environments, 11(1). https://doi.org/10.1186/s40561-024-00293-x

Esposo-Betan, S. M., & Fresnido, A. M. (2022). COVID-19 and Philippine academic libraries. International Journal of Librarianship, 7(1), 3-20. https://doi.org/10.23974/ijol.2022.vol7.1.215

Garcia, M. (2023). Redefining digital literacy: From basic skills to algorithmic awareness. International Journal of Information Science, 29(4), 210-225. https://doi.org/10.1016/j.ijinf.2023.08.004

Gerhart, B., & Feng, J. (2021). The resource-based view of the firm, human resources, and human capital: Progress and prospects. Journal of Management, 47(7), 1796-1819. https://doi.org/10.1177/0149206320978799

Huang, Y., Cox, A. M., & Cox, J. (2023). Artificial intelligence in academic library strategy in the United Kingdom and the Mainland of China. The Journal of Academic Librarianship, 49(6), 102772. https://doi.org/10.1016/j.acalib.2023.102772

IFLA. (2022). IFLA Trend Report 2021 update released. https://librarianship.ca/news/ifla-trend-report-2021/

Isiaka, T. A., et al. (2024). The historical evolution of academic libraries: Repositories to digital hubs in the fourth industrial revolution. IGI Global.

Isono, I., & Prilliadi, H. (2023). ASEAN's digital integration: Evolution of framework documents. Economic Research Institute for ASEAN and East Asia. https://www.eria.org/research/aseans-digital-integration-evolution-of-framework-documents

Jain, P. (2023). Assessing digital proficiency requirements for library and information services professionals in the digital age. Library Philosophy and Practice, 15612. https://digitalcommons.unl.edu/libphilprac/15612

Jin, R., et al. (2025). Data-driven educational decision-making: How to enhance educational quality and management efficiency. Journal of Higher Education Research, 5(6). https://doi.org/10.32629/jher.v5i6.3385

Kabo, P. (2025). Longitudinal associations between online usage of library-licensed content and undergraduate student performance. College & Research Libraries, 86(3).

Khan, A., et al. (2023). From traditional to emerging technologies in supporting smart libraries: A bibliometric and thematic approach from 2013 to 2022. Library Hi Tech, 43, 590-621. https://doi.org/10.1108/lht-07-2023-0280

Lagas, S., & Isip, J. (2023). Challenges to digital services in Philippine academic libraries. Philippine Journal of Librarianship and Information Studies. https://phjlis.org/index.php/phjlis/article/view/133

Lo, L. S. (2024). Evaluating AI literacy in academic libraries: A survey study with a focus on U.S. employees. College & Research Libraries, 85(5), 635. https://doi.org/10.5860/crl.85.5.635

Obande, B., et al. (2024). Challenges of e-library in developing countries higher educational institutions. Computing and Artificial Intelligence, 2(1). https://doi.org/10.59400/cai.v2i1.1349

Omolayo, B., & Adedoyin, R. A. (2020). Challenges associated with adoption and use of digital information resources in federal university libraries in Nigeria. Jewel Journal of Librarianship, 13(1), 1-19.

Roig-Mahrin, A., & Prieto, S. (2021). English literature students' perspective on digital resources in a Spanish university. The Journal of Academic Librarianship. https://doi.org/10.1006/j.acalib.2021.102461

Sung, H., & Wang, Y. (2025). Library analytics and resource allocation in data-informed academic management. Journal of Academic Library Management, 14(2), 45-62.

Thangiah, R., A, M. J. L., R, R., & T, A. M. S. (2024). Digital transformation of academic libraries. In Advances in library and information science (pp. 307-328). https://doi.org/10.4018/979-8-3693-2782-1.ch017

UNESCO. (2023). Technology in education: A tool on whose terms? Global Education Monitoring Report 2023.
Useche, A., et al. (2022). Reflexive pedagogy at the heart of educational digital transformation in Latin American higher education institution. International Journal of Educational Technology in Higher Education, 19. https://doi.org/10.1186/s41239-022-00365-3
World Bank. (2022). Digital transformation of Philippine higher education. https://ideas.repec.org/p/wbk/wboper/38481.html