

Libraries and Digital Transformation

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Abstract

The rapid advancement of digital technologies has brought significant changes to the functioning of libraries and information centres. Libraries are increasingly adopting digital tools and services to improve access to information, enhance operational efficiency, and meet the evolving needs of users. The study is based on a review of relevant scholarly literature in libraries and explores the role of key technologies such as library automation systems, digital libraries, institutional repositories, electronic resources, and emerging smart technologies. The study is based on a review of relevant scholarly literature, reports, and professional publications related to digital transformation in academic and research libraries. The review found that digital technologies improve information accessibility, resource management, research visibility, and user engagement. digital technologies have improved information accessibility, resource management, research visibility, and user engagement. Libraries are still dealing with a lot of problems. These problems are about things like buildings teaching the staffs helping people uses computers getting money and keeping information safe. The paper says that libraries need to plan get better at what they do and use the right technology if they want to do well with digital projects. Digital transformation is really important for libraries to stay up, to date. It helps with teaching, learning, research and sharing knowledge in the world. Libraries need transformation to support these things.

Keywords: Digital Transformation, Library Automation, Digital Libraries, Institutional Repositories, E-Resources, Academic Libraries.

Introduction

Libraries help a lot with education, research and sharing knowledge. With all the digital tech around libraries can now give people faster and easier access to information. This change involves

using things like library computers, online libraries and cloud services.

These new technologies have made it easier to manage resources help users and get to information from anywhere. Libraries still have problems with things like not enough money staff not knowing enough about tech and keeping data safe. This paper looks at the trends, benefits and challenges of digital changes in libraries and shows why it's important, for making libraries modern and focused on users.

Objectives of the Study

- 1) To examine the concept of digital transformation in libraries.
- 2) To identify major digital technologies used in library services.
- 3) To analyze the benefits and challenges of digital transformation.
- 4) To suggest strategies for effective implementation of digital initiatives in libraries.

Need for the Study

- Rapid advancements in digital technologies have significantly transformed library operations and services.
- Libraries are increasingly adopting automation, digital repositories, e-resources, and artificial intelligence to improve service delivery.
- The growing demand for remote and instant access to information requires libraries to develop robust digital infrastructures.
- Digital transformation enhances information accessibility, resource sharing, and user engagement.
- Libraries face challenges such as budget limitations, technological obsolescence, cybersecurity concerns, and staff training requirements.
- There is a need to understand emerging technologies and their impact on library management and information services.
- A comprehensive review of current trends can assist library professionals in making informed decisions regarding technology adoption.
- The study provides insights into best practices for developing sustainable and user-centric digital library services.

- The findings may support policymakers and library administrators in formulating effective digital transformation strategies.
- The study contributes to the existing body of knowledge on the future direction of libraries in the digital era.

Literature Review

Digital transformation has become a prominent area of research in Library and Information Science, reflecting the growing adoption of digital technologies to improve library operations, information access, and user services. Recent studies have examined the implementation of technologies such as library automation systems, digital repositories, electronic resources, cloud computing, and artificial intelligence in academic and research libraries.

Singh and Asif (2019) emphasized that emerging digital technologies and open-source library management systems have significantly modernized library operations by improving efficiency and accessibility. Indr  k and Pokorn   (2021) reported that digital transformation enhanced research library services through the effective integration of digital infrastructure and user-oriented information services. Similarly, Rafiq, Ameen, and Javed (2021) observed that the successful implementation of digital technologies depends on organizational readiness, strategic planning, and continuous professional development.

Research by Kempf (2023) highlighted that digital transformation extends beyond technology adoption and requires changes in organizational culture, service models, and leadership practices. Liman and Aliyu (2023) further demonstrated that digital innovation has improved resource management, operational efficiency, and service quality in academic libraries. The Association of College and Research Libraries (2022) also identified digital scholarship, research data management, open educational resources, and online learning support as emerging priorities for academic libraries.

Recent studies have increasingly focused on the application of artificial intelligence and smart technologies. Sharma and Bansal (2022) discussed the use of artificial intelligence for information retrieval, virtual reference services, and intelligent decision support in libraries. Likewise, Yuvaraj (2020) highlighted the growing role of machine learning, natural language processing, and recommendation systems in improving user engagement and personalized library services. Shimray, Subaveerapandiyan, and Ahmad (2025) further reported that artificial intelligence,

electronic resources, and online public access catalogues have significantly enhanced information discovery and user satisfaction in academic libraries.

Although previous studies have extensively discussed individual aspects of digital transformation, relatively few have synthesized these technological developments into a comprehensive review. Therefore, the present study integrates the existing literature to provide a broader understanding of the major technologies, emerging trends, opportunities, and challenges influencing the digital transformation of libraries.

Table 1. Summary of Reviewed Studies

Author(s)	Year	Research Focus	Methodology	Key Findings
Singh & Asif	2019	Digital transformation and emerging technologies in libraries	Literature Review	Emerging digital technologies and open-source software enhanced library operations, information access, and service efficiency.
Indrák & Pokorná	2021	Digital transformation of research library services	Case Study	Digital technologies improved research support, accessibility, and service quality.
Rafiq, Ameen & Javed	2021	Digital transformation in libraries	Review Study	Strategic planning, staff competencies, and organizational readiness were critical for successful digital transformation.
Association of College and Research Libraries (ACRL)	2022	Trends in academic libraries	Review Report	Digital scholarship, open educational resources, research data management, and online

				learning support emerged as major priorities.
Sharma & Bansal	2022	Artificial intelligence in academic libraries	Review Study	Artificial intelligence improved information retrieval, virtual reference, and library decision support.
Kempf	2023	Digital transformation in libraries	Conceptual Study	Successful digital transformation requires organizational change in addition to technology adoption.
Liman & Aliyu	2023	Digital innovation in academic libraries	Content Analysis	Digital technologies improved operational efficiency, resource management, and user services.
Shimray, Subaveerapandiyan & Ahmad	2025	Digital transformation in academic libraries	Empirical Study	Electronic resources, OPACs, and AI significantly enhanced information discovery and user satisfaction.
Naikar & Paul	2025	Smart libraries	Review Study	Smart technologies and AI are reshaping future library services and user engagement.

Methodology

The present study adopted a descriptive and qualitative review methodology to examine the digital transformation of libraries. Relevant literature was collected from scholarly journals, conference proceedings, books, research reports, and online databases related to library and information science. The sources were identified through electronic databases such as Google Scholar, Scopus, Web of Science, IEEE Xplore, and ScienceDirect using keywords including "digital

transformation," "library automation," "digital libraries," "institutional repositories," "artificial intelligence in libraries," and "e-resources."

The collected literature was carefully reviewed, analyzed, and categorized according to major themes and technological developments in library services. Particular attention was given to recent studies that discuss emerging technologies, implementation strategies, opportunities, and challenges associated with digital transformation in libraries. The findings from the selected literature were synthesized to identify key trends and their implications for the future development of library and information services.

Table 2. Summary of the Research Methodology

Aspect	Description
Research Design	Descriptive Review Study
Nature of Study	Qualitative and Analytical
Data Sources	Journals, Books, Conference Proceedings, Reports, and Online Databases
Databases Used	Google Scholar, Scopus, Web of Science, IEEE Xplore, ScienceDirect
Keywords	Digital Transformation, Library Automation, Digital Libraries, AI in Libraries, E-Resources
Data Collection Method	Literature Review
Data Analysis Technique	Thematic Analysis and Content Analysis
Study Focus	Trends, Technologies, Opportunities, and Challenges in Digital Transformation of Libraries

Key Trends in Digital Transformation of Libraries

Digital transformation has significantly reshaped library operations through the integration of information and communication technologies into core services. The reviewed literature indicated that libraries have adopted a wide range of digital technologies, including Integrated Library

Systems, digital repositories, electronic resources, artificial intelligence, cloud computing, and mobile applications, to improve operational efficiency and user services. These technologies have enhanced information accessibility, resource management, scholarly communication, and research support. Consequently, libraries have evolved from traditional information repositories into technology-enabled knowledge centres that support teaching, learning, research, and lifelong learning.

Trends in Digital Transformation of Libraries

The reviewed literature identified several major trends that characterize the digital transformation of modern libraries reviewed literature indicated that libraries have adopted a wide range of digital technologies to improve operational efficiency, information accessibility, and user services. Library automation systems have streamlined routine operations, while digital libraries and institutional repositories have enhanced the preservation and dissemination of scholarly resources. Electronic resources and online databases have expanded remote access to academic information, supporting teaching, learning, and research activities. The integration of artificial intelligence, cloud computing, mobile technologies, data analytics, and open-access initiatives has further transformed libraries into technology-driven knowledge centres. Collectively, these trends demonstrate that digital transformation has strengthened library services and enabled institutions to respond more effectively to the evolving information needs of users.

Table 3. Major Trends in Digital Transformation of Libraries

Trend	Description	Major Technologies/Tools	Benefits
Library Automation and Integrated Library Systems	Automation of routine library functions and services.	Koha, SOUL, NewGenLib, LibSys	Improved efficiency, accuracy, and resource management.
Digital Libraries and Institutional Repositories	Creation and management of digital collections and scholarly repositories.	DSpace, EPrints, Greenstone, Fedora Commons	Enhanced access, preservation, and dissemination of information.

E-Resources and Online Databases	Provision of electronic books, journals, databases, and digital content.	IEEE Xplore, ScienceDirect, SpringerLink, JSTOR, NDL	Remote access to current and comprehensive information resources.
Artificial Intelligence and Smart Technologies	Integration of AI-based tools and intelligent systems in library services.	Chatbots, NLP, Machine Learning, OCR, Predictive Analytics	Personalized services, automation, and improved user experience.
Cloud Computing	Delivery of library services through cloud-based platforms.	Google Cloud, AWS, Microsoft Azure	Cost reduction, scalability, and data accessibility.
Mobile and Remote Library Services	Access to library resources through mobile devices and online platforms.	Mobile Apps, Responsive Web Portals	Anywhere-anytime access to information resources.
Data Analytics and Decision Support Systems	Use of data for service improvement and strategic planning.	Business Intelligence Tools, Analytics Platforms	Better decision-making and user-focused services.
Open Access and Digital Scholarship	Promotion of unrestricted access to scholarly information.	Open Access Repositories, OER Platforms	Increased research visibility and knowledge sharing.

Library Automation and Integrated Library Systems

The reviewed literature identified several major Integrated Library Systems (ILS) that are widely used in academic, public, and special libraries. The reviewed literature indicated that these systems have significantly improved the automation of core library functions, including cataloguing, circulation, acquisitions, serials management, and Online Public Access Catalogue (OPAC) services. Open-source software such as Koha, NewGenLib, and Evergreen has gained widespread adoption because of its cost-effectiveness, flexibility, and community support, whereas proprietary

systems such as SOUL and LibSys provide specialized features and dedicated technical support. The comparison demonstrates that the selection of library management software depends on institutional requirements, available financial resources, and the scale

Table 4. Comparison of Major Library Automation and Integrated Library

Software	Type	Key Features	Advantages	Common Users
Koha	Open Source ILS	Cataloguing, Circulation, OPAC, Acquisitions, Serials Control	Cost-effective, customizable, community support	Academic, Public, and Special Libraries
SOUL	Proprietary ILS	Library Automation, Membership Management, OPAC	Developed specifically for Indian libraries	University and College Libraries
NewGenLib	Open Source ILS	Cataloguing, Circulation, Digital Content Integration	User-friendly and scalable	Academic Libraries
Evergreen	Open Source ILS	Resource Sharing, Cataloguing, Circulation	Suitable for library consortia	Public and Academic Libraries
LibSys	Commercial ILS	Integrated Library Management, Reporting Tools	Professional support and maintenance	Large Academic and Corporate Libraries

Digital Libraries and Institutional Repositories

Digital libraries provide organized access to electronic resources such as e-books, e-journals, multimedia content, and databases through computer networks. Institutional repositories serve as digital platforms for preserving and disseminating the scholarly output of institutions, including theses, dissertations, research articles, and conference papers. Open-source platforms such as DSpace, EPrints, and Greenstone have played a significant role in supporting digital content management and enhancing the visibility of institutional research. These systems facilitate long-

term preservation, wider dissemination of knowledge, and support for teaching, learning, and research activities.

Table 5. Comparison of Digital Libraries and Institutional Repositories

Software	Type	Main Purpose	Key Features	Access Type
DSpace	Institutional Repository	Preservation and dissemination of scholarly works	Metadata management, Open Access support	Open Source
EPrints	Institutional Repository	Research publication management	Easy submission workflow, Search tools	Open Source
Greenstone	Digital Library Software	Digital collection creation and management	Multimedia support, Full-text search	Open Source
Fedora Commons	Repository Platform	Digital preservation and content management	Scalability and interoperability	Open Source
Invenio	Digital Repository Platform	Research data and publication management	Advanced indexing and retrieval	Open Source

E-Resources and Online Databases

Electronic resources and online databases have become essential components of modern library services. They provide users with convenient access to scholarly information irrespective of time and location. Resources such as e-books, e-journals, bibliographic databases, and digital reference sources support academic learning and research activities. Although these resources improve information accessibility and research productivity, libraries often encounter challenges related to subscription costs, licensing restrictions, technological infrastructure, and user awareness. Effective management of these challenges is necessary to maximize the benefits of digital information resources.

Table 6. Major Electronic Resources and Online Databases Used in Academic Libraries

Resource/Database	Content Type	Subject Coverage	Access Mode	Benefits
IEEE Xplore	Journals, Conference Papers	Engineering and Technology	Subscription	Access to high-quality technical literature
ScienceDirect	Journals and E-books	Multidisciplinary	Subscription	Extensive scholarly resources
SpringerLink	Journals, Books, Reference Works	Science and Technology	Subscription	Comprehensive academic content
JSTOR	Journals and Archives	Humanities, Social Sciences	Subscription	Access to archival literature
Shodhganga	Theses and Dissertations	Multidisciplinary	Open Access	Supports research visibility
NDL (National Digital Library)	Books, Articles, Learning Resources	Multidisciplinary	Open Access	Free educational resources

Artificial Intelligence and Smart Technologies

The adoption of artificial intelligence and smart technologies has transformed the delivery of library services. Applications such as chatbots, recommendation systems, automated indexing, and intelligent search tools support efficient information retrieval and enhance user experience. Smart technologies including RFID systems, self-check kiosks, and automated inventory management systems help libraries reduce staff workload and improve operational efficiency. These technologies also address challenges such as increasing user expectations, limited staff resources, and the need for faster access to information. As a result, libraries are increasingly integrating intelligent technologies to provide more responsive and user-centred services.

Table 7. Applications of Artificial Intelligence and Smart Technologies in Libraries

AI Technology	Application Area	Function	Benefits
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Chatbots	Reference Services	Responds to user queries instantly	24/7 user support
Machine Learning	Recommendation Systems	Suggests relevant books and resources	Personalized services
Natural Language Processing (NLP)	Information Retrieval	Improves search accuracy	Better user experience
Optical Character Recognition (OCR)	Digitization Projects	Converts printed documents into digital text	Faster digitization
Predictive Analytics	Collection Development	Identifies user preferences and trends	Improved decision-making
Virtual Assistants	User Support Services	Assists with library navigation and information access	Enhanced accessibility

Results and Findings

The literature review indicated that digital transformation has significantly influenced library operations, information management, and user services. The reviewed studies consistently demonstrated that the adoption of digital technologies improved operational efficiency, expanded access to information resources, and enhanced user engagement. The major findings emerging from the reviewed literature are presented under the following thematic areas.

- **Library Automation:** The reviewed studies indicated that library automation has become a fundamental component of digital transformation in libraries. The implementation of Integrated Library Systems (ILS), including Koha, SOUL, and NewGenLib, improved core library functions such as acquisition, cataloguing, circulation, serial control, and Online Public Access Catalogue (OPAC) services. These technologies reduced manual processing, improved operational accuracy, and enhanced the efficiency of library resource management.
- **Digital Libraries and Institutional Repositories:** The literature demonstrated that digital libraries and institutional repositories have significantly enhanced scholarly

communication by preserving and disseminating digital information resources. Platforms such as DSpace, EPrints, and Greenstone improved the visibility of institutional research outputs through open-access initiatives and ensured long-term preservation of scholarly content.

- **E-Resources and Online Databases:** The reviewed studies showed that electronic resources and online databases have expanded access to scholarly information by enabling users to retrieve digital content irrespective of geographical location and time. The availability of e-books, e-journals, and bibliographic databases has supported teaching, learning, research, and evidence-based academic activities.
- **Artificial Intelligence and Smart Technologies:** The findings indicated that artificial intelligence has emerged as an important technology in library services. Applications including chatbots, machine learning, natural language processing, recommendation systems, RFID, and Optical Character Recognition (OCR) improved information retrieval, personalized user services, and operational efficiency. These technologies also reduced routine workloads and enhanced the overall user experience.
- **Cloud Computing:** The reviewed studies indicated that cloud computing has become an important component of digital transformation in libraries. Cloud-based technologies enhanced the storage, management, and delivery of digital library resources by providing scalable and cost-effective infrastructure. The adoption of cloud platforms improved remote access to electronic resources, facilitated resource sharing among libraries, and supported collaborative digital services. The literature further demonstrated that cloud computing reduced hardware maintenance requirements, improved data accessibility, and strengthened the continuity of library services. However, the reviewed studies also identified challenges related to data security, privacy, internet dependency, and institutional policies, which should be addressed to ensure the effective implementation of cloud-based library services.
- **Challenges Identified:** Despite the substantial benefits of digital transformation, the reviewed literature identified several implementation challenges. The most frequently reported barriers included inadequate technological infrastructure, financial limitations, cybersecurity concerns, copyright and licensing issues, insufficient digital competencies

among library professionals, and resistance to organizational change. Addressing these challenges is essential for achieving sustainable digital transformation in libraries.

Table 8. Summary of Major Findings from the Reviewed Literature

Theme	Major Findings	Key Technologies	Implications
Library Automation	Automation improved acquisition, cataloguing, circulation, OPAC, and resource management.	Koha, SOUL, NewGenLib	Increased operational efficiency and reduced manual workload.
Digital Libraries and Institutional Repositories	Digital repositories enhanced preservation, accessibility, and dissemination of scholarly information.	DSpace, EPrints, Greenstone	Improved research visibility and promoted open-access initiatives.
Electronic Resources and Online Databases	Electronic resources expanded remote access to scholarly information and supported research activities.	IEEE Xplore, ScienceDirect, SpringerLink, JSTOR, Shodhganga	Enhanced teaching, learning, and research productivity.
Artificial Intelligence and Smart Technologies	AI applications improved information retrieval, automation, and personalized user support.	Chatbots, Machine Learning, NLP, RFID, OCR	Enhanced user experience and library service efficiency.
Cloud Computing	Cloud-based platforms improved digital resource management, remote access, and collaborative library services.	Google Cloud, AWS, Microsoft Azure	Enhanced scalability, cost efficiency, resource sharing, and accessibility of digital library services.

Challenges	Infrastructure limitations, funding constraints, cybersecurity risks, copyright issues, and staff training were identified as major barriers.	Digital infrastructure, cybersecurity measures, professional training	Sustainable digital transformation requires strategic planning, continuous investment, and capacity building.
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Discussion

The present review showed that digital transformation has fundamentally changed operations through the integration of advanced information and communication technologies. The reviewed literature consistently indicated that libraries have moved beyond their role of information storage to become technology-enabled knowledge centres that support teaching, learning, research and scholarly communication through digital transformation. The adoption of technologies has made library operations more efficient while improving the accessibility organization and dissemination of information resources. The review demonstrated that library automation remained a component of digital transformation in libraries. The implementation of Integrated Library Systems (ILS) including Koha, SOUL, NewGenLib and LibSys improved cataloguing, circulation, acquisitions, serial control and Online Public Access Catalogue (OPAC) services in libraries. These systems reduced manual tasks, improved data accuracy strengthened resource management and enabled library professionals to devote greater attention to user-oriented services through digital transformation. The reviewed studies further indicated that digital libraries and institutional repositories have significantly strengthened communication through digital transformation. Repository platforms such as DSpace, EPrints, Greenstone and Fedora Commons improved the preservation organization and dissemination of institutional research outputs through libraries. These platforms promoted open-access initiatives increased the visibility of publications and ensured the long-term preservation of digital resources thereby supporting research, teaching and lifelong learning through digital transformation.

The review also showed that electronic resources and online databases have become components of modern library services through digital transformation. Access to e-books, e-journals,

bibliographic databases and digital reference sources expanded opportunities for learning and research while improving the availability of current scholarly information through digital libraries. These developments contributed to research productivity and facilitated evidence-based academic activities through digital transformation. Another significant finding was the growing integration of intelligence and smart technologies into library services through digital transformation. Applications such as chatbots, machine learning, natural language processing, recommendation systems, RFID and optical character recognition enhanced information retrieval, personalized user support and service efficiency in libraries.

The reviewed literature suggested that these technologies improved the quality of library services while reducing operational workloads through digital transformation. Cloud computing also emerged as an enabling technology in digital transformation of libraries. Cloud-based platforms improved access to digital collections supported collaborative resource sharing and provided scalable infrastructure for managing library resources through digital transformation. These technologies contributed to cost- service delivery and increased the flexibility of digital library operations through digital transformation. Despite these advancements the review identified challenges that continue to influence the successful implementation of digital transformation initiatives in libraries. Financial constraints, technological infrastructure, cybersecurity concerns, copyright and licensing issues and insufficient digital competencies among library professionals were consistently reported across the reviewed studies on digital transformation. The findings indicated that sustainable digital transformation depends not on technological adoption but also on institutional commitment, strategic planning, continuous professional development and adequate financial investment in digital transformation.

Overall, the literature reviewed in this study indicated that digital transformation has become a strategy for improving the quality, accessibility and sustainability of library services through digital transformation. Continued technological innovation, combined with policy implementation and skilled human resources will remain critical, for supporting the future development of modern libraries through digital transformation.

Suggestions and Recommendations

Based on the study of digital transformation in libraries, the following suggestions and recommendations are proposed for effective implementation and sustainable development:

- 1) Strategic Planning and Policy Development
- 2) Infrastructure Development
- 3) Adoption of Standardized Systems
- 4) Staff Training and Capacity Building
- 5) User Awareness and Digital Literacy
- 6) Strengthening Research Support
- 7) Cybersecurity and Data Protection
- 8) Continuous Evaluation and Improvement

Conclusion

This review looked at the changes, new technologies, opportunities and challenges that come with digital transformation in libraries. The things we read showed that using technologies has made library work better made it easier for people to get information helped with scholarly communication and improved services for users. Things like Integrated Library Systems, digital repositories, electronic resources, artificial intelligence, cloud computing and smart technologies have all helped make library services more efficient, easier to use and focused on the users. This review also showed that digital transformation is not about using new technology it also needs careful planning, support from the organization training for staff and money to invest. Even though many libraries have successfully used technologies there are still some problems, especially with things like infrastructure keeping things safe on the internet managing copyrights and making sure people have the skills they need to use digital things. We need to fix these problems so that digital library services can keep going for a time. What we found out from this review is that libraries should focus on technologies making things available to everyone keeping digital things safe using cloud-based services and sharing resources with other libraries. If library professionals can use things well and we can make services that are focused on the user's library services will be even better. In the end digital transformation is a part of what libraries are like today. If libraries can use technologies well with good rules, skilled workers and support, from the organization they will be able to respond to the changing needs of people who use them and keep helping with teaching, learning, research and sharing knowledge in the digital age.

The digital transformation of libraries is very important and libraries need to keep working on transformation to stay relevant. Libraries need to focus on transformation and make sure they have the right digital technologies to help people. Digital transformation is changing libraries and libraries need to change with transformation to keep helping people.

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Received: Apr 08, 2026

Accepted: Jun 25, 2026

Published: Aug 01, 2026

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