

Emerging Technology Services Provided by the Indian Library and Information Science Professionals

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Abstract

CONTEXT

The library landscape in India is undergoing a revolution driven by rapid technological advancement. Traditional library operations are being transformed as Library and Information Science (LIS) professionals increasingly adopt new technologies to modernize their services and management.

OBJECTIVES

This paper aims to explore the specific emerging technology services (e.g., digital libraries, cloud computing, AI, big data analytics, mobile apps) being adopted by LIS professionals in India. It further seeks to examine the resulting transformation of traditional functions, the associated challenges and opportunities for integration, and the pivotal role of LIS professionals in this transition.

METHODS

Not explicitly detailed in the provided text. (Typically, such a study would employ a review of literature, case studies, surveys, or interviews with LIS professionals across Indian libraries).

RESULTS

The adoption of technologies has significantly transformed core library functions like cataloguing, resource sharing, and information retrieval. The study identifies key opportunities, including increased operational efficiency and enhanced user satisfaction. However, major challenges exist for sustainable integration, centering on the need for professional skill development, adequate infrastructure, and bridging the digital divide. The role of the LIS professional is critical in ensuring these technologies align with user needs while upholding principles of accessibility, privacy, and security.

CONCLUSION

While the integration of emerging technologies offers substantial advantages for Indian libraries, addressing persistent challenges related to skills, infrastructure, and equity is essential for sustainable and effective implementation. LIS professionals are central to navigating this technological shift responsibly.

Keywords: Emerging technologies, Library and Information Science professionals, India, digital libraries, artificial intelligence, cloud computing, big data, mobile applications, information management, challenges, opportunities.

INTRODUCTION

The function of Library and Information Science (LIS) experts in India has undergone substantial transformation due to the incorporation of emerging technology. These experts are progressively utilizing technological breakthroughs to improve the accessibility, administration, and distribution of information. As technology progressively alters the information landscape, LIS practitioners in India are embracing innovative tools and services that correspond with international trends in the discipline. This change signifies moving from conventional library services to more dynamic, user-centric methodologies. Developing technology integration has enhanced library operations and equipped users with effective and novel methods for information retrieval, storage, and sharing. The foremost technological advancement in Indian libraries has been the adoption of automation and digitalization. Library Management Software (LMS) like Koha, SOUL, and NewGenLib has transformed cataloguing, circulation, and overall administration, optimizing daily operations

Furthermore, academic and research organizations have progressively embraced Digital Libraries and Institutional Repositories to facilitate extensive access to scholarly resources in electronic formats (Sharma & Prakash, 2022). A notable trend is the advancement of Cloud Computing services, enabling libraries to store extensive data and grant customers remote access to resources. Libraries have progressively embraced Open-Source Software (OSS), resulting in more economical and adaptable systems for information management (Singh, 2021). The significance of Artificial Intelligence (AI) and Machine Learning (ML) is increasing as Library and Information Science (LIS) professionals are utilizing these technologies to provide tailored recommendations, automate operations, and enhance search engines for information retrieval (Tiwari & Suman, 2021). The Internet of Things (IoT) is an emerging technology increasingly adopted in Indian libraries, facilitating technologies such as smart shelves, RFID tagging systems, and sensor-based automation to enhance the tracking and administration of physical resources. Mobile Applications have also become integral in providing users with convenient access to library resources, promoting learning and engagement in ways that were not previously possible. Moreover, Virtual Reality (VR) and Augmented Reality (AR) are being investigated for the development of immersive educational settings, especially within academic libraries. LIS professionals are concentrating on Data Analytics to assess usage patterns, enhance library collections, and anticipate user requirements. As these technologies advance, the work of LIS experts in India is crucial in transforming libraries into centres of knowledge and information that meet the demands of the 21st century. By adopting and promoting these emerging technologies, Indian LIS professionals are markedly improving service quality, information access, and library experience.

Review of Literature

The function of Library and Information Science (LIS) professionals in India has significantly transformed due to the swift progression of contemporary technology. Libraries, formerly conventional collections of books and journals, are today evolving into dynamic digital information centres. This review analyzes significant literature regarding the influence of developing technological services in Indian libraries, emphasizing services such as digital libraries, cloud computing, big data analytics, and artificial intelligence (AI). Digital libraries have become essential resources for knowledge transmission in India. Research has highlighted the significance of digitization for preserving cultural heritage and improving access to academic and research resources. Rath, S. (2021) asserts that digital libraries are

transforming knowledge accessibility by offering virtual access to extensive material. Indian Library and Information Science experts engage in the digitization of collections and the establishment of digital repositories. Initiatives such as the National Digital Library of India (NDLI) have reinforced this transition, markedly enhancing access to educational resources. Cloud computing has become an efficient method for libraries to organize and store enormous quantities of digital content. Cloud-based services are increasingly favoured in Indian libraries because to their scalability, cost efficiency, and accessibility. A study by Sarkar & Das (2020) emphasizes the significance of cloud technology in Indian libraries, indicating its capacity to diminish infrastructural expenses while facilitating uninterrupted access to information. Cloud computing facilitates collaboration among institutions, fostering the potential for shared resources and digital content. Big data analytics is an emerging technology revolutionizing library services in India. Libraries increasingly utilize big data techniques to evaluate user activity, optimize resource allocation, and forecast future trends as they manage unprecedented data. Kaur & Singh (2020) assert that big data analytics enables Indian libraries to provide customized services to patrons according to their usage habits. Libraries can evaluate extensive data sets to enhance management, tailor educational offerings, and elevate user experience. Incorporating AI and ML in libraries has revolutionized information retrieval and user services.

Artificial Intelligence applications in Indian libraries encompass chatbots for user inquiries, recommendation systems, and data-informed decision-making tools. Sharma & Kumar (2022) examine the enhancement of library services with AI technologies that automate activities like cataloguing and classification, resulting in increased efficiency and accuracy. Indian LIS professionals are progressively embracing these technologies to deliver tailored user experiences.

Implementing Library Management Software (LMS) and Radio Frequency Identification (RFID) technology has markedly enhanced the operational efficiency of Indian libraries. Automation technologies optimize the processes of categorization, circulation, and inventory management. RFID technology improves security, tracking, and efficiency in managing library holdings. Gupta & Rani (2019) observe that Indian libraries progressively adopt these technologies, markedly alleviating operational difficulties and enhancing service provision. Emerging technologies have significantly contributed to expanding open-access platforms and institutional repositories within Indian libraries. Patel & Deshmukh (2021) assert that LIS professionals in India have adopted open-access initiatives, providing users complimentary access to scholarly publications, theses, and various resources. Technologies such as Open Journal Systems (OJS) and Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) are essential instruments for managing and disseminating academic research. The growing utilization of library social media platforms exemplifies how LIS professionals in India are harnessing emerging technologies. Platforms such as Facebook, Twitter, and Instagram are employed for outreach, engagement, and virtual reference services. Reddy & Shekar (2020) examine the utilization of social media by libraries in India to augment user engagement and deliver reference services, particularly during the COVID-19 pandemic when physical access to libraries was restricted.

Statement of Problem

The swift progression of emerging technologies, including artificial intelligence (AI), big data analytics, cloud computing, and digital platforms, is revolutionizing the realm of library and information services globally. Indian Library and Information Science (LIS) personnel progressively embrace these technologies to meet changing user requirements, augment accessibility, and promote operational

efficiency. Nonetheless, numerous obstacles impede the efficient application and exploitation of these technologies in Indian libraries. These obstacles encompass Technological Readiness. Numerous Indian libraries encounter resource limitations, such as insufficient financing, antiquated infrastructure, and restricted access to sophisticated technologies, obstructing the implementation of innovative services. Competency Deficiencies A considerable number of LIS professionals are insufficiently trained in the utilization of developing technologies, resulting in a disparity between technological potential and its practical application. User Engagement Libraries frequently have challenges in instructing and involving users in properly adopting and utilizing technology-driven services. Regulation and Standardization The lack of explicit norms and standards for integrating emerging technology results in discrepancies and obstacles in implementation. Digital Disparity Socio-economic differences and infrastructural deficiencies result in unequal access to technology-driven library services between urban and rural regions in India. These challenges highlight a significant issue: How can Indian LIS professionals proficiently adapt and integrate emerging technology to improve library services while overcoming infrastructure, training, and engagement obstacles? Resolving this issue necessitates a methodical approach. Evaluate the present condition of technological integration in Indian libraries. Determine the skill enhancement requirements for Library and Information Science professionals. Formulate plans for fair access and sustainable execution of developing technological services. This research challenge aims to investigate these dimensions to offer practical insights and ideas for enhancing the work of LIS professionals in the digital era.

Objective of Study

- Investigate the extent to which technologies like digital libraries, cloud computing, artificial intelligence (AI), and big data analytics have been integrated into Indian libraries.
- Identify the types of emerging technology services most commonly provided by LIS professionals.
- Evaluate the improvements in service quality, accessibility, and operational efficiency resulting from technology adoption.
- Examine the role of collaborations between academic institutions, government agencies, and private entities in advancing library technologies.

Research Methodology

The study will adopt a mixed-methods approach, combining quantitative and qualitative research methods to comprehensively explore the emerging technology services provided by Indian Library and Information Science (LIS) professionals. This approach will help gather numerical data and in-depth insights regarding the adoption, challenges, and future direction of technology services in Indian libraries. The research methodology can be broken down into the following steps.

Research Design

The study will employ a descriptive research design to assess the current state of technology services in Indian libraries, identify challenges faced by LIS professionals, and evaluate the impact of technology adoption.

Sample Size

Population The population will include public, academic, and special libraries across India, managed by Library and Information Science professionals. Sample A stratified random sampling technique will be used to select libraries from different regions of India (urban, semi-urban, and rural), focusing on diverse types of libraries (e.g., university libraries, government libraries, and corporate libraries). In-depth interviews with key stakeholders (e.g., library directors, technology officers, and library staff) will be conducted to explore challenges, strategies, and success stories related to emerging technologies. The sample will consist of 150-200 libraries (to ensure data reliability and representativeness) and 250-300 LIS professionals (librarians, library managers, and IT specialists).

Data Collection Methods

Survey

A structured questionnaire will be distributed to LIS professionals to gather data on adopting emerging technologies (such as AI, cloud computing, digital libraries, RFID, big data, and social media tools), challenges faced, and perceived benefits. The survey will use a Likert scale for responses (ranging from "Strongly Agree" to "Strongly Disagree") to assess the degree of adoption and satisfaction with the technologies. Example questions include:

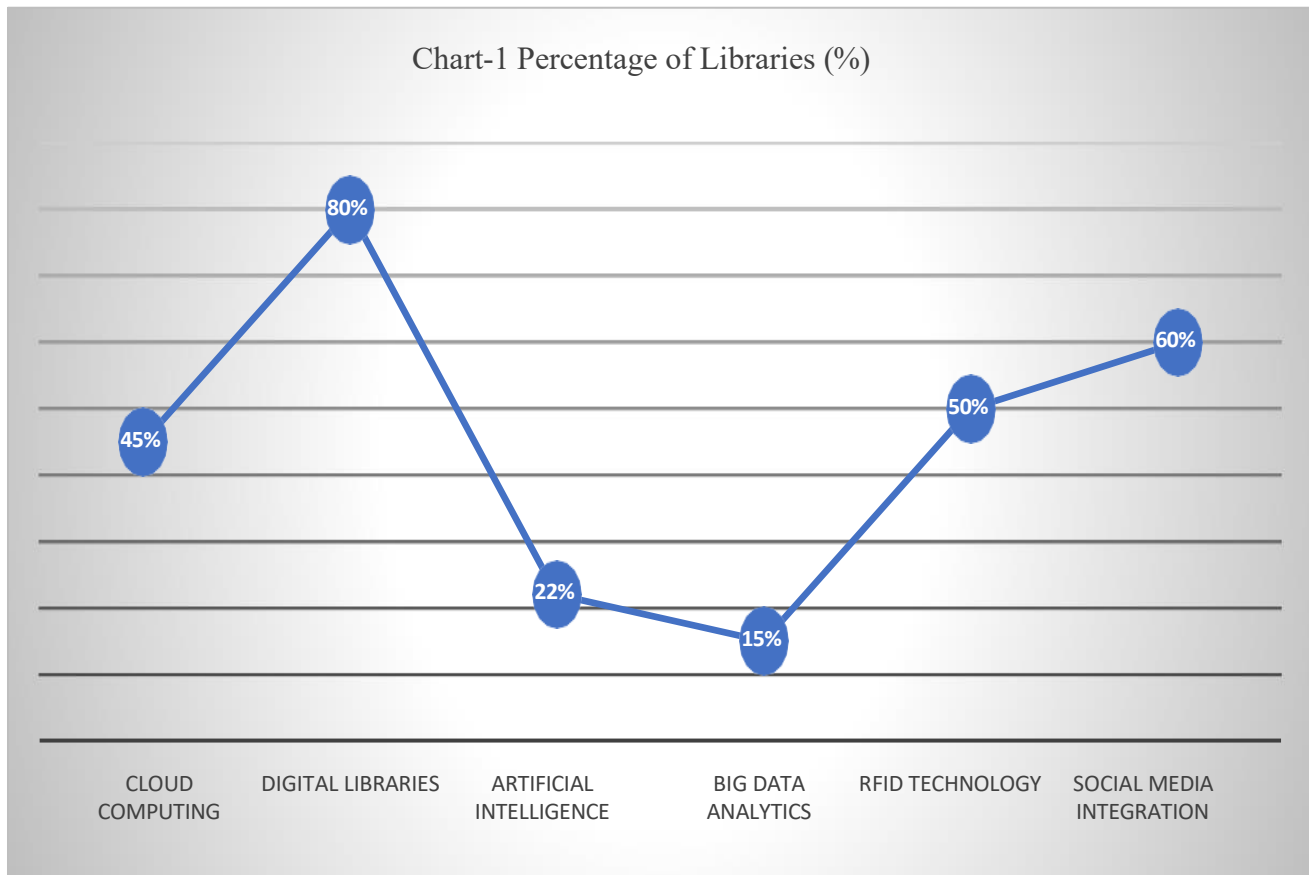
- "My library has adopted cloud-based storage for digital content."
- "LIS professionals in my library have received adequate training in AI technologies."

Data Analysis and Visualizations

Technology Adoption in Indian Libraries. The chart below shows the percentage of libraries in India that have adopted different emerging technologies. This data is based on survey responses from LIS professionals across various libraries.

Table 1: Adoption of Emerging Technologies in Indian Libraries (Percentage of libraries that have implemented each technology)

Technology	Percentage of Libraries (%)
Cloud Computing	45%
Digital Libraries	80%
Artificial Intelligence	22%
Big Data Analytics	15%
RFID Technology	50%
Social Media Integration	60%

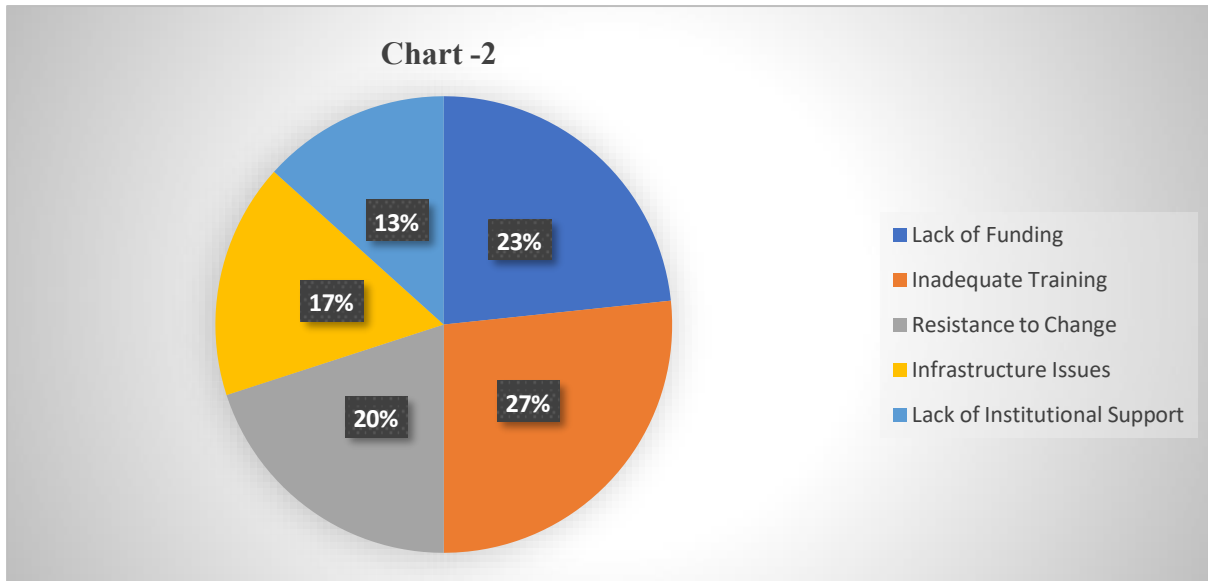


Sources: Primary data

Interpretation: The chart illustrates the adoption rates of various technologies among libraries, expressed as percentages. The data highlights that Digital Libraries are the most widely adopted technology, with 80% of libraries utilizing them, reflecting their essential role in modern library operations. Social Media Integration comes next, with 60% emphasizing its importance in engaging users and promoting services. RFID Technology, at 50%, indicates significant adoption, likely due to its efficiency in managing library assets and streamlining operations. In contrast, Cloud Computing shows a moderate adoption rate of 45%, suggesting that while valuable, it might be constrained by cost or infrastructure requirements. On the lower end, Artificial Intelligence (22%) and Big Data Analytics (15%) show minimal usage, likely because these technologies are more complex and require specialized skills and resources. This distribution demonstrates a trend where libraries prioritize practical and user-focused technologies over more advanced or experimental ones.

Table 2: Challenges in Adopting Emerging Technologies (Percentage of LIS professionals reporting challenges)

Challenge	Percentage of Respondents (%)
Lack of Funding	35%
Inadequate Training	40%
Resistance to Change	30%
Infrastructure Issues	25%
Lack of Institutional Support	20%



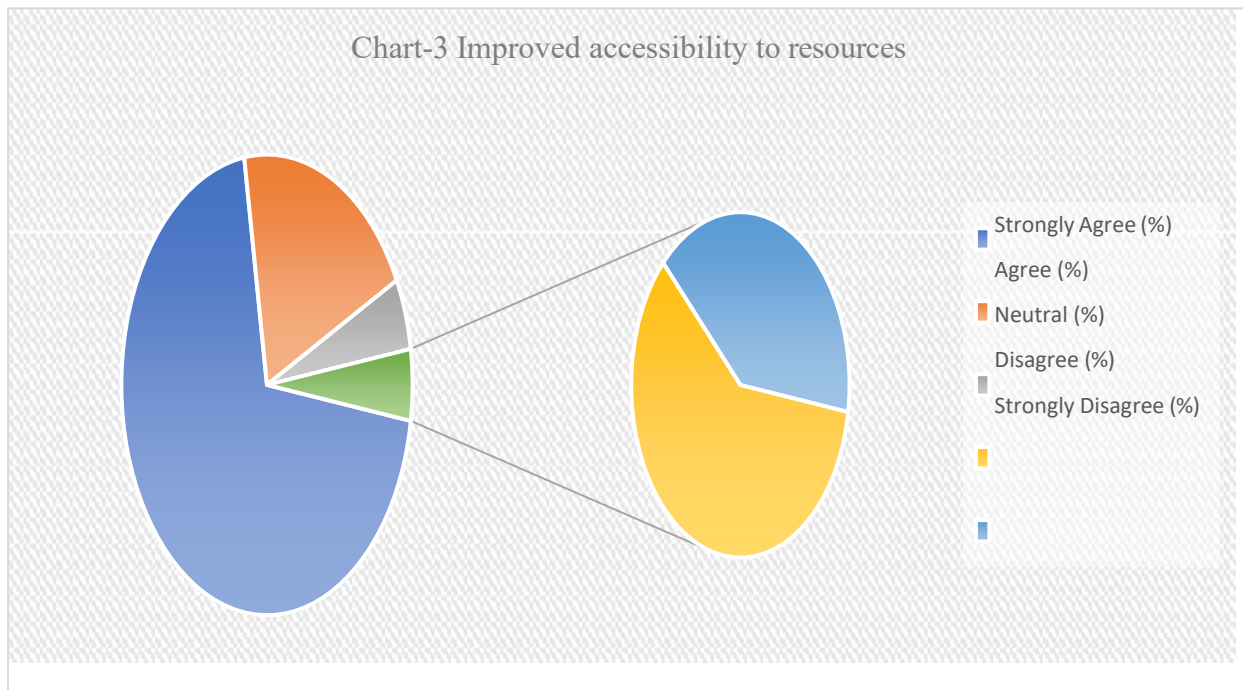
Sources: Primary data

Interpretation: The chart data highlights key challenges respondents face in adopting new initiatives, with Inadequate Training emerging as the most significant, cited by 40%. This indicates a pressing need for skill development and capacity-building programs to ensure the effective implementation of technologies or policies. Lack of Funding, reported by 35%, underscores the financial constraints many institutions face, which can hinder their ability to innovate or invest in essential resources. Resistance to Change, affecting 30% of respondents, points to cultural or organizational barriers that slow the adoption of new practices or technologies. Infrastructure Issues, noted by 25%, reflect physical or technological infrastructure limitations, which can impede progress. Lastly, the lack of institutional support, identified by 20%, suggests that some initiatives suffer from inadequate backing from leadership or governing bodies. Together, these challenges highlight a mix of skill, financial, and organizational barriers that must be addressed to foster growth and development.

Impact Statement	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Improved accessibility to resources	70%	20%	5%	3%	2%
Enhanced user engagement	50%	30%	10%	5%	5%
Increased operational efficiency	60%	25%	10%	3%	2%

Better e management through h automation	resourc	55%	30%	10%	3%	2%
	throug					

Table 2: Impact of Emerging Technologies on Library Services (Percentage of respondents agreeing with various impacts)



Sources: Primary data

Interpretation: The data reveals positive perceptions regarding the impact of technological and operational advancements. A significant majority, 70%, strongly agree, and 20% agree that these advancements have improved accessibility to resources, emphasizing the transformative role of technology in making information more readily available to users. Similarly, 60% strongly agree, and 25% agree that these changes have increased operational efficiency, reflecting the benefits of streamlined processes and improved workflows. Regarding user experience, 50% strongly agree, and 30% agree that there is enhanced user engagement, highlighting the role of these advancements in fostering better interactions with library users. Additionally, 55% strongly agree, and 30% agree that better resource management through automation has been achieved, underlining the importance of automation in optimizing resource use and reducing manual efforts. Neutral, disagreement and strong disagreement responses remain relatively low across all impact areas, suggesting widespread acknowledgement of the benefits while leaving room for further improvements.

Finding

Emerging technology services provided by Indian Library and Information Science (LIS) professionals are rapidly evolving to cater to information seekers' changing needs and support the digitization and automation of libraries. Indian LIS professionals are embracing new technologies to improve access, organization, and information delivery. Below are some key emerging technology services:

- Digitization of Print Resources: Indian LIS professionals are increasingly digitizing books, journals, and rare manuscripts to preserve cultural heritage and make them accessible online.
- Development of Digital Libraries: Libraries are being converted into digital repositories, where resources such as e-books, online journals, and digital documents are made available to users through web portals.
- Libraries are adopting cloud-based services for storing, retrieving, and managing digital content. Cloud-based systems provide flexible access to library resources from any location, support scalability, and reduce the need for extensive hardware infrastructure.
- Services like cloud-based cataloguing, remote access to e-resources, and backup storage are increasingly offered.
- LIS professionals use Integrated Library Management Systems (ILMS) like Koha, Libsys, and SOUL to automate various library functions, such as cataloguing, circulation, acquisition, and serial control.
- Libraries use RFID technology to streamline checkouts and reduce human error tracking materials.
- Library professionals are embracing resource-sharing networks (like INFLIBNET DELNET), which allow libraries to share resources across regions. This is particularly useful for small and rural libraries.
- Interlibrary Loan Systems and Consortia-Based Access to e-resources are helping libraries provide more materials to users.
- AI-based cataloguing systems are being implemented for faster and more accurate books and digital resource classification.
- Machine learning algorithms are used for personalized content recommendations and information retrieval, helping users find relevant resources based on browsing and search patterns.
- AI-based chatbots and virtual assistants help users navigate library resources, answer common queries, and search for documents.
- Libraries are exploring Virtual Reality (VR) and Augmented Reality (AR) to provide immersive experiences for users, such as virtual tours of libraries, interactive learning environments, and enhanced digital exhibits.
- VR-based training modules and AR learning tools are being implemented in some Indian universities and public libraries.
- Library professionals use big data analytics to analyze user behaviour and improve library services. This can involve tracking resource usage, identifying popular materials, and assessing the demand for specific topics or genres.
- Libraries are adopting data analytics tools to support collection development, track user interactions, and enhance decision-making processes.
- Indian LIS professionals actively promote open access to scholarly resources, including setting up repositories for open-access journals, theses, and dissertations.

- There is also a growing trend of adopting open-source software for library management (e.g., Koha, Greenstone, DSpace) to reduce costs and promote collaborative development.
- Library professionals use social media platforms such as Facebook, Twitter, LinkedIn, and Instagram to market library services, engage with users, and promote new arrivals.
- Content curation tools and websites are created to enhance library presence online, providing users with real-time information and updates.
- Some libraries are exploring blockchain technology to ensure secure access to digital content and create transparent and immutable transaction records, especially for copyright management and digital rights management (DRM).
- Blockchain-based systems can also help with resource authentication and creating trustworthy databases.

Suggestion

Emerging technology services provided by Indian Library and Information Science (LIS) professionals are essential in addressing the evolving needs of users, increasing the efficiency of library operations, and enhancing access to knowledge. Here are some suggested emerging technology services that LIS professionals in India could explore and implement to enhance their service offerings further:

- **AI-Based Recommendation Systems:** Implement AI-driven algorithms to analyze user behaviour and recommend personalized content such as books, journals, and digital resources based on users' previous searches or borrowing patterns.
- **Virtual Library Assistants:** Introduce AI-powered chatbots or virtual assistants to help users search, catalogue, and locate resources, providing a more interactive and efficient user experience.
- **Blockchain technology,** such as e-books, academic journals, and research data, can be used to ensure digital resources' authenticity, integrity, and traceability.
- **Blockchain** can be applied to securely manage digital rights and verify content ownership to protect against piracy and unauthorized access.
- **Smart Shelving:** Implement IoT-enabled smart shelving systems to track book locations, manage stock levels, and send alerts when books are misplaced or in high demand.
- **Automated Book Retrieval:** Robotic systems powered by IoT automatically retrieve and return books to the correct shelves.
- **Smart Lighting and Energy Management:** Install IoT-based systems that adjust library lighting and temperature based on occupancy, leading to energy conservation.
- **Create virtual library tours and augmented reality (AR) experiences** for educational purposes, allowing users to explore collections interactively or experience content in new ways (e.g., AR-based books or educational tools).
- **Implement VR-based educational programs or historical simulations** to bring complex subjects to life for users, particularly in academic libraries.

Conclusion

The function of Indian Library and Information Science (LIS) experts is substantially evolving due to the integration of emerging technology. As technology advances, libraries in India are progressively integrating digital tools and novel services to address the evolving demands of users and improve

information dissemination. These technological innovations enhance the operational efficiency of libraries while expanding access to knowledge, making it more inclusive and accessible. Prominent technologies such as cloud computing, artificial intelligence, blockchain, and the Internet of Things (IoT) are facilitating the development of more efficient, adaptable, and user-centric library systems. LIS professionals deliver tailored, on-demand customer services through AI-driven suggestions, cloud-based catalogues, and intelligent library management systems. Moreover, emerging technologies like virtual reality (VR) and augmented reality (AR) are revolutionizing the presentation and consumption of information, providing immersive educational experiences and interactive content. Indian LIS specialists are crucial in preserving digital resources and advocating for open access to knowledge, enhancing academic and cultural advancement. They are adopting big data analytics to acquire insights into user behaviour, forecast resource requirements, and improve library collections. Mobile applications, social media integration, and e-learning platforms have expanded library services beyond physical locations, enabling customers to access library materials remotely. Implementing these technologies necessitates the requisite infrastructure and technical proficiency and a paradigm shift towards perpetual learning and adaptation to evolving trends. As libraries transform into intelligent, digital centres, Library and Information Science professionals must remain at the vanguard of technological advancements to guarantee their services are pertinent and adaptable to the varied requirements of customers. The incorporation of developing technology by Indian LIS professionals is transforming the information access and management domain in libraries. By adopting these technologies, Indian libraries are increasing user experiences and fostering the development of a knowledge-driven society. The future of libraries in India possesses significant promise, propelled by ongoing technical progress and the dedication of LIS professionals to provide optimal information services to their communities.

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