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Exploring Digital Rights Management in Modern Libraries: Present Scenario, Legal Perspectives, and Emerging Prospects in India

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Abstract

The rapid expansion of digital information resources has transformed library services and intensified the need for effective Digital Rights Management (DRM) systems to protect intellectual property while ensuring equitable access to knowledge. This article critically examines the evolving landscape, challenges, and future prospects of DRM in libraries within the digital era. DRM encompasses a range of technologies, protocols, and policies designed to regulate the creation, distribution, access, and use of digital content, thereby safeguarding the rights of authors, publishers, and content creators. The COVID-19 pandemic further accelerated the adoption of digital library services, leading to unprecedented growth in electronic resources, including e-books, e-journals, online databases, electronic theses, dissertations, and institutional repositories. This study reviews the major DRM tools, techniques, implementation strategies, and best practices adopted by libraries, with particular emphasis on the Indian copyright framework and legal provisions governing digital information. It also explores the integration of DRM with library management systems and digital repositories to enhance secure content delivery, licensing compliance, and user authentication while supporting fair use and lawful access. The findings highlight that a balanced DRM framework strengthens the relationship among creators, content providers, and users by protecting intellectual property without undermining the fundamental mission of libraries to provide open and equitable access to information. The article concludes that future DRM strategies should prioritize interoperable technologies, user-centric policies, ethical standards, and collaborative governance to achieve sustainable digital knowledge management in academic and research libraries.

Keywords: *Digital Rights Management, DRM Copyright, Watermark, Digital Content Protection, Fair Use, Digital Preservation, Information Access, Indian Legislation.*

1. Introduction

The rapid advancement of digital technologies has transformed libraries from traditional repositories into digital knowledge centres that provide seamless access to e-books, e-journals, databases, institutional repositories, electronic theses and dissertations (ETDs), and other online resources. While this digital transformation has significantly improved information accessibility and scholarly communication, it has also created challenges related to copyright protection, digital piracy, unauthorized sharing, licensing compliance, and the ethical use of intellectual property.

Digital Rights Management (DRM) has emerged as an essential technological and legal framework for protecting digital content while enabling secure and controlled access to electronic resources. By employing encryption, authentication, licensing systems, access controls, and digital watermarking, DRM helps libraries, publishers, and content creators safeguard intellectual property, regulate content usage, and ensure compliance with copyright laws.

The importance of DRM has grown considerably with the expansion of digital publishing, online education, and remote learning, particularly after the COVID-19 pandemic. Libraries have increasingly relied on digital collections and online services to meet the information needs of students, researchers, and faculty members. In India, national initiatives such as the National Digital Library of India (NDLI), e-ShodhSindhu, Shodhganga, SWAYAM, and the National Knowledge Network (NKN) have further accelerated digital access while highlighting the need for effective copyright management and secure digital content delivery. The legal framework supporting DRM in India includes the Copyright Act, 1957 (as amended in 2012), the Information Technology Act, 2000, and licensing agreements governing electronic resources.

Despite its advantages, DRM remains a subject of debate because restrictive systems may limit fair use, accessibility, interoperability, and long-term digital preservation. Therefore, libraries must adopt balanced DRM strategies that protect intellectual property while preserving equitable access to information.

This article, *"Exploring Digital Rights Management in Libraries: Present Scenario, Legal Perspectives, and Emerging Prospects in India,"* examines the concept, applications, legal framework, challenges, and future prospects of DRM in Indian libraries. It highlights the importance of developing secure, legally compliant, and user-centric DRM practices that support sustainable digital library services while balancing the interests of authors, publishers, libraries, and users.

2. Methodology and Scape of Review of Related Literature

To explore the scope of the study, a systematic literature review was conducted on Digital Rights Management (DRM) in modern libraries, focusing on implementation challenges, technological solutions, user access rights, blockchain-based DRM, smart

contracts, interoperability, AI-assisted content management, and fair use. Relevant literature was retrieved from Scopus, Web of Science, Springer Nature, Elsevier, Emerald, Taylor & Francis, Wiley, IEEE Xplore, ResearchGate, Google Scholar, and other peer-reviewed sources. Studies published in English between 2012 and 2026 were considered, while duplicate, non-peer-reviewed, and irrelevant publications were excluded. The initial search identified 118 relevant studies, which were screened through title, abstract, and full-text evaluation. To enhance comprehensiveness, backward and forward citation chaining was employed, resulting in the identification of an additional 25 relevant publications. The final corpus provided a robust and reliable foundation for analysing current developments, challenges, emerging technologies, and future research directions in digital rights management within library and information science.

3. Review of Literature

Digital Rights Management (DRM) has become an essential component of digital library management, ensuring the protection of intellectual property while facilitating authorized access to digital resources. Early research primarily focused on copyright protection, legal compliance, and technological safeguards. Hombal and Prasad (2012) identified copyright infringement as a major challenge for digital libraries and emphasized the need for effective DRM policies. Baraliuc et al. (2012) highlighted the importance of balancing copyright enforcement with users' rights, including privacy and equitable access, while Tamilselvan and Balasubramanian (2012) advocated integrating technological measures such as encryption, digital watermarking, and authentication with legal frameworks.

Subsequent studies expanded the discussion to practical implementation in libraries. Handa and Bhatt (2015), Mir (2016), Chattopadhyay (2016), and Niqresh (2018) emphasized copyright awareness, licensing agreements, institutional policies, and the evolving role of librarians in managing digital resources and promoting ethical information use. Patil and Agarwal (2019) and Panda (2021) further highlighted DRM as a key element of electronic resource management while stressing the need for continuous professional training in copyright and licensing.

Liu et al. (2022) highlighted the potential of blockchain technology to transform digital library systems by enabling secure, decentralized peer-to-peer interactions through smart contracts and advanced cryptographic mechanisms. Their study suggested that blockchain eliminates the need for intermediaries, thereby enhancing transparency, security, and trust in digital content management. Similarly, Khan (2022) examined the application of blockchain-based Digital Rights Management (DRM) in domains such as music and image licensing. The study observed that although blockchain has demonstrated significant potential for improving copyright protection and licensing transparency, its application in library environments remains limited. Khan further emphasized the need for library-specific DRM frameworks incorporating robust cryptographic key management, secure content access mechanisms, and efficient rights administration to support the evolving requirements of digital libraries.

Recent research has shifted toward balancing copyright protection with accessibility and user rights. Garcia and Thompson (2023) and Santos and Pereira (2023) observed that

restrictive DRM policies often limit digital lending, interlibrary loan, and educational use, recommending more flexible licensing models. Accessibility has emerged as a critical concern, with Bhardwaj and Tyagi (2024) and Devi and Kumar (2024) demonstrating that DRM restrictions can hinder access for visually impaired users and advocating accessibility-by-design approaches aligned with the Marrakesh Treaty.

Technological innovation has become a dominant theme in recent years. Erickson and Stobo (2024) reported that restrictive DRM systems impede scholarly communication, text and data mining, and digital preservation. Madushanka et al. (2024) proposed a blockchain-based DRM framework integrating smart technologies to improve copyright authentication and licensing transparency. Breslin (2025) examined the implications of generative AI for copyright governance, while Singh and Singh (2025) conceptualized DRM as an integrated framework combining legal, technological, and institutional components for managing digital collections.

The latest studies focus on blockchain-enabled, privacy-preserving DRM systems. Rajkumar, Ibekeme, and Ngololo (2026) and Laboso et al. (2026) demonstrated the potential of blockchain to improve transparency, security, authentication, and decentralized rights management, although challenges related to scalability, interoperability, and implementation remain. Abdelrahman (2026) further emphasized the importance of privacy-by-design, cybersecurity, and user-centric governance in next-generation DRM systems.

These, reviewed literature indicates a clear evolution from traditional copyright protection toward integrated, user-centric DRM frameworks that incorporate accessibility, blockchain, artificial intelligence, privacy, interoperability, and digital preservation. However, significant challenges remain in developing DRM systems that effectively balance intellectual property protection with fair use, accessibility, scholarly communication, and long-term preservation in digital library environments.

4. Objectives of the Study

The objectives of study are as follows:

- (i) To examine the present scenario and emerging prospects of Digital Rights Management (DRM) in modern libraries.
- (ii) To identify and evaluate the tools, technologies, and best practices for the effective implementation of Digital Rights Management in library environments.
- (iii) To present a comparative analysis of the legal frameworks governing Digital Rights Management in the United States and India, with particular reference to copyright laws, licensing agreements, and intellectual property rights applicable to libraries.
- (iv) To explore the challenges, opportunities, and implications of Digital Rights Management for library services, digital content access, preservation, and user rights.
- (v) To propose strategic recommendations for strengthening Digital Rights Management practices in Indian libraries in the context of emerging technologies, artificial intelligence, and evolving digital information management systems.

5. Essential Role and Significance of Digital Rights Management

In today's digital environment, Digital Rights Management (DRM) has become indispensable for protecting intellectual property and ensuring the lawful use of digital resources. By preventing unauthorized copying, distribution, and access, DRM not only minimizes piracy but also strengthens overall content security. Its adoption in libraries and other digital platforms is vital for several reasons:

- (i). **Safeguarding Revenue:** For content creators and publishers, financial sustainability depends on the legitimate use of digital materials. DRM helps regulate access by enforcing licensing conditions and restricting unauthorized distribution. This mechanism protects revenue streams and enables the fair monetization of digital assets.
- (ii). **Promoting Content Creation:** The production of high-quality digital resources demands significant effort, creativity, and financial investment. DRM reassures authors, publishers, and investors that their work is protected from misuse. This assurance fosters ongoing investment in innovative, diverse, and valuable digital content.
- (iii). **Ensuring Copyright Compliance:** In the global digital landscape, compliance with copyright laws is essential. DRM supports this by enforcing licensing agreements and usage restrictions, protecting creators' rights while guiding users toward responsible and ethical engagement with content.
- (iv). **Preserving Market Integrity:** The spread of unauthorized or counterfeit materials threatens the stability of digital markets. DRM combats this issue by ensuring authenticity and reliability, thereby sustaining a transparent and trustworthy digital ecosystem where creators and users alike benefit.

The digital content ecosystem comprises publishers, device manufacturers, and educational institutions, all of which rely on DRM for secure and controlled distribution of materials.

- (i) **Digital Media Publishers:** Publishers apply DRM technologies to prevent piracy and unauthorized distribution of their digital assets. It ensures that only licensed users can access their intellectual property.
- (ii) **Digital Component Manufacturers:** Hardware manufacturers, such as those producing e-readers, tablets, or media players, integrate DRM systems at the device level. This ensures that only authorized content is accessible, enhancing security across digital platforms.
- (iii) **Educational Institutions:** Libraries within schools, colleges, and universities provide access to a wide range of digital resources. DRM helps regulate usage in accordance with licensing agreements, preventing unauthorized sharing and ensuring compliance with publishers' rights.

6. Significance of DRM in Modern Libraries

The pandemic has adversely impacted all sectors include libraries, prompting them to adapt by delivering services through digital platforms due to limited physical access. This shift raises copyright concerns, addressed by creating digital repositories and digitizing materials to promote open access. Digital Rights Management (DRM) plays a crucial role in controlling access, tracking usage, and regulating digital content distribution, ensuring copyright compliance. Effective DRM implementation requires foundational support with hardware and software that enable encryption and adhere to licensing agreements, safeguarding digital materials against unauthorized use.

Authors and creators sought a technology that would give them control over their content, allowing them to govern its authorized use and manage the consequences throughout its lifecycle. This need led to the development of Digital Rights Management (DRM). DRM is designed to regulate the use of digital content, but it has also raised concerns about potential misuse. It can be employed for questionable purposes, such as infringing on privacy, personal profiling, price discrimination based on identifiable information, and hindering the growth of open-source software. For libraries, DRM poses challenges to the first-sale doctrine, preservation efforts, and introduces pay-per-use pricing models.

In 2003, the Congressional Internet Caucus Program on Digital Rights Management and the American Library Association described DRM as a set of technologies that control the use of digital content. Information scientists, engineers, and technologists have proposed DRM as a solution to address key issues, including:

- (i) **Digital Rights Enforcement (DRE):** Ensuring compliance with content usage rules.
- (ii) **Digital Rights Management:** Defining and managing user rights to access content.
- (iii) **Standardization for Interoperability:** Promoting compatibility across different systems and platforms.

The pandemic has affected libraries globally, pushing them to transition to digital platforms to continue serving users. However, this shift raises concerns about copyright policies. To address this, libraries create digital repositories and convert materials for open access. Digital Rights Management (DRM) technology helps manage copyright by allowing creators to control access, track usage, and limit distribution of digital content. For effective DRM use, libraries need the right hardware and software to support encrypted content and comply with licensing agreements, preventing unauthorized copying, printing, and sharing.

However, many organizations and libraries worry that DRM could be exploited by copyright holders to restrict user rights traditionally protected under copyright law, such as fair use, the first-sale doctrine, and limitations on copyright terms. These fears highlight the delicate balance between protecting content and preserving user freedoms. Users can access this encrypted content via a license that the user can get from the license manager. A license may be a digital certificate, passcode, or any other machine-readable rights expression language that contains the term of use and the information required to access the encrypted content on a digital platform.

A comparative statement of Digital Rights Management in Modern Library systems is presented in Table1

Table 1: Comparative Statement of DRM Models in Modern Library Systems

Dimensional Feature	Traditional Vendor DRM	Controlled Digital Lending (CDL)	Decentralized / Blockchain DRM
Control Paradigm	Centralized publisher/vendor server	Library-managed owned-to-loaned ratio	Distributed ledger & smart contracts
Legal Foundation	Contract Law / EULA licensing	Copyright Exhaustion & Fair Use	Smart contract protocol / Open standards
Patron Privacy Risk	High (commercial telemetry & tracking)	Low (internal library system logs)	Very Low (zero-knowledge proof auth)
Interoperability	Low (walled-garden apps & formats)	Moderate (standard PDF/ePub readers)	High (open cryptographic standards)
Current Status	Dominant commercial practice	Highly restricted post- <i>Hachette</i> decision	Active academic & technical research stage

7. Future-Ready Approaches to Digital Rights Management in Modern Libraries

Digital Rights Management (DRM) technologies protect digital content by restricting unauthorized access, copying, distribution, and modification. They enforce usage policies through encryption and other security mechanisms, allowing only authorized users or devices to access protected content while limiting actions such as copying, printing, or sharing.

The working principle of DRM is based on two key processes:

- (i) **Encryption** of digital content before distribution.
- (ii) **Authentication and authorization** to ensure that only legitimate users can access the content.

The details description of DRM technology working system is categorized in six sections as following:

- (i) **Encryption:** Converts digital content into unreadable cipher text that can only be accessed using the appropriate decryption key. It commonly employs public-key and private-key cryptography.
- (ii) **Digital Watermarking:** Embeds hidden copyright or ownership information into digital content to protect intellectual property and trace unauthorized distribution.

- (iii) **Digital Certificates:** Electronic credentials issued by trusted Certification Authorities (CAs) that verify the identity of users or devices using cryptographic key pairs, typically following the X.509 standard.
- (iv) **Digital Fingerprinting:** Generates unique identifiers for digital content to verify authenticity and detect unauthorized distribution, widely used by online media platforms.
- (v) **Secure Communication Protocols:** Protocols such as SSL and TLS secure data transmission between clients and servers by preventing interception, tampering, and forgery.
- (vi) **Access Control:** Restricts access to protected content based on user authentication and permissions, ensuring that only authorized users can view or use copyrighted materials.

8. Role of Library Professionals for DRM in Modern Libraries

Library professionals have diverse perspectives regarding Digital Rights Management (DRM), as it often transfers considerable control over digital resources from libraries to technology providers, publishers, and content intermediaries. While DRM can support copyright protection and secure digital content, its improper implementation may create challenges for libraries and users, such as:

- (i) Restricting the traditional “first sale doctrine” by limiting libraries’ ability to lend, transfer, or manage digital resources.
- (ii) Promoting a “pay-per-use” model, this may increase the cost of accessing digital information resources.
- (iii) Imposing time-based access restrictions that limit the long-term availability and usability of digital content.
- (iv) Hindering digital preservation and archiving activities, which are essential responsibilities of libraries for maintaining scholarly and cultural heritage.
- (v) Limiting the application of the fair use/fair dealing provisions under copyright law and affecting users’ legitimate rights to access and utilize information.
- (vi) Conducting Intellectual Property Rights (IPR) awareness and training programmes for library users to promote ethical access, responsible use, and compliance with copyright regulations while using digital content.

In the DRM-enabled digital environment, library professionals play a crucial role in balancing copyright protection with the fundamental library objectives of providing equitable access, preserving knowledge resources, and supporting information literacy among users.

9. Legal Perspective and Indian Legislation for DRM in Modern Libraries.

Traditional copyright laws face significant challenges in the digital environment, particularly due to the unique characteristics of digital content. The digitization process has created two major concerns:

- **Easy and Cost-Free Reproduction and Distribution:** Digital technologies enable the rapid, accurate, and almost cost-free reproduction and large-scale distribution of copyrighted materials, increasing the risk of unauthorized copying and dissemination.
- **Creation of Derivative Works:** Digital content can be easily modified, remixed, and combined with other digital materials to create new works, raising complex questions regarding ownership, licensing, and copyright protection.

In response to these challenges, copyright holders have increasingly adopted legal and technological measures, including Digital Rights Management (DRM), to protect intellectual property and regulate the use of digital resources. However, effective DRM implementation requires a balanced approach that considers both the rights of content creators and the legitimate needs of users. Legal and Ethical Considerations of DRM in libraries are following:

- (i) **Fair Use and User Rights:** Fair use, also known as personal or permitted use, allows limited reproduction of copyrighted works under specific conditions without requiring prior authorization. The concept is recognized in several countries, including the United States under Section 107 of the Copyright Act. In the landmark *Sony Corporation of America v. Universal City Studios, Inc. (Sony Betamax Case, 446 U.S. 417)*, the U.S. Supreme Court established that certain forms of copying for legitimate purposes could be considered fair use. However, many DRM systems may not automatically accommodate fair use provisions, requiring users to seek permission from rights holders or licensing authorities for activities such as educational use, research, quotation, or content excerpting.
- (ii) **Privacy Concerns:** DRM systems often involve monitoring and tracking mechanisms to control access and usage of digital resources. While such tracking may support copyright enforcement and licensing management, it also raises serious concerns regarding user privacy, data collection, and surveillance. Libraries, as institutions committed to intellectual freedom and confidentiality, must ensure that DRM technologies protect content without compromising users' privacy rights.
- (iii) **Rights Holder Control and User Accessibility:** DRM provides copyright owners with greater control over the distribution, access, and usage of digital materials. Although strict control mechanisms may be essential for enterprises and publishers to protect valuable content, excessive restrictions can negatively affect user experience and limit legitimate access. The success of platforms such as Apple's iTunes Music Store, which adopted relatively flexible DRM practices, demonstrates the importance of balancing content protection with consumer convenience and accessibility.
- (iv) **Rights Management Information:** Rights Management Information (RMI) refers to metadata embedded within digital content that identifies details such as the title, author, copyright owner, and terms of use. Unlike user identification systems, RMI primarily focuses on information related to ownership and usage rights. In India, the Copyright Act, 1957, through Sections 65A and 65B, provides protection against circumvention of technological protection measures and unauthorized alteration or removal of rights management information. Section 65A addresses violations related to technological

protection measures (TPM), while Section 65B protects the integrity of RMI by penalizing the intentional removal or modification of such information.

10. Comparison of Indian and USA Legislation Related to DRM

The legal framework governing DRM differs significantly between the United States and India in terms of scope, enforcement, and user rights. In the United States, the Digital Millennium Copyright Act (DMCA), 1998 provides comprehensive legal protection for technological protection measures (TPMs) through stringent anti-circumvention provisions. The DMCA distinguishes between access-control measures and copy-control measures, prohibits the circumvention of access controls, and provides both civil and criminal remedies for copyright infringement. At the same time, it recognizes certain statutory exemptions, including those related to fair use, library preservation, research, and educational activities.

In contrast, India's Copyright Act, 1957, as amended by the Copyright (Amendment) Act, 2012, introduced provisions relating to Technological Protection Measures (Section 65A) and Rights Management Information (Section 65B). However, unlike the DMCA, Indian legislation does not clearly differentiate between access-control and copy-control mechanisms and primarily relies on criminal penalties for the unauthorized circumvention of DRM technologies or the removal of rights management information. The Act does not provide an equivalent civil cause of action specifically for DRM violations.

Overall, while the U.S. legal framework offers a more comprehensive and technologically mature approach to DRM enforcement, the Indian framework places greater emphasis on copyright protection through criminal sanctions. Strengthening India's DRM legislation by introducing clearer provisions on technological protection, civil remedies, interoperability, fair use, and library exceptions would help achieve a more balanced framework that protects intellectual property while preserving lawful access to digital knowledge in modern libraries.

11. Discussions

The several studies indicate that Digital Rights Management (DRM) has evolved from a traditional copyright protection mechanism into a comprehensive framework integrating technological innovations, legal regulations, institutional governance, and ethical information management. As digital libraries continue to expand through e-books, e-journals, institutional repositories, online databases, and cloud-based services, DRM has become an essential component of digital library management. Rather than merely preventing unauthorized copying, DRM now enables libraries to balance intellectual property protection with secure, lawful, and equitable access to digital resources.

The early literature primarily focused on copyright protection and legal compliance. Hombal and Prasad (2012) identified copyright infringement as a major challenge for digital libraries, emphasizing the need for effective DRM policies. Similarly, Baraliuc et al. (2012) highlighted the importance of balancing copyright enforcement with users' rights, privacy, and equitable access to information, while Tamilselvan and Balasubramanian (2012) advocated

integrating technological safeguards such as encryption, authentication, digital watermarking, and licensing mechanisms with institutional policies and legal frameworks. These studies collectively established that DRM requires a combination of technological, legal, and organizational measures to be effective.

Subsequent research shifted towards the practical implementation of DRM in academic and research libraries. Handa and Bhatt (2015), Mir (2016), Chattopadhyay (2016), and Niqresh (2018) emphasized copyright awareness, licensing agreements, institutional policies, and the expanding role of librarians in managing digital resources. Patil and Agarwal (2019) and Panda (2021) further recognized DRM as a key component of electronic resource management and recommended continuous professional training in copyright legislation, licensing negotiations, and digital content administration. These studies suggest that effective DRM implementation depends equally on technological infrastructure and the expertise of library professionals.

The COVID-19 pandemic significantly accelerated digital transformation in libraries. The rapid expansion of remote learning and online research increased dependence on digital collections, including e-books, e-journals, databases, and institutional repositories. Although this transition improved access to scholarly information, it also intensified concerns regarding unauthorized copying, digital piracy, cybersecurity, and licensing compliance. Consequently, DRM emerged as a strategic requirement for protecting institutional digital assets while ensuring uninterrupted access for authorized users.

Recent studies reveal a paradigm shift from centralized DRM systems towards decentralized, intelligent, and user-oriented technologies. Blockchain has emerged as one of the most promising innovations in this field. Liu et al. (2022) demonstrated that blockchain enables secure decentralized rights management through smart contracts and cryptographic mechanisms. Khan (2022) similarly highlighted the potential of blockchain-based DRM to improve copyright authentication, licensing transparency, and transaction security. Madushanka et al. (2024), Rajkumar, Ibekeme, and Ngololo (2026), and Laboso et al. (2026) further confirmed that blockchain-based DRM enhances transparency, accountability, authentication, and decentralized governance. However, issues relating to scalability, interoperability, implementation costs, and institutional readiness continue to restrict its widespread adoption in library environments.

Another important finding concerns the need to balance copyright protection with equitable access to information. Garcia and Thompson (2023) and Santos and Pereira (2023) observed that overly restrictive DRM policies may limit digital lending, interlibrary loan, educational use, and collaborative research. Erickson and Stobo (2024) further noted that restrictive DRM may impede scholarly communication, text and data mining, and long-term digital preservation. Accessibility also remains a critical concern. Bhardwaj and Tyagi (2024) and Devi and Kumar (2024) reported that conventional DRM systems often restrict compatibility with assistive technologies, thereby limiting access for visually impaired users. These findings emphasize the importance of developing flexible, interoperable, and accessibility-oriented DRM systems that support both copyright protection and inclusive access.

The literature also demonstrates that DRM has evolved into a broader governance framework rather than simply a technological solution. Breslin (2025) highlighted the implications of generative artificial intelligence for copyright governance and stressed the need for adaptive DRM policies capable of managing AI-generated content. Similarly, Singh and Singh (2025) viewed DRM as an integrated framework combining technological safeguards, legal regulations, institutional governance, and ethical information management, while Abdelrahman (2026) emphasized privacy-by-design, cybersecurity, and user-centric governance as essential components of future DRM systems.

In the Indian context, DRM has become increasingly significant with the expansion of initiatives such as the National Digital Library of India (NDLI), Shodhganga, e-ShodhSindhu, SWAYAM, and institutional repositories. These initiatives have enhanced access to scholarly information but have also increased the need for effective copyright management and secure digital content delivery. The Copyright Act, 1957 (as amended in 2012), together with the Information Technology Act, 2000, provides the legal foundation for DRM implementation. Nevertheless, practical challenges remain, including inadequate technological infrastructure, limited copyright awareness, interoperability issues, accessibility concerns, and the need to balance copyright protection with fair dealing provisions.

The review also highlights the evolving responsibilities of library professionals. Modern librarians are expected to negotiate licensing agreements, ensure copyright compliance, educate users on intellectual property rights, formulate institutional copyright policies, and promote ethical information use. Their role has expanded from collection management to digital rights administration, making continuous professional development in copyright, licensing, and emerging DRM technologies increasingly important.

Overall, the literature confirms that DRM has matured into a multidimensional framework encompassing technology, law, institutional governance, and ethical information management. Emerging technologies such as blockchain, artificial intelligence, decentralized identity management, and privacy-preserving architectures offer significant opportunities for developing more transparent, secure, and user-centric DRM systems. Future DRM strategies in India should therefore prioritize interoperability, accessibility, fair use, and sustainable digital preservation while protecting intellectual property. Such a balanced approach will enable libraries to strengthen digital resource management, support research and innovation, and continue fulfilling their fundamental mission of providing equitable access to knowledge in the digital era.

12. Challenges Ahead DRM in Modern Libraries

In the digital environment, while DRM offers numerous benefits, it also presents the following key challenges:

- (i) **Balancing Copyright Protection and User Access:** One of the foremost challenges is maintaining an appropriate balance between safeguarding copyrighted digital resources and ensuring seamless access for legitimate users. Excessively restrictive DRM

policies may hinder teaching, research, interlibrary loan, preservation, and fair use, thereby limiting the core mission of libraries.

- (ii) **Technological Interoperability and Platform Compatibility:** Many DRM solutions are proprietary and often lack interoperability across different devices, operating systems, e-book platforms, and digital repositories. The adoption of open standards and interoperable DRM frameworks is essential to improve accessibility, reduce vendor dependence, and support long-term digital preservation.
- (iii) **Legal, Ethical, and Privacy Concerns:** DRM implementation raises important issues related to copyright exceptions, licensing terms, user privacy, data protection, and intellectual freedom. Libraries must ensure compliance with applicable copyright laws while protecting users' personal information and preserving legitimate educational and research uses of digital resources.
- (iv) **Cyber Security and DRM Circumvention:** No DRM system is entirely immune to hacking, reverse engineering, or unauthorized circumvention. Libraries must therefore adopt multi-layered security mechanisms, continuous system monitoring, encryption technologies, and periodic security audits to minimize piracy and unauthorized access.
- (v) **Emerging Technologies and AI Challenges:** The rapid adoption of Artificial Intelligence (AI), generative AI, cloud computing, blockchain, and decentralized digital platforms has introduced new challenges in managing digital rights, automated content creation, ownership attribution, and AI-generated materials. DRM frameworks must evolve to address these technological developments while ensuring transparency, accountability, and compliance with intellectual property laws.
- (vi) **Capacity Building and Policy Development:** Many libraries continue to face shortages of skilled personnel, financial resources, and institutional DRM policies. Regular professional training, awareness programmes, and the development of standardized national DRM guidelines are essential for the effective management of digital collections in the rapidly evolving information environment.

13. Recommendations and Future Research Areas

Based on the findings of this study, several recommendations are proposed to strengthen the implementation of Digital Rights Management (DRM) in modern libraries. First, policymakers should develop a balanced and comprehensive DRM framework that safeguards intellectual property while ensuring fair, equitable, and uninterrupted access to digital information for library users. Indian copyright legislation and institutional policies should be periodically updated to address emerging technologies such as Artificial Intelligence (AI), Blockchain, cloud computing, and digital preservation. Libraries should adopt interoperable, standards-based, and user-centric DRM solutions that support secure content sharing, long-term preservation, and accessibility without imposing unnecessary restrictions on legitimate users. Capacity-building programmes should also be organized to enhance the legal, technical, and ethical competencies of library professionals in DRM implementation.

Future research should focus on AI-enabled DRM systems, Blockchain-based copyright protection, smart contract applications, privacy-preserving access control, and the impact of DRM on Open Access and Open Educational Resources (OER). Comparative studies

examining DRM policies and legal frameworks across different countries, including India, the United States, and the European Union, would provide valuable policy insights. Further empirical research is also needed to investigate users' perceptions of DRM, the effectiveness of various technological solutions, and the role of DRM in supporting digital preservation, research data management, and sustainable digital library ecosystems in the evolving information society.

14. Conclusion

Digital Rights Management (DRM) has become a fundamental component of modern library services, enabling the secure management, distribution, and use of digital resources while protecting intellectual property rights. The rapid growth of digital collections and online access has increased the need for robust DRM frameworks that balance copyright protection with equitable access to information. In India, strengthening DRM requires the integration of advanced technologies, clear legal and policy frameworks, and user-centric implementation strategies. Emerging technologies such as artificial intelligence, blockchain, and smart licensing mechanisms offer significant opportunities to develop transparent, secure, and interoperable DRM systems. Library professionals will play a pivotal role in implementing these innovations while ensuring compliance with copyright laws, safeguarding user privacy, and promoting ethical information use. By adopting effective DRM policies and best practices, modern libraries can protect the interests of authors and publishers without compromising the fundamental mission of libraries to provide fair, lawful, and sustainable access to knowledge. Such an approach will support the development of a resilient digital information ecosystem and strengthen the future of library and information services in India

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