



NEXT GENERATION PLATFORMS IN LIBRARY MANAGEMENT SYSTEMS: A REVIEW OF WEB-BASED AND CLOUD-BASED SOFTWARE



H.A. Moruf¹ and I. Z. Abu²

¹Department of Library and Information Science, Federal University Dutsin-Ma, Katsina State, Nigeria

²Department of Computer Science, Bayero University, Kano, Kano State, Nigeria

*Corresponding author: hawwau.moruf@yahoo.com

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Abstract: Library Management Systems (LMS) are essential in modern libraries, facilitating efficient cataloging, circulation, and user management. Technological advancements have led to the development of next-generation LMS platforms. This review explores the emerging trends in web-based and cloud-based LMS software, examining their advantages, challenges, and potential impact on library operations. By evaluating the features such as scalability, security, and accessibility of these systems, libraries can make informed decisions about the most suitable LMS for their needs. Hence, LMS is vital for libraries to effectively serve their staff and patrons. Libraries must collaborate closely with LMS providers to implement robust security measures and privacy practices to mitigate potential risks.

Keywords: Cloud Computing, Library Management System, Integrated System, Software

Introduction

Libraries today operate in a hybrid system, encompassing information in physical, electronic, and digitized formats. As technology advances, libraries evolve into dynamic organisms, serving as reservoirs of organized information resources for their patrons (Moruf and Adeleke, 2018). The diverse range of resources and rapid technological developments have compelled libraries to offer more efficient and convenient services, facilitated by Library Management Systems (LMS). According to Moruf *et al.* (2020), the primary software used by libraries today is the LMS platforms, which consists of multifunctional, adaptable applications allowing libraries to manage, catalog, and circulate their materials to patrons.

An LMS is software designed to handle the primary housekeeping functions of a library. It is a computer-based library information system, acting as a data framework for library administration and serving as a bibliographic information system for members. LMSs play a vital role in modern libraries, streamlining various administrative tasks and enhancing overall operational efficiency by automating processes such as cataloguing, circulation, acquisitions, resource management as well as reducing manual efforts by saving time for library staff (Shanmugam *et al.*, 2020). According to Begum and Elahi (2022), LMS platforms provide seamless access to library resources for patrons through online catalogs, enabling users to search, request, and reserve materials remotely, thereby enhancing user experience and satisfaction. LMSs also offer comprehensive data management capabilities, allowing libraries to generate reports, analyze usage trends, and make data-driven decisions, which help optimize collections and services (Shanmugam *et al.*, 2020).

Recent developments in library management systems propose models for next-generation LMS. The need for transition to these platforms arises from the rapidly evolving technological landscape and changing user expectations. Next-generation platforms offer enhanced functionalities, improved user experiences, and better scalability, addressing the limitations of traditional systems. They leverage the latest technologies, such as cloud computing, artificial intelligence, and data analytics, to provide advanced features and capabilities that

significantly improve library operations and user services (Varghese and Buyya, 2018).

Next-generation platforms in libraries are innovative technological systems designed to enhance the management, accessibility, and dissemination of information. They support diverse media formats and facilitate seamless integration with external databases and digital resources, allowing libraries to offer a more dynamic and responsive service (Varghese and Buyya, 2018). Additionally, next-generation platforms enable better data management and security, support collaborative workspaces, and enhance digital literacy programs, ensuring libraries remain relevant and valuable in the evolving digital landscape.

Library today operates in hybrid system containing information in physical, electronic or in a digitized format. It is a fast growing organism, progressing as technology advances and serves as a pool of information sources by providing organised collection of information resources to the clientele (Moruf and Adeleke, 2018). The diverse myriad of resources with rapid technology developments had compelled libraries to offer services that are more efficient and serve their community more conveniently with the aid of Library Management Systems (LMS). Moruf *et al.* (2020) noted that the main type of software in use in libraries today is the LMS platform, which are multifunction adaptable software applications that allows libraries to manage, catalog and circulate their materials to patrons.

A Library Management System can be regarded as software built to handle the primary housekeeping functions of a library. It is a computer-based library information system, which functions as data framework for the administration of library, and fills in as a bibliographic information system for library members. LMS play a vital role in modern libraries, streamlining various administrative tasks and enhancing the overall efficiency of library operations by automating library processes (cataloging, circulation, acquisitions, and resource management, reducing manual efforts and saving time for library staff) (Shanmugam *et al.*, 2020). According to Begum and Elahi (2022), LMS platforms facilitate seamless access to library resources for patrons through online catalogs, enabling users to search, request, and reserve materials remotely. This improved accessibility enhances user experience and satisfaction. Library Management Systems provide comprehensive data

management capabilities, allowing libraries to generate reports, analyze usage trends, and make data-driven decisions (Shanmugam *et al.*, 2020). These insights help libraries optimize their collections and services.

Recent developments in library management systems propose model for Next Generation Library Management System. The need for transition to next-generation platforms in library management systems arises from the rapidly evolving technological landscape and the changing expectations of library users. Next-generation platforms offer enhanced functionalities, improved user experiences, and better scalability, which address the limitations of traditional systems. Next-generation platforms leverage the latest technologies, such as cloud computing, artificial intelligence, and data analytics, to provide advanced features and capabilities that can significantly improve library operations and user services (Varghese and Buyya, 2018).

A number of literatures has been written on LMS, however, few publications exist on the discussion of next generation platform in LMS. To fill this literature gap, this article aims to reiterate awareness on the next generation library system by providing overview of web-based and cloud-based LMS, their dissimilarities, as well as the implementation approaches and prospects of the next generation library systems. Scholarly databases such as Science hub, ERIC and Google scholar search engines were explored for literature search. Methodical review was carried out using classical approach to analyse the existing literature.

Evolution of Library Management Systems

The origin of Library Management Systems (LMS) can be found in the initial stages of computerising library operations, which subsequently gave rise to web-based and cloud-based solutions. Library administration used to be totally manual, with card catalogues and handwritten records serving as the sole means of collection management and borrowing tracking. Cataloguing and circulation were among the first library operations to be mechanised with the introduction of personal computers in the '60s and '70s (Sivankalai, 2020). The first steps towards computer-based management were these early systems, which were placed on local servers.

A software suite that integrated many library functions into one became common in the 1980s and 1990s; this was called an Integrated Library System (ILS) (Sanaullah and Uddin, 2020). According to Attaran *et al.* (2017), library operations were greatly simplified by implementing ILS solutions, which streamlined cataloguing, circulation, acquisitions, and more. Around this time, OpenBiblio, NewGenLib, Koha, and Evergreen were among the first open-source ILS systems that were adopted by libraries (Moruf *et al.*, 2020).

Online learning management systems sprang up in the late '90s and early '00s, when the internet was just starting to take off. These systems made it possible for users to access library services remotely through web browsers, making it more convenient for users. Attaran *et al.* (2017) noted that cloud-based learning management systems rose to prominence in the 2010s, a time of broad cloud computing deployment. Because they could be accessible from any device with an internet connection, these systems were more cost-effective, scalable, and flexible than traditional on-premises servers.

The historical development of LMS can be traced back to the early computerization of library processes, leading to the emergence of web-based and cloud-based systems. In the early days, library management was entirely manual,

relying on card catalogs and handwritten records to manage collections and track borrowing. With the advent of computers in the 1960s and 1970s, libraries started using automated systems for tasks like cataloging and circulation (Sivankalai, 2020). These systems were installed on local servers and marked the initial steps towards computer-based management. In the 1980s and 1990s, Integrated Library Systems (ILS) became prevalent, combining various library functions into a single software suite (Sanaullah and Uddin, 2020). ILS solutions integrated cataloging, circulation, acquisitions, and more, streamlining library operations (Attaran *et al.*, 2017). At the same time, open source ILS was in its beginning phases of testing. A few libraries started moving to such open source ILSs as OpenBiblio, NewGenLib, Koha, Evergreen etc. (Moruf *et al.*, 2020).

As the internet gained prominence in the late 1990s and early 2000s, web-based LMS emerged. These systems offered access to library services through web browsers, enabling remote access and enhancing user convenience. With the widespread adoption of cloud computing, cloud-based LMS became prominent in the 2010s (Attaran *et al.*, 2017). These systems provided more flexibility, scalability, and cost-effectiveness, as they did not require on-premises servers and could be accessed from any internet-enabled device.

Challenges and limitations of traditional on-premises LMS

Traditional on-premises Library Management Systems (LMS) have been foundational for libraries over the years, yet they come with various challenges and limitations that have become more apparent as technology and user expectations have evolved. According to Shaw and De Sarkar (2021), these challenges and limitations include:

1. **Cost and Infrastructure:** Implementing and maintaining on-premises LMS require significant upfront costs for hardware, software licenses, and IT infrastructure. Libraries must invest in servers, storage, and networking equipment, leading to substantial expenses.
2. **Maintenance and Updates:** Libraries are responsible for the ongoing maintenance and updates of on-premises LMS, which can be time-consuming and resource-intensive. Managing software updates, security patches, and backups necessitates dedicated IT staff and continuous effort.
3. **Scalability:** Traditional LMS often face scalability limitations, making it difficult for libraries to accommodate growing collections and user bases. Expanding the system to meet increasing demands may require additional hardware and system upgrades.
4. **Remote Access:** On-premises LMS can struggle to provide seamless remote access to library services for users outside the library premises. This limitation is significant as users increasingly expect remote access to resources and services.
5. **Data Security:** Ensuring data security on local servers can be more challenging than relying on secure cloud-based solutions. On-premises LMS may be more vulnerable to security risks, requiring libraries to implement additional measures to protect sensitive patron information.
6. **Integration and Interoperability:** Traditional on-premises LMS may lack flexibility in integrating with other library systems or external

applications. This lack of interoperability can hinder seamless data exchange and limit the effectiveness of library services.

Emergence of Web-Based and Cloud-Based LMS as Alternatives

LMS as alternatives to traditional on-premises systems has been driven by technological advancements and the need for more flexible and scalable solutions. Web-based LMS started gaining popularity in the late 1990s and early 2000s with the widespread adoption of the internet (Otto, 2017). These systems allowed libraries to access and manage their resources through web browsers, enabling library staff and users to interact with the system from any internet-connected device. Web-based LMS offered several advantages, including improved accessibility for library staff and users, reduced hardware and maintenance costs, and faster software updates and enhancements (Roy and Kumar, 2017). The ease of use and remote access capabilities made web-based LMS an attractive alternative to traditional on-premises systems.

The concept of cloud computing gained traction in the 2000s, leading to the development of cloud-based LMS. These systems offered libraries even greater flexibility and scalability by leveraging cloud infrastructure to host and deliver services over the internet. Cloud-based LMS provided numerous benefits, including easier scalability to accommodate changing library needs, automatic backups and data recovery, enhanced security measures, and a reduced IT management burden for libraries (Attaran *et al.*, 2017). They also facilitated seamless integration with other cloud services and third-party applications.

Over the years, the adoption of both web-based and cloud-based LMS has grown significantly. Libraries of all sizes and types have embraced these alternatives due to their cost-effectiveness, improved user experience, and ability to stay up-to-date with the latest technologies (Sanaullah and Uddin, 2020). The comparison between these two LMS platforms is illustrated in Table 1.

The emergence of web-based and cloud-based Library Management Systems (LMS) as alternatives to traditional

on-premises systems has been driven by advancements in technology and the need for more flexible and scalable solutions. Web-based LMS started gaining popularity in the late 1990s and early 2000s with the widespread adoption of the internet (Otto, 2017). These systems offered libraries the ability to access and manage their resources through web browsers, allowing library staff and users to interact with the system from any internet-connected device. Web-based LMS provided several advantages, including improved accessibility for library staff and users, reduced hardware and maintenance costs, and faster software updates and enhancements (Roy and Kumar, 2017). The ease of use and remote access capabilities made web-based LMS an attractive alternative to traditional on-premises systems.

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Table 1: Dissimilarity between Two Next Generation Platform (Asampana *et al.*, 2017; Shaw and De Sarkar, 2021)

Features	Web-Based System	Cloud-Based System
Accessibility	Accessible through web browsers from any internet-connected device	Accessible through web browsers, but hosted on cloud servers, enabling remote access and providing greater flexibility.
Scalability	Limited scalability based on the capacity of the on-premises server	Highly scalable, resources can be dynamically adjusted based on demand, accommodating growing library needs without hardware upgrades
Cost-Effectiveness	May require upfront costs for servers and infrastructure	Follows a pay-as-you-go model, reducing upfront costs and offering more cost-effective options for libraries with limited budgets
Maintenance and Updates:	Libraries are responsible for maintenance and updates, which can be time-consuming and require dedicated IT staff.	Service providers handle maintenance and updates, ensuring libraries always have access to the latest features and enhancements.
Data Security	Libraries need to manage data security on local servers, which may require additional security measures	Providers implement robust security measures, including encryption, access controls, and regular backups, ensuring data safety.
Reliability and Performance	Performance and reliability depend on the quality of the local network and server infrastructure	Operates on distributed infrastructure, providing high availability, reliability, and faster response times.
Integration and Collaboration	Integration and collaboration may be limited due to local server dependencies	Facilitates easier integration with other cloud services and third-party applications, enhancing collaboration and workflow efficiency

Nowadays, most web-based applications are just a part of a cloud. Resources from web application, at the back end are

done by a massive collection of servers and computers. However, cloud-based application utilizes network of

remote servers facilitated on the Internet to store, oversee and process information, as opposed to a local server or a personal computer (Shaw and De Sarkar, 2021).

Benefits of Cloud-Based LMS Over Web-Based Systems

Cloud-based Library Management Systems (LMS) offer numerous advantages over traditional web-based systems, especially regarding scalability, cost-effectiveness, ease of maintenance, reliability, data security, faster implementation, and enhanced collaboration and integration (Aldheleai *et al.*, 2027).

- **Scalability:** Cloud-based LMS provide dynamic resource scaling based on demand. Libraries can easily expand services and accommodate growing collections and user bases without needing significant hardware upgrades.
- **Cost-Effectiveness:** Cloud-based LMS follow a pay-as-you-go model, allowing libraries to pay only for the resources they use. This eliminates the need for upfront capital investments in servers and other hardware, making it a more economical solution, especially for smaller libraries with limited budgets.
- **Automatic Updates and Maintenance:** Service providers maintain cloud-based LMS, so libraries do not have to worry about software updates, security patches, or routine maintenance. This ensures libraries always have access to the latest features and improvements.
- **Reliability and High Availability:** Cloud-based LMS operate on distributed infrastructure across multiple data centers, providing high availability and reliable performance. This redundancy minimizes downtime and ensures library services are accessible around the clock.
- **Data Security and Backup:** Cloud-based LMS employ robust security measures, including data encryption, access controls, and regular backups. Data is stored in secure data centers with disaster recovery mechanisms.
- **Faster Implementation:** Cloud-based LMS can be quickly implemented compared to web-based systems, which may require more setup and configuration. Libraries can get up and running faster with cloud-based solutions.
- **Enhanced Collaboration and Integration:** Cloud-based LMS enable better collaboration among library staff and facilitate integration with other cloud services and third-party applications, enhancing overall efficiency and workflow.

User Experience and Accessibility

User experience and accessibility are crucial factors in evaluating the effectiveness and usability of web-based and cloud-based Library Management Systems. Both systems aim to provide intuitive interfaces and seamless access to library services for staff and patrons, regardless of location or device.

Web-Based LMS User Experience Considerations (Althobaiti and Mayhew, 2016):

- **Interface Design:** Web-based LMS typically offer user-friendly interfaces with intuitive navigation and visually appealing layouts. Clear and well-organized menus help users easily find the functions they need.

- **Responsive Design:** These systems are designed to be responsive, adapting to different screen sizes and devices, ensuring a consistent experience across desktops, laptops, tablets, and smartphones.
- **Speed and Responsiveness:** User experience depends on the system's responsiveness. Web-based LMS should provide quick response times, minimizing waiting periods for users when performing tasks.
- **Customization:** Some web-based LMS allow libraries to customize interfaces, tailoring the system's appearance and features according to specific needs and branding.

Cloud-Based LMS User Experience Considerations (Utami *et al.*, 2021):

- **Consistent Experience:** Cloud-based LMS offer a consistent experience for users regardless of location or device, accessible through web browsers.
- **Real-Time Updates:** These systems receive regular updates automatically, ensuring users always have access to the latest features and improvements without manual interventions.
- **Accessibility and Flexibility:** Cloud-based LMS provide easy remote access for library staff and patrons, enabling them to manage library services from any location with internet connectivity.
- **Collaboration Features:** Cloud-based LMS often include collaboration tools that allow library staff to work together in real-time, improving communication and workflow efficiency.

Accessibility Considerations for Both Systems

According to Asampana *et al.* (2017) and Chatterjee *et al.* (2022), accessibility considerations for both web-based and cloud-based LMS include:

- **Accessibility Standards:** Both LMS types should adhere to web accessibility standards (e.g., WCAG) to ensure that all users, including those with disabilities, can access and use the system effectively.
- **Compatibility with Assistive Technologies:** LMS interfaces should be compatible with commonly used assistive technologies like screen readers, voice recognition software, and keyboard navigation.
- **Alternative Formats:** The system should support alternative formats for content, such as accessible PDFs and structured metadata, to facilitate inclusivity for all users.
- **Multilingual Support:** Providing multilingual interfaces and content options enhances accessibility for libraries serving diverse communities.

Security and Privacy Concerns

Security and privacy are critical considerations for web-based and cloud-based LMS, as these systems handle sensitive library data and user information. Ensuring robust security measures and privacy protection is essential.

Security and Privacy Concerns in Web-Based LMS (Jain *et al.*, 2021):

- **Data Encryption:** Encrypting data transmitted between users and the LMS is crucial to prevent unauthorized access to sensitive information.
- **Secure Authentication:** Strong authentication mechanisms, such as multi-factor authentication, help protect user accounts from unauthorized access.
- **Vulnerability to Web-Based Attacks:** Web-based LMS may be vulnerable to various attacks, such as cross-site scripting (XSS) and SQL injection, which can compromise data and system integrity.
- **Patch Management:** Regularly applying security patches to the underlying software and components is essential to address known vulnerabilities.

Security and Privacy Concerns in Cloud-Based LMS (Alenizi *et al.*, 2021):

- **Data Protection:** Data stored in cloud-based LMS requires strong encryption and access controls to safeguard against unauthorized access.
- **Data Ownership and Location:** Libraries must ensure control over their data and know where it is physically stored to comply with data protection regulations.
- **Vendor Security Measures:** Libraries should assess the security practices of cloud service providers to ensure they meet industry standards.
- **Cloud Account Security:** Secure access controls and regular password updates are essential to protect against unauthorized access to cloud-based LMS accounts.

Cloud-based Library Management Systems offer several advantages over web-based systems, particularly in terms of scalability, cost-effectiveness, ease of maintenance, reliability and high availability, data security and backup, faster implementation and enhanced collaboration and integration (Aldheleai *et al.*, 2017).

- **Scalability:** Cloud-based LMS provide the ability to scale resources dynamically based on demand. Libraries can easily expand their services and accommodate growing collections and user bases without the need for significant hardware upgrades.
- **Cost-Effectiveness:** Cloud-based LMS follow a pay-as-you-go model, allowing libraries to pay for the resources they use. This eliminates the need for upfront capital investments in servers and other hardware, making it a more cost-effective solution, especially for smaller libraries with limited budgets.
- **Automatic Updates and Maintenance:** Cloud-based LMS are maintained by the service provider, meaning that libraries do not have to worry about software updates, security patches, or routine maintenance. The provider handles these tasks, ensuring that libraries always have access to the latest features and improvements.
- **Reliability and High Availability:** Cloud-based LMS operate on distributed infrastructure across multiple data centers, providing high availability and reliable performance. This redundancy reduces the risk of downtime and ensures that library services are accessible around the clock.
- **Data Security and Backup:** Cloud-based LMS employ robust security measures to protect library

data, including data encryption, access controls, and regular backups. Data is stored in secure data centers with disaster recovery mechanisms in place.

- **Faster Implementation:** Cloud-based LMS can be quickly implemented compared to web-based systems that may require more setup and configuration. Libraries can get up and running faster with cloud-based solutions.
- **Enhanced Collaboration and Integration:** Cloud-based LMS enable better collaboration among library staff and facilitate integration with other cloud services and third-party applications, enhancing overall efficiency and workflow.

User Experience and Accessibility

User experience and accessibility are crucial factors in evaluating the effectiveness and usability of web-based and cloud-based Library Management Systems. Both types of systems aim to provide intuitive interfaces and seamless access to library services for staff and patrons, regardless of their location or device. Althobaiti and Mayhew (2016) stated the below user experience consideration for web-based LMS:

- **Interface Design:** Web-based LMS typically offer user-friendly interfaces with intuitive navigation and visually appealing layouts. Clear and well-organized menus help users easily find the functions they need.
- **Responsive Design:** Web-based LMS are designed to be responsive, adapting to different screen sizes and devices, ensuring a consistent experience for users across desktops, laptops, tablets, and smartphones.
- **Speed and Responsiveness:** User experience depends on the system's responsiveness. Web-based LMS should provide quick response times, minimizing waiting periods for users when performing tasks.
- **Customization:** Some web-based LMS allow libraries to customize interfaces, allowing them to tailor the system's appearance and features according to their specific needs and branding.

Utami *et al.* (2021) stated the user experience consideration for cloud-based LMS as mentioned below:

- **Consistent Experience:** Cloud-based LMS offer a consistent experience for users regardless of their location or device, as the system is accessible through web browsers.
- **Real-time Updates:** Cloud-based LMS receive regular updates automatically, ensuring users always have access to the latest features and improvements without manual interventions.
- **Accessibility and Flexibility:** Cloud-based LMS provide easy remote access for library staff and patrons, enabling them to manage library services from any location with internet connectivity.
- **Collaboration Features:** Cloud-based LMS often include collaboration tools that allow library staff to work together in real-time, improving communication and workflow efficiency.

According to Asampana *et al.* (2017) and Chatterjee *et al.* (2022), the accessibility considerations for both web-based and cloud-based LMS are:

- **Accessibility Standards:** Both web-based and cloud-based LMS should adhere to web accessibility standards (e.g., WCAG) to ensure

that all users, including those with disabilities, can access and use the system effectively.

- **Compatibility with Assistive Technologies:** LMS interfaces should be compatible with commonly used assistive technologies like screen readers, voice recognition software, and keyboard navigation.
- **Alternative Formats:** The system should support alternative formats for content, such as accessible PDFs and structured metadata, to facilitate inclusivity for all users.
- **Multilingual Support:** Providing multilingual interfaces and content options enhances accessibility for libraries serving diverse communities.

Security and Privacy Concerns

Security and privacy are critical considerations when using web-based and cloud-based LMS. As these systems handle sensitive library data and user information, ensuring robust security measures and privacy protection is essential. Jain *et al.* (2021) wrote on the overview of security and privacy concerns in web-based LMS as follows:

- **Data Encryption:** Encryption of data transmitted between users and the web-based LMS is crucial to prevent unauthorized access to sensitive information.
- **Secure Authentication:** Strong authentication mechanisms, such as multi-factor authentication, help protect user accounts from unauthorized access.
- **Vulnerability to Web-Based Attacks:** Web-based LMS may be vulnerable to various web-based attacks, such as cross-site scripting (XSS) and SQL injection, which can compromise data and system integrity.
- **Patch Management:** Regularly applying security patches to the underlying software and components is essential to address known vulnerabilities.

According to Alenizi *et al.* (2021), security and privacy concerns in cloud-based LMS are:

- **Data Protection:** Data stored in cloud-based LMS requires strong encryption and access controls to safeguard it from unauthorized access.
- **Data Ownership and Location:** Libraries must ensure that they have control over their data and know where it is physically stored to comply with data protection regulations.
- **Vendor Security Measures:** Libraries should assess the security practices of the cloud service provider to ensure they meet industry standards.
- **Cloud Account Security:** Secure access controls and regular password updates are essential to protect against unauthorized access to cloud-based LMS accounts.

Integration and Interoperability of Library Management Systems

Integration and interoperability of Library Management Systems (LMS) are essential for libraries to streamline workflows, enhance services, and improve operational efficiency (Muhamad *et al.*, 2019). Integration refers to the ability of an LMS to connect with other systems and exchange data seamlessly. This capability allows for better data exchange and collaboration with other library systems, external databases, and third-party applications.

Integration with discovery systems enhances libraries' search and discovery capabilities, providing users with a single search interface that covers both the LMS and external resources. According to Breeding (2019), integrating LMS with third-party applications, such as digital content providers or learning management systems, extends the library's capabilities and offers more comprehensive services to users. Functionally, integrated LMS can automate data exchange between various library functions, reducing manual tasks, enhancing operational efficiency, and providing a cohesive patron experience where users can seamlessly access different library services without needing to log in multiple times (Muhamad *et al.*, 2019).

Interoperability, on the other hand, is the capacity of different systems to work together and share information effectively. Interoperability between LMS and institutional repositories ensures seamless access to locally produced content, such as research publications and theses (Agosti *et al.*, 2016). Interoperable systems reduce the risk of data duplication and errors, ensuring that information available to library staff and users is up-to-date and accurate (Fraga *et al.*, 2020).

Integration and interoperability of Library Management Systems (LMS) are critical factors that enable libraries to streamline their workflows, enhance services, and improve the overall efficiency of their operations (Muhamad *et al.*, 2019). Integration refers to the ability of an LMS to connect with other systems and exchange data seamlessly. Seamless integration with other library systems, external databases, and third-party applications allows for better data exchange and collaboration.

Integration with discovery systems allows libraries to enhance their search and discovery capabilities, providing users with a single search interface that covers both the LMS and external resources. According to Breeding (2019), integrating LMS with third-party applications, such as digital content providers or learning management systems, extends the capabilities of the library and offers more comprehensive services to users. Functionally, integrated LMS can automate data exchange between various library functions, reducing manual tasks, enhancing operational efficiency, and allows for a cohesive patron experience, where users can seamlessly access different library services without the need to log in multiple times (Muhamad *et al.*, 2019).

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Future Implications and Trends

As technology continues to evolve, LMS Technology is also expected to undergo advancements and witness emerging trends. Some anticipated developments and emerging trends in Library Management System technology are shown in Table 2.

Table 2: Anticipated Developments and Emerging Trends in Library Management System Technology

S/N	Anticipated Technology	Anticipated Trend	Author
1	Artificial Intelligence and Machine Learning in LMS	Enabling intelligent automation, personalized recommendations, and predictive analytics for better collection development and user engagement.	Asemi <i>et al.</i> (2020)
2	Linked Data and Semantic Web in LSM	Adoption of linked data and semantic web technologies to enhance data integration, interlinking library resources, and enabling more sophisticated search capabilities for users	Hyvonen (2022)
3	Open Access and Institutional Repository Integration	Greater integration of open access repositories into LMS to facilitate seamless discovery and access to open access resources, as well as the integration of institutional repositories for better showcasing of institutional research output	Anyira and Idubor (2020)
4	Mobile-First and Mobile-Friendly LMS	Development of LMS with a mobile-first approach, ensuring that interfaces are optimized for mobile devices, enabling users to access library services on-the-go.	Ajibade (2022)
5	Cloud-Native and Serverless LMS	Transition towards cloud-native and serverless LMS architectures, offering increased scalability, cost-efficiency, and simplified maintenance for libraries.	Raj <i>et al.</i> (2022)

These anticipated developments and emerging trends in Library Management System technology are likely to shape the future of libraries and their services, offering enhanced capabilities and improved user experiences. Libraries need to stay updated on these trends and consider their adoption to ensure they remain efficient and relevant in the digital age.

Conclusion

This paper provided an overview on the rationale for the transition to next-generation platforms, offering insights into the technological and user-driven factors influencing this shift in libraries. The comparative analysis of web-based and cloud-based Library Management Systems (LSM), exploring their features, advantages, and limitations. Ensuring a positive user experience and high accessibility levels in both web-based and cloud-based LMS is essential for libraries to effectively meet the needs of their staff and patrons. Libraries must work closely with their LMS providers to implement robust security measures and privacy practices to mitigate potential risks.

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