Seamless Integration of Koha and DSpace for Enhanced Management of Theses and Dissertations in Hybrid Environment: A Case of the University of Zambia Library

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Authors Note

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Abstract

Academic libraries are increasingly handling a growing volume of digital resources. Managing Electronic Theses and Dissertations (ETDs) in a hybrid environment poses significant inefficiencies in processing and metadata management (Enweani, 2018). This study proposed an innovative approach to overcoming these challenges by integrating Koha, an open-source Integrated Library System (ILS) with DSpace, a leading digital repository platform, to create a unified solution for ETD management at the University of Zambia Library. The integration addressed key issues such as fragmented workflows, duplicated processing efforts and limited resource discoverability when physical and digital collections were managed separately (Deng & Reese, 2009). By leveraging Koha's comprehensive library management functionalities alongside DSpace's robust repository capabilities, the integration sought to streamline cataloging, acquisition, and access processes, ultimately improving efficiency and user experience for both library staff and patrons (Oboko & Ireri, 2020). To explore the feasibility of this integration, the study conducted desk research, drawing from academic literature, case studies, and technical documentation (Hasselbring, 2000). Expert consultations with professionals in library science, information technology, and open-source software development provided additional insights into the technical, functional, and organizational considerations required for successful integration (Khan, 2017). The study included a detailed feasibility analysis examining system compatibility, customization potential and implications for metadata synchronization (Ranasinghe & Perera, 2017). Preliminary findings indicated that the integration of Koha and DSpace would be feasible and could significantly enhance ETD visibility, improve metadata quality and streamline data management (Lazarinis, 2015). The study outlined a phased implementation roadmap, addressing potential challenges such as data migration and technical complexities. It proposed a forward-looking solution that aligns with the evolving needs of academic libraries in the digital age (Kumar & Jasimudeen, 2012).

Keywords: Koha, DSpace, Integrated Library Systems, Repository Software, electronic resources, academic libraries, integration, feasibility, open source, library management, User Satisfaction.

1. Introduction

A hybrid library is in the continuum between conventional and digital libraries where electronic and paper-based information sources are used alongside each other. In the rapidly evolving landscape of academic libraries, managing Electronic Theses and Dissertations resources has become increasingly complex and integral to supporting academic institutions' teaching, learning and research missions. The proliferation of digital content, including Electronic These and dissertations (ETDs), e-books, journals, databases and multimedia resources, presents both opportunities and challenges for library professionals tasked with acquiring, organizing, and providing access to these materials (Enweani, 2018).

Koha, a widely adopted open-source ILS, has gained popularity for its comprehensive library management functionalities, including cataloging, circulation, acquisitions, and serial management. Similarly, DSpace, an open-source repository software has emerged as a leading platform for managing and preserving digital content, enabling institutions to showcase their scholarly output, institutional archives and special collections (Bansode and Dange, 2019).

While Koha and DSpace excel in their respective domains, their standalone implementations at the University of Zambia library lead to siloed systems, fragmented workflows and duplication of efforts when managing ETDs in a hybrid environment (UNZA, 2010). Recognizing the need for a holistic approach to electronic theses and dissertations management, there was a need to explore the feasibility of integrating Koha and DSpace to create a unified solution that would seamlessly bridge the gap between library collections and digital repositories. This integration holds the promise of streamlining processes, enhancing discoverability, and improving user experiences across the entire spectrum of ETDs. By leveraging the strengths of Koha's library management functionalities and DSpace's repository capabilities, academic libraries

could achieve greater efficiency, consistency, and interoperability in managing ETDs (Oboko and Ireri, 2020). This research delved into the feasibility of integrating Koha and DSpace for enhanced library management of ETDs in academic institutions for improved visibility. By examining the technical, functional, organizational and strategic considerations involved in such integration, drawing on existing literature, by elucidating the potential benefits, challenges and implementation strategies, this study aimed to provide insights and guidance for academic libraries embarking on the journey toward seamless integration of Koha and DSpace.

2. Objectives

This paper was guided by the following objectives:

1. To explore the feasibility of providing unified access to physical and Electronic collections of theses and dissertations through a single interface.
2. To ascertain the need to sync ETD metadata between Koha and DSpace for resource discoverability.

3. Methodology

3.1. Research Design

This study adopted a qualitative research approach. A case study design was employed to explore the possibility of integrating Koha and DSpace in a real-world academic institution setting. This design was appropriate for an in-depth investigation into the feasibility and need for KOHA and Dspace workflows syncing and unified access for improved resource discovery.

3.2. Data Collection Methods

To meet the above research objectives, the following data collection methods were used:

3.2.1. Desk research

A comprehensive review of existing literature, including; 3 academic papers, 1 case study, 2 technical documents, and 2 professional journal articles, were conducted to gain insights into the possible integration of Koha and DSpace, as well as best practices in electronic theses and dissertations in resource management in academic libraries.

3.2.2. Expert Consultation:

3 system Librarians with experts in the fields of library science and information technology and 1 open-source software development expert were consulted. These experts provided valuable perspectives on technical considerations, customization requirements, implementation strategies, and potential pitfalls associated with Koha/DSpace system integration.

3.2.3. Questionnaires

Questionnaires were purposely distributed to 3 librarians, 2 IT professionals, and 3 other stakeholders in academic libraries to gather data on current practices, challenges, and preferences related to ETD metadata management in Koha and in DSpace on resource discoverability in a hybrid environment. The responses obtained helped inform the development of recommendations and best practices for integrating Koha and DSpace.

3.2.4. Feasibility Analysis

A comprehensive analysis of the technical, functional, organizational and financial aspects of integrating Koha and DSpace was conducted to assess feasibility. This analysis considered factors such as compatibility, customization requirements, data migration, user training, maintenance costs, scalability, and community support.

By employing a multifaceted methodology encompassing literature review, case studies, expert consultation, surveys, feasibility analysis, risk assessment, and implementation planning, this study aimed to provide a comprehensive understanding of the integration

of Koha and DSpace for enhanced library management of information resources in physical and electronic resources in academic institutions.

4. Results

4.1. Feasibility of providing unified access to physical and Electronic collections of Theses and Dissertations through a single interface.

The results from a comprehensive review of existing literature and expert consultations indicated that integrating Koha and DSpace is technically feasible as there exists tools and resources that would facilitate integration (Bhowmick & Chakrabarty, 2021). while Compatibility checks revealed that both systems could be configured to communicate with each other effectively, allowing for seamless data exchange and interoperability (Khan, 2017; Adrakatti, Wodeyar & Kumbar, 2017).

The integration of Koha 24.05.01, DSpace 8.0, Moodle 4.2.1, and Calibre-web 6.26 as presented in the ISO image by Thirunavukarasu and Kavimani (2024) offers a comprehensive solution for academic institutions and libraries seeking to streamline their resource management and learning environments. This integration addresses common challenges such as data redundancy, disjointed workflows, and inefficiencies by creating a unified system where library management, digital repositories, e-learning platforms, and e-book access are interconnected. By synchronizing these platforms, the integrated system could enhance user experience through consolidated search functionalities, simplified resource access and improved operational efficiency. For instance, managing Electronic Theses and Dissertations (ETDs) could become more efficient as metadata and content are seamlessly shared between Koha and DSpace, reducing the need for duplicate entries and ensuring consistency across platforms. Despite potential technical challenges, such as compatibility issues or the need for customized configurations, the benefits of improved resource management, reduced redundancy, and enhanced accessibility make this integrated approach a valuable asset for institutions looking to optimize their digital and learning ecosystems.

4.2. KOHA and Dspace Integration through Application Programmable Interface (API)

A system analysis showed that Koha's RESTful API could facilitate access to bibliographic records, user data, and circulation information. The API could be leveraged to manage and synchronize data between Koha and DSpace. Similarly, DSpace's REST API could allow for managing digital objects, collections and metadata. By utilizing both APIs, a middleware application could be developed to enable seamless data transfer and synchronization.

4.2.1. Steps for KOHA and DSpace Integration

1. **Setup API Access:**
    - Ensure both Koha and DSpace instances have their REST APIs enabled and accessible.
    - Obtain API keys or access credentials for both systems.
2. **Define Data Mapping:**
    - Determine which data fields from Koha need to be synchronized with DSpace and vice versa.
    - Create a mapping schema for bibliographic records, user data, and circulation information between the two systems.
3. **Develop Middleware:**
    - Create a middleware application that acts as a bridge between Koha and DSpace.
    - This application handles API requests, data transformation, and synchronization.

4.2.2. Synchronization Logic

1. **Fetch Data from Koha:**
    - Use the Koha API to retrieve bibliographic records or user data.

2. **Transform Data:**
    - Convert the data into a format that DSpace API could understand.
3. **Push Data to DSpace:**
    - Use the DSpace API to create or update records in the DSpace repository.

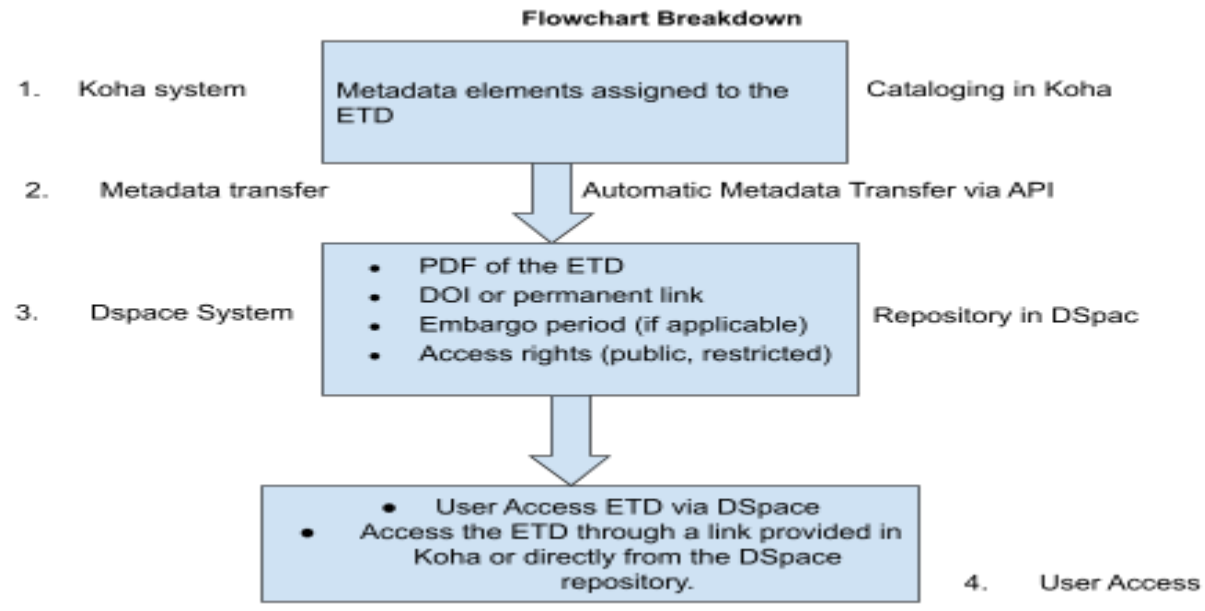
4.2.3. Automation

Middleware could be scheduled to run periodically using a task scheduler (e.g., cron jobs) or implement real-time synchronization using webhooks if supported by both systems.

4.2.4. Error Handling & Logging

There is a need to ensure that robust error handling and logging mechanisms are implemented to track the synchronization process and troubleshoot issues effectively.

The diagram below shows the integration flow chart:



4. Ascertaining the need for synchronization of Electronic Theses and Dissertations metadata between Koha and DSpace

The synchronization of Electronic Theses and Dissertations (ETD) metadata between Koha and DSpace could enhance resource discoverability, as evidenced by the following results.

4.1. Enhanced Electronic Theses and Dissertations Visibility

Results from the respondents showed that the unification of metadata across these systems, could enhance resource visibility, improve user experiences, and optimize operational efficiency in libraries. This is because the integration of KOHA and DSpace would result in a Single Access Point and Users could search for ETDs through either Koha or DSpace, reducing the need to search in multiple systems.

The study also found that a unified metadata would allow for more advanced search options, including full-text searches, subject-based searches, and author searches. It was also observed that cross-system linking of metadata would facilitate easier access and exploration of resources. By appearing in both library catalogs (Koha) and institutional repositories (DSpace), ETDs could gain a wider audience.

4.2. .Improved Electronic Theses and Dissertation Metadata Quality

The study observed that synchronizing metadata would lead to Consistent Metadata Standards. Synchronized metadata ensures that the same standards are applied across both systems, improving the accuracy and completeness of metadata. At the same time, consistent and comprehensive metadata improves the chances of ETDs being indexed by external search engines like Google Scholar due to Search Engine Optimization (SEO).

The study also discovered that metadata synchronization would lead to enhanced metadata records**.** Integration would allow for the enrichment of metadata with additional fields and details, making ETDs more discoverable. Well-synchronized metadata could be more easily shared with other academic and research databases, increasing the visibility of ETDs.

4.3. Streamlined Processing and User Experience

It was observed that metadata synchronization would result in users encountering a consistent presentation of ETD metadata regardless of the platform they would use, which could enhance user satisfaction and engagement.

The study also found that KOHA and Dspace integration would eliminate redundancy in the processing of ETDs using two systems, a case that makes UNZA library to have a huge backlog of unprocessed ETDs. Without synchronization, librarians would need to manually input metadata for ETDs separately in Koha and DSpace. This double entry leads to inefficiencies, as the same metadata (e.g., title, author, publication date, keywords) would be entered twice. Synchronization would therefore eliminate the need for this redundancy, ensuring: Reduced manual labor, Lower risk of human error and promoting consistency across systems**.**

4.4. Enhanced Data Management

System synchronization could automate the update and maintenance of metadata across both systems, ensuring that records are always up-to-date. This could result in efficient data handling. Library staff could then manage ETD records in one system, with changes automatically reflected in the other, reducing administrative burden.

4.5. Analytics and Reporting

It was also found that combined metadata could provide more accurate analytics on the usage and access patterns of ETDs, which could help the libraries understand user needs and improve services. Integrated systems workflows allow for more detailed and comprehensive reporting on the availability and impact of ETDs.

5. Conclusion

Synchronizing metadata between Koha and DSpace creates a more efficient, user-friendly, and discoverable system for accessing ETDs. It leverages the strengths of both platforms to provide a unified search experience, improved metadata quality and

broader visibility of resources, ultimately enhancing the academic and research environment.

The integration would enhance functionality for managing electronic resources, including improved metadata management, unified search capabilities and streamlined cataloging, acquisition, and access control workflows. The cost-benefit analysis revealed that while there were upfront costs associated with customization, data migration and staff training, the long-term benefits of integrating Koha and DSpace outweigh the initial investment. Cost savings would be realized through reduced maintenance costs, improved ETD processing efficiency and enhanced resource utilization.

The study also concluded that stakeholders would be highly satisfied with the integrated system, citing potential improvement in accessing ETDs, simplified workflows and enhanced discoverability as key benefits. Library staff would express appreciation for the centralized management interface and streamlined processes.

Risk assessment identified potential challenges such as data integrity issues during migration, technical complexities during integration, and resistance to change among users. Risk mitigation strategies would include thorough testing, staff training, and user support, which would help to address these challenges and minimize their impact on the integration process.

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