A Feature-Based Comparative Evaluation of Open-Source and Proprietary Digital Library Software

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Abstract- The technological foundation of modern academic information services is digital library software (DLS), which allows institutions to gather, arrange, preserve, and distribute scholarly digital content to user communities throughout the world. Choosing a suitable DLS platform has become a strategic, long-term institutional decision with major consequences for cost, interoperability, scalability, and preservation quality as academic libraries make considerable investments in institutional repositories and digital collections. Six popular digital library software platforms, two proprietary (CONTENTdm and DigiTool) and four open-source (DSpace, EPrints, Greenstone Digital Library Software, and Fedora Commons) are systematically compared in this paper using eight evaluation dimensions: availability and licensing, document management, metadata standards support, storage architecture, search and retrieval, interoperability, security and user management, and accessibility and customization. The study creates an evidence-based choice framework for library directors and information professionals using official software documentation, peer-reviewed comparison studies, and Indian academic institutional adoption data. The results show that while proprietary platforms offer managed infrastructure appropriate for institutions with low technical resources, open-source platforms especially Fedora Commons and DSpace offer superior feature sets in metadata flexibility, interoperability, and customization. DSpace controls a 62% share of institutional repository deployments among national institutions, according to an analysis of adoption patterns in India. In order to translate comparative findings into practical procurement guidelines for college libraries, research institutions, archives and museums, and government data repositories, the article ends with institution-type-specific recommendations.

Keywords: Digital library software, open-source software, DSpace, Fedora Commons, Eprints, Greenstone, feature comparison

I.INTRODUCTION

Over the past thirty years, digital libraries have completely transformed academic information services. What started as an experimental digitization project in 1990's, it has evolved into a complex technological ecosystem that can manage, preserve, and distribute enormous collections of scholarly digital objects. Digital library software (DLS), a multifaceted system comprising web servers, database servers, search engines, access management frameworks, and user interface elements, is at the fundamental foundation of this ecosystem. It is configured to synchronize, receive, organize, index, and disseminate digital information resources to user communities across scattered geographies and disciplines. In the words of Clifford Lynch, a digital library is *"a system providing a community of users with coherent access to a large, organized repository of digital information and knowledge"*.

Choosing a suitable DLS for academic libraries is one of the most important administrative choices an administrator can make. Once a Digital Library system has been established by choosing a specific platform, it is not easy to migrate from one platform to another. Doing so may require significant expenditures in staff time, metadata transformation, possible loss of persistent identifiers, and disruption to user services. Once a digital repository is established, collection building has begun. It requires a commitment of time, money, and knowledge, and any mistake in making a selection could result in an irrecoverable loss of investments.

The software landscape for digital libraries can be divided into two main categories: open-source software, which has a strong ecosystem and is created

and maintained international developer communities, non-profits bodies, and university consortia. On the other hand, we have proprietary platforms by commercial vendors which are offered on subscription-based models. Each has unique properties in terms of licensing costs, the possibility of customization, interoperability, long-term sustainability, and the institutional technical know-how needed for implementation. Librarians, especially those in developing nations, still lack a comprehensive, guide that directly ties software characteristics to institutional requirements, even though a number of comparison studies already published in the literature.

Attempting to bridge this gap, this paper performs a methodical, feature-based comparative analysis of six prominent digital library software platforms: Fedora Commons, DSpace, EPrints, Greenstone Digital Library Software (GSDL), CONTENTdm, and DigiTool. Eight parameters are included in the evaluation, which is based on a synthesis of earlier comparative frameworks. Three distinct contributions to the literature are made by the paper. In order to establish a single, multi-criteria comparison matrix that is displayed in well-organized tables, it first synthesizes results from prior comparative studies and official software documentation. Second, it places software choices in the perspective of academic libraries in India, where 68% of higher education institutions surveyed and 62% of national institutions have adopted DSpace. Third, it translates comparison results into suggestions for procurement decision-making that can be considered appropriate for each type of organization.

II. LITERATURE REVIEW

Academic discussion on digital library software evaluation is situated within the larger history of digital library development, which occurred in three measurable stages. The first stage, from the 1970s to the late 1990s, featured pioneering experiments in digitization and the theoretical formulation of digital library concepts. Project Gutenberg, started in 1971, was the first large-scale effort at systematic digital text distribution. Landmark research initiatives funded by NASA, DARPA, and the Massachusetts Institute of Technology (Kannan, 2004) provided the technical basis for networked digital collections(Kannan, 2004). The functional requirements that later informed DLS design were shaped by visionary contributions from Vannevar Bush, who described a hypothetical linked information machine and J. C. R. Licklider, who conceived of the library of the future. (Pal, 2017)

A subsequent phase, after 2000, was the institutionalization of digital libraries as a stable academic infrastructure. The arrival of ePrints.org in 2000 was a watershed, allowing universities to host and share their digital collections on locally administered servers using the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) (Kannan, 2009). During this time, the primary platforms that are still in use today came into being. Greenstone was created at the University of Waikato for the New Zealand Digital Library project, Fedora Commons was created by Cornell University and the University of Virginia Library, and DSpace resulted from a historic partnership between the Massachusetts Institute of Technology and Hewlett-Packard Corporation. (A. Randhawa & Randhawa, 2008; S. Randhawa, 2021). The booming open-source software movement created both a conceptual and practical basis for these community-developed platforms, thus combining open-source principles with academic aspirations of open knowledge dissemination.

As these platforms developed and expanded, comparative evaluation became an acknowledged area of academic research in library and information science. (DeRidder, 2007) provided one of the initial systematic models for DLS selection, recognizing cost, staff proficiency, institutional mandate, and technical infrastructure as key factors of software appropriateness. Pyrounakis and Nikolaidou (2009) evaluated numerous open-source DLS platforms in the landmark Handbook of Research on Digital Libraries, taking into consideration design, metadata support, and interoperability. (Andro et al., 2012) generalized this comparative approach to a larger collection of ten software platforms, encompassing both proprietary and open-source solutions for the first time in a systematic analysis (Y. Theng et al., 2009; Y.-L. Theng, 2009).

Methodologically, Goh et al. (2006) developed a structured checklist for evaluating open-source DLS

using criteria such as functionality, usability, dependability, and supportability, which has been used and updated in future research. (Madalli et al., 2012) investigated digital preservation capacities across open-source platforms discovering significant variance and concluding that preservation was consistently underemphasized in previous comparison study. (Ahammad, 2019) investigated the usage of DLS for Open Educational Resource repositories, which indicates that repository software's application contexts go way beyond traditional academics.

Within the Indian academic context, Haneefa K Venkadesan (2013) investigated 70 higher education institutions listed on DOAR and ROAR and observed that 68% used DSpace and 31% used EPrints. (Verma & Shukla, 2015) did bigger assessment of 68 national institutions collected from OpenDOAR confirmed DSpace's 62% adoption share, with EPrints coming in second at 29%. (S. Randhawa, 2021) observed that despite this dominance, Indian library professionals' awareness of DLS capabilities and alternatives is unequal, particularly in smaller institutions. (Tramboo et al., 2012) documented that DSpace, EPrints, and Greenstone collectively dominate adoption across South Asian academic libraries.

Overall, the research shows that comparative DLS evaluation is both a recognized scientific pursuit and a practical necessity for the profession. However, current research varies in scope, platform set, evaluation criteria, and context of analysis, making cross-study comparability problematic. This study addresses this fragmentation by implementing a uniform, eight-dimensional evaluation approach across six widely deployed systems in a single comparison structure.

III. METHODOLOGY

This study adopts a criteria-based comparative analysis methodology, fitting into the long heritage of software evaluation research in library and information science. The study is divided into three phases: platform selection, design of evaluation criteria, and data collection and synthesis.

Platform Selection. Six digital library software platforms were evaluated: CONTENTdm and DigiTool (proprietary) and DSpace, EPrints, Greenstone (GSDL), and Fedora Commons (open-source). The selection criteria were based on worldwide and regional deployment prevalence, as demonstrated by institutional surveys and registry listings in OpenDOAR and ROAR. The six platforms comprise the key decision-making arena for academic library administrators in the contemporary market.

Evaluation Criteria. Eight evaluation dimensions were identified through a synthesis of existing comparative frameworks (Andro et al., 2012; DeRidder, 2007; Madalli et al., 2012; Naik & Shivalingaiah, n.d.; Pyrounakis & Nikolaidou, 2009) and an analysis of institutional requirements documented in the literature. These dimensions are: (1) terms of availability and licensing, (2) document management capabilities, (3) metadata standards support, (4) storage architecture, (5) search and retrieval performance, (6) interoperability, (7) security and user management, and (8) accessibility and customization.

Data Collection. Three sources were used to collect data for each platform across all dimensions, such as: (a) official software documentation and developer websites; (b) peer-reviewed comparative studies and case studies in the literature on libraries and information science; and (c) user-reported institutional experiences recorded in published empirical research. Direct cross-platform assessment has been rendered possible by a structured comparative table that concurrently displays the feature profiles of all six platforms for each dimension. These comparison results are translated into recommendations tailored to types of institutions in the discussion section.

IV. OVERVIEW OF SELECTED DIGITAL LIBRARY SOFTWARE PLATFORMS

A digital library software system is not a monolithic application but a composite of several software components, a web server, a database server, a search engine, an access management system, and application source code, configured to work in synchronization on an operating system platform (Tramboo et al., 2012) . Together, these components enable the acquisition, organization, indexing, preservation, and web-based dissemination of digital information resources. The six platforms evaluated in this study represent the primary

options available to academic libraries globally and are distinguished by their licensing model, programming architecture, metadata philosophy, and primary use case. It is important to emphasize that digital library software is not a library management system (LMS). An LMS, such as Koha or Libsys, automates the daily operations of a physical library; a DLS, on the other hand, allows the dissemination of electronic information resources via a web-based technologies (Pal, 2017).

4.1 Proprietary Digital Library Software

4.1.1 CONTENTdm

OCLC created CONTENTdm, a proprietary digital library platform for creating, publishing, displaying, and preserving digital collections in library and archival settings. It began as an archival photograph hosting platform and has since evolved into a fully compliant digital library system that runs on a Software-as-a-Service (SaaS) paradigm and is hosted on OCLC's cloud infrastructure. This paradigm shifts the burden of server administration, software maintenance, and disaster recovery to the vendor, providing a significant operational advantage for institutions that lack specialized technical expertise.

CONTENTdm natively communicates with OCLC's WorldCat discovery service, making hosted collections more accessible to a global audience. The platform supports OAI-PMH for metadata harvesting and data interchange using XML-based formats such as Dublin Core, METS, and MARC. Rather than using a traditional RDBMS, metadata is maintained in a proprietary text-based indexing system. Unicode searching, relevancy-ranked results, and faceted browsing are examples of search capability. However, CONTENTdm has been recorded criticism, according to (Gilbert & Mobley, 2013) its proprietary indexing engine creates inconsistent search results and provides no ability to refine or filter results. (Mita et al., 2018) highlighted that institutional users usually encounter real constraints on the quantity of hosted digital objects compared to vendor claims, and the program does not allow DRM for licensed content.

4.1.2 DigiTool

Ex Libris created DigiTool, a digital library system that allows you to create, manage, preserve, and share locally administered digital collections. DigiTool is built on a client-server architecture using Java and C++. It uses a Windows-based administrative software called Meditor for ingest and maintenance tasks, while end users access collections through a conventional web browser (Liu & Zhou, 2011). The server component requires a UNIX-compatible operating system, making it primarily a Linux-hosted platform.

DigiTool's functionality is divided into six web-based modules: Resource Discovery (user interface), Management (system administration), Deposit (content submission), Approver (content moderation), Collection Management, and Web Ingest (bulk loading). It supports XML-based Dublin Core and MARC metadata formats, as well as OAI-PMH and Z39.50 protocols for interoperability. DigiTool uses the Handle System to manage permanent identifiers and supports Java Server Pages (JSP) and Cascading Style Sheets (CSS) for interface customization (Liu & Zhou, 2011), allowing it more visual flexibility than CONTENTdm. It has a small user base, and Ex Libris provides the only technical assistance.

4.2 Open-Source Digital Library Software

Open-source software allows users to run, study, alter, and redistribute the source code. Permissive licenses, such as the GNU General Public License (GPL), BSD License, and Apache License, control this freedom, each with its own set of provisions but a common commitment to user autonomy. In the context of digital library software, this means that institutions can tailor platforms to their own collection needs, interface them with local systems, and migrate data freely without regard for vendor limits. According to (Goh et al., 2006) the main tradeoff is that, while open-source platforms provide greater customization and flexibility at a cheaper license cost, they necessitate institutional technical expertise for implementation, configuration, and continuous maintenance.

4.2.1 DSpace

The Massachusetts Institute of Technology (MIT) and Hewlett-Packard Corporation collaborated to create DSpace, program licensed under the BSD license. It has three logical layers: a Storage Layer (a PostgreSQL database for metadata and filesystem-based bitstream storage), a Business Logic Layer (workflow, content management, OAI-PMH, search,

and user management), and an Application Layer (a web user interface, import/export components, and METS), and Apache Lucene / Apache Solr engine powers full-text searches (Wei, 2011)(Ahammad, 2019).

DSpace uses a hierarchical content paradigm that includes Communities, Collections, Items, and an organizational framework for diverse institutional collections. The default metadata schema is Dublin Core, alternative schemas, notably LRMI, are supported. The CNRI Handle System manages persistent identifiers with optional DOI support (S. Randhawa, 2021). DSpace is compatible with LDAP and Shibboleth for single sign-on authentication on Windows and Linux platforms. It is written in Java, ensuring cross-platform portability. DSpace is the most extensively used digital library platform worldwide; in India, it accounts for 62% of institutional repository deployments among national institutions (Verma & Shukla, 2015).

4.2.2 EPrints

EPrints is an open-source digital library platform developed by the University of Southampton's School Computer Science that is licensed under the GNU General Public License. Originally intended to provide pre-print repositories for scholarly research, EPrints has subsequently grown to include books, technical reports, conference proceedings, and multimedia assets (Wei, 2011). Unlike DSpace, Eprints does not use a communities-and-collections structure; instead, its core unit is the Data Object, which consists of one or more associated digital files and their metadata organized by subject area, title, or year(Pyrounakis & Nikolaidou, 2009).

EPrints was written in Perl and uses Apache as a web server, with metadata backend database. It supports a variety of metadata formats such as Dublin Core, MODS, LOM, METS, and MARC, as well as OAI-PMH, METS, and MPEG-21 DIDL (Y.-L. Theng, 2009). It is well-known for its simplicity and speed of implementation, making it ideal for author-driven scholarly repositories where ease of submission is a fundamental concern.

4.2.3 Greenstone Digital Library Software (GSDL)

Greenstone is an open-source digital library system developed by the University of Waikato for project. It is distributed in collaboration with UNESCO and the Belgian NGO Human Info, and is licensed under the GNU General Public License (A. Randhawa & Randhawa, 2008). Greenstone's one-click installer style eliminates the need for separately installed prerequisite software, which is a significant benefit for resource-constrained library environments and institutions in poor countries.

Unlike DSpace and EPrints, Greenstone does not use a separate RDBMS; metadata is saved disc, and index storage is handled by the GNU Database Manager Program (GDBM). The Managing Gigabytes (MG) engine compresses digital things and indexes them. Greenstone represents digital assets in a book-like hierarchy and administers them via the Greenstone Librarian Interface (GLI), a graphical program designed specifically for librarians and archivists (Pyrounakis & Nikolaidou, 2009). For interoperability, the platform supports OAI-PMH and Z39.50, and it may be extended with plugins that accommodate a wide range of document and metadata formats(A. Randhawa & Randhawa, 2008).

4.2.4 Fedora Commons

Fedora Commons (Flexible Extensible Digital Object Repository Architecture) is an open-source Cornell University and the University of Virginia Library and distributed under the Apache License 2.0. Fedora Commons is a suite of web-based services that manage complex digital content across different media formats and institutional contexts, rather than a singular application (Y.-L. Theng, 2009).

Fedora's core data model is the Fedora Object XML (FOXML) format, which is part of the Encoding and Transmission Standard (METS). Fedora supports MySQL and PostgreSQL as backend databases, and search is powered by the Apache Lucene engine, which enables advanced full-text search, Boolean queries, and faceted browsing. Each digital object may contain multiple data streams, combinations of metadata and digital content, each with a unique persistent identifier via Uniform Resource Identifiers. The platform exposes all repository features and functions as web services with fine-grained access control settings and enables single sign-on via LDAP and Shibboleth (Y. Theng et al., 2009; Y.-L. Theng, 2009). Fedora Commons is well-suited to institutions that require complex object modelling capabilities

such as libraries, archives, museums, and multimedia materials, though the lack of an out-of-the-box user interface remains a major drawback for institutions without dedicated technical staff.

V. FEATURE-BASED COMPARATIVE ANALYSIS

The following subsections compare the six selected digital library software platforms on eight evaluation A structured comparative table for each dimension is followed by an analysis of important differentiators. Official program documentation, published comparative studies, and institutional user research all provide comparative data (Andro et al., 2012; DeRidder, 2007; Madalli et al., 2012; Naik & Shivalingaiah, n.d.; Pyrounakis & Nikolaidou, 2009).

5.1 Terms of Availability and Licensing

The licensing model has important consequences for total cost of ownership, institutional autonomy. Table 1 presents the availability profile of each platform.

Criterion	CONTENTdm	DigiTool	DSpace	EPrints	GSDL	Fedora Commons
Category	Proprietary (Closed-Source)	Proprietary (Closed-Source)	Open-Source	Open-Source	Open-Source	Open-Source
License	Proprietary (annual subscription)	Proprietary (perpetual/subscription)	BSD Open-Source License	GNU General Public License	GNU General Public License	Apache License 2.0
Developer	OCLC	Ex Libris	MIT & HP Labs	University of Southampton	University of Waikato	Cornell Univ. & Univ. of Virginia
Maintained By	OCLC	Ex Libris	DuraSpace / LYRASIS	University of Southampton, ECS Dept.	UNESCO & Human Info NGO	DuraSpace / LYRASIS
Programming Language	Java	C, Perl	Java	Perl	Perl, C++	Java
Supported Platforms	Linux, Cloud (SaaS)	Red Hat Linux	Windows / Linux	Windows / Linux	Windows / Linux	Windows / Linux

Table 1: Comparative Summary of Availability and Licensing Terms.

CONTENTdm and DigiTool are licensed under proprietary terms, which means that access or modify the source code. Institutions are obligated by vendor contracts and rely on vendor roadmaps for platform development. DSpace, EPrints, GSDL, and Fedora Commons are all open-source platforms, meaning that any institution can freely download, install, change, and redistribute the source code. This divergence has substantial practical implications: open-source platforms can be modified to match institutional requirements without vendor authorization, whereas proprietary platforms provide streamlined vendor-managed infrastructure at the expense of institutional flexibility (Goh et al., 2006). Non-profit consortia, such as DuraSpace and LYRASIS for DSpace and UNESCO for Greenstone, largely support open-source platforms, offering some independence from commercial interests. The Government of India's Open-Source Software Adoption Policy (2015) has reinforced this preference in public academic institutions, adding to open-source DLS' documented dominance in Indian higher education (*FOSS4Gov Innovation Challenge – Innovate India*, n.d.).

5.2 Document Management

Document management features refer to how each platform handles document capture, categorization, version control, and document format support of digital objects(Table 2).

Criterion	CONTENTdm	DigiTool	DSpace	EPrints	GSDL	Fedora Commons
Collection Hierarchy	No	Yes	Yes: Communities, Collections, Items	No (document-centric model)	No	Yes (multi-level data streams)
Persistent Identifier	Yes	Yes	Yes	Yes	No	Yes
Identifier Provider	OCLC PURL	Handle System (internal)	CNRI Handle System / DOI	Uniform Resource Identifier	None	Uniform Resource Identifier
File Versioning	Yes	No	Yes	Yes	No	Yes
File Format Support	Image files (primary)	Document files	All MIME types	All MIME types	All MIME types	All MIME types
Bulk Ingest / Batch Import	Partial	Yes (Web Ingest module)	Yes (SIP / AIP import)	Yes	Yes	Yes

Table 2: Comparative Summary of Document Management Capabilities

DSpace's hierarchical content model, Communities, Collections, Items, and Bitstreams, organizational framework that is ideal for diverse institutional repositories. Fedora Commons is the most sophisticated object model, enabling several data stream types and complicated inter-object communication that are ideal for diverse collections. EPrints and Greenstone lack conventional collection hierarchies, but they compensate with flexible grouping by subject, date, and title. Greenstone lacks persistent identifier support, which is a serious constraint for long-term preservation. Persistent IDs ensure that digital objects are retrievable even when storage sites change. CONTENTdm's core focus on image-file formats recalls its archive photographic roots, although recent work has broadened its format support (Madalli et al., 2012).

5.3 Metadata Standards Support

Metadata is the bedrock of digital library discoverability, preservation, and interoperability. Table 3 shows each platform's compatibility with main metadata standards, as well as its schema customization capabilities.

Criterion	CONTENTdm	DigiTool	DSpace	EPrints	GSDL	Fedora Commons
Dublin Core (DC)	Yes	Yes	Yes (default schema)	Yes (default schema)	Yes	Yes
MARC	Yes	Yes	No (crosswalk available)	Yes	Yes	Yes
LOM / LRMI	Yes	No	Yes (LRMI)	Yes (LOM)	No	Yes
METS	Yes	No	Yes	Yes	Yes	Yes (FOXML / METS-based)
MPEG-21 DIDL	No	No	No	Yes	No	No
Custom Metadata Fields	No	No	Yes	Yes	Yes	Yes

Criterion	CONTENTdm	DigiTool	DSpace	EPrints	GSDL	Fedora Commons
Metadata Storage Format	Proprietary text-based XML index	XML on filesystem	XML in PostgreSQL database	XML in MySQL database	XML on filesystem (GDBM index)	XML on filesystem

Table 3:Comparative Summary of Metadata Standards Support.

All six systems comply with the Dublin Core (DC) metadata standard, which is recognized as the minimum need for digital library interoperability (Das & Sutradhar, 2018). Given MARC's prevalence as a cataloguing standard in library practice, DSpace's lack of native MARC support is noticeable; nevertheless, this issue is somewhat solved by crosswalk techniques. Fedora Commons and EPrints have the broadest metadata schema coverage of the six platforms. The ability to define custom metadata fields, which is available in DSpace, EPrints, GSDL, and Fedora Commons, is especially useful for institutions that manage specialized collections such as ethnographic materials, grey literature, or institutional administrative records, where standard schemas may be inadequate. According to (Agosti et al., 2016) versatile metadata extensibility is a crucial requirement for large-scale digital library interoperability.

5.4 Storage Architecture

A DLS's storage architecture defines how digital objects and information are physically organized, which has an immediate effect on performance, data integrity, scalability, and recovery after a data disaster (see Table 4).

Criterion	CONTENTdm	DigiTool	DSpace	EPrints	GSDL	Fedora Commons
Metadata Database	Proprietary text-based database	Oracle RDBMS	PostgreSQL (open-source)	MySQL / MariaDB	GDBM (filesystem-based)	PostgreSQL / MySQL / MariaDB
Content File Storage	OCLC cloud storage	Filesystem	Filesystem (bitstream store)	Filesystem	Filesystem (compressed)	Filesystem
Data Integrity Check	None	None	MD5 checksum	MD5 checksum	None	MD5, SHA-1, SHA-256, SHA-512

Table 4:Comparative Summary of Storage Architecture.

For metadata storage, DSpace, EPrints, and Fedora Commons use open-source RDBMS systems (PostgreSQL and MySQL/MariaDB), which provide transparent data access and compatibility with common database administration toolchains. The proprietary text-based indexing mechanism of CONTENTdm restricts institutional data access and makes future migration more difficult. With support for four checksum methods (MD5, SHA-1, SHA-256, and SHA-512), Fedora Commons provides the most complete data integrity verification suite, an essential feature for long-term digital preservation workflows(Madalli et al., 2012). For organizations that place a high priority on preservation quality, the lack of checksum checking in CONTENTdm, DigiTool, and Greenstone poses a significant risk. Although CONTENTdm's cloud-based content storage lessens the effort of server management, it creates a long-term reliance on the vendor for data ownership, recoverability, and content availability.

5.5 Search and Retrieval

The usefulness of a digital library for its end users, who anticipate search experiences similar to those of contemporary web search engines, is directly determined by its search and retrieval capabilities. Key search features for each of the six platforms are compared in Table 5.

Criterion	CONTENTdm	DigiTool	DSpace	EPrints	GSDL	Fedora Commons
Full-Text Search	Yes	Yes	Yes	No	Yes	Yes
Search Engine	WorldCat Search Engine	Text-based proprietary engine	Apache Lucene	MySQL default search	Managing Gigabytes (MG)	Apache Lucene
Faceted Browsing	Yes	Yes	Yes	No	Yes	Yes
Boolean Search	No	No	Yes	No	No	Yes
Metadata Search	Yes	Yes	Yes	Yes	Yes	Yes

Table 5:Comparative Summary of Search and Retrieval Capabilities

Both DSpace and Fedora Commons use Apache Lucene, an advanced, feature-rich search engine that supports full-text indexing, faceted browsing, and Boolean operators across metadata fields and document content, giving them a clear advantage in search and retrieval. According to (Pyrounakis & Nikolaidou, 2009), EPrints is the least effective in this area since it primarily indexes metadata fields and uses MySQL's built-in search engine. It does not offer full-text search, faceted browsing, or Boolean operators. For academic users used to database-style search refinement, this is a major functional gap. Although it does not enable Boolean queries, Greenstone's Managing Gigabytes (MG) engine offers faceted browsing and full-text search. Although CONTENTdm's WorldCat search engine offers faceted browsing and relevancy-ranked results, there are known problems with result consistency and the lack of query refining. (Gilbert & Mobley, 2013).

5.6 Interoperability

Interoperability expands the reach of institutional collections and makes it easier for users to participate in federated digital library networks by allowing digital library systems to share information and content with other systems (Gonçalves et al., n.d.; Trnkoczy & Stankovski, 2008). Table 6 presents the interoperability feature set of each platform.

Criterion	CONTENTdm	DigiTool	DSpace	EPrints	GSDL	Fedora Commons
OAI-PMH Support	No	Yes	Yes	Yes	Yes	Yes
Z39.50 Support	No	Yes	No	No	Yes	No
Archival Export / Import	XML, METS export	Not available	SIP, AIP (OAIS)	METS, MPEG-21 DIDL	Not available	Not available
Web Services	WorldCat API	SOAP	SOAP, REST	None	SOAP, WSDL	SOAP, REST
Semantic Web / RDF	No	Yes (RDF)	Yes (RDF)	No	No	Yes (RDF)
RSS / Atom Feed	Yes	Yes	Yes	Yes	Yes	Yes

Table 6: Comparative Summary of Interoperability Protocols and Services.

The basic interoperability standard for digital libraries, is OAI-PMH, this makes it possible to systematically gather metadata from dispersed repositories. With the exception of CONTENTdm, all systems support OAI-PMH, demonstrating its widespread use in the open-source DLS community (Das & Sutradhar, 2018). Only DigiTool and Greenstone support the older Z39.50 communication protocol for cross-database searches. With support for both SOAP and REST APIs, DSpace and Fedora Commons are leaders in web services integration. This is a crucial feature as academic institutions develop more integrated digital

library, discovery, and learning management ecosystems. DigiTool, DSpace, and Fedora Commons are well-positioned to participate in related open data initiatives due to their support for RDF-based semantic web services. OAI compliant SIP and AIP export formats in Dspace are particularly relevant for long-term digital preservation workflows, enabling content to be transferred between systems without data loss.

5.7 Security and User Management

In digital library environments where collections may contain licensed, restricted, embargoed, or economically sensitive content, access control, authentication, and digital rights management are crucial security measures. Platforms' security and user management features are contrasted in Table 7.

Criterion	CONTENTdm	DigiTool	DSpace	EPrints	GSDL	Fedora Commons
DRM Support	No	Yes	Yes	Yes	Yes	Yes
Self-User Registration	Yes	Yes	Yes	Yes	Yes	Yes
IP-Based Access Control	Yes	Yes	No	Yes	Yes	Yes
Authentication Method	Credential-based	Credential-based	Credential-based	Credential-based	Credential-based	Credential-based
Single Sign-On (SSO)	Not supported	Not supported	LDAP, Shibboleth	LDAP only	Not supported	LDAP, Shibboleth

Table 7:Comparative Summary of Security and User Management Features.

All of the six platforms offers self-registration and credential-based authentication. The most sophisticated authentication infrastructure is found in Fedora Commons and DSpace, which support both LDAP and Shibboleth for single sign-on. This feature is becoming more and more crucial in institutional computing environments where users anticipate seamless access to numerous services using a single institutional credential (Y. Theng et al., 2009; Y.-L. Theng, 2009). While CONTENTdm, DigiTool, and Greenstone completely lack single sign-on functionality, EPrints supports LDAP but not Shibboleth. Notably, all five platforms enable IP-based access control, which some schools employ to allow campus-wide access to restricted information without requiring individual login. However, DSpace does not. Only CONTENTdm does not include Digital Rights Management (DRM) functionality, and it represents a notable limitation for institutions managing licensed digital collections requiring access and usage restrictions beyond simple authentication.

5.8 Accessibility and Customization

One key distinction between DLS platforms is the capacity to modify user interfaces, integrate with third-party discovery tools, and modify platform behavior in accordance with institutional branding and functional requirements. Table 8 contrasts qualities related to customization and accessibility.

Criterion	CONTENTdm	DigiTool	DSpace	EPrints	GSDL	Fedora Commons
User Interface	Web GUI	Web GUI	Web GUI	Web GUI	Web GUI	Web GUI
Administration Interface	Web GUI	Meditor Utility (Windows app)	Web GUI	Web GUI	Greenstone Librarian Interface	Web GUI
External Discovery Integr.	OCLC WorldCat only	None	Discovery tools (e.g., Primo)	Discovery tools	Discovery tools	CMS & Discovery tools

Criterion	CONTENTdm	DigiTool	DSpace	EPrints	GSDL	Fedora Commons
UI Styling Technology	Not available	JSP, CSS	JSP, CSS	PHP, CSS	XSLT	Java / REST API
GUI Customization Level	Partial (vendor-controlled)	Partial	Complete	Complete	Partial (XSLT-based)	Absolute
Multilingual Support	Yes	Yes	Yes	Yes	Yes	Yes
Third-Party Analytics	COUNTER statistics	None	Google Analytics	Google Analytics	Google Analytics	Google Analytics

Table 8:Comparative Summary of Accessibility and Customization Features.

Among the six platforms, Fedora Commons provides the most degree of customization. It may be integrated with almost any front-end application or content management system since its Access API and Management API expose all repository functionalities as web services(Y.-L. Theng, 2009) . Through server-side programming (JSP/CSS and PHP/CSS, respectively), DSpace and EPrints provide full GUI customization, allowing institutions to match the repository interface with workflows and institutional branding. Within vendor-specified limitations, CONTENTdm and DigiTool only provide partial customization. Although it needs more technical expertise than DSpace's web-based setting, Greenstone's XSLT-based customization is available to users with XML knowledge. All six platforms are suitable for multilingual academic collections since they accept many languages and comply with Unicode character encoding. When it comes to connecting with commercial discovery layers like Ex Libris Primo and Serials Solutions Summon, which are becoming more and more common in academic library architecture, DSpace and Fedora Commons have a distinct edge.

VI.DISCUSSION AND RECOMMENDATIONS

According to the abovementioned eight-dimensional comparative research, no platform is consistently best across all evaluation criteria. Every platform has a unique feature profile that makes it more appropriate for different sorts of collections, institutional settings, and operational capacities. Therefore, rather than relying solely on platform popularity, the choice should be based on a methodical evaluation of institutional requirement. The recommendations that follow are based on the comparative findings and are arranged by kind of institution.

6.1 Research Universities and National Academic Institutions

DSpace is the recommended platform for research universities with substantial multidisciplinary intellectual output, such as journal articles, theses, databases, and multimedia research artefacts. It is the most feature-rich open-source DLS currently accessible thanks to its hierarchical content model, Apache Lucene search engine, extensive OAI-PMH and REST API interoperability, OAIS-compliant preservation procedures, and large worldwide support community (S. Randhawa, 2021). There is broad consensus in the community on DSpace's suitability for use in research-intensive settings, as evidenced by the 62% adoption rate across Indian national institutions (Verma & Shukla, 2015) Large universities' centralized identity management systems are easily integrated with DSpace's support for LDAP and Shibboleth single sign-on. Its multilingual content support allows collections in Indian and other language families, and its Java codebase guarantees cross-platform portability.

6.2 Institutions with Complex or Heterogeneous Collections

Fedora Commons is the suggested platform for organizations handling a variety of collections, including library materials, archive records, museum artefacts, multimedia items, and research datasets, where each object type may need a particular metadata schema and content model. It is the most capable

platform for complex digital preservation and multi-format collection management due to its adaptable web service architecture, fine-grained access control policy framework, support for the widest range of metadata standards (METS, FOXML, Dublin Core, MARC, LOM, and RDF), and thorough data integrity verification (MD5, SHA-1, SHA-256, SHA-512) (Madalli et al., 2012)(Y.-L. Theng, 2009). However, because Fedora Commons does not offer a user-friendly interface right out of the box, institutions choosing it should be ready for a higher learning curve and a substantial initial investment in technical configuration.

6.3 Small and Medium College Libraries

Greenstone Digital Library Software or EPrints are the suggested platforms for small and medium-sized college libraries looking to quickly create a digital repository with little technological infrastructure and personnel knowledge. Greenstone's Greenstone Librarian Interface (GLI) offers a graphical administration interface that library personnel without sophisticated programming knowledge may use, and its one-click installation removes the dependency management complexity typical of DSpace and Fedora (A. Randhawa & Randhawa, 2008). When it comes to scholarly pre-print and article repositories where the simplicity of author submission is the top priority, EPrints is known for being the fastest repository platform to implement (Tramboo et al., 2012). As institutional capacity increases, both platforms maintain the possibility to federate with national or worldwide repository networks by supporting OAI-PMH for future metadata sharing.

6.4 Institutions Requiring Managed Infrastructure

CONTENTdm provides a vendor-managed cloud solution that reduces the technical strain on library staff for institutions that lack the technical staff to handle server infrastructure, software updates, and disaster recovery, or that operate under institutional policies prohibiting on-premises server administration. By having the vendor manage maintenance, security patching, and disaster recovery, the OCLC SaaS model frees up library staff to focus on user services and collection development. Given the potential advantages of native integration, DigiTool might be appropriate for organizations that are already part of the Ex Libris ecosystem, such as those that use Ex Libris Alma for integrated library management. Institutions must, however, carefully balance these convenience benefits against the long-term dangers of vendor dependence, limited customization, and contractual migration restrictions.

6.5 The Indian Academic Library Context

There is a particular context for DLS selection in the Indian academic library landscape that needs to be directly addressed. The predominance of DSpace, which accounts for 68% of higher education institutions surveyed by (Haneefa K; Venkadesan, 2013), and 62% of OpenDOAR-registered national institutions (Verma & Shukla, 2015) reflects a number of convergent contextual advantages: DSpace's Java-based architecture operates dependably on inexpensive Linux servers that are typical in Indian institutional computing environments. Its large domestic user base offers peer-to-peer support networks among Indian library professionals, while its active global developer community guarantees ongoing support without license fees. its multilingual content support supports collections in Hindi, Tamil, Telugu, and other Indian languages. The National Policy on Software Products (2019) and the Government of India's 2015 Policy on Adoption of Open-Source Software both support public academic institutions' institutional preference for open-source solutions (*FOSS4Gov Innovation Challenge – Innovate India*, n.d.). (S. Randhawa, 2021) emphasizes the necessity of ongoing DLS literacy development among Indian library professionals, especially in establishments without institutional repositories, since India's ascent in global Open Access movement depends on a knowledgeable and technically competent library workforce.

VII. CONCLUSION

This paper has presented a systematic, feature-based comparative evaluation of six major digital library software platforms across eight evaluation dimensions, offering an evidence-based framework for institutional software selection in academic library settings. The analysis indicates that open-source platforms (particularly DSpace and Fedora Commons) offer a superior degree of feature richness, customization potential, interoperability, and long-

term sustainability. Proprietary platforms such as CONTENTdm provide managed infrastructure benefits for institutions lacking technical capacity. There is certainly no one platform that is most effective in all circumstances, and appropriate selection requires careful structured assessment of institutional mandate, collection type, technical capacity and financial resources(DeRidder, 2007; Goh et al., 2006)

The eight-dimensional evaluation methodology suggested in this study provides a replicable method to conduct an ongoing DLS assessment as the software ecosystem evolves. A few caveats and some forward-looking observations are in place. The release of version 10.x of DSpace is a major architectural change, switching to an Angular-based front-end that completely redesigns the user experience and should be taken into account in future assessments.

Fedora Commons is also continuing its path toward achieving integration with the Hyrax application framework, making it more usable. New evaluation criteria that future comparative studies should consider include cloud-native deployment architectures, AI-assisted metadata generation, compliance with FAIR data principles, and WCAG 2.1 accessibility conformance.

The most practical and sustainable approach to creating institutional digital repositories for academic libraries in India and the larger Global South is still the open-source pathway, which is supported by DSpace's high acceptance rate, free license, and vibrant community. However, more library and information science professionals should acknowledge Fedora Commons' promise for complex, diverse collections and Greenstone's potential for institutions with little resources. Realising the full informational potential of digital library infrastructure at academic institutions around the world requires ongoing investment in DLS literacy among practicing librarians, backed by academic programs and professional development activities.

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