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Knowledge Management in University Libraries

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Chapter – 5

Knowledge Management in University Libraries

Beware of false knowledge; it is more dangerous than ignorance.
George Bernard Shaw

Knowledge is a process of piling up facts; wisdom lies in their simplification.
Martin H. Fischer

5.1 Introduction

Libraries in Universities work as the knowledge resource centers. Libraries are the foundations of the education system where the knowledge can be conserved and diffused. In the digital era, the libraries face challenges of providing knowledge in a specific format which otherwise was not seen as a threat in traditional libraries. While libraries are equipped with very rich information in the form of books, periodicals, journals and other research material, only problem with the existing libraries is the time required to search the content and its availability. The main function of academic libraries is to assemble, process, store, disseminate and use information to provide services to the academic fraternity of the University. Due to the advancements in the informational technology, the role of academic libraries has drastically changed. Academic libraries are an important component of the University. The growth of University largely depends on intellectual assets its academic library has. Knowledge Management is the workable solution to improve the services of the libraries. DIGITAL library is the best solution to provide the knowledge on hand as and when required. In this chapter, we discuss different approaches to digitize, organize and disseminate knowledge through the Library Management System.

As contemplation, we have carried out our study at Department of Library & Science & Bhaikaka Library of Sardar Patel University and contributed in
developing various models for making a Digital Library for Knowledge Management. We also present our study on using the freeware namely DSPACE, GREENSTONE and others. The Success of academic libraries depends on their ability to utilise information and knowledge of its staff to better serve the needs of the academic community. This requires academic libraries to reappraise their functions, expand their roles and responsibilities to effectively contribute and meet the needs of a large and diverse university community. Knowledge Management is a viable means in which academic libraries could improve their services in the present knowledge era\(^{[39]}\).

Establishing Knowledge Management concept in digital library will enhance and expand the capability, scope and depth of knowledge services. By providing the knowledge services through digital library, the society in general and the students in particular will be benefitted. In the modern age where knowledge economy has upper edge over others, the libraries are striving hard to provide knowledge with the concepts anytime, anywhere to everyone. Digital Libraries and electronics publishing have taken over from traditional libraries and traditional publishing. The advancements in technology like computers, Internet and World Wide Web has contributed much in the trend of developing digital libraries. The concept of digital library is being supported by experts from almost all disciplines of study. In fact building a digital library is a multidisciplinary approach when computer scientists work with library professionals, economists, and scientists and so on\(^{[51]}\).

Digital Library is a managed collection of information (in the form of books, journals etc.) that is stored in digital formats and can be retrieved over networks\(^{[51]}\). Digital libraries contain diverse collection of information that can be used by different users. Digital libraries can be of different sizes depending on the type of collection they have. In order to facilitate the users to access the digitized data, the digital libraries need suitable hardware and software. There should be
appropriate procedures to create the information, collect at organization, arrange, and make it available to the users.

The academic and research libraries across the globe are striving hard to harness technology for achieving scholarly Knowledge Management, which is fast proliferating, distributed and scattered. Building world standard digital libraries as power houses of knowledge that are able to address complex issues put forth by the technology push as well as the demand pulls are first catching up worldwide attention. 70% of world’s scholarly literatures are born digital.

There is a gap between the “information rich” and the “information poor,” and various organizations are working to bridge the digital divide—to address inequities in the ability to access and effectively use information technologies. Libraries have traditionally represented a culture of the book, and call up for many the tactile associations of pages, bindings, and dust jackets. Libraries have been places of quiet reflection, inquiry, and sustained reading. They not only are timeless and comforting in a too-hectic world but also have preserved the human record through the ages. At the same time, libraries have entered the information superhighway and have come to represent digital culture as much as book culture[33].

Digital Library offers new levels of access to broader audiences of users and new opportunities for library and information science field. Creating effective digital libraries and providing cutting edge digital information services faces serious challenges. For existing and future technologies they include collection building infrastructure, acceptability, access restriction, readability, standardization, authentication, preservation, copyright policy and strategic issues, user interface, funding etc.
“Digital libraries are organization that provide the resources, including the specialized staff to select, structure, offer intellectual access to interpret, distribute, preserve the integrity of and ensure the persistence over time of collection of digital works so that they are readily and economical available for us by a defined community or set of communities”([8]).

Digital library enables the creation of local content, strengthen the mechanisms and services. They help to:

- Increase portability
- Efficiency of access
- Flexibility
- Availability
- Preservation of Content
- Move towards “anytime anywhere” access to latest and best knowledge resources

It is essential to have a robust and flexible digital collection and presentation software for creating and delivering digital knowledge. Digital library technologies and contents are not static. Continual evaluation and investment are required to maintain digital library.

5.1.1 Difference Between Traditional and Digital Libraries:

Once the digital library is created, the collection of digitized content keeps on growing with time. There in comes the responsibility of the computer technologist when he has to continuously select the hardware that will support this growth. In fact the technology dictates the pace at which the digital libraries develop. For this the computer professionals have to work collaboratively with the library professionals to face the challenges of creating and maintaining digital libraries. At the same time there is a need for users’ awareness to take the advantage of
digital libraries. Digital technology has reached a point where it is so pervasive that it cannot be ignored.

It is a part of society, a part of daily life, and a part of the student and faculty experience in using academic libraries. The digital library enhances the support that a library can offer to its University community, particularly in offering convenient, enriched, and enhanced access to library resources and services. This is true in both traditional and distance education environments. An understanding of digital library culture can help scholars move beyond grappling with the mechanics of using digital libraries to becoming active contributors[^33].

5.1.2 Advantages of Digital Libraries:

Given below is the list of significant advantages offered by Digital Libraries:

- Digital library brings the library to the user.
- IT power is used for searching and browsing
- Information can be shared
- Information is easier to keep current
- The information is always available
- New forms of information become possible
- The cost of digital libraries is less
- Technical Advancement
- Electronic storage is becoming cheaper than pages
- Access to digital libraries has become easy

In a traditional library, the user has to visit the library personally. This activity involves time, availability and other factors that may affect the easy accessibility of information. The digital library helps the reader to provide the information at his desk. We can say that digital library helps the scholars to manage knowledge resources from a distant place.
Digital libraries help overcome this problem of searching. The knowledge resources available in one library can be shared easily by another library user in case of digital libraries. This helps in expensive duplication of physical content in the form of books, journals, etc. Updating of printed document is very expensive and difficult but the digitized content can be easily updated. This is the greatest advantage of a digital library. For example online directories, encyclopaedias, can be easily updated and information can be kept current.

The doors of digital libraries are always open and hence the information is available any time the user needs. The scope of digital libraries expands beyond the walls of the library. With a proper hardware and network information the digital libraries can be saved from crashing. The digital libraries provide wide range of services that allow collaboration and exchange of ideas. Digital libraries are cheaper as compared to conventional libraries. This factor has significance after the creation of digitized content.

Many well-known digital libraries exist which are the treasure of knowledge. They help the user to acquire knowledge about the intellectual resources available in their knowledge repository. Many digital libraries are free for the public and some give restricted access to the users. The digital libraries are spread around the globe and may be purely digital or hybrid where part of the libraries work as traditional libraries.
The following table shows examples of some of the existing digital libraries:

<table>
<thead>
<tr>
<th>Digital Library</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library of congress</td>
<td>URL : <a href="http://www.loc.gov/">http://www.loc.gov/</a> Provides a gateway to the digital and non-digital collections of the Library of Congress. Includes LC online catalogues and other library catalogues, historical digital collections, legislative information, and digitized photographs. It is open to public.</td>
</tr>
<tr>
<td>ACM Digital Library (Association for Computing Machinery)</td>
<td>URL : <a href="http://www.acm.org/dl/">http://www.acm.org/dl/</a> It provides access to ACM publications. It contains citations and full text of ACM journal and newsletter articles and conference proceedings.</td>
</tr>
<tr>
<td>Cuneiform Digital</td>
<td>URL : <a href="http://cdli.ucla.edu/">http://cdli.ucla.edu/</a></td>
</tr>
</tbody>
</table>
Harnessing Knowledge Management through ICT

Library Initiative (CDLI) | It provides form and content of cuneiform tablets dating from the beginning of writing, ca. 3200 B.C., until the end of the third millennium”. It contains text and images, including document transliterations, text glossaries, and digitized originals and photo archives of early cuneiform.

New Zealand Digital Library (University of Waikato) | URL: [http://www.nzdl.org/](http://www.nzdl.org/) Uses Greenstone Digital Library software. It is open to public. The contents of the library are Humanitarian and UN collections and example collections including text, images and music.

5.2 Open Source Digital Library Software

As a part of this study we have carried out detailed study of two open source software namely:

5.2.1 DSpace
5.2.2 Greenstone

5.2.1 DSpace

The Dspace is a joint project of the MIT Libraries and HP labs which caters to the community needs. Dspace is a digital asset management system which helps create, index and retrieve various forms of digital content. Interoperability between systems is built-in and it adheres to international standards for metadata format. Merits of DSpace are listed below:

- Dspace is an open source technology platform which can be customized or one can extend its capabilities.
- Dspace is a service model for open access and/or digital archiving for perpetual access.
• Dspace is a platform to build an Institutional Repository and the collections are searchable and retrievable by the Web.
• It can be used to make available institution-based scholarly material in digital formats. The collections will be open and interoperable.

Major features of DSpace include support for Lucene search engine and query language, Handle system, OAI-PMH.

5.2.1.1 System Architecture of DSpace
The system architecture comprises of three layers. The storage layer consists of physical data i.e. metadata and the content. The Business logic layer manages the content archive, users archive, authorization and workflow (Figure 5.2). The application layer contains components that communicate with the world outside of the individual DSpace installation[22].

![Figure 5.2 : System Architecture of DSpace][22]
Each layer only invokes the layer below it; the application layer may not use the storage layer directly, for example. Each component in the storage and business logic layers has a defined public API. The union of the APIs of those components are referred to as the Storage API (in the case of the storage layer) and the DSpace Public API (in the case of the business logic layer). These APIs are in-process Java classes, objects and methods. It is important to note that each layer is trusted. Although the logic for authorising actions is in the business logic layer, the system relies on individual applications in the application layer to correctly and securely authenticate e-people. If a 'hostile' or insecure application were allowed to invoke the Public API directly, it could very easily perform actions as any e-person in the system. The reason for this design choice is that authentication methods will vary widely between different applications, so it makes sense to leave the logic and responsibility for that in these applications. The source code is organized to cohere very strictly to this three-layer architecture. Also, only methods in a component's public API are given the public access level. This means that the Java compiler helps ensure that the source code conforms to the architecture.

5.2.2 GREENSTONE Digital Library Software

Greenstone is digital library software developed by the New Zealand Digital Library Project at the University of Waikato, New Zealand. It is a suite of software for building and distributing digital library collections that provides a way of organizing information and publishing it on the Internet and or on removable media i.e. (CD-ROM/DVD) (Figure 5.3). The aim of the Greenstone is to empower users, particularly Universities, libraries and other public service institutions throughout the world, to build their own digital library collections in the field of education, science and culture. The software is distributed in cooperation with UNESCO and the Human Info NGO. UNESCO has been promoting Greenstone since 2000 and since then arranging workshops on
Greenstone, helps with internationalization. The first version of Greenstone was made available during 1997 under the GNU Public License.

Collections of information comprise large numbers of documents (typically several thousand to several million), and a uniform interface is provided to them. Libraries include many collections, individually organized though bearing a strong family resemblance. A configuration file determines the structure of a collection. Existing collections range from newspaper articles to technical documents, from educational journals to oral history, from visual art to videos, from MIDI pop music collections to ethnic folksongs, etc[14].

Greenstone supports duplicate checking. While uploading the document if the same document is selected again, the system gives a message as ’document already exists’. Greenstone supports to browse all collections using all the metadata sets that are supported by Greenstone and that are used while collection building. Greenstone supports rich browsing facility apart from other features, such as manually linking parts of the documents together and building explicit indexes and tables of contents. Greenstone supports browsing by subjects, publications by titles a-z, publications by organization, publications by how to listing and browsing collections chronologically.

The software supports both Windows and Linux operating systems for Web server. A list of some of the salient features supported by Greenstone can be summarized as shown below:

- The administration function built in it enables the items to authorize new users to build collection, protect documents so that registered users on presentation of password can only access them.

- It builds collection with effective full-text searching and metadata-based browsing facilities. Collection containing millions of documents requiring
up to several gigabytes can be built. Full-text searching is fast because compression is used to reduce the size of the indexes and text. Users can browse the list of authors, titles, date, class no., etc.

- Plug-ins can be written to accommodate new document types. The collection can contain pictures, music, audio, video clips, etc. It also supports multilingual documents.
- Collection can be updated and new one brought online any time without bringing down the system.

Some of the examples of Digital repositories at national level include:

- http://dspace.nitrkl.ac.in/dspace/
- http://etd.ncsi.iisc.ernet.in
- http://eprints.iisc.ernet.in/
- http://dspace.library.iitb.ac.in/dspace/

![Figure 5.3: Module of Greenstone Digital Library Software](image-url)
5.2.3 A Comparative Evaluation of Selected Open Source DLS

The survey conducted by http://www.opendoar.org shows that DSpace is more popular in comparison to other open source digital library software (Figure 5.4). DSpace is the most popular software among the digital library solutions available in the open source domain. Moreover, DSpace is functionally richer and supports a wide range of object types, including text, sound, images and video. It provides detailed implementation guidelines.

![Figure 5.4: Usage of Open Access Repository Software – World Wide](image)

**Figure 5.4 : Usage of Open Access Repository Software – World Wide**

The table given below gives a comparison between the above mentioned software:

**Table 5.2 : Comparison – Dspace and Greenstone DLS**

<table>
<thead>
<tr>
<th>Features</th>
<th>Dspace</th>
<th>Greenstone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creator</td>
<td>MIT libraries and Hewlett-Packard</td>
<td>University of Waikato</td>
</tr>
<tr>
<td>License type</td>
<td>BSD license</td>
<td>GNU General Public license</td>
</tr>
<tr>
<td>Language</td>
<td>Java and JSP</td>
<td>C++, Java &amp; Perl</td>
</tr>
<tr>
<td>Installation pre-requisites</td>
<td>Windows/ UNIX/ LINUX JDK 1.5 or later Apache Maven 2.0.8 or later Apache Ant 1.6.5 or later PostgreSQL 7.3 or later/Oracle 9 or later Tomcat 5.x or later</td>
<td>JDK 1.5 or later, Perl 5.0 or later and GCC GNU Database Manager IIS 5.0 or later/Apache web server</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Installation Type</td>
<td>Command line installation, requires special knowledge</td>
<td>Easy to install as it supports Installshield.</td>
</tr>
<tr>
<td>Content Storage</td>
<td>File System format</td>
<td>Greenstone Archive format managed by GDBM.</td>
</tr>
<tr>
<td>Metadata Storage</td>
<td>Stores in RDBMS either in PostgreSQL or Oracle</td>
<td>Stores along with the content in Greenstone Archive format.</td>
</tr>
<tr>
<td>User-Interface</td>
<td>JSP based interface</td>
<td>User friendly interfaces : one is for librarian and other is for users.</td>
</tr>
<tr>
<td>Content creation</td>
<td>Any authorized e-people can create the content</td>
<td>Librarian can only create the collections using GLI</td>
</tr>
<tr>
<td>Support of Document formats</td>
<td>Most commonly used formats like TXT, DOC, PPT, PDF, AVI etc. with add-ons support</td>
<td>Most commonly used formats like TXT, DOC, PPT, PDF, AVI etc. with plug-ins support</td>
</tr>
<tr>
<td>Metadata format</td>
<td>Dublin core</td>
<td>Dublin core</td>
</tr>
<tr>
<td></td>
<td>OAI-PMH compliant</td>
<td>RFC 1807</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NZGLS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>New metadata types can also be supported</td>
</tr>
<tr>
<td>Simple and Complex objects</td>
<td>Partially supported</td>
<td>Not supported</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Browsing and Searching</td>
<td>Keywords in metadata or extracted full-text and browsing through title, author, date or subject indexes. It uses Lucene search engine</td>
<td>Provides interactive mode for browsing and searching. It provides full-text search facilities. It uses MG for indexing and searching</td>
</tr>
<tr>
<td>Multi-Lingual</td>
<td>Presently supporting 19 languages.</td>
<td>Presently supporting more than 40 languages including Indian languages</td>
</tr>
<tr>
<td>Easy workflows</td>
<td>Supported</td>
<td>Partially supported</td>
</tr>
<tr>
<td>Security Mechanisms</td>
<td>Provides good security mechanisms</td>
<td>Not sufficient.</td>
</tr>
<tr>
<td>Reporting features</td>
<td>Supported</td>
<td>Not supported</td>
</tr>
<tr>
<td>Extensibility</td>
<td>Supports through Add-ons features</td>
<td>Supports through plug-ins features</td>
</tr>
</tbody>
</table>

### 5.3 Initiation in Implementing Knowledge Management for libraries

This section overviews some of the steps necessary to be taken for KM implementation in University libraries:

1. Development of knowledgebase to assist research scholars at the remote areas and especially for those who have limited exposure to basics of research methodology. This knowledgebase may be documented in the form of manual.
2. Provide micro-level data and information that is published by government serials, newsletters of autonomous bodies and regulatory agencies.

3. Result of the analysis of requests received for compilation of bibliographic and literature search from electronic databases can be documented properly to prepare a user responsive collection development policy. This will help in providing an insight into information seeking behavior of the scholars. Knowledge Management system should have a collection of knowledge base that is reliable as per the view point of readers.

4. Digital Library

Knowledge Management in a library has to do a lot with one’s intuitive judgment. It depends on the use of experience to recognize key patterns that indicate the dynamics of the situation.

Knowledge Management is to provide knowledge to the users with the help of management and technical means, to create a model of performance and a culture for sharing knowledge, and to create values for the society through the knowledge application and innovation. Knowledge Management in the digital library attempts to collect, organize, store and disseminate knowledge. It reflects in the following three aspects. Firstly, it is to arrange the dominant knowledge in order to build up a storehouse of knowledge for the use of readers. Secondly, it is to explore the recessive knowledge. That is to emphasize that human is the core of the Knowledge Management. And the library should establish a machinery of environment and stimulation to innovate, exchange, learn and apply the knowledge. Thirdly, it is to guide the library service with the concept of Knowledge Management, to make the most of the values of both service and
knowledge, to take the way of knowledge service. The flow and transformation of recessive knowledge is the key to the Knowledge Management of the library[35].

### 5.4 Implementation of Digital Library at Sardar Patel University:

As a part of the team to establish digital library at Sardar Patel University, several options were studied and finally DSpace was used to create institutional repository. Necessary infrastructure was developed like procurement of Computers, high-end book scanners, software for converting the scanned material into a presentable form. Training was given to the staff and students. Figure 5.5 shows the screen shot of the digital library of Sardar Patel University. We started by selecting the University’s own publication series “Gyan Gangotri”. Research journal of Basic Sciences of the University is already digitized and will be published soon. Main aim of establishing such a platform is to provide knowledge to the faculty and students in various disciplines. It is also planned that the same platform will be used to digitize the administrative contents like agenda, minutes, notices, circulars for the ready reference of the concerned users. This project is in the stage of infancy but will be an extensive source of knowledge. It requires skills to locate necessary research materials using the digital technology, hence due considerations are kept in mind so that appropriate resources and services are made available to the students and faculty through this library.
5.5 Proposed Digital Library System for Sardar Patel University

After extensive study of the existing open source digital library and comparing the advantages and disadvantages of those systems, we propose a knowledge based digital library system with following characteristics:

1. Low cost robust, and platform-independent system
2. Developed using open source tools & simple to install and manage
3. Interoperable, scalable and modular
4. User-friendly multiuser system
5. Support for all the existing digital formats and the scope to incorporate new formats

Certain principles should be followed while designing a digital library; they include the service-driven approach, scalability, preservation, privacy, practicality, modularity, time frame among others. Hence we propose an architecture which should be driven by services, developed using open source software tools. The architecture should be scalable, robust and reliable at the high transactions with the server. It should also take care of the privacy issues. The system should be planned so that it works even when the technology changes. Components of a Digital Library include repository, handle system, search system, and user interface. The repository consists of digital content in the form of legacy databases and Web servers. Necessary protocols should be defined to access the repositories. Handle systems are used to identify and manage Internet resources which include digital objects. A digital library contains digital data objects metadata which contains information about the digital data objects stored in the repository. Metadata helps in defining, searching and retrieval of the digital objects. The proposed digital library system will have data residing in different servers located at different networks. The users will be provided a single interface which will show that the required knowledge is disseminated through a single source. Figure 5.6 shows the flow of information in the digital library.

Figure 5.6 : Information Flow in SPUDLS
Figure 5.7: Architecture of the proposed Digital Library - SPUDL

The architecture shown in the Figure 5.7 is the result of study of several architectures available for digital libraries. The first step to build a digital library in any University is the procurement of necessary hardware and software. We recommend using the open source software tools so that the low cost principle of
building the library is maintained. But the developers may use any platform to develop the system. It is recommended that Java should be used along with MySql database. The other software tools include the tools to convert the digitized content to a presentable form. These tools are required when the existing non-digitized content is scanned. Computers, Servers, Scanner and printer are the list of minimum hardware required for building a digital library. The content to be digitized should be the strategic decision of the University. The knowledge repository of the digital library may contain digitized books, published papers, journals published by the University, informative articles, etc. The existing digital library systems are not very user-friendly; they require the content providers to be well versed with information technology. We propose a system where a layman user who may be a content provider or end user can also interact with the system easily. The knowledge will be provided at each and every stage to facilitate the user. The proposed architecture consists of Metadata Library that stores the details of the content stored in local repository and external repository which may be the repositories of other libraries. The other functionalities like search, browse and print are also shown in the architecture. We propose the functionality that doesn’t exist in any of the digital library systems that we have studied such as analytics available to the end users as well decision makers. It includes the knowledge provided to the users on availability of content in the library, and indication of most popular contents in terms of frequency of accessing, etc.

5.6 Conclusion

Knowledge Management through digital libraries is a challenging area where Universities as the highest seat of learning need to concentrate on developing libraries on continuous basis. Such attempts would help making the intellectual knowledge available in the University, in the form of books, journals and other knowledgeable resources are shared among the users. This knowledge shared will help in contributing for knowledge innovations.
In this chapter, we presented our systematic study on digital Libraries in general and designed a Knowledge Development model of Digital Library for Central Library of Sardar Patel University, as a contemplation exercise. The chapter undergoes extensive study and comparative evaluation of selected open source digital library software packages. Our study includes various models available as freeware namely DSPACE, GREENSTONE.

We have made an attempt to propose an architecture of a knowledge-based digital library system for University. The chapter discusses features of the system – SPUDL – proposed for Sardar Patel University.