CHAPTER 3

DIGITAL LIBRARY ENVIRONMENT

3.1 DIGITAL LIBRARY ENVIRONMENT

Digital libraries are comprehensive systems providing users with instant access to large volumes of information and knowledge sources. This era of information technology has triggered a radical change in the functioning of libraries. These developments have led to the emergence of new patterns of preservation of information available on network and instant access to information overtaking geographical and time barriers.

Containing primary sources of information (typically articles and papers produced by individual scholars or institutes) unlike the secondary sources found in conventional libraries, the digital libraries are characterized by a unique feature wherein digital records from both local and foreign databases are used repetitively for multiple purposes. This Chapter has been devoted to focus on various issues pertaining to the digital library environment like growth of digital libraries in India, transformation of conventional libraries into digital libraries, user expectations and management of digital libraries.

Digital libraries are expected to support the following features: provide access to very large information collections, support multi-media content, support advanced search and retrieval, focus on providing access to primary information, and provide user-friendly interface, available for a very long time, supports traditional library missions of collection development, organization, access and preservation.
Several large scale digitization projects are initiated by Google, the Million Book Project, MSN and Yahoo! With continued improvements in book handling and presentation technologies such as optical character recognition and e-books and development of alternative depositories and business models, digital libraries are rapidly growing in popularity as demonstrated by Google, Yahoo, and MSN’s efforts.

Most of the libraries provide a search interface which allows resources to be found. Some digital libraries create special pages to allow search engines to find all their resources. Digital libraries also use the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) to expose their metadata to other digital libraries and search engines like Google Scholar, Yahoo! And Scirus can also use OAI-PMH to find these deep web resources (Koehler, 2006). A digital library can be built around specific repository software. The best known examples are DSpace, Eprints, Fedora, DLibra (Poland) and Greenstone Digital Library Software. In 2009, Fedora Commons and the DSpace Foundation merged to create a new organization Dura Space (www.duraspace.org/pressrelease.html, 2009). The Reference Model for an Open Archival Information System (OAIS) provides a framework to address digital preservation (Baudoin P, 2004).

3.2 GROWTH OF DIGITAL LIBRARIES IN INDIA

The first step towards creating a digital library is to digitize existing printed media material into digital formats. For example, the Centre for the Study of Cultural and Societies (CSCS) Media Archive has digitized its archival collection on media-based articles such as newspaper clippings. Common procedures adopted in this process were scanning and storing the clippings as either image or document formats to be readable over the internet. Also, the archive is stored in offline formats such as CD-ROMs. This project was originally intended to be an income-generating model, however, issues of
Intellectual Property Rights (IPR) over media-related information posed major constraints to make it available for free access. Also, meta-data standards adopted do not seem to reveal a sophisticated organization of data.

Early research suggests that the process of making resources available through digital libraries in India may suffer a great deal due to lack of relevant content, poor connectivity in rural areas and dearth of metadata standards capabilities. For example in Karnataka over 70 percent of students live in rural areas that lack the resources which their urban counterparts may enjoy. Digital Libraries in India would afford greater access to resource material, outweigh operational costs of setting up conventional libraries and create better opportunities for enrich classroom learning. Digital Libraries in India also have the potential to create a variety of user communities as they can provide tools for teacher training and adult education as well.

One of the greatest challenges in the establishment of a digital library network in a country like India is Internet connectivity. The lack of network infrastructure and inappropriate pricing patterns can also prove significant hurdles for a fledgling Information Communication Technology (ICT) initiative. Several connectivity options now exist and it is helpful to understand their relative costs and benefits. Dial Up access, using regular telephone lines emerges as an immediate connectivity solution as existing network infrastructure can be tapped.

Due to limited bandwidth and slower speeds, Dial Up is suitable only for basic e-mailing and browsing. Moreover, it ends up being exorbitantly expensive for longer durations of use.

The Indira Gandhi National Centre of Arts (IGNCA) digital library for example, primarily supports a variety of multimedia formats including audio and video files of archaeological or cultural significance. Interactivity to a very
limited degree is also embedded. However, even for such minimal activity broadband connection is preferable. Broadband connectivity, including ISDN (Integrated Services Digital Network), an older technology, and DSL (Digital Subscriber Line), offers high speeds with high costs, but may not be available in most rural areas.

Digital Library concepts sought to educate audiences on the basic features, aspects and workings of a digital library. The most popularly used software to build the digital libraries themselves was Greenstone Digital Library as this was open source and free to download. This software supports metadata standards such as XML and Dublin Core to name a few. Therefore, one can see a GSDL Software-Dublin Core combination in most of the initiatives. Indian software includes SOUL developed by UGC-INFLIBNET consortium, LibSys and LIBSuite that follow GSDL. The areas of greater challenge in building a digital library seemed to lie in the actual process of digitizing existing resource material on print as the cost factors involved were not sufficiently supported due to lack of dedicated funding for digital library efforts in academic institutes. One of the associated reasons for such impedance cited was also lack of trained professionals to maintain the smooth functioning of various technical functions in libraries.

However, a majority of institutes have taken a step forward in automating their libraries and making Online Public Access Catalogue (OPAC) facilities available at their premises. Under the consortium efforts of INFLIBNET several state universities have received funding for digital library initiatives.

Some key applications identified for digital libraries included (i) archival preservation such as manuscripts, ancient literary works, cultural artifacts, community identities, (ii) legal documentation such as government documentation of plans and policies, history of legal cases, census and statistical
data, spatial data and other relevant information that can be brought into the public domain, and (iii) educational and research purposes such as scholarly publishing, theses, research work, hosting reference material. With particular reference educational and research applications, a number of initiatives in India seem to focus on advanced research and scholarly publishing. One of the reasons for this concentration around research is the availability of a comparatively larger resource base in both universities as well as academic libraries. The paucity of digital library resources is due to lack of documentation of practices and limited use of extra-curricular content.

3.3 DIGITAL LIBRARY SUPPORTING ORGANIZATIONS

A library network is broadly described as a group of libraries coming together with some agreement of understanding to help each other with a view to satisfying the information needs of their clientele.

3.3.1 Developing Library Network (DELNET)

DELNET was started at the India International Centre Library in January 1988 and was registered as a society in 1992. It was initially supported by the National Information System for Science and Technology (NISSAT), Department of Scientific and Industrial Research (DSIR), Government of India. It was subsequently supported by the National Informatics Centre (NIC), Department of Information Technology, Ministry of Communications and Information Technology, Government of India and The Ministry of Culture, Government of India. DELNET has been established with the prime objective of promoting resource sharing among the libraries through the development of a network of libraries. It aims to collect, store, and disseminate information besides offering computerized services to users, to coordinate efforts for suitable collection development and also to reduce unnecessary duplication wherever possible. (http://delnet.nic.in/)
3.3.1.1 DELNET Initiatives

DELNET undertook the compilation of the National Bibliographic Database with the support of the Department of Culture, Government of India in 1998 as a Pilot Project. Fifty thousand records of books: 20,000 in English, 15,000 in Tamil and 15,000 in Punjabi were created at the Punjab University, Patiala and International Institute of Tamil Studies, Chennai. At Andhra University Library, Visakhapatnam, 15,000 records in English and 10,000 records in Telugu have also been created. Similarly 25,000 records have been created at the Asiatic Society, Mumbai. The work is in progress at the Asiatic Society, Kolkata.

3.3.1.2 DELNET Databases

The following Databases are maintained by DELNET


3.3.1.3 AICTE-DELNET MoU

To promote access to more relevant information in each library of AICTE approved technical institute

➤ Give training to library staff so that they get associated with database creation work using international bibliographic standards.

➤ Create union catalogues of resources available within the technical institutes and institutes for resource sharing purposes through DELNET.
Locate resources of national importance through DELNET online databases and make them available through Inter-Library Loan (ILL).

Enable each library to have access to global resources and help them through DELNET in procuring necessary documents on loan for research and reference. ([http://delnet.nic.in/aicte-delnet-mou.htm](http://delnet.nic.in/aicte-delnet-mou.htm))

### 3.3.2 Indian National Digital Library in Engineering Sciences and Technology (INDEST)

The Ministry of Human Resource Development (MHRD) has set-up the "Indian National Digital Library in Engineering Sciences and Technology (INDEST) Consortium" on the recommendation made by the Expert Group appointed by the ministry under the chairmanship of Prof. N. Balakrishnan. The Ministry provides funds required for subscription to electronic resources for (48) institutes including IISc, IITs, NITs, IIMs and a few other centrally-funded Government institutes through the consortium headquarters set-up at the IIT Delhi. Besides, (60) Government or Government-aided Engineering institutes and technical departments in Universities have joined the Consortium with financial support from the AICTE. Moreover, the INDEST-AICTE Consortium, as an open-ended proposition, welcomes other institutes to join it on their own for sharing benefits it offers in terms of highly discounted rates of subscription and better terms of agreement with the publishers. All electronic resources being subscribed are available from the publisher’s Website. The Consortium has an active mailing list and a Web site hosted at the IIT Delhi.

The INDEST-AICTE Consortium is the most ambitious initiative taken so far in the country. The benefit of consortia-based subscription to electronic resources is not confined to 38 major technological institutes in the
country but is also extended to all AICTE-accredited and UGC-affiliated institutes. (http://paniit.iitd.ac.in/indest/)

3.3.3 National Information Center Network (NICNET)

This network is being sponsored by Planning Commission, Govt. of India. The membership covers four national and regional nodes, 32 state and union territory nodes; seventy cities and towns. The services of NICNET include, bulk file transfer; teleconferencing; full text and bibliographic retrieval services. (http://gurgaon.gov.in/nicnet.htm)

3.3.4 Calcutta Libraries Network (CALIBNET)

The Calcutta Libraries Network is being supported by NISSAT - Govt. of India. The major applications of this network include Cataloging; serials control; acquisitions; circulation. The services of this network are- CAS; SDI; union catalog; partial database; editing and retrieval of records; global information; search; full-text document delivery; library.

3.3.5 Bombay Library Network (BONET)

This network is known as Bombay Library Network this network was started with the support of NISSAT & NCST. The main objective of this network is to promote cooperation among libraries in Bombay (now Mumbai). The services include online catalog; online document delivery; IRS; interlibrary loan; dissemination of information.

3.3.6 Ahmedabad Library Network (ADINET)

Ahmedabad Library Network is supported by NISSAT, DSIR & INFLIBNET the major objective of this network is to bring cooperation among
its regional libraries, to develop databases and to integrate scientific and technical information systems. The services of this network include library automation, library holdings and database in progress.

3.3.7 Mysore Library Network (MYLIBNET)

Mysore Library Network was sponsored by NISSAT. The main objectives of MYLIBNET are developing software tools, conducting seminar, workshops/training programs and conduct surveys. This network is supported by CFTRI, Mysore as host site. There 116 members in this network. The main services of this network are MYLIB Database; E-journals; food patents; CFTRI Library Bulletin; public services.

3.3.8 Defence Science Information Network (DESINET)

The Defence Science Information Network is a dedicated network for defence communities. This network is supported by DESIDOC, Delhi. The main activities of this network are to focus on scientific, research and defence communities.

3.3.9 The Educational and Research Network (ERNET)

The Educational and Research Network is supported by Department of Electronics, Government of India and UNESCO. ERNET received financial support from UNDP. The members in this institute include the IITs, IIMs, IISc, National Centre for Software Technology, Mumbai, CCI wing of Department of Electronics. The services include Communication services such as e-mail, file transfer, remote log on, database access, bulletin board etc.,
3.3.10 Scientific and Industrial Research Network (SIRNET)

The Scientific and Industrial Research Network is sponsored by CSIR and Commissioned by NCST, Mumbai. The Members include 40 labs of CSIR and R&D Institutions. The applications of this network are scientific communication; leather technology; natural products; food technology; medicinal Plants.

3.3.11 VIDYANET

VIDYANET is a dedicated Communication Computer Net. This network is sponsored by TATA Institute of Fundamental Research, Mumbai. The main objectives of this network are (i) to provide rapid means of communications by linking computers at various institutions in India and to similar networks outside the country; (ii) to stimulate corporate research, the day-to-day exchange of research information and the execution of joint projects and publications. The main services of this network are file transfer facility; sharing of computer resources and access to remote applications, databases, libraries, etc.

3.3.12 Bio Technology Information Services Network (BTISNET)

Bio Technology Information Services Network is a specialized information network supported by Department of Bio Technology, Government of India, and this network is connecting ten Specialized Information Centres in genetic engineering, plant tissue culture; photosynthesis and plant molecular biology; cell transformation; bio-process engineering. The services provided by this network are Services Data processing using applications software; online communication access; facsimile facility.
3.3.13 The Information Library Network (INFLIBNET)

The Information Library Network popularly known as INFLIBNET was sponsored by University Grants Commission. The connectivity of this network is very vast and covers computer communication network of universities and R&D; libraries and bibliographic information centers throughout the country. All the universities, autonomous institutions of UGC and R&D libraries are members of this network. The services provided by this network include catalog service; database Services; document supply services; e-mail; audio and video conferencing, etc. (Anil Kumar J, 2010)

3.4 TRANSFORMATION OF CONVENTIONAL LIBRARIES INTO DIGITAL LIBRARIES

Digital content is all-pervasive and invading life and libraries. Most Indian Science and Technology libraries already have about 15 percent of their content in digital form and it is increasing at the rate of about 5 percent per annum. The ICT has successfully dismantled strong fences built around information sources. Traditionally, libraries have been champions of access restrictions with chained books, closed access, restricted membership and punitive measures for using books for longer than stipulated duration.

3.5 ISSUES AND CHALLENGES

3.5.1 Metadata Standards and protocol

Metadata or data about data is a critical element for searching information through a database especially, when the information available in an invisible space like the internet, unlike a conventional library. The function of Metadata is to standardize the structure and content of indexing or cataloguing information. Digital Library efforts to create better information management systems and improve existing ones have resulted in multiple standards. However, among the diverse standards that have been tested and tried and at present, there
are a few universally recognized standards of classification that are being used around the world for digital resource management purposes.

A brief summary of existing worldwide meta-data standards is as follows: The International Standards Organization’s (ISO) Metadata Working Group has a related standard, ISO 11179, Specification and Standardization of Data Elements. It may also be made available to private sectors, civil societies and citizens. The American National Standards Institute (ANSI) has established the NCITS L8 (formerly X3L8), the National Committee on Information Technology Standards. The committee covers naming, identification, definitions, classification, and registration of metadata. The World Wide Web Consortium (W3C), a major governing body of the Web has developed de facto standards including RDF (Resource Description Framework) and the Platform for Internet Content Selection (PICS) specifications. PICS was originally intended to aid adults in controlling children's access to the Internet. However, its standards are usually at a very general level over which meta-standards can be improvised. The National Spatial Data Infrastructure (NSDI) has developed an NSDI metadata standard for spatial data. A software utility has also been developed by Indian Space Research Organization (ISRO) that allows agencies to populate their own metadata in the NSDI Metadata Standard format and then link it with the overall metadata server. Maps and satellite images made available through this facility will be used for decisions at the local, regional, state and central level planning, implementation of action plans, infrastructure development, disaster management support, and business development.

While metadata standards are protocols per se, metadata systems are those that describe a set of metadata elements such as Title, Author, Rights, Date and so forth for a given digital material. For example, Dublin Core, MARC, DESIRE, SHOE, XML are metadata systems, of which Dublin Core is more widely adopted around the world. The Dublin Core Metadata Initiative (DCMI) began in 1995 with an invitational workshop in Dublin, Ohio that brought
together librarians, digital library researchers, content-providers, and text-markup experts to improve discovery standards for information resources. The original Dublin Core emerged as a small set of descriptors that quickly drew global interest from a wide variety of information providers in the arts, sciences, education, business, and government sectors. It also has official standing within the W3C and the Z39.50 standard. Dublin Core metadata is endorsed formally by governments in three countries for promoting discovery of government information in electronic form, and Dublin Core is under consideration as national information standard in at least five others.

At present, digital library initiatives in India make use of Dublin Core for web-based publications, Encoded Archival Description (EAD) for archiving and Visual Resources Association (VRA) for visual data. Consortia such as the INFLIBNET and INDEST are involved in developing Indian metadata standards and software applications as part of the OAI-PMH. This would be used to automatically extract metadata information from digital libraries and enhance interoperability between systems. This would also enable users to access all information repositories of participating institutes of the OAI. eprints@iisc, the eprint archive of Indian Institute of Science, is probably the first OAI compliant institutional repository initiative in India.

3.5.2 Software Issues

Greenstone is Digital Library open source software used for building and distributing digital library collections, organizing information and publishing it on the internet or CD-ROM. This software produced by the New Zealand Digital Library Project. The Indian Labour Archives was one of the first Indian digital library initiatives to use Greenstone.

In India at present, Information Library Network (INFLIBNET) developed a software SOUL. The IISc in Bangalore is closely involved with the
INFLIBNET for developing and standardizing protocols of information management for digital libraries as well as information repository initiatives.

The National Informatics Centre (NIC) of India also developed digital library software DelSis that is used by the Developing library Network (DELNET).

Ecole solutions help organisations to create digital libraries using the open source software ‘Dspace’. Dspace provide tools for management of digital assets and is commonly used as the basis for an institutional repository. It supports wide variety of data includes books, thesis, photographs, films etc. It is open source and therefore there is no license cost, completely customized to suit different needs and supports international metadata includes resource identifier, OAI.

Ecole solutions also offer installation of the software, training about software, configuration, customization, post implementation support and upgrades.

3.5.3 Digital Rights Management

Given the vulnerability of materials accessible over the public access networks like the Internet, issues of IPR of material over the digital domain has become a serious concern. Digital Rights Management involves ways in which the digital library operators manage issues of IPR, those of ownership of material made available on the digital library, how one controls access to as well as dissemination of copyrighted material. Several methods of managing digital rights do exist now-a-days from which one could choose to adopt the more convenient one for their purposes.
3.6 DIGITAL RESOURCES

In this section, we will briefly discuss various some types of library materials such as journal, books, theses & dissertations, patents, course material etc.

3.6.1 E-Journals

Libraries have been exploring easy to cope with the problems of ever increasing prices of the journals, space requirements and decreasing level of usage as the journals get older. Nevertheless, libraries are required to maintain back issues of the journals, usually in bound form. Electronic Journal helps the librarians in addressing these problems to a great extent without significantly affecting the service levels. Electronic Journals can be accessed via internet from any web enabled PC. Depending on the type of subscription, one or more users can access the service simultaneously, either directly from an independent web enabled PC or in a local area network through a proxy server (IP addresses based access). Electronic journals also offer benefit of full text searching and downloading of articles. Many publishers of electronic journals offer their journals through consortia of libraries at much lower rates. Indian Digital Library of Engineering, Science and Technology (INDEST), Information Library Network (INFLIBNET), UGC-INFONET, IIM Library Consortia, Health Science Library Network (HELINET) includes some important consortia operating in India. Access to articles in electronic journals can also be made through aggregator services which offer searchable databases of contents of e-journals from several publishers, and links to journal site for full text. Emerald, OCLC and J-Gate are some of the example of e-journal aggregator services. The main disadvantage of electronic journal is that libraries cannot physically possess the journals.
3.6.2 E-Books

E-Book has been described as a text analogous to a book that is in digital form to be displayed on a computer screen. E-books can be read just like a paper book, using dedicated E-Book reader such as GemStar eBook or on a computer screen after downloading it. There are also some newer technologies developing such as electronic paper, which is much like paper, except that the text can be changed, and talking books in MP3 format. E-book offer advantages like portability, 24 hours access, text search, annotation, linking, and multimedia and self-publishing possibilities. Development of e-book is still in the infancy stage and issues like compatibility, e-book readers, availability and intellectual property rights are to be addressed before it can be implemented on large scale.

3.6.3 Electronic Theses and Dissertations (ETD)

Dissertations and theses produced at universities are important sources of information and knowledge for further research. A large number of universities have converted their theses and dissertation collection into digital libraries and have made it available on Internet for global access. A number of universities have also implemented Electronic Theses and Dissertation programmes, where researchers submit theses in electronic format. Some initiatives such as Networked Digital Library of Dissertation and Theses (NDLTD) in development of web based union catalogues of ETDs submitted over 100 libraries throughout the world are worth mentioning.

3.6.4 Patents

Many patent issuing authorities now have made their complete full text patent records online. For example United States patent documents can be searched and downloaded free of cost. Some of the commercial organizations such as Derwent also provide downloading of full text patent from either an
online database vendor (e.g. Dialog, STN) or directly from their site to the subscribers.

3.6.5 Course Material

A large number of web based courseware and teaching aids are being developed to facilitate flexible open learning by many universities and commercial organizations. Many academic institutes have adopted such course material for their curricula. Libraries can provide access to course material to the learners and teacher and thus contribute to open learning. This can be done by providing links to the courseware sites through subject gateways or provide local access after downloading the material. Some of the important sites where web based course material and tools can be found are Ask ERIC, CAREO-Campus Alberta Repository of Educational Objects Alexandria, LESTER-Learning Science & Technology Repository, MERLOT-Multimedia Educational Resources for Learning and Online Teaching, and GEM- The Gateway to Educational Materials.

3.6.6 Subject Gateways

Preparing subject guides or path finder’s has been an intellectual activity for reference librarians. Such guides are normally prepared in consultation with the subject experts or by a subject librarian, who picks up the sources after careful evaluation. Random surfing of the Internet may be a popular pastime, but is an inefficient use of bandwidth and time. One of the most useful ways to discover quality resources in a particular subject area is use of subject-based Internet gateways and directories. A subject gateway thus is a facility that allows easier access to web based resources in a defined subject area. These are basically a dynamic catalogues of pre-dominantly online resources, though some libraries include information on print resources as well. Generally access to subject gateways is provided through library website, designed to help library users discover high-quality information on the internet in a quick and effective
way. A simple subject gateway may list web based or print resources on a given subject with links to the website of the resources and some useful information such as keywords, class number, description and how to access. Advanced subject gateways offer searchable catalogue or even full text search facility on listed sources.

3.6.7 Digital Library and Archives

Many Libraries traditionally have been repositories of local information and heritage documents such as manuscripts, rare books, maps, photographs and paintings etc. Archives or record management is also part of LIS function, particularly in business and research organizations. In other cases such as university libraries, documents generated in-house such as dissertation and theses, research reports etc represent the intellectual strength of the institute. Libraries are developing digital repositories of such resources, and providing internet or intranet access to these.

3.6.8 Databases

The following paragraphs have been devoted to describe various databases of e-resources.

3.6.8.1 IEL Online

The IEEE/IEE Electronic Library (IEL) covers almost one third of the world's current electrical engineering and computer science literature, providing access to publications from the Institute of Electrical and Electronics Engineers (IEEE) and the Institution of electrical Engineers (IEE). The resource covers more than 950,000 documents from over 12,000 publications, including 219 journals, transactions, magazines, conference proceedings, IEEE Standards with back files from 1988 onwards plus select content dating back to 1950. More than 25,000 new pages are added per month. It provides access to more than two
million full-page PDF images, including all original charts, graphs, diagrams, photographs, and illustrative material.

3.6.8.2 **JCCC – J-Gate Custom Content for Consortia**

JCCC – J-Gate Custom Content for Consortia, is a customized solution for accessing and sharing journal literature subscribed by all the IITs, IISc and IIMs, individually and collectively through INDEST Consortium. It is a common gateway to access 5,676+ e-Journals from 1,028 publishers.

3.6.8.3 **ACM Digital Library**

The ACM Digital Library incorporates digital versions of works published by ACM since its inception. The major components of the resource is an enhanced version of the ACM Digital Library plus an extended bibliographic database, consisting of more than a quarter-million citations of core works in computing. The ACM Digital Library hosts over 103,000 full-text articles from ACM journals, magazines, and conference proceedings and half million bibliographic Records with about 2,50,000 links to full bibliographic information and 70,000 further links to full text resources. The access is for 32 Full text journals +Conference proceedings+ others.

3.6.8.4 **ABI/Inform-Global**

The ABI / Inform is one of the premier sources of business information for more than 30 years. The database contains content from thousands of journals that help to track business conditions, trends, management techniques, corporate strategies, and industry-specific topics worldwide. It consists of 1800 full-text journals (Back files from 1971-present) and 2000 journals that are indexed and abstracted. The resource is offered on Web with CD ROM backup.
3.6.8.5 *Blackwell Journals*

306 titles of 'Humanities & Social Sciences' journal collection of Blackwell Publishers are available online. Most of the journals have back files from 1997+. For list of journals refer Library Public Folder.

3.6.8.6 *Bloomberg*

Bloomberg is the leading global provider of data, news and analytics. The Bloomberg Terminal and Bloomberg's media services provide real-time and archived financial and market data, pricing, trading, news and communications tools in a single, integrated package to corporations, news organizations, financial and legal professionals and individuals around the world.

3.6.8.7 *Business Source Premier (EBSCO)*

Business Source Premier is a comprehensive database which contains index and abstracts for more than 3,800 business-related periodicals with coverage back as far as the first half of the 20th century for many leading scholarly journals. It also includes the research community’s foremost business thesaurus as well as searchable citations (a.k.a. linked, cited references) for more than 1,100 academic journals. In addition, this database provides full text for more than 3,000 periodicals, including nearly 1,000 full text peer-reviewed journals, the most found in any business database. Business Source Premier is the most comprehensive archive available for business journals, offering hundreds of thousands of peer reviewed business articles in PDF prior to 1985.

3.6.8.8 *Capitaline 2000*

Capitaline 2000 is a corporate database on listed and unlisted Indian companies. It provides Information on more than 10000 companies with their financial and non-financial information with company query, industry, finance, and scoreboard and projection models. The Capitaline 2000 incorporates the state
of the art facilities like, graphics currency conversion forecasters, multimedia and web-link.

3.6.8.9 *EBooks from Elsevier*

Online Book series in "Business Management and Economics" on Science Direct platform provides electronic access to information currently available in print book series published by Elsevier. The package has 54 titles and is Advances and Research publications. It offers four back years and current year building following the journal model. Abstracts, Summary plus and full text HTML will be offered with linked references, e-mail alerting and integrated searching with journals.

3.6.8.10 *Emerald Management Xtra*

Emerald Management Xtra database covers 155 journals on management and related subjects brought out by MCB University Press, UK. The journals are indexed from 1989 and full-text available from 1994 onwards.

3.6.8.11 *TIFR Digital Library Initiative*

The TIFR online public access catalogue provides access to several standard international publications and journals such as IEEE and Springer. This resource is also involved in the process of providing digital access to materials, e-books. It uses Dublin Core metadata for this purpose.

3.6.8.12 *CSCS Media and Culture Archive*

This component of the CSCS Media Project assembles what could be the definitive media archive of post-Independence India. Material will include press clippings and reviews; pamphlets, reports and papers by government agencies, independent organisations, and individual work; visual images,
advertising and publicity leaflets; market research reports; it will also facilitate video archiving through the Internet.

3.7 SERVICES OFFERD BY DIGITAL LIBRARIES

Any document that is not collected and preserved is likely to be lost, unavailable both now and future. Digitization is a viable solution to make it eternal; to maintain the digital collections and provide access digital libraries became essential in the contemporary information society. In a digital environment university libraries have a new role to fill. To fulfill the mission of the library it has to provide the traditional reference services, retrieval and dissemination of information and at the same time it has to stretch its services to information search services, to organize the information resources for easy access, to filter qualitative information from the vast ocean of World Wide Web, to facilitate translation services to resolve both linguistic and format incompatibilities and also to take up publishing service in which libraries also aggregate information, add value to information products, and create new information. Another traditional library activity that will surely expand in University Digital Libraries is the collection and creation of reviews or annotations for information resources.

The exponential growth of information in the World Wide Web and the number of users searching for information on the web sites is increasing day by day. To cope with the situation digital libraries have emerged with the tasks of massive digitization, storage, access, digital knowledge mining, digital reference services, electronic information services, search co-ordination, and manage the archive and its access. A Digital Library is a machine readable representation of materials which might be found in a library, together with conventional information sources, intended to help users find specific information. A Digital Library service is an assemblage of digital computing, storage, and communications machinery together with the software needed to reproduce,
emulate, and extend the services. A full service digital library must accomplish all essential services of traditional libraries and also exploit digital storage, searching, and communication (Gladney . Henry M et al. 1994). So, digital libraries are viewed as a boon for the present and future generations.

### 3.7.1 Online Public Access Catalogue service

OPAC provides access to the catalogue through a computer terminal. OPAC allows searching the entire catalogue online, conveniently and quickly, using one or more search criteria. OPAC even shows the current status of a book, whether it is loaned out, available on the shelf or lying elsewhere. Another advantage of OPAC is its ability to display catalogue records in a variety of formats such as AACR2, MARC etc, and the records can be displayed in a desired order. Most library management packages offer printing of bibliographies from OPAC either on a printer or on a file. An OPAC terminal should be equipped with search software, which is usually part of integrated library management systems such as LibSys, EasyLib, NewGenLib, SOUL, etc. Some integrated library management packages even use OPAC for other user services like reservation, membership enquiry and registration, interlibrary loans etc.

Another convenience that OPAC offers is accessibility from a remote computer, using a Local Area Network (LAN) or a Wide Area Network (WAN). With modern library systems offering interface to OPAC, it is also possible to provide access from anywhere in the world via Internet. An internet enabled OPAC is called Web OPAC. Web OPAC can be searched using any common browser, such as Microsoft Internet Explorer, Mozilla Firefox, Opera, Google Chrome, Konqueror and Safari. Apart from searching OPAC, some libraries allow their remote users to avail certain online services like book reservations, loan requests for postal loan, loan renewals, membership application, address change, suggesting books etc.
3.7.2 Reference Service

Asynchronous tools such as email, subject gateways, FAQs, and electronic libraries and interactive tools like chat rooms, virtual reference desk, and ask-me are replacing the conventional means of post, phone or in-person reference enquiries. Ask-a-Librarian allows the user to click on ask-a-librarian link to send a formatted enquiry to the reference librarian. The reference librarian either provides an answer, links to resources or link to a subject expert. Interactive tools now allow a reference interview online.

3.7.3 Bibliographic Service

Compilation of bibliographies, reading lists and state-of-art reports are very parts of LIS work, particularly in research and academic libraries. Browsing through the manual indexes and abstracts is a tedious and time consuming work, and does not always produce up to date result. Availability of databases in electronic form on CDROM or online, offers convenient, efficient and cost effective information retrieval. Electronic databases also provide unique search features such as searching on multiple criteria (key-word, subject, author, source, classification code, year of publication, language etc.), and variety of display formats & styles. Advance features like natural language query ranking the search results in also available in many databases. Web based services facilitate full text searches and link to full text of the documents. Dialog, STN and Silver Platter are some of the popular database companies that offer bibliographic and reference databases on CDROM and Online platforms.

3.7.4 Current Awareness Service

Current Awareness Services (CAS) has been important means for keeping the users up to date in their areas of interest. A current awareness service may be as simple as copy of table of contents or a bulletin containing bibliographic records, of articles selected from the current issues of journals and
other material, and usually organized by subjects. Libraries now compile current awareness bulletins using predefined search strategy and running on the database either on CDROM or online periodically and getting the desired output. Subject to copyrights, the output can also be stored on a local system, and disseminated online (internet, intranet) and offline (print, CDROM, email). Table of contents of most journals are available free from the publishers’ sites. Some publishers even offer free email update of table of contents. A large number of electronic publishing sites or portals now offer current information via email to registered users.

Internet has enabled a lot of innovations in contents, methods of production and distribution of current awareness products. Tools such as Listserv, Weblog, Webzines and e-newsletters are common. Listserv give the latest information, hot topics, ideas and opinions, a chance to discuss issues, a source of advice and assistance. Weblogs literally log the web. They review, select and package the latest relevant information, in a subject area.

### 3.7.5 Document Delivery Service

It is not possible for libraries to have everything that its clients may need. Libraries use document delivery services from other libraries and commercial organizations for copies of research papers etc not held by them. Locating a source and procuring the document requires considerable time and efforts and the process is laden with uncertainties. ICT has made the document delivery services very simple and reliable. From searching the holdings to ordering and delivery have been benefited by the use of ICT. A large number of libraries now host their up-to date holdings on their website and can be searched on internet. Many library networks such as INFLIBNET and DELNET maintain union catalogue of their member’s journal holdings. One such document delivery service provider British Library Document Supply Service (BLDSC) offers a flexible system of receiving orders and tracking. BLDSC’s email based
document supply system Artmail allows registered users to send requests through a formatted email that automatically is processed by BLDSC’s system, which generates location of the sources. The documents can be received in print as well as electronic format. Online and web based database services such as STN provides link to document delivery services of their own or a third party. Some of the commercial document delivery services are Ingenta and BioMedNet, OCLC and Science. Full text of electronic journal articles that are available in electronic form may also be downloaded through links provided by aggregator or gateway services such as Informatics’s J-gate.

3.7.6 Inter-Library Loan (ILL) Service and union catalogues

Resource sharing through Inter-library loan is a necessity for the libraries. Access to the catalogue of partner libraries is crucial to Inter-Library Lending. Union catalogues, standardization and machine readable catalogues are aimed at promoting resource sharing. Printed union catalogues and Computer Output on Microfiche (COM) catalogues and CDROM are now being replaced by web OPAC and web based union catalogues. Librarians can now access catalogues of thousands of libraries across the world using Internet. Developments in digital library and internet technologies have made it possible to automatically update the catalogue records from member library systems, distributed searches using a single user interface, and value added services. RedLightGreen is one of the world’s largest web based union catalogues. It contains about 130 million records from 160 member libraries of Research Libraries Group (RLG) in USA. In India, bodies like INFLIBNET, DELNET are also developing union catalogues of books, serials and theses.

3.7.7 Audiovisual Services

Audiovisual materials are important sources of information, education and entertainment. Many libraries particularly media libraries and large academic and public libraries hold audio visual material such as music, films, pictures and
photographs etc. Old media of LP records and tape slide have long been replaced with audio and video tape. The new multimedia of audio CD, Video CD (VCD), and Digital Video Disks (DVD) have advantage of higher storage capacity, random access and longer life than audio and video tapes and cassettes. Many libraries allow their members to borrow these. Multimedia documents can now be played on standard PCs, stand-alone or networked. Recent developments in storage media, compression and encryption technology have made it possible to store large amount of multimedia documents on hard disk and disseminate through internet. Software such as Quick Time Player, Microsoft Media Player etc are now freely available to play or see these documents in a browser.

### 3.7.8 Customer Relations and User Education

LIS being service organization, customer services and user training are important aspects of its activities. A continuous interaction with users for feedback and information is a must to maintain the standards of service. While the conventional means of interaction such as meetings, suggestion box, surveys and interviews are still important, use of new means of communications such as email, web forms, bulletin boards, discussion forums and listserv are fast replacing these. Not only these tools provide a fast, convenient and transparent and cost effective medium, but also offer scope for innovations and greater peer participation. Some of these tools can even be used by the libraries to involve the users in book selection etc. LIS customer relations can be tremendously improved by innovative use of technology like virtual library tours, making interactive library maps and floor plan available on the library website. A highly ICT enabled environment requires appropriate training to its users also. The contents of user training must include use of internet tools and resources. Conventional user education programmes can be supplemented with web based instructions and guides for use of resources. In the conventional class room based user education also ICT tools are used for presentation and demonstration.
3.7.9 Selective Dissemination Information Services (SDI)

Services provided by customer oriented digital libraries may include proactive services such as Selective Dissemination of Information (SDI) (Salto, 1968) or may provide real-time routing of information to customers. In a customer-oriented Digital Library the collection profile may be constructed by combining the user profiles for all users, which the Digital Library is intended to serve.

3.7.10 Search Services

This service provides fast access to dynamic information as well as multiple static collections for a wider range of users. The success of a search service relies on the implementation of a powerful retrieval engine and a flexible user interface. The search service should allow users to do “across database” searching without having to modify a query. The approach requires constantly hunting for, connecting to, and integrating a variety of resources which, as a function of time, are constantly updated, relocated, created, and scattered across the breadth of cyberspace.

3.7.11 Classification Service

Classification is a powerful intermediation service useful for discriminating information resources at both broad and specific levels. Digital Libraries will require both broad categorization to identify relevant libraries and specific categorization to select specific resources within libraries. In fact, it is likely that many levels of representation will be needed to support across-collection and within-collection information seeking (Marchionini, 1971). In addition, digital storage enables the development of machine-based classifications increasing the efficiency of classification activities, but also
allowing the development of classifications that extend beyond the typicality that
is the hallmark of traditional library classifications.

3.7.12 Information Filtration

There is good evidence that some workers in many information
settings serve as unofficial information consultants to their colleagues. Historically individuals serving this role for other individuals and organizations have acted as information gatekeepers (Lewin, 1947). Filtering provides an improvement in the signal to noise ratio through the reduction of channel noise. This is accomplished by removing content which is not needed or undesired. A user will seek a service which improves productivity or enhances the value of information delivered. A Digital Library must support filtering from its inception to select messages and documents for incorporation into its collection. In traditional libraries this activity, referred to as collection development is the process of information acquisition controlled by judgments regarding acquiring information resources for incorporation into a collection. This activity clearly transfers to the Digital Library. Filtration is also essential to the traditional collection management activities of weeding and preservation. These activities can be carried over to University Digital Libraries.

3.7.13 Translation Service

The Internet is multilingual in several senses. It is concerned with multiple languages and a multitude of digital representations for text and multimedia objects which exhibit a lack of standardization. Incompatibilities in language and format occur in human-to-human, human-to-computer and computer-to-computer communication. Translation intermediary services should help resolve both linguistic and format incompatibilities. Translation services add value to information transfer by transforming a document into another language, or another format thus making it understandable to the user.
3.7.14 E-Publishing

E-Publishing is a form of intermediation that links the creators of information products with users. Libraries are often associated with the terminal aspects of the publishing process (e.g., purchasing and circulating books) but libraries also aggregate information, add value to information products, and create new information. Digital Libraries will surely be even more active in all aspects of publishing and will provide many new forms of intermediation to link information seekers with the information resources. University digital library can do this service by publishing peer-reviewed articles from staff and students and research scholars in the library website.

3.7.15 Information Literacy

In a changed environment it is very important to educate the user how to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information. Timeliness is an important variable in many information-seeking activities. Archivists and librarians consider information from a life-cycle perspective - some information is timeless (fiction, biography, etc.) and some are highly temporal (e.g., news, events calendars, etc.).

3.8 USER EXPECTATIONS ABOUT DIGITAL LIBRARIES

While libraries and information centres would like to achieve their objectives, they must first understand their user’s requirements. This would help them offer the products which satisfy user’s requirements better than the competitors. The key concepts which are central to the understanding of the user requirements are: needs and satisfaction.

The user is the central focus of the library and information center, the management has to take necessary care in the quality in library which include identifying every individual user and user group; assessing their needs;
segmenting user needs and satisfying or delighting them. Identification of users in large libraries like academic institutes or universities is difficult due to a large volume of users and lack of personal contact with them. Users of the academic libraries have a need for definite information and its resources while users of industrial information unit have a wide range of needs which are ever-changing in nature. Similarly, it is difficult to identify the users who do not use the library regularly in comparison with users who make regular use. Furthermore, information delivery through electronic access has made it difficult to identify the actual end-users.

User’s satisfaction is the current day approach in library and information centres. The success or failure of any library and information system is gauged from the extent of the user’s delight from the person, process or product. “User’s satisfaction has a close linkage with the expectations of the users and their perceptions. Every user has some image of the service even before it is offered. A number of users are also generally aware that services exist. However, they have never crossed the threshold of particular library nor have used any resources somewhere else”, as realized by Brophy and Couling (1996). The marketing promises may affect the image and the interaction with the services will redefine their image. User’s perceptions are related to the actual experience gained during service delivery, e.g., when a user enters the library to make some queries from the reference desk, he tries to find out the desk and the person who responds to queries.

### 3.9 MANAGEMENT OF DIGITAL LIBRARY SERVICES

#### 3.9.1 Management of Digital Library Contents

Contents in digital library are organized and managed for the purpose of immediate access to the target audience. How contents are developed and managed is a critical issue to the long-term success of digital library services
especially when technical resources are limited. Content management includes the following key functions:

- Selection and Acquisition
- Indexing
- Storage
- Retrieval
- Maintenance
- Rights Management

### 3.9.1.1 Selection and Acquisition

Libraries select content according to a well-defined collection development policy. Such policy manifests the mission of a library and determines how budgets on materials expended. There are two key challenges in content selection i.e. cost and quality. Firstly, a librarian should consider the cost of acquisition. Intellectual property rights are important considerations, but the cost digitization and maintenance must also be taken into account. Secondly, librarian should consider the quality of the content before acquiring it. This is more problematic consideration because issues of authorities as well as veracity arise.

As soon as decision about selection is made, content must be acquired. For objects, which are already in digital form, the file transfers through networks or mass storage is straightforward as long as file formats is well specified. In case of traditional objects, digitization must be done.

### 3.9.1.2 Indexing

Once content has been selected and acquired, it will be added to the collection in such a way that users may retrieve it easily. And thus, indexing is
required for digital content to search and access in a selective way like OPAC for printed content. Decisions are to be taken regarding what to be indexed (author, keywords, phrase, etc), how the content and index files are linked, what sort of access points are provided, etc. Indexing strategy comprises not only of what types of fields are to be indexed, but how they are to be treated (exhaustive or sparse).

Automatic indexing techniques are used to index the content of digital library. Several World Wide Web-based services use a hybrid approach by manually creating classification system and then using automatic techniques to assign objects. Most retrieval systems for images, video, audio recordings and other non-textual objects have depended on items such as title, creator name or manually assigned subject headings for retrieval.

It seems certain that digital library research and development activity of 1990s will ensure that considerable progress is made in automatic indexing for textual and non-textual objects. New indexing challenges will emerge as more dynamic objects (e.g., virtual conference proceeding, active networks) are added to digital libraries. The temporal nature of such objects will require ongoing indexing techniques.

3.9.1.3 Storage

The next thing is how to store the content of digital library. Decisions regarding procuring suitable hardware, software, networking, etc. are to be made at this stage. Storage is mainly a technical requirement, although new media may complicate storage decision and costing. When data are to deliver continuously (e.g., streaming video or audio) rather than as discrete files, alternative technologies are required (Arora, Jagdish, 2001). Large digital repositories are required for multiple levels of mass storage media (e.g., disk, tape, etc) and mechanical robots to locate and mounts the media. Various supercomputer centres are using tape robots that store and access to many terabytes of data.
Digital libraries will surely apply such technology just as libraries of today apply movable shelving and complex conveyer systems to move physical materials.

3.9.1.4 Retrieval

Retrieval is another major issue, as far as digital library content and its access is concerned. Ultimately, users must be able to retrieve the content, which has been selected, indexed and stored by the librarians. During 1970s to 1980s, a large number of libraries invested heavily in computerizing cataloguing and circulation functions to give users better access and services. Online Public Access Catalogues (OPACs) have long provided author, title, and limited subject access to local holdings (and more recently to union holdings across to multiple libraries). The expectation for digital collection is that catalogue should seamlessly link to the digital content itself so that remotely located users can find and display not only bibliographic records, but also primary information objects. In physical libraries, the card catalogues or OPAC is physically distinct from the items on shelves. These distinctions are difficult to make in electronic environments because everything is displayed on the same physical screen and thus, the boundaries between metadata and primary data are often blurred. Expectation to provide primary data with metadata yields several challenges to librarians. The challenges are first to extract and provide multiple levels of representation and second to provide users with control mechanisms to move from high-level surrogates to detailed objects (Marchiomini G, 1995). Today most retrieval is facilitated through words, titles, captions, manually created subscriptions, automatically extracted keywords and so on. There is enormous attention focused on creating non textual surrogates such as colour and shape characterization for images and speaker identification schemes for audio recordings, but there are more difficult metadata issues looming as more contents are not stored at all but created on the fly according to the specification of the users.
3.9.1.5 Maintenance

Maintaining buildings, systems and preserving content are important and costly activities in physical libraries. Digital libraries may avoid some of the cost of wear and tear on buildings and books but still have significant maintenance costs, including some unique to electronic environments. New equipments, improved or alternative network solutions (e.g. ISDN, ATM, Wireless), and software upgrades will require excellent technical personnel.

Just as the computational system changes, digital content may also change. A digital document may have numerous versions, especially given the ease with which electronic documents may have changed. Maintaining the most essential document requires that versions be well managed, which includes updating and deleting the links to those objects (Richvalsky & Walkins, 1998). In addition to this version control problem, digital librarians must manage the multiplicity of indexes and file formats. Requirements for link managements are more problematic, as hypertext links are created among distinct documents although much research and development efforts in digital libraries have been devoted to maintaining the content. But further improvements are required to maintain security, updating versions, tools for automatically checking links, database tools for property rights, etc. for the smooth library functions and services.

3.9.1.6 Rights Management

Intellectual property right and information security and authority are two global interdependent issues, which influence research and development in digital libraries. Copyright exists to promote intellectual production by providing economic incentives. Security protects unauthorized access as well as ensures the veracity and authority of digital information objects. The misuse that can be put to digital content is far more serious and voluminous than for printed content. The efforts have been made to change copyright laws to protect the illegal use of
digital objects and also to develop technical solutions that protect copyright either through copy protection or automatic billing mechanism. Research on encryption algorithms, digital watermarking and electronic commerce are leading to the development of trusted system that protect intellectual property rights by managing the necessary financial transactions while protecting consumers by providing authoritative information securely (Wiederhold G., 1992). These techniques ensure the veracity of an object and may help to prevent copying and distribution in an open market place.

3.9.2 Need for Specialized Staff to Manage Digital Libraries

The most crucial component of any digital library is its staff. Although the endeavor to build a team of knowledgeable and skilled staff who are capable of managing a successful digital library may be a one-time investment, it is bound to be a time consuming project. It has become more essential than ever that librarians understand the general principles of creating and managing Web content, for instance.

As digital gatekeepers, the librarians’ expertise must match or even surpass those possessed by the user. We live in an age whereby information users not only have the knowledge but the capacity of generating information on their own, as well. Therefore there has to be a unique set of professionals who are specially trained to distinguish between information that is palatable to any given set of users, from that which is not. Librarians fit this role perfectly and being information gatekeepers and gateways, they already have the know-how of matching user needs with information resources, predominantly in traditional libraries.

“Digital librarians must thrive on change. They should read constantly (but selectively) and experiment endlessly. They need to love learning, be able to self-teach and be inclined to take risks. And they must have a keen sense of both the potentials and pitfalls of technology” (Hastings and
Tennant, 1996). Along with that, schools of library and information science should be proactive enough to include the digital libraries module in their respective curricula. This should be done with the view of churning out generations of graduates who are technologically savvy and have the capability to rise up to the occasion when called upon to do so. Specifically, digital librarians are required for the purposes outlined below, among a host of emerging functions:

- To manage digital libraries;
- To organize the digital knowledge and information resources;
- To disseminate digital information from computer-held digital information;
- Provide digital reference services and other electronic information services;
- To provide knowledge mining from the emerging knowledge warehouses;
- To handle the tasks of mass digitization, digital storage process and digital preservation;
- To provide universal access and retrieval of digital knowledge, ultimately access to all knowledge resources available in digital form;

The modern emphasis is on value-for-money concepts, accuracy, and timelines in information provision, among many other issues. In another school of thought, there is a belief that the information professional who manages a digital library is, in fact a knowledge manager.
Optical Character Recognition (OCR): Scanning will capture an image but in order to make it searchable, a good knowledge of OCR technology is required.

Imaging Technologies: Digital librarians must be aware of the various ways in which surrogates of physical items (for example, journal articles) can be captured. They must be familiar with the typical manipulation required to edit and save in different formats.

Markup Language: Digital librarians should have the knowledge of Hypertext Markup Language (HTML) and also a suitable combination of other Web authoring tools (such as SGML, XML, Scripting languages e.g. JavaScript or VBScript, Dreamweaver, Macromedia Flash and so on).

Cataloguing and Metadata: Digital objects require organization and description. Digital librarians must understand the ways in which metadata can be captured. They should be familiar with standards such as Machine Readable Catalogue (MARC), Anglo-American Cataloguing Rules II (AACR II), Z39.50 protocol, Dublin Core and so on.

Indexing and Database Technology: Digital librarians must be familiar with a variety of tools from simple and easy indexing and searching tools to complex relational or object-oriented database systems.

User Interface Design: The digital librarian should be able to write the functional specifications and work with other knowledgeable professionals to achieve the desired goal of developing a user-friendly computer interface with the library automation system, in case the library has one.

Programming: Digital librarians need not be full-time programmers, but it would be an added advantage if they were familiar with programming
languages such as C, C++ or Java. Knowledge of handling open source software such as Dspace or Greenstone Digital Library would definitely come in handy.

**Web Technology:** Digital librarians must know their way around the Internet and be well-versed in Web technology.

**Project Management:** Digital library projects need skilled management. Digital librarians should be good communicators and relate well with people both inside as well as outside the organization. Projects initiated need to be completed on time and within the stipulated budget.

**Interoperability:** Digital libraries are at the heart of interrelationships between several information service-related disciplines like library management, archives management, museum management, document management, knowledge management and e-commerce systems. This brings about the need for the different kind of systems to talk to each other.

### 3.9.3 Provision of Digital Content

The digital library must contain information resources. It may either be new material prepared digitally from scratch (i.e. born digital), or it may be old material, converted into digital form (i.e. digitized). It may be bought, donated or converted locally from previously purchased library stock. Digital content then needs to be stored and retrieved. Information is widely found as text stored as characters and images acquired using optical scanners. These images are frequently scans of printed pages, as well as illustrations or photographs. More recently, audio and video, plus interactive material is accumulating rapidly in the digital form both newly generated and converted from older material. Copyright aspects also have to be carefully considered, at this stage, and everything has to be carried out without contravening the existing laws on fair use of information resources, in this regard.
3.9.4 Searching of Digital Information Resources

After storing information in a digital library, mechanisms ought to be in place for one to accurately identify and locate the piece of information sought. Most digital libraries provide a search interface, which allows information resources to be found. These resources are typically deep Web (or invisible Web) resources, since search engine crawlers cannot locate them. Some digital libraries create special pages or sitemaps to allow search engines to find all their resources. Digital libraries frequently use a protocol developed by the Open Access Initiative namely, the Open Access Initiative Protocol for Metadata Harvesting (OAI-PMH) to expose their metadata to other digital libraries and search engines like Google can also use the same to find the deep Web resources. There are two general strategies for searching a federation of digital libraries:

- Distributed searching, and
- Searching previously harvested metadata.

Distributed searching typically involves a client sending multiple search requests in parallel to a number of servers in the federation. The results are gathered, duplicates either eliminated or clustered, and the remaining items sorted and presented back to the client. Scalability (the capability of the system to increase total throughput under increased load emanating from added resources, typically hardware) and performance issues tend to plague distributed searching for large federations of digital libraries. Protocols like Z39.50 (a client server protocol for searching and retrieving information from remote computer databases) are frequently used in distributed searching.

Searching over previously harvested metadata requires the pooling of metadata collected from every digital library in the federation. This solution scales better than distributed search, but it introduces the problem of data freshness; digital libraries need to be re-harvested on a periodic basis to discover
new and updated resources. OAI-PMH is frequently used by digital libraries for harvesting metadata.

Interoperability in digital libraries, allows organizations and communities to retain their specialist practices, while putting high-level standards and protocols in place for sharing information. Achieving interoperability is difficult as it requires resource creators, users, funding agencies, systems and resource managers to agree on the development of standards and formats for information interchange that may not map exactly onto their established practices.

3.9.5 Sustainable Funding

Digital librarians need to establish the financial wherewithal to pay for and sustain digital libraries. One can unequivocally declare that finding a way to fund digital libraries is the single most frustrating obstacle facing librarians in the present day. Digital libraries are bound to change the social system by which information is collected, transformed, managed, disseminated and preserved, both in the present day as well as in the future.

Libraries will most certainly be at the helm of actualizing that phenomenon and therefore it is imperative that they strive to build sufficient capacity, in terms of financial backing. This means that digital librarians must also be reasonably adept in the dual skills of fund-raising and fund management; if at all their libraries are to survive in the medium and long term.

There is no doubt that the utility of digital libraries as they facilitate live and interactive access to wide variety of content online. But the problems of managing digital library content and its development are manifold. Management of digital library content requires two prolonged strategies (i) to digitize local content;(ii) to devise options for accessing external resources. Generally there is
a feeling that publishers copyright most of the contents available in our library, and we are not in a position to provide online access to those contents.

Though our libraries are facing a shortage of content, there is a wide spectrum of formal and informal sources available with them but could be converted into digital form by devising suitable action plan. Image format, compression schemes, network transmission, monitor and printer design, and image-processing capabilities are all likely to improve dramatically over the next decade. But technology alone will not determine the future; relationship, economic and pattern of behavior are equally important.