

# A Study of Digital Libraries Design and Development towards Usage in India

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## ABSTRACT

The emergence of Internet has added a new dimension to information technology which gave birth to the new concepts of Digital Libraries (DLs), Knowledge Management (KM), and archiving of indigenous culture and heritage materials. The Digital Libraries have emerged as a crucial component of global information infrastructure, adopting the latest Information and Communication Technology (ICT) to promote an organisational structure that encourages communication and resource sharing between the academicians and scholars across the nations. In India, a number of digital library initiatives and digitization programmes have been initiated across the country. Most of the digital library initiatives are government funded. The Ministry of Communications and Information technology has also established the Digital Library of India. This paper discusses various problems, challenges and issues involved in design and development of digital libraries in India.

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## 1. Introduction

Information is considered as the fulcrum for power and prosperity and very essential for economic and social development of the society. The revolution in Information and Communication Technology has bridged knowledge gap by providing free flow of information. With this technology driven revolution, information was started delivering in digital format with greater speed and economy which triggered in development of digital library. It has provided wider opportunities in archiving accessing digitizing and preserving the traditional knowledge. The open source software movements added weightage in proliferation of digital libraries worldwide. Traditional knowledge available in one and another form was being explored, documented preserved and made accessible through networks of digital archives. The formal project of digital library under the Digital Library Initiative (DLI) was started in 1994 as a joint initiative of the National Science Foundation (NSF), Department of Defense Advanced Research Projects Agency (DARPA), and the National Aeronautics and Space Administration (NASA), in 1994. Six universities were given the funds for investigation and development of underlying technologies for digital libraries. The second phase of the project was initiated in February 1998.. The landmark initiatives that led the path towards the Digital Library movement are the CMU, MERCURY project; CORE project at Cornell University the TULIP project and ENVISION, Cornell Institute of digital collection, Yale University Open Book Project, Networked Digital Library of Theses and Dissertation (NDLTD), National Science, Mathematics, Engineering and Technology (SMET) Education Digital Library (NSDL), National Policy, Digital Library development in emerging country like India is taken up with preserving art culture and heritage of India in mid 1990s. India became de-facto signatory of the UNESCO Universal Declaration on Cultural Diversity, adopted unanimously by the UNESCO General Conference at its 31st session held on 2 November 2001 to strengthen the access to diverse cultural resources available across the country. Indian state and non-state agencies in collaboration with the Carnegie Mellon University, Universal Digital Library project of the US-

NSF (under and Indo-US Science and Technology Collaboration initiatives) have taken significant initiatives in digitization and preservation of vast pool of knowledge available in the physical forms of manuscripts, rare books, out-of-print books and archival materials and also with neighboring South Asian countries and shared to a networked community using an online platform. Indian universities are participating as members in the Networked Digital Library of Theses and Dissertations (NDLTD). Library and information centre of higher education and research institutes have taken up task for creating website with in- house digital content like research reports, publications of researchers, theses and dissertation etc. Later on eminently practical approach was evolved for building operational digital library, their maintenance, operations and services. The problem encountered for digitization initiatives in India, National Policy and existing digital library initiatives of India.

## 2. National Policy On Digital Library

The National Task Force on IT and Software Development (2003) has given some valuable recommendations for development of DLs in the country related to development of pilot project on Digital Library, preservation of vast wealth of Indian traditional knowledge, digitization of Indian Theses and Dissertations and copyright protection. However, there is no any clear cut national policy on Digital Libraries. In India digitization initiatives are in need of national policy on Digital Library to identify framework and best practice in all spheres for development of Digital Libraries. There is also need of preservation policy, Intellectual Property Rights policy for content development, collection development policy, digital information rigidity in the publishers' policies and data formats etc.

### Digital Library

A digital library is a library in which collections are stored in digital formats (as opposed to print, microform, or other media) and accessible by computers. The content may be stored locally, or accessed remotely. The first published use of the term has been traced to a 1988 report to the Corporation for

National Research Initiatives. The term was first popularized by the NSF/DARPA/NASADigital Libraries Initiative in 1994. Bush (1945) created a vision based on experience (“Digital library.”)

Traditional Libraries	Digital or Electronic Library
Print collection	All resources in digital form.
Stable, with slow evolution	Dynamic and ephemeral
Individual objects not directly linked with each other	Multi-media and fractal objects
Flat structure with minimal contextual Metadata	Scaffolding of data structures and richer contextual metadata
Scholarly content with validation process	More than scholarly content with various validation processes
Limited access points and centralized management	Unlimited access points, distributed collections and access control
The physical and logical organization correlated	The physical and logical organization may be virtual
One way interactions	Dynamic real time dialogue
Free and universal access	Free as well as fee based

**Traditional libraries are shifting towards Hybrid Library**

With the development of new technologies, the traditional closed access libraries are shifting towards the open access libraries and the open access libraries are shifting towards automated libraries, the automated one towards the electronics, the electronics to digital and finally end in digital library. Nobody knows what will be the future of libraries. On the basis of technology used, the libraries can be categorized as:

- a. Traditional Library:** The collection of the traditional libraries is mostly print media, manuscripts, etc. and are not well organized. The documents are deteriorating at a rapid pace, the collection information is not easy to locate and so does not easily reach users, again the traditional libraries are confined within a physical boundary.
- b. Automated Library:** A library with machine-readable catalogue, computerized acquisition, circulation and OPAC are called as automated library. The holding of this type of libraries are same as the traditional libraries.
- c. Electronics Library:** When automated library goes for LAN (Local Area Networking), CD-ROM networking, starts procuring e-journals and other similar kind of publications then it is known as electronic library. The resources of the electronic libraries are in both print and electronic form. The electronic media are used for storage, retrieval and delivery of information.

- d. Digital Library:** It is a later stage of electronic library. In digital library, high speed optical fibers are used for LAN and access is over WAN and provides a wide range of Internet based services, i.e., audio and video conferencing and like others. Majority of holding of a digital library are in the computer readable form and also act as a point of access to other online sources.
- e. Hybrid Library:** The libraries, which are working both in electronic or digital and print environment, are known as hybrid library. Actually it is a transitional state between print and digital environment.

**3. Characteristics Of Digital Libraries**

- The different characteristics of digital library are as follows:
- ⊗ **Collection:** A digital collection of electronic documents or other resources presented as a purposeful assemblage, e.g., organized and presented according to library or archival principles or representing the digital holdings of an institution.
  - ⊗ **Work:** Digital libraries are to be used by individuals working alone. There is work oriented perspective focusing on a group of information analysts, work being done and the documents and technologies that support it.
  - ⊗ **Technology:** Technologies which are used for digitization are as follows:
    - ◆ Computer Technologies
    - ◆ Processing Technology
    - ◆ Communication Technologies
    - ◆ Display Technologies
  - ⊗ **Trans-bordering of Information:** Breaking the physical boundaries of data transfer within and outside the countries. It is viewed that the support for communication and collaboration is as important as information seeking activities.

**4. Functions Of Digital Library**

- Functions of digital libraries are:
- ⊗ Access to large amounts of information to users wherever they are and whenever they need it.
  - ⊗ Access to primary information sources.
  - ⊗ Support multimedia content along with text.
  - ⊗ Network accessibility on Intranet and Internet.
  - ⊗ User-friendly interface, hypertext links for navigation.
  - ⊗ Client-server architecture.
  - ⊗ Advanced search and retrieval.
  - ⊗ Integration with other digital libraries.

**5. Purpose Of Digital Library**

- Purpose of a digital library is:
- ⊗ Expedite the systematic development of procedures to collect, store, and organize, information in digital form.
  - ⊗ Promote efficient delivery of information economically to all users.
  - ⊗ Encourage co-operative efforts in research resource, computing, and communication networks.
  - ⊗ Strengthen communication and collaboration between and among educational institutions.

- ⊞ Take leadership role in the generation and dissemination of knowledge.

## 6. Components Of Digital Library

The components of a digital library are:

- ⊞ Infrastructure, Digital Collection, Systems function
- ⊞ Telecommunication facility, Human resources
- ⊞ Hardware Requirements are:
  - ⊞ Computer servers, Networks, LAN/WAN, Converters, Scanners
  - ⊞ Internet Connectivity, Storage media, Multimedia Interface, UPS
- ⊞ Software Requirements are:
  - ⊞ Liner Operating Systems, Digital Library Software, Greenstone, Fedora
  - ⊞ D-space, Editing Software, E-print

## 7. Basic Needs for Digital Library

- ⊞ For the development and operation of digital library, the technological environment is provided by the Internet and World Wide Web. The web provides tools and techniques for publishing the information over internet while the internet provides the TCP/IP and or its associated protocol for accessing the information. Some of the basic requirements for a digital library are:
  - ⊞ **Computer:** Server, PC, with multimedia, UPS, etc.
  - ⊞ **Software:** Any suitable software, which is interconnected and suitable for LAN and WAN connection
  - ⊞ **Network:** LAN, MAN, WAN, internet, etc.
  - ⊞ **Storage devices:** Optical storage device, CDROM, Jukebox, etc.
  - ⊞ **Scanner:** H.P. Scan Jet, Flatbed, sheet feeder, Drum Scanner, Slide Scanner, Microfilm Scanner, digital camera, Barcode Scanner, etc.
  - ⊞ **Printer:** Laser Printer, Dot Matrix Printer. Digital Graphic Printer, etc.
  - ⊞ **Audio Visual:** Color TV, V.C.R, Sound box, Telephone, etc.

## 8. Planning For Digital Library

'Digital libraries serve communities of people and are created and maintained by and for people. People and their information needs are central to all libraries, digital or otherwise. All efforts to design, implement, and evaluate digital libraries must be rooted in the information needs, characteristics, and contexts of the people who will or may use those libraries. For the development of digital library, firstly we should plan for our task or objectives of any type of library and what issues are addressed prior for the development of digital library. It is not a detailed of step by step guide, it is used to provide guidance what is wrong and what is right to his/her library, which resources are more valuable for library. Planning is used to provide backbone for any digital library.

**Information Needs:** There are three main components of any library, resources, librarian and the most important one is its user. If there are no users there is no need for establishing library. For planning for digital library, we have to keep in our mind which type of users have access to it and if access are

not restricted, what are the next steps for library to fulfill the need of its users.

**Quality in plan:** We plan for what type of software is beneficial for our digital library. Are users satisfied with it? What are benefits of using this? Is it easy to learn? How searching facility is provided to users in an easy way? Those entire questions have to be answered before we prepare plans for creating digital library.

**Security issues:** Security issues for the development of any digital library are must. There are some pre-planned rules of using digital library which are to be clarified concern how users access their desired information. Backup plan, in case of any mishapening is also required. How to control security threat protection (firewall, antivirus, etc.), has to be determined.

**IT Infrastructure:** Digital library requires well tested and proven information technologies including the multimedia kit, data handling, memory, processing and storage, computer software such as OCR and library application software, etc.

**Digitization:** For digitalization of library resources such as book, serials, thesis, dissertation reports, current and back volumes of periodicals, institutional publications, seminar proceedings in digital form equipment like scanners, printers, digital camera have to be procured.

**Access:** Users are required to be given user ID and password to access the materials in digital form. There should not be limitations for access of digital materials for authorized users.

**Staffing:** The staffs have to be trained in handling digital work.

**Funding and Budget:** To meet the expenditure for the digital library, appropriate funds should be provided by the library authorities. Plan for budget, other aspects related to digital library like, human resources, software, hardware application, etc. Upgrading new technologies, etc. are another important aspect for planning a digital library.

**Digital Library Committee:** A digital library committee should be formed to plan for its creation and maintenance. The members must be from various library departments and, if necessary, consultants can be hired. There are at least two ways of developing a digital library, firstly by converting a traditional library into a digital library, and secondly, by direct development of a digital library.

**Creation of Digital Library:** After preparing plan it is time to create the digital library.

## 9. Maintenance Of Digital Libraries

Once digital library is created, for its long term benefits, maintenance is must. This is to ensure that library system is working in good condition and for conducting routine review of library holdings. It is also to be ensured that files are downloaded properly. New content have to be identified. Tools which are chosen for accessing information should work properly. Converted file format to required format have to be secured. Financial resources for review of materials in library have also to be secured. For this, feedback from library user is to be obtained. Antivirus has been properly worked or not. (Figure 1)



Figure 1: Maintenance Process of Digital Libraries

10. Digital Library: A Global Connection

Digital libraries are emerging in many parts of the world to give access to the world's scientific developments. Searching across these multidisciplinary repositories is a daunting task. Some of the research in the digital libraries initiatives is beginning to indicate that this can be done. A global interconnected library network of existing collections has begun to emerge. Its Website (www.ifla.org) is maintained by the International Federation of Library Association and Institutes (IFLA). IFLA launched an electronic network strategy in 1994 as an experiment to connect its members to its conference in Havana, Cuba. At the beginning of 1998, libraries in more than 70 countries were connected to this global library network, sharing information and expertise. The Figure 2 shows the digital archive in the library.

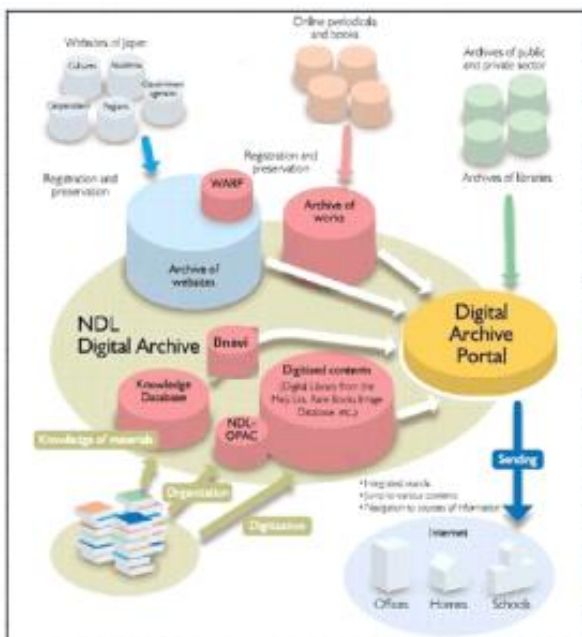


Figure 2: Digital Library Achieve

11. Problems & Challenges

In India, the digitization initiatives are encountered with the problems such as lack of national policy, lack of preservation policy, no intellectual property rights policy for content development of digital information, rigidity in the publishers' policies and data formats, lack of multiple Indian language OCR facilities etc. Jeevan (2004) mentioned following problems for digital library developments in India i) Lack of Interest from Parent Institutions, ii) Copyright, iii) Implementation of Access Right iv) Selection and Security of Content v) Efficient Internet bandwidth vi) Financial Support vii) Proper documentation, retrieval and access of indigenous knowledge have gained more prominence viii) lack of ability, lack of incentives, and lack of role model initiatives ix) acute shortage of competent personnel to take up the task of digitizing local content and evolving digital information repositories. According to Bhattacharya (2004) the challenges that libraries in India face are: Intellectual property rights, security, technological change, lack of expertise, inadequate finance and infrastructure, suitability, information explosion on the internet, cost of regular refreshing, preservation existing infrastructure, bandwidth problem, political and social constraints, lack of training.

Dr. Gurram Sujatha (2008) has encountered following problems of the digitization initiatives in India:

- a) Lack of clear cut policy at National level with main focus on sustainability
- b) Outdated software and hardware and difficulty in upgrading the same.
- c) Non-availability of cost effective new technological advancement.
- d) Lack of multiple Indian language OCR facilities.
- e) Non-standard technical activities, data description and transmission characteristics.
- f) Non-availability of well-trained skilled personnel.
- g) Lack of management support
- h) Lack of proper preservation policy
- i) No Intellectual Property Rights policy for content development of digital information.
- j) Rigidity in the publishers' policies and data formats

The above factors affect the success of digitization initiatives and the creation of digital libraries. These problems have to be addressed positively for development of digital libraries in the country. According to Dr. Gurram Sujatha three factors- national policy for digitization, sustainability issues and digital divide should be taken into consideration to ensure planned digital resource development programmes and digital libraries in the country

12. Conclusion

With the availability of advanced information and communication technologies (ICTs) and information infrastructure, India becomes an active contributor in digital library movement by digitizing and providing free access traditional knowledge, century-old publications and rare documents, theses and dissertation and journals available in Indian libraries. The Digital Library of India is one major initiative that is striving to create a truly digital library. Online availability of electronic theses through centrally-maintained digital repositories called ShodhGanga does not only provide easy access and archiving of Indian doctoral theses, it also helps in raising the standard and quality of the research. Open

courseware and cross archive search services are also being developed by different organizations, including the apex higher education agencies. India has spearheaded the digital library movement in developing countries.

More and more libraries will have departments and programs in the digital library arena. Digital libraries will build upon work being done in the information and data management area. Digital libraries provide an effective means to distribute learning resources to students and other users. Planning a digital library requires thoughtful analysis of the organization and its users, and an acknowledgement of the cost and the

need for infrastructure and ongoing maintenance. Digital libraries present opportunities and challenges for the library and information communities and all stakeholders. It also is going to be part of day to day professional activity in the next couple of years. In simple words, it is quite impossible for libraries and information centers to meet the various information needs of the present day society without library networking. One hope in the near future that all the libraries in world will be without walls and resources of all libraries will be available to the whole user community through networked digital libraries.

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