DIGITIZATION OF SCHOLARLY MATERIALS IN INDIA FOR DISTANCE AND OPEN LEARNERS

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In India, a number of national level institutions are digitising their own information resources and some rare items. The Ministry of Communication and Information Technology has also established Digital Library of India Initiative. The digital libraries in India include digitized collection of academic publications, like, dissertations, theses, research reports, working papers and research papers other than rare books and manuscripts. All these digitized materials can be made available and accessible to the learners of distance education. The distance and open learners should not be confined into the study materials provided to them and can explore the universe of knowledge through the digital libraries available today. This paper explores the digital libraries projects and initiatives in India that can be helpful to the distant and open learners.

Introduction

The digital libraries, digital archives, institutional repositories and learning objects repositories are the present day buzzwords which enable persons from different sections of the society in accessing different kinds of digital information and knowledge resources for different purposes. Open and Distance Learning (ODL) system has already embraced information and communication technologies (ICT) to deliver quality education to the learners, who may be located even remote places. The digital libraries, digital archives, institutional repositories and learning objects repositories are also products of advanced research in the areas of ICT and information storage and retrieval system (ISARS). The ODL system also explores possibilities to provide access to quality learning materials that will cater various information needs and demands of distance learners. All these would be possible if the digitization of scholarly and learning materials is carried out at the institutional, national and international level. In India, a number of institutions already have initiated digitization projects and programmes that will later integrate into digital library or digital repository systems. William Y. Arms, Editor-in-Chief of D-Lib Magazine, explains how digital libraries could serve distance learners, "At conventional universities, a few students delve deeply into the resources offered by the libraries, but most do not. Remote students cannot visit the library, but if the digital collections are broad enough and accessible enough, perhaps more of these students will be heavy users of digital libraries" (2000, D-Lib Magazine, volume 6, number 10). There are also some guidelines on library services for distance learners, prepared by professional library associations, such as:

- *Guideline of Library Services for Distance Learners* (2001): by Sectional Committee of Distance Education of Indian Library Association (ILA).
- *Guidelines for Distance Learning Library Services* (2004): by Association of College and Research Libraries (ACRL), a division of the American Library Association
- *Guidelines for Library Support of Distance and Distributed Learning in Canada*: by Canadian Library Association's (CLA).

These guidelines can be considered as roadmap to ODL institutions for creating digital objects and setting up digital repositories for the learners.

Digital Libraries

Digital libraries initially evolved to support preservation of cultural resources of human civilizations, specially which are in the forms of rare documents and archival records, like, manuscripts, antiquarian

books, paintings, photographs, historical records, etc. These documents not only have very limited access to the scholars and general public, but also most documents are not in usable condition. If these documents are physically accessed regularly there is high probability of permanently damage of such rare items. Also there is security and other reasons for restricted access. Sometimes we come across instances where priceless rare items are either lost, or stolen or swapped with fake ones from the museums and archives, especially in India and other developing countries. Digitization of rare documents addresses some of these problems. The accessibility and visibility of these rare documents increase many folds and scholars across the nations can access these documents. Digitization of rare documents from personal collections, organizational collections as well as community collections could help to maintain national records of cultural heritage, which is one of the objectives Memory of the World Programme of UNESCO (2004).

Digital libraries presently embrace digitised documents as well 'born digital' documents. Digitised documents are reproduced using latest digitization technologies and stored in digital form. Digital libraries provide easy access to digital collections of documents where users can search and retrieve the documents of users' interest in networked environment. A document can reside in a central computer server, but can concurrently be used by a number of users in a network. On the other hand, born digital documents are for the first time produced in digital format, and later may be substituted as analogue documents (like printed books).

Digitization of Scholarly Materials

The scholarly materials are available in diverse physical formats. Some materials are rarely available to the users in spite of constant demand from the society. Our cultural and knowledge resources in the forms of various kinds of materials can be made available and accessible to society, if digitized. Deegan and Tanner (2004, p.491) provide the following list of advantages of digitization of scholarly materials:
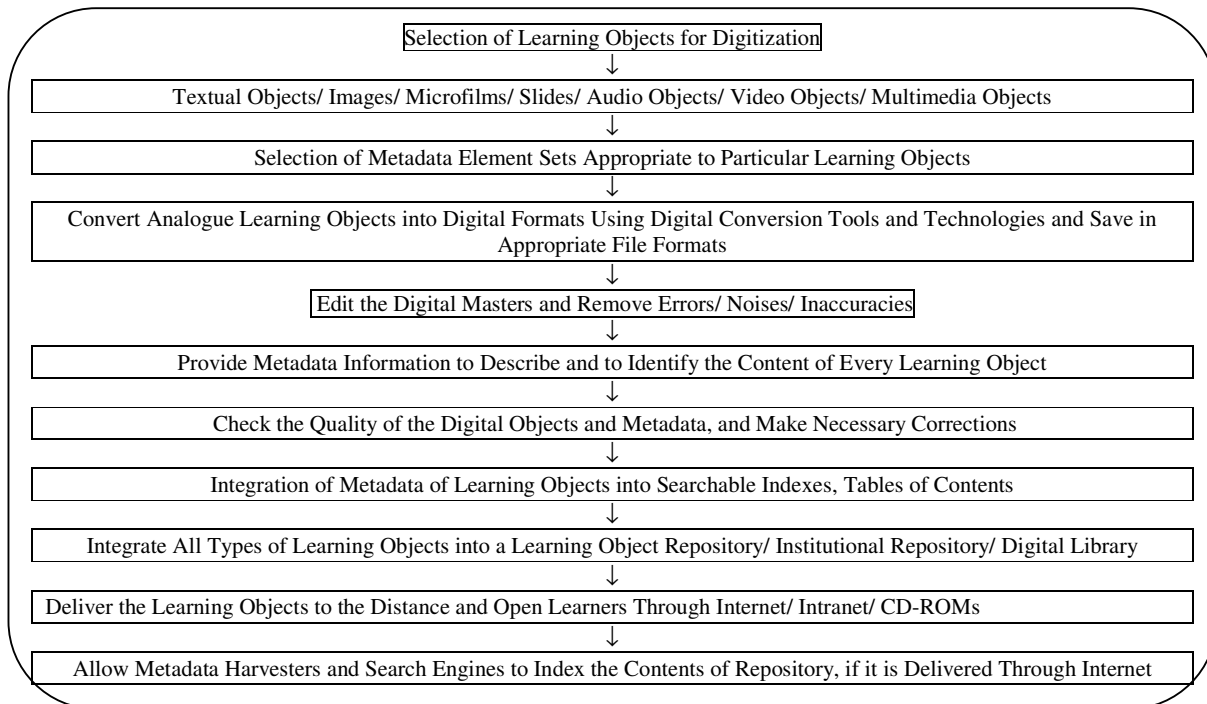
- the ability to republish out-of-print materials;
- rapid access to materials held remotely;
- potential to display materials that are in inaccessible formats, for instance, large volumes or maps;
- 'virtual reunification'—allowing dispersed collections to be brought together;
- the ability to enhance digital images in terms of size, sharpness, color contrast, noise reduction, etc.;
- the potential for integration into teaching materials;
- enhanced searchability, including full-text;
- integration of different media (e.g., images, sounds, video); and
- the potential for presenting a critical mass of materials for analysis or comparison.

The learning objects, like, self-learning study materials, tutorials, exercises, assignments, case studies, project reports, dissertations, theses, articles, seminar presentations, conference papers, audio-visual materials, etc. are essentially used by the open and distance learners in their learning process. These materials can be made available to this section of the society, if these learning objects are digitized and stored in a learning objects repository or in a digital library. The advantages of digitizing learning objects, apart from the list provided by Deegan and Tanner, are:

- the qualitative learning objects can be shared by learners of different programmes within open and distance learning (ODL) institution;
- the qualitative learning objects can be shared by learners of different ODL institutions within or outside the country;
- the learning objects would be made available to the cross sections of the learners;
- the learning objects would be made available to learners of different ODL institutions;
- duplication of efforts of preparing self-learning study materials can be minimized;
- duplication of final projects, dissertations, theses of learners can be restrained;

- creativity and innovation of the learners can be ignited when they see others' works;
- visibility and prestige of the ODL institutions, which initiate learning objects repositories, would be increased.

If a document is created in digital environment and available in a digital format, it can be called a 'born-digital' object. On the other hand, if the document is only available in physical format, it can be converted into digital format through the process of digitization or through re-keying the texts. Similarly, if a learning object is not electronically available, but already available in the form of analogue format, can be digitized through digitization programme. An ODL institution has to plan a digitization project of learning materials that aims to establish a learning objects repository with a robust architecture and structure. The *Figure 1* shows different stages, processes and flows of digitization of learning materials. The selection of types of documents is foremost step of digitization. After identifying types of documents to be digitized, appropriate tools and technologies can be adopted. For examples, for textual documents and images, document scanner will be required; for microfilmed documents, microfilm scanner will be required; for audio materials, sound converter will be required; and so on. After converting analogue objects into digital objects, there will be a need of quality control that may check quality of digital masters. The digital masters can be edited to remove inaccuracies, inconsistencies, errors and noises. The digital masters should be stored in appropriate file formats and should use appropriate feature (e.g. resolution, size, etc.). Metadata elements are required to describe different attributes of a document. Metadata helps to describe and to identify a document. Metadata creation is another important aspect in the digitization process. Metadata elements should be appropriate to the types of documents. For example, some metadata element sets for journal articles can be different from metadata element sets for dissertations or audio materials. Metadata also helps to search and retrieve a document from a digital repository. After metadata creation, the learning objects are to be integrated into a learning objects repository or into a digital library. This digital repository can be made accessible through online mode using Internet or Intranet technologies or can be made available through offline mode using CD-ROM technology. If it is made accessible through Internet, metadata harvesters and search engines should be allowed to index the contents of learning objects. This would increase the visibility of the digital repository, promote interoperability and flexibility of search. *Figure 1* illustrates an outline of workflow in a digitization project that can be elaborated further in each stage.

Selection of Learning Objects for Digitization
↓
Textual Objects/ Images/ Microfilms/ Slides/ Audio Objects/ Video Objects/ Multimedia Objects
↓
Selection of Metadata Element Sets Appropriate to Particular Learning Objects
↓
Convert Analogue Learning Objects into Digital Formats Using Digital Conversion Tools and Technologies and Save in Appropriate File Formats
↓
Edit the Digital Masters and Remove Errors/ Noises/ Inaccuracies
↓
Provide Metadata Information to Describe and to Identify the Content of Every Learning Object
↓
Check the Quality of the Digital Objects and Metadata, and Make Necessary Corrections
↓
Integration of Metadata of Learning Objects into Searchable Indexes, Tables of Contents
↓
Integrate All Types of Learning Objects into a Learning Object Repository/ Institutional Repository/ Digital Library
↓
Deliver the Learning Objects to the Distance and Open Learners Through Internet/ Intranet/ CD-ROMs
↓
Allow Metadata Harvesters and Search Engines to Index the Contents of Repository, if it is Delivered Through Internet

Figure 1: Digitization work flow for learning objects

The digitization of documents, particularly textual and image documents, should adhere to certain guidelines. The guideline helps to maintain standards and quality of digital objects as well as digital repositories. A number of guidelines have been prepared by different agencies, which are the guiding principles to digitization initiatives abroad. Most digitization projects in India either adopt international digitization guidelines or follow the norms as per international practice. In India, a few guidelines are also available for digitization of certain types of documents. Recently, *University Grants Commission* has drafted a guideline for electronic theses and dissertations. *National Mission for Manuscripts* has prepared a guideline for digitization of manuscripts. This guideline can be used in other digitization initiatives that involve digitization of visual materials. On the other hand, *Digital Library Federation* and *Research Libraries Group* of the United States have drafted several guidelines of digitization for maintaining quality in imaging projects. Some of the national and international guidelines of digitization are shown in *Table 1*.

Table 1: List of some guidelines for digitization

Indian	International
1. Guidelines for Digitization of Manuscripts [National Mission for Manuscripts, 2005] <http://namami.nic.in/DigiStds.htm> 2. Electronic Thesis Online (India): UGC (Submission of Metadata and Full-text of Doctoral Theses in Electronic Format) Regulations, 2005: Current Scenario, Major Issues, Data Standards and Implementation Process [University Grants Commission, 2005] <http://www.ugc.ac.in/new_initiatives/etd_hb.pdf>	1. Guides to Quality in Visual Resource Imaging Guide 1: Planning an Imaging Project Guide 2: Selecting a Scanner Guide 3: Imaging Systems: the Range of Factors Affecting Imaging Quality Guide 4: Measuring Quality of Digital Masters Guide 5: File Formats for Digital Masters [Digital Library Federation and Research Libraries Group, 2000] <www.rlg.org/visguides/> 2. General Guidelines for Scanning [Colorado Digitization Project, 2002] <www.cdpheritage.org/resource/scanning/std_scanning.htm> 3. Standards and Guidelines for Digitization Projects [Canadian Digital Cultural Content Initiative, 2001] <www.pch.gc.ca/cdcci-icccn/pubs.htm>

Digital library initiatives and digitization programmes in India

In India a number of digital library initiatives and digitization programmes have been initiated across the country. *Table 2* depicts major digital library initiatives and digitization programmes in India. Most of the digital library initiatives are government funded. These initiatives aim to preserve and provide access to knowledge resources and cultural heritage resources of India. These initiatives would also help to protect rare, out of print, inaccessible documentary resources from extinction. If these resources decay over time, their digital surrogates will exist forever. *Digital Library of India* (DLI) is the biggest national level digital library initiative in India. This initiative is a part of the *Universal Library Project*, envisaged by Carnegie Mellon University, USA, which has some other international partners. DLI is coordinated by Indian Institute of Science, Bangalore and is supported by Ministry of Communications and Information Technology, Government of India. This initiative covers scholarly materials, like, books, journals, manuscripts, conference papers and reports. DLI in its Mission Statement declares: "The mission is to create a portal for the Digital Library of India which will foster creativity and free access to all human knowledge. As a first step in realizing this mission, it is proposed to create the Digital Library with a free-to-read, searchable collection of one million books, predominantly in Indian languages, available to everyone over the Internet. This portal will also become an aggregator of all the knowledge and digital contents created by other digital library initiatives in India. Very soon we expect that this portal would provide a gateway to Indian Digital Libraries in science, arts, culture, music, movies, traditional medicine, palm leaves and many more." The digitization of materials for this initiative is carried out in a number of organizations spread all over India, including in 20 mega scanning centres.

Traditional Knowledge Digital Library (TKDL) is another project that is engaged in creation of digital objects in the areas of traditional knowledge of India, flora and fauna of Indian origin, and geographical indicators; especially it is documenting knowledge resources from the original texts of Indian systems of medicine, like, Ayurveda, Unani, Siddha, Yoga, Naturopathy and Tribal Medicine. This initiative also helps India to retain her biodiversities and their intellectual property rights. TKDL is coordinated and implemented by National Institute of Science Communication and Information Resources (NISCAIR) with collaboration from the Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha & Homeopathy (AYUSH), Office of the Controller General of Patents, Designs and Trade Marks, and a few other Government of India organizations. The portal of TKDL is accessible in different languages in English, French, German, Spanish and Japanese. Traditional Knowledge Resource Classification has evolved from TKDL project. NISCAIR is undertaking another digital library initiative *National Science Digital Library* (NSDL) that will disseminate information on the broad spectrum of science and technology.

Digitization programme of *National Mission for Manuscripts* (NMM) is another initiative to preserve knowledge resources available in the form of Manuscripts. National Mission for Manuscripts spreads over India through a number of Manuscript Resource Centres (27) and Manuscript Conservation Centres (20). The NMM has already identified a few thousand manuscripts in Indian languages through nation-wide survey. It has started pilot projects of digitization of manuscripts that will be integrated into a national digital library of manuscripts.

Indira Gandhi National Centre for Arts (IGNCA) has established a Digital Library, known as *Kalasampada: Digital Library-Resource for Indian Cultural Heritage* (DL-RICH), which is supported by the Ministry of Communications and Information Technology, Government of India. It includes non-printed as well as printed materials, including audios, videos, slides, microfilms, manuscripts and photographs.

National Library of India has initiated a digitization programme, known as 'Down the Memory Lane', to digitize rare books, manuscripts and resources from its collection. Similarly, *Central Secretariat Library* has initiated a digitization programme to digitize some government publications, such as, Gazette of India, Commission and Committee Reports, Annual Reports of the Ministries. Some other organizations are digitizing their own publications, including journals, theses, research reports, and some rare materials from their collections. Table 2 shows some of the major digital library initiatives and programmes. All these digitization programmes in India create huge knowledge resources that can be utilized by the distance and open learners. Their expertise can be used to initiate similar programme on learning objects for distance learners.

Institutional repositories in India

After arrival of Internet and worldwide web, the processes of scholarly communications have changed significantly. Institutional repositories and open access electronic journals are now becoming popular media for scholarly communication as they publish scholarly materials much before their print counterparts. Institutional Repository (IR) is "a digital archive of intellectual product created by the faculty, research staff, and students of an institution and accessible to end users both within and outside of the institution, with few if any barriers to access" (Rajashekar, 2005, p.82). Institutional repositories hold documents of scholarly materials that may provide first hand information on research findings of researchers of the host institutions. They also increase access to scholarly materials, as these are freely available to the scholars and peer groups. An institutional repository may include full-text contents of journal articles, conference papers, book chapters, monographs, research reports, project reports, theses, dissertations, patents, presentations, computer programs, tutorials, convocation addresses, audio materials, video materials, multimedia materials, handbooks, data books, technical manuals, beside many others types of documents. Institutional repositories have capability to build up collections for different users categories and incorporate different forms of documents. On the other hand, learning objects repositories have functionalities similar to institutional

repositories, but provide access to learning materials, tutorials, exercises, assignments and other materials beneficial to the learners. A learning object repository can be integrated into a *Learning Management System* (LMS). The LMS is considered as a backbone of online mode of learning, that integrates different learning and assessment modules. The LMS provides online access to different learning objects, maximizes their use, assures their utilization by the learners, and assesses the progress of the learners.

Table 3 depicts different institutional repositories in India. Some digital repositories are national in nature and accept submissions from Indian scholars across the institutions. For example, *Librarians' Digital Library* of DRTC allows self-archiving of library and information science scholars and professionals. *Vidyanidhi* of Mysore University accepts submission of theses and dissertation from Indian scholars in all areas of studies. *OpenMed* of National Informatics Centre builds up collection of Indian biomedical literature. Some repositories build up collections from the scholars through self-archiving. The collections of these institutional repositories also reflect areas of interests of the host institutions. These repositories provide access to their collections through Internet. Among the institutional repositories in India, ETD at IISc, ePrints at IISc, ePrints at IIT Delhi, NAL Institutional Repository, Digital Repository of NCL, OpenMed at NIC, are growing faster and already achieve international acclamation. Some of the institutional repositories in India are *Open Archive Initiative* (OAI) compliant and expose metadata to external harvesters and search engines through *OAI–Protocol for Metadata Harvesting* (OAI-PMH). Institutional repositories use open source software IR software like DSpace or GNU EPrints that takes care of related protocols and metadata standards. Some institutions in India have initiated IR on experimental basis and available only through Intranet within their campus. Although literature available in Indian IRs is not presently peer-reviewed, an approval model does exist in every IR for inclusion of a submitted item into main collection.

Conclusion

India is a country with diverse cultures, languages, races, schools of thoughts and religions. Her knowledge resources are in existence since Indic civilization of ancient times. Many knowledge resources could not be retrieved due to lack of preservation. Now, awareness and consciousness in preservation and conservation of knowledge resources have emerged allover the society. Digitization of knowledge resources can provide a solution to their preservation and conservation, although it is still unknown whether digitization can solve long term goals of preservation. On the other hand, learners want to pursue their higher education and continuing education through open and distance learning mode, due to its flexibility, accessibility and affordability to the learners. Today, ODL institutions bring education at the doorsteps of the learners through networks of facilitating centres. The other network, the Internet, cannot be ignored since Internet is a strong and powerful media of communication to the learners as well as to the ODL institutions. Digitization of scholarly materials is one of the many initiatives undertaken by institutions across the globe that facilitates wide access and availability of such materials. There are a number of initiatives of establishing digital libraries, institutional repositories and learning objects repositories in India, although some of them are available within the campus wide networks (Intranet) and some others are available through Internet. Some of the initiatives have just started a modest beginning, whereas some other initiatives could achieve national and international acclamation. There is also a great demand of learning objects to the learners, and thus, learning objects repositories are gaining popularity to the learners and institutions. The ODL institutions of a country can form a consortium that will plan, coordinate and implement a national level learning objects repository or digital library for the benefits of distance learners of the country. Each individual member institution of the consortium should share its learning objects, publications, theses, dissertations and other scholarly materials. This way a wide range of collection of learning objects and other scholarly materials can be developed. This repository should be made available to the learners and accessible through Intranet and Internet. A digital rights management system can be interlinked with the repository to address the copyrights and other related issues.

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Table 2: Major digital library initiatives and digitization programmes in India

Name of Digital Library Initiative	Host Institution	Funding Body	URL	Subject	Types Documents Digitizing
Digital Library of India (DLI)	Indian Institute of Science (IISc)	Ministry of Communication and Information Technology (MCIT)	www.dli.ernet.in	All subjects	Books, Manuscripts, etc.
Kalasampada: Digital Library- Resource for Indian Cultural Heritage (DL-RICH)	Indira Gandhi National Centre for Arts (IGNCA)	Ministry of Communication and Information Technology (MCIT)	www.ignca.gov.in/dlrich/	Oriental Studies, Literature, Culture and Heritage	Slides, Books, Manuscripts, Photographs, Microfilms, Audios, Videos, newsletter, journal, etc.
Traditional Knowledge Digital Library (TKDL)	National Institute of Science Communication and Information Resources (NISCAIR)	Department of Indian Systems of Medicine and Homoeopathy (ISM&H)	www.tkdl.res.in	Traditional Knowledge, Indian Systems of Medicine, Health and Hygiene	Monographs, Patents, Excerpts/ Slokas from Ancient Literature, etc.
Mobile e-Library	C-DAC Noida	Ministry of Communication and Information Technology (MCIT)	http://mobilelibrary.cdacnoida.in	All subjects	Books
Nalanda Digital Library	NIT Calicut	All India Council for Technical Education (AICTE)	www.nalanda.nitc.ac.in	Science and Technology, Management	Monographs, Articles, etc.
Archives of Indian Labour: Integrated Labour History Research Programme	V.V.Giri National Labour Institute and Association of Indian Labour Historians	-	www.indialabourarchives.org	History, Indian Labour, Industrial Relations	Monographs, Reports, Archival Records, Photographs, etc.
National Science Digital Library (NSDL)	National Institute of Science Communication and Information Resources (NISCAIR)	-	www.niscair.res.in	Science and Technology, History of Science	Monographs, articles, etc.
Learning Objects Repository	Consortium for Educational Communication	University Grants Commission (UGC)	www.cec-vhe.ac.in	All Subjects	Audio-Visuals, Audios, Videos, etc.
Digital Library in Business and Management	Center for Development of Digital Libraries (CDDL), Indian Institute of Management Kozhikode (IIMK)	Ministry of Human Resource Development (MHRD)	http://intranet.iimk.ac.in/gsdl/cgi-bin/library	Management, Business, Industries	Books, Reports, Articles, etc.

Cont… Table 2: Major digital library initiatives and digitization programmes in India

Name of Digitization Programme	Host Institution	Funding Body	URL	Subject	Types Documents Digitizing
Down the Memory Lane	National Library	Ministry of Culture	www.nlindia.org	All subjects	Books, Manuscripts, etc.
	Central Secretariat Library	Ministry of Culture	http://csl.nic.in	All subjects	Gazette of India, Commission/ Committee Reports, Annual Reports, etc.
Digitization of Manuscripts	National Mission for Manuscripts	Ministry of Culture	http://namami.nic.in	Oriental Studies, Literature, Culture and Heritage	Manuscripts
	Technology Information, Forecasting & Assessment Council (TIFAC)	Department of Science and Technology (DST)	www.indianpatents.org.in	Science and Technology	Patents, Designs
Digitization of Patents, Designs and Trademarks	Patent Office	Ministry of Commerce and Industry	www.patentoffice.nic.in	Intellectual Properties, Science and Technology	Patents, Designs and Trademarks
Digitization, electronic archiving, indexing and retrieval system of the *Indian Journal of Medical Research* (IJMR)	Indian Council of Medical Research (ICMR)	Indian Council of Medical Research (ICMR)	www.icmr.nic.in	Medical Sciences, Biological Sciences	Journal Articles, Monographs, Reports

Table 3: Major institutional repository initiatives in India

Name of IR	Institution	Pattern of Submission	Website address	Type of Documents available	Software Used
Librarians' Digital Library (LDL)	Documentation Research and Training Centre, Indian Statistical Institute	National	https://drtc.isibang.ac.in	Articles, conference papers, theses	Dspace
Vidyanidhi	University of Mysore	National	http://www.vidyanidhi.org.in	Theses and dissertations	Dspace
OpenMed@NIC	National Informatics Centre	National	http://openmed.nic.in/	Articles, conference papers	GNU EPrints
ePrints@IIMK	Indian Institute of Management, Khozhikode	Institutional	http://eprints.iimk.ac.in	Articles, conference papers	GNU EPrints
ETD at IISc	Indian Institute of Science	Institutional	http://etd.ncsi.iisc.ernet.in/	Theses and dissertations	Dspace
ePrints at IISc	Indian Institute of Science	Institutional	http://eprints.iisc.ernet.in	Articles, conference papers	GNU EPrints
ePrints at IIT Delhi	Indian Institute of Technology, Delhi	Institutional	http://eprint.iitd.ac.in/dspace	Convocations addresses, faculty research publications	Dspace
NAL Institutional Repository	National Aerospace Laboratories	Institutional	http://nal-ir.nal.res.in	Articles, seminar papers, technical reports	GNU EPrints
Digital Repository of NCL	National Chemical Laboratory	Institutional	http://dspace.ncl.res.in/	Theses, patents, project reports	Dspace
DSpace@NITR	National Institute of Technology, Rourkela	Institutional	http://dspace.nitrkl.ac.in/dspace/	Conference Papers, journal articles, preprints	Dspace

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