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Driving on the Green Road: Self-archiving Research for Open Access in India

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Abstract

The basic purpose of this paper is to review the relevance of Institutional Repository in the context of India and to prepare an account of the present state and future prospects of Institutional Repository in India. The paper is an outcome of a review of works in the area of Institutional Repository with specific reference to India. For this purpose, quite a good number of sources of information have been explored, analysed and assessed. The Study reveals that India has a huge potential for the growth of Institutional Repository. Hundreds of universities and thousands of colleges and other institutions including IITs, IIMs, IISc, IGNOU, CSIR and ICSSR centers provide a great scope for Institutional Repository in this country. DSpace is the most dominant software used by 37 (59%) institutional repositories followed by E-Print used by 18(29%) institutional repositories. The institutional repository created by Indian Institute of Science (IISc) Bangalore has been placed among top 116 institutional repositories in the world.

Introduction

In last few years there has been a sea change in the scholarly communication process due to the impact of Internet and the spread of 'open access' philosophy. Internet has emerged as a wonderful tool for providing unparalleled opportunities for expanding availability of research information to everyone. As a result of gradual but growing acceptability of the open access philosophy, a large number of open access repositories (both subject and institutional based) have been coming up. According to ROAR (*Registry of Open Access Repositories*) there are more than 33202944 journal articles, theses, databases, conference proceeding available most of them are free. OpenDOAR and ROAR (Repository Service providers) has registered 1800, 2242 institutional and subject repositories. Similarly, DOAJ (Directory of Open Access Journals), an open access journals service provider has listed more than 6337 journals which are freely available through Internet connection. Other example will be Open J-gate, open journal systems and PubMed central. These are a few of the indicators which explain the mounting growth of Open Access resources day by day. Open access philosophy is shaping the new brave world of scholarly communication where the gap between haves and have-nots of research information is reduced. The

road to new scholarly communication which can be called as open access to scholarly resources is fulfilling by two ways, open access repositories and open access journals. Open access repositories which also called *green road* is showing lot of possibilities for cent percent open access. India's growth with regard to open access to scholarly information can be measured through a recent survey which has ranked top 1200 repositories for supporting and advocating open access. The survey found 20 Indian repositories which are in top 1000 figured in the list of top 1200 repositories.

Self Archiving: The Green Road to Open Access

According to Harnad (2004) Self-archiving is one of the two general methods for providing open access. The other one is publishing in an open access journal. The former is called as "green" and the later as the "golden" road to open access. Self-archiving was first explicitly proposed universal practice by Stevan Harnad in his 1994 posting "*Subversive Proposal*". The Green Road is meant for continuing publishing in subscription based journals but the author of each article makes it Open Access by self archiving a copy of the author's peer reviewed final draft (the post print) in the author's OA institutional Repositories (IR). The green road of open access will be fulfilling through creating institutional repositories. An institutional repository is a digital collection of institution intellectual output. About 91% of peer-reviewed journals surveyed by eprints already endorse authors self-archiving of preprint and/or post-print versions of their papers.

Scientific Knowledge and India

India is one of the oldest civilizations with rich culture and diverse knowledge base from the ancient *Harappa* and *Mahenjodaro* civilization. It is one of the world's largest educational systems. It has a strong institutional framework for research in science, technology, humanities, and social science education and research with more than 2,900 R&D organizations including many labs in government and private domain (Lalitha Kumari, 2008). It is the third largest scientific and technical manpower in the world with about 300 private and government universities, 45,000 and more colleges. The scientific output of all these agencies is quite substantial with India occupying the 13th rank among the top 146 countries in the world (Arunachalam, 2004). According to Web of Science India has produced 24659 in 2004, 27350 in 2005 and 30641 in 2006 articles, and the number is continuously increasing.

Barriers of Research Communication

In spite of its strength in research both at individual and institutional level, India is not yet placed in the top list of qualitative research publications. There are several reasons, of which two major problems are access and visibility. There is a need to improve the global access to local research and vice versa to make Indian research more competitive (Rajasekhar, 2003). According to Swan, India has suffered considerably from the scourge of journal impact factor (Swan, 2007). Indian scholars are trying to make their work visible to the world by publishing in western journals, which always have higher visibility than Indian journals. On the other hand, getting access to the same journals has been a long term problem for Indian scholars due to the high cost of subscription. Subbiah Arunachalam, an Indian scientists and OA advocate has also reserve his concern on these two issues- high cost of access and low visibility (Arunachalam; 2008).

Open Access Can Resolve the Problem

Nothing that has happened in the recent past could have as great influence as open access to science and scholarships in the developing world. 'Open Access' can resolve the access and visibility problem to a great extent. Research information will be more accessible to global researchers, and hence, will be better known and more widely used and cited. The prestige of researchers will increase significantly. All research will be open to all entrepreneurs and the general public with internet access. This will be beneficial both commercially and culturally. In a nutshell, the advantages of open access will be as follows:

- The authors and researchers benefit because their research papers are given a much wider dissemination and can be read without restriction by anyone with internet access;
- Articles self-archived by author receive between 50-250% more citation.(Brody, 2007)
- Researchers benefit because they will increasingly be able to access and use the full text of all research published in that area.

Spread of Open Access Philosophy in India

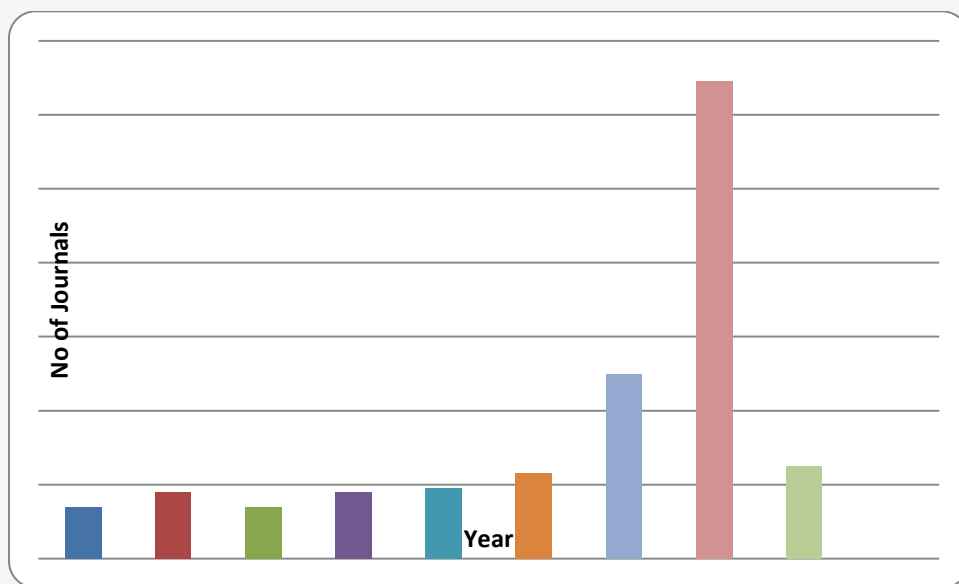
A growing number of Indian journals are moving towards the open access format of Internet publishing. These include the journal publishing by Indian Academy of Science (11 Journals), the Indian National Science Academy (4 Journals), Indian Medlars Center at the National Informatics Center (38 biomedical journals) and DOAJ(Directory of Open Access Journals) have listed 310 journal including the above. One Mumbai based private firm Med Know published 61 open access journals on behalf of their publisher 75 professional societies. Recently, DESIDOC Journal of Library and Information Technology joined the league; it is the premier journal from library field published by DESIDOC. In terms of number of journals included in DOAJ, India ranked number five ahead of the many developed countries. Top 15 countries in terms of open access journal in DOAJ listed in table 1.

Table 1: list of Top 15 Countries in DOAJ

No	Country	Total No of Journal
1	United States	1211
2	Brazil	579
3	United Kingdom	501
4	Spain	361
5	India	310
6	Germany	212
7	Canada	203
8	Romania	174
9	Italy	164
10	Turkey	157
11	France	131
12	Chile	123
13	Colombia	121
14	Australia	113
15	Japan	105

Taking all these into account, India has now spread head in the OA journals regime. Below graph shows year wise growth of OA journal, 2010 is the year 100 and above journals registered in DOAJ

Fig.1: Year wise growth of OA journals in DOAJ from INDIA



There are more than 63 institutional and subject based repositories in India. Most of them are created at higher level of institutions like Indian Institute of Science (IISc), IITs (Indian Institutes of Technology) and IIMs (Indian Institutes of Management) and other CSIR, ICAR, ICMR research organizations.

The Indian Institute of Science, Bangalore is coordinating the Digital Library of India project along with Carnegie Mellon University. In this project, 22 other institutions are participating and have digitized more than 4,50,000 books, out of which 2,20,000 books are web accessible. Secondary services for OA materials like Informatics India launched, Open J-Gate a free search service for materials available via open Access. Its covers 4360+ open access e-journals (<http://openj-gate.com/>).

There are open access courseware are also provided in India. NPTEL (National Programmes on Technology Enhanced Learning) jointly launched by the IITs and IISc, is a world class open courseware programme. IITs and IISc faculty prepare the course material and these are recorded in real life teaching situation for transmission over the web or as a video film or as both.

The Green Road for India

The present study has been carried out by taking data from various sources like Registry of Open Access Repository (<http://roar.eprints.org/>) and OpenDOAR(<http://www.opendoar.org/>). Data downloaded from above site were exported into a spreadsheet for analysis. A general search has been done in internet to found repositories which are not registered in both the above repository service. Duplicate data removed from the spreadsheet, total number of record taken from the repository website if not available through ROAR and OpenDOAR. After checking through all this above the final data were interpreted and analyzed based on certain parameter to get the whole picture of repository in India.

India is spread heading open access movement by developing a number of open access repositories using open source software like Dspace, Greenstone, Eprints, etc. There are more than 63 institutions which have operational institutional repositories in India. The following are the six Indian repositories which have been placed in the list of top 1200 repositories in the world in a ranking of world repositories done by Cybermetrics Lab, Spain.

Table 2: Top Twenty Institutional Repositories from India

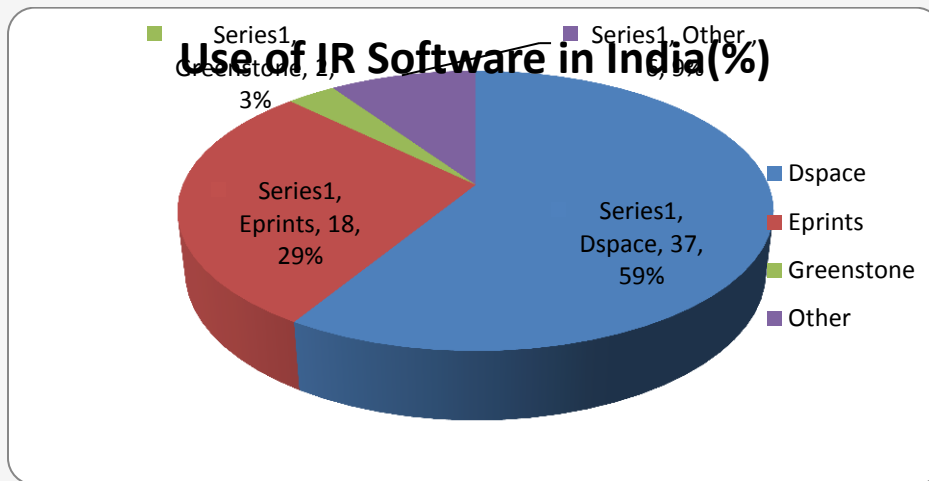
Sr. No	Name of the repository	Top Repository
1	Eprint at Indian Institute of Science, Bangalore	116
2	Indian Institute of Astrophysics, Bangalore	222
3	Openmed@nic	248
4	Vidyanidhi Digital Reptsitory, Mysore University	271
5	ISI Digital Library	341
6	National Institute of Oceanography, Digital Reptsitory	382
7	National Institute of Technology, Rourkela	519
8	National Aerospace Laboratories , Bangalore	527
9	Central Marine Fisheries Research Institute	529
10	Indian Institute of Technology, Bombay	555
11	Cochin University	558
12	North East Hill University	629
13	Raman Research Institute	647
14	National Science Digital Library, CSIR	654
15	Thapar University	655
16	Indian Institute of Management, Kozhikode	689
17	Indian Institute of Science, ETD Bangalore	771
18	National Metallurgical Laboratory, Jamshedpur	864
19	Central Drug Research Institute, Lucknow	920
20	Information and Library Network (INFLIBNET), Ahmedabad	973

The E-Print Repository at Indian Institute of Science (Eprints@IISc) is the first repository in the country and one of the earliest in the world to set up an interoperable institutional repository (<http://eprints.iisc.ernet.in/>), under the leaderships of the late Dr. T. B. Rajashekar. This archive is now India's fastest growing repository having collection of more than 26,106 journal articles and conference papers on diverse fields of science. Indian Institute of Science used GNU eprints software (<http://eprints.org>) which is developed by University of Southampton. Besides the eprints@IISc, Indian Institute of Science has another repository dedicated for thesis and dissertation collection build on Dspace (www.dspace.org) institutional repository software.

Few other major IR initiatives in India have been taken place at IIT Kanpur, where more than 9000 MTech and Phd Thesis have been archived using state of art Dspace software. Vidyanidhi is a major initiative by University of Mysore for archiving doctoral thesis of Indian research. It is supported by Department of Scientific and Industrial Research and Ford Foundation. Vidyanidhi maintains mainly two kinds of database, a bibliographic database and a full text repository using Dspace Software. It provides full text access to 5480 theses on doctoral research in India. Indira Gandhi National Open University (IGNOU), one of the biggest open universities in the world has a repository with a collection of more than 23,160. OpenMed@nic is a discipline based institutional archive in area of medical and allied science having collection of more than 2761 using Eprints software for repositories. Mahatma Gandhi University have 1128 collection of thesis, they are using software called Nitya for repository. This is only one repository which is included in INTUTE, a web based service providing best online resources for education and research [5]. There are few other repositories which are consistently growing, namely Indian Institute of Astrophysics, Bangalore, National Aeronautics Laboratory, Bangalore, National Center for Catalysis Research, IIT Madras, Open MED National Information Center, Raman Research Institute, Bangalore and National Institute of Oceanography, Goa. A detail list of institutional repositories in India can be found in the Table- 3 appended at the end of this paper.

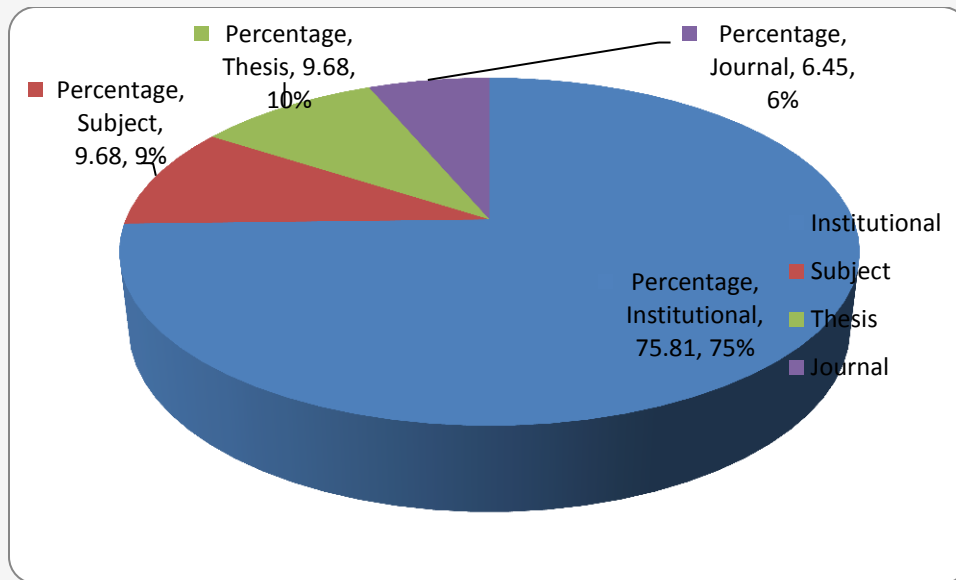
Among all repository software Dspace is the most dominant Institutional Repository software for content management followed by Eprints. From 63 repository taken in the study 37(59%) are built in Dspace, Second one is Eprints 18(29%) followed by Other 6(9%) and Greenstone 2(3%). The format of materials stored in the repositories was diverse including pre- print, post print journal articles, book chapters, working papers, theses and dissertations, and multimedia and course materials. There are a good number of institutional repository are in the pipeline. A list of institutional repositories included in the study has been depicted in Fig.1.

Fig. 2: Use of IR Software in India



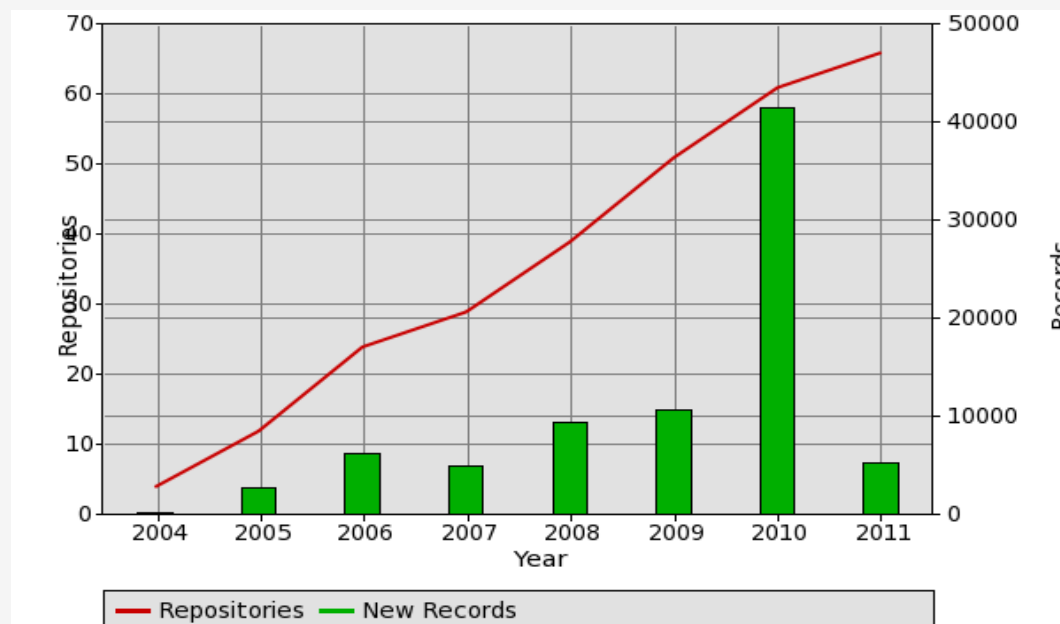
There are mainly four types of e-print repositories in India. Out of 63 repositories, 47 (75%) are institutional repositories which hold intellectual and research output of the respective institutions. Followed by subject repositories 6 (9%), like INFLIBNET, Librarian Digital Library, which use to aggregate scattered information and store it for centralized access. There are another 6 (10%) of the repository which are dedicated to thesis only followed by 4 repository exclusively for journal articles.

Fig. 3: Type of IR in India



The growth of e-print repositories and the number of records archived in India have been continuously increasing. Starting with 2004 when there was no record in the repositories it has reached a stage when first 15 repositories have archived above 100000 records in various formats. The fig-4 below discloses the steady growth of institutional repositories in India.

Fig. 4: Growth of Open Access Repositories in India (Data taken from ROAR)



For searching all Indian repositories in one place CASSIR (Cross Archive Search Service for Indian Repositories) a service which harvest metadata from all registered OA archive. This service is a part of the ongoing project "Development of OAI-based institutional research repository services in India sponsored by Department of Scientific and Industrial Research Ministry of Science and Technology, Government of India. As of now the repositories was closed to 50000 papers from different repositories (<http://casin.ncsi.iisc.ernet.in/oai/index.php/index>).

Advocacy and Training Program for IR inside and outside

Organizations need to concentrate on developing few strategies to influence the authors for populating repositories within and outside the organization. This needs a good policy, organizational commitment, advocacy services, and legal aspects in context to Intellectual Property Right. For a country like India, a better national level policy is required for visualizing the importance of open access in the research and dissemination. In that connection recently National Knowledge Commission of India has recently prepared a draft proposal for open access. Its has stated in the draft that, "all research articles published by Indian authors receiving any government or public funding must be made available under open access and should be archived in the standard OA format on his/her website. Further, a national academic OA portal has to be developed and the research articles should be made available through this portal".

Apart from National level policy, Organization has to play a bigger role for implementing open access. It is always a tough task to influence the stakeholder for implementing open access repositories. Organization can take new initiative in policy decision to popularize institutional repositories. Influential factor like Faculty Reward system for highest viewed/cited article, provide email alert to all when new article will submitted to institutional repositories etc. Mandating is another way to increase collection. NIT, Rourkela in Orissa has already mandated for compulsory deposit of research paper to their institutional archive. Research shows that after mandating there is an increase in collection.

Conclusion

Institutional repositories are important for a developing country like India, as they instantly make available the work of their scientists to the rest of the world. IR is meant for increase access to knowledge for research. It provides opportunity to access high quality research publications even to those who can not afford to pay for it. The research publications of IIT, Madras like institution can be available to someone who is studying or doing research in the same field in an engineering college in Bhubaneswar. Easy availability of research publications will lead to greater use and more citation. IRs can increase visibility of researcher and bring about an increase in readerships and an increase institution/country status and reputation.

But Institutional Repositories (IR) are still in a formative stage in India, except 20 repositories most of the IRs has a very low collection, less than 1000, progress remain slow, many hurdles are there. India spends about 170 million rupees of public money annually on science and technology research. The return on this investment must be maximized (Harnard and Swan, 2007). The public funded research should be open access. There is a need for active commitment by all those involved in the production of scientific knowledge. India needs a better National level policy to visualizing the importance of IR in the institution and country at large. The government and funding agencies in India should insist that publicly funded research should be available through institutional repositories that are open to all. The recommendations of National Knowledge Commission on the issues of Open Access should be implemented in letter and spirit.

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Appendix 1. List of Repositories in India

Sl. No	Type	Home page	Organisation Name	Software	Record
1	Institutional	http://eprints.iisc.ernet.in/	Indian Institute of Science, Bangalore, India	eprints	26106
2	Institutional	http://www.egyankosh.ac.in	Indira Gandhi National open University, Delhi	dspace	23160
3	Institutional	http://nopr.niscair.res.in/	NISCAIR ONLINE PERIODICALS REPOSITORY (NOPR)	dspace	10145

4	Institutional	http://eprints.cmfri.org.in	Central Marine Fisheries Research Institute	eprints	7972
5	Theses	http://dspace.vidyanidhi.org.in:8080/dspace	University of Mysore, Mysore	dspace	5480
6	Institutional	http://drs.nio.org/	National Institute Of Oceanography, India	dspace	3802
7	Institutional	http://dspace.rii.res.in/	Raman Research Institute Digital Repository	dspace	3774
8	Institutional	http://nal-ir.nal.res.in/	National Aerospace Laboratories, Bangalore	eprints	3494
9	Subject	http://openaccess.icrisat.org	International crops research institute for the semi arid tropics	dspace	3414
10	Institutional	http://dspace.nehu.ac.in/jspui/	North East Hill University, Shillong	dspace	3269
11	Institutional	http://prints.iiap.res.in/	Indian Institute of Astrophysics, Bangalore	dspace	3060
12	subject	http://openmed.nic.in/	National Informatics Center, New Delhi	eprints	2761
13	Institutional	http://eprints.nmlindia.org/	National Metallurgical Laboratory, Jamshedpur	eprints	2431
14	theses	http://eprint.iitd.ac.in/dspace	Indian Institute of Technology, Delhi	dspace	2143
15	Institutional	http://library.isical.ac.in/jspui/	Indian Statistical Institute, Kolkata	dspace	2097
16	Institutional	http://dspace.library.iitb.ac.in/jspui/	Indian Institute of Technology, Bombay	dspace	1659
17	Institutional	http://www.eprints.iitm.ac.in/	National Centre for Catalysis Research (IIT): Catalysis Database	eprints	1640
18	Institutional	http://dyuthi.cusat.ac.in/	Cochin University of Science & Technology, Kochin	dspace	1417
19	Institutional	http://dspace.nitrkl.ac.in/dspace/	National Institute of Technology, Rourkela, India	dspace	1366
20	Institutional	http://dspce.thapar.edu:8080/dspace	Thapar University	dspace	1280
21	Theses	http://mgutheses.org/	Mahatma Gandhi University - Online THESIS Search, Kerala	Nithya	1128
22	Subject	http://www.dspace.dce.edu	Delhi Technological University, Delhi	dspace	1071
23	Theses	http://etd.ncsi.iisc.ernet.in/	Indian Institute of Science, Bangalore, India	dspace	1039
24	Subject	http://www.agropedia.net/openaccess	Open Access: Agriculture Research Repository	other	915
25	Institutional	http://bma.ac.in:8080/dspace	Bangalore Management Academy	dspace	823
26	Institutional	http://bhagirathi.iitr.ac.in/dspace	Indian Institute of Technlogy Roorkee, India	dspace	823
27	Theses	http://eprints.csirexplorations.com/	CSIR Unit for Research and Development of Information Products, Pune	eprints	680
28	Institutional	http://nsdl.niscair.res.in	National Science Digital Library at NISCAIR, India: Home	dspace	541
29	Institutional	http://mdrf-eprints.in/	Dr. Mohan's Diabetes Specialities Centre,Diabetes	eprints	527
30	Subject	http://ir.inflibnet.ac.in/	Information and Library Network Center, Ahmedabad	dspace	505
31	Institutional	http://dspace.iimk.ac.in/	Indian Institute of Management Kozhikode	dspace	503
32	Institutional	http://dspace.vpmthane.org:8080/jspui/index.jsp	Vidya Prasarak Mandal, Thane	dspace	497
33	Institutional	http://220.227.138.214:8080/dspace/index.jsp	Indian Institute of Spices Research, Kozhikode (Calicut), INDIA	dspace	490

34	Institutional	http://dspace.ncaor.org:8080/dspace/	National Center for Antarctic Research , Goa , India	dspace	489
35	Institutional	http://ncralib.ncra.tifr.res.in:8080/dspace/	National Center for Radio Astrophysics	dspace	415
36	Theses	http://dspace.ncl.res.in/	National chemical Laboratory - Pune	dspace	357
37	Institutional	http://dspace.mdi.ac.in/dspace	Management Development Institute	dspace	356
38	Institutional	http://dkr.cdri.res.in:8080/dspace	Central Drug Research Institute	dspace	342
39	Institutional	http://eprints.iari.res.in/	Indian Agricultural Research Institute	eprints	221
40	Institutional	http://202.131.96.59:8080/dspace	ICFAI Business School Ahmedabad	dspace	213
41	Institutional	http://eprints.atree.org/	Ashoka Trust for Research in Ecology and the Environment	eprints	206
42	Institutional	http://oii.igidr.ac.in:8080/dspace	Indira Gandhi Institute of Development Research, Mumbai	dspace	204
43	Institutional	http://library.isibang.ac.in:8080/dspace/	Indian Statistical Institute Library, Bangalore	dspace	191
44	Subject	https://drct.isibang.ac.in/	Librarians' Digital Library	dspace	188
45	Institutional	http://www.erepo.ihr.ernet.in/	Indian Institute of Horticultural Research	dspace	180
46	Institutional	http://eprints.du.ac.in/	Delhi University, Delhi	eprints	170
47	Institutional	http://kr.cimap.res.in	Central Institute of Medicinal and Aromatic Plants	dspace	120
48	Institutional	http://eprints.bicmku.in/	School of Biotechnology, Madurai Kamaraj University	eprints	92
49	Institutional	http://www.imsc.res.in/eprints/	Institute of Mathematical Sciences, Chennai	eprints	43
50	Institutional	http://eprints.immt.res.in/	Institute of Minerals and Materials Technology, Bhubaneswar	eprints	33
51	Institutional	http://www.kashmiruniversity.net/	Allama Iqbal Library Digital Collection, Jammu and Kashmir	greenstone	Not Available
52	Institutional	http://dspace.ipu.ernet.in:8080/dspace/	Guru Gobind Singh Indraprastha University, Delhi	dspace	Not Available
53	Institutional	http://eprints.iita.ac.in/	Indian Institute of Information Technology, Allhabad	eprints	Not Available
54	Institutional	http://eprints.nii.res.in/p	National Institute of Immunology (NII), India	eprints	Not Available
55	Institutional	http://library.pdpu.ac.in:8080/xmlui	Pandit Deendayal Petroleum Univeristy	dspace	Not Available
56	Institutional	http://www.prl.res.in/~library	Physical Research Laboratory Library, Ahmedabad	greenstone	Not Available
57	Journal	http://www.rqcb.res.in	Rajiv Ghandi Center For Biotechnology	other	Not Available
58	Institutional	http://eprints.svnit.ac.in/	S.V. National Institute of Technology Repository, Surat	eprints	Not Available
59	Journal	http://www.freewebs.com/siddhapapers/	Siddha Articles	other	Not Available
60	Journal	http://www.iioab-journal.webs.com/	The Institute of Integrative Omics and Applied Biotechnology	openrepo	Not Available
61	Institutional	http://digilib.uohyd.ernet.in/dspace	University of Hyderabad	dspace	Not Available
62	Journal	http://www.bioinformation.net/	Bioinformation	other	Not Available
63	Institutional	http://eprints.mkuoa.in/	Madurai Kamaraj University Repository	eprints	Not Available