

# Global Access to Science Information: The Changing Dynamics of Access and Practices in India

By

**Dr. Manik Mandal**

Librarian  
NIT Library  
Durgapur-713209 WB,India,  
e-mail: [mm\\_lib@nitdgp.ac.in](mailto:mm_lib@nitdgp.ac.in)

**Dr. K. C. Panda**

Reader & Coordinator  
P.G. Dept of Lib. & Inf. Sc.  
UGC-SAP-DRS  
Sambalpur University  
India Jyoti Vihar – 768019 (Orissa)  
[krushna52@yahoo.co.in](mailto:krushna52@yahoo.co.in)

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## Abstract

[Provides an insight in to the changing dynamics of access to Science information currently practiced in India. Vividly describes the changing dynamics of publishing technology, open access journals and their impact and some key science consortiums in India viz. FORSA, VIC, NISCAIR, INDEST, and IASB]

## 1. Introduction

Science has a profound impact on the way we live, largely through technology and the use of scientific knowledge for practical purposes. Science is practiced formally in universities, R&D institutions, scientific and research institutes, corporate research laboratories, etc. The results of the practices or the research results are communicated to the wider populace. The quantum of the results is enormous and is published as scientific literature in various journals, magazines, proceedings and books as well. A significant fraction of this literature is also available on the World Wide Web. Several groups of scientists and scientific researchers have put their best efforts to use www to disseminate scholarly publications globally giving rise to Open Access movement. It has occupied center stage in the journals market place in 2005, eclipsing issues of price, publisher merger, and big deals. As a consequence, the Directory of Open Access Journals (DOAJ) was set up through the efforts of Lars Bjorshauge of the University of Lund, Sweden in 2003. This service covers free full-text, quality controlled scientific and scholarly Journals. Its' primary aim is to cover all subjects and languages and has demonstrated the power of 'open access' by accruing an impressive impact factor. Open Archives Initiatives (OAI) have been evolved to harvest metadata to provide value added

service. Initially, the OAI was involved in the development of a technological framework and interoperability standard, specifically for enhancing access to e-print archives in order to increase the availability of scholarly communication. OAI is, therefore, closely related to Open Access movement. India has one of the worlds largest scientific and research workforce which is responsible for producing a large number of published papers to its credit. Elsevier has reported that it has published 26.8% (Letter from Elsevier, dt 6.10.2006) of all the journal papers published in India across all subject areas. Research and development activities have gathered momentum in the recent past and as a result there has been tremendous growth in published literature. Basu reports that, with the exception of Agriculture, there has been an increase in publication in virtually every field, with significant increase in the overall mean Impact factor (Basu, 1999). An attempt has been made to take stock of the efforts undertaken in India in order to facilitate global access to scientific publications.

### **1.1 Science: The Concept**

The term, 'science' has been defined variously by different scientific researchers. Science, essentially, is an attempt to establish hypotheses linking cause and effect in observed phenomena. The dictionary meaning of 'Science', therefore, refers to a branch of knowledge conducted on objective principles involving the systematized observation of an experiment with phenomena, especially concerned with the material and functions of the physical universe. Science also denotes a systematic and formulated knowledge, especially of a specific type or on a specified subject (say, Political Science), the pursuit or principles of this. Science is an organized body of knowledge on a subject (say, the science of Philosophy), skilful techniques rather than the strength of a subject. In its simplest connotation, science means 'knowledge of any thing'.

Science is often understood as 'natural science'- an investigation usually made, by a process of trial and error, of the natural world- that a researcher can observe and measure. Natural Science in this sense grows- both out of curiosity and necessity. It has probably a history as long as human kind itself. Science is, therefore, possible only when humans are allowed by their fellows to call in

question what is generally accepted as true and are themselves able to give up old beliefs when they no longer prove to be in agreement with facts that have newly come to light.

(<http://www.dynagen.co.za/eugene/science.html>).

## **1.2 Taxonomy of Science**

Science is broadly sub-divided into the categories of **natural sciences** and the **social sciences**. There are also related disciplines that are grouped into interdisciplinary and applied sciences, such as engineering and health science. Within these categories are specialized scientific fields that can include elements of other scientific disciplines, but often possess their own terminology and body of expertise. According to Dewey Decimal Classification (DDC) System, *Pure Sciences* have been assigned class numbers from 500 to 599 and *Applied Sciences* (Technology) have been assigned class numbers from 600 to 699.

## **1.3 Aims & Objectives**

This study aims to achieve the following objectives:

- (a) To ascertain the current status of global access to Science Information;
- (b) To determine the changing dynamics and nature of such access to science information being practiced in India; and
- (c) To unmask the Indian initiatives for providing access to Science information.

## **1.4 Scope and Limitations of the Study**

This study confines in it's' scope only to unfold the key Indian initiatives currently in practice to access to Science information globally and hence, does not study the access to such information in any other discipline or country beyond 'Science' and 'India' so as to make the present study more specific in context.

## **1.5 Methodology Followed**

Since the present study aims to provide a conjectural approach to the current state of access being practiced to access globally to Science Information, it primarily followed '*Library Method*' coupled

with '*web-browsing method*' by searching the following key websites relevant to the study so as to gather information on the subject:

- a) <http://www.openarchives.org>
- b) <http://www.doaj.org>
- c) [http://en.wikipedia.org/Open\\_Archives\\_Initiative](http://en.wikipedia.org/Open_Archives_Initiative)
- d) [http://www.j\\_gate.informindia.co.in](http://www.j_gate.informindia.co.in)
- e) [http://www.ncsi.iisc.ernet.in/scigate\\_about.php](http://www.ncsi.iisc.ernet.in/scigate_about.php)

## **2. Changing Dynamics of Publishing Technology**

Technology has changed the trend of publishing and the mode of access to information and scientific communication. The Technology of Publishing (both books and journals) has witnessed spectacular changes. All major publishers are currently making available the contents of their respective publications electronically, although print format still predominant. Information professionals in all quarters of the world are desperately trying to provide users with e-access to the global knowledgebase and tools to help them gain maximum benefit out of e-access. Electronic publishing provides an extremely high global visibility with remarkable speed of publication and cost-effectiveness. The electronically published papers can incorporate text, images, video or sound clips, etc at greater ease. E-publishing offers several other benefits also in respect of scholarly communications. Many publishers have also come out with their electronic publications, like e-books, e-contents, e-resources and online journals to facilitate simultaneous access through IP-based services, saving cost of acquiring multiple copies and supplying most current and up to date documents in least time and trouble. The communication and dissemination of scholarly information has become possible and convenient owing to the enormous power of the World Wide Web, the popular information superhighway.

2.1 **E-Publishing** is a very broad term which includes a variety of different publishing models, including e-books, e-journals, print-on-demand (POD), e-mail publishing, web-publishing etc. It uses new technology to deliver books and other contents to readers. The demand for E-Publishing content

is motivated owing to the surge in digital storage and use of Internet for information search, business and entertainment.

The use of e-journals, e-publications, archives and databases in Science, Technology and Medical Science (STM) have become very popular among various disciplines for research. STM publishing includes scientific, technical, medical sciences as well as social sciences, humanities and arts. E-Publishing has the leverages of the most advanced design, development and hosting technologies to create and maintain websites. The technology behind e-publishing allows disseminating information to readers quickly and efficiently. It is causing major changes to the publishing industry and has a profound impact on the way we read, offering new hardware and software devices.

### **3. Communication Channels: The Key Mediums**

Open Access and Open Archive Initiative are the buzzwords in the academic and research community of the current web-age. It is an attempt to build a “low- barrier interoperability framework” for digital archives or institutional repositories (IR) containing digital resources. It is a digital archive (e-print archive) of the research output created by the faculty, research staff, and students of an institution which are made accessible over the Internet to the end-users, both within and outside the institution. Many consortiums have been established at different levels to facilitate access to different valuable e-resources amongst member institutions at highly discounted rates of subscription.

#### **3.1 Open Access Journals**

Open Access journals are primarily non-profit electronic publishing service committed to provide open access to quality research journals published worldwide. The Directory of Open Access Journals (DOAJ) is comprehensive and covers all open access scientific and scholarly journals, and acts as a quality control system to guarantee the contents of such scholarly journals ([www.doaj.org](http://www.doaj.org)). This is one of the effective mechanisms to increase the visibility and ease of use of open access scientific and scholarly journals, there by promoting their increased usage and impact.

For instance, the portal **Free Full Text.com** provides direct links to over 7000 scholarly periodicals which allow some or all of their online contents to be viewed freely by anyone with Internet access. The issues which are available for free are indicated for each title on the alphabetical periodical lists. The design of this site is optimized for users seeking specific articles for which they already have citations. If some of the articles are not available for free online, they can be obtained on payment of the prescribed fee through a document delivery service, such as Pinpoint Documents (*Access*; March 2006, p. 11).

### **3.2 The Abdus Salam International Centre for Theoretical Physics (ICTP)**

The ICTP has organized an Open Access Archive (OAA) to allow the scientific work of any scientist from any country to be posted free of charge. The OAA of ICTP ([www.ictp.it](http://www.ictp.it)) allows scientists from anywhere to post online, at no cost, their scientific work and scientific CV in electronic format (*Access*; March 2006, p.12).

### **3.3 Open Course Ware Consortium (OCWC)**

It is a consortium of more than 100 higher education institutions and associated organizations around the world creating a broad and deep body of open educational content using a shared model. The mission of OCW consortium is to advance education and empower people worldwide through open courseware. MIT's (Massachusetts Institute of Technology) **Open Courseware** is an ideal example of open access. It is a free and open educational resource (OER) for educators, students, and self-learners around the world. It is true to MIT's values of excellence, innovation, and leadership (<http://ocw.mit.edu>).

### **3.4 Library Consortium**

A 'library consortium' is any local, regional, or national cooperative association of libraries that provides the systematic and effective coordination of the resources of schools, public, academic, and special libraries and information centers and improving services to the satisfaction of the clientele of such libraries. Its' basic purpose is to share information resources so that, the collective strengths of

these member institutions can facilitate the research and learning of the member's constituents (US Federal Communications Commission, <http://www.library.yale.edu/...>).

Yale University has joined in an international consortium to make prestigious scientific journals in the environmental sciences available online to the developing world at little or no cost. A digital Internet library for developing countries, namely, OARE (Online Access to Research in the Environment) has been established. OARE provides access to peer reviewed scientific literature of leading international publishing houses. Organizations eligible to use OARE include approximately 1000 public, non-profit institutions in more than 100 under developed nations in Africa, Asia, Latin America, the Caribbean's and Eastern Europe (*Access*, March 2006,p-13).

The Health Inter Network Access to Research Initiative (HINARI) is another initiative which provides free or very low cost online access to the major journals in biomedical and related social sciences to local, not-for profit institutions in developing countries. It was launched in January 2002, with some 1500 journals from 6 major publishers. Presently, there are more than 70 publishers offering their contents in HINARI.

PERI (Programme for the Enhancement of Research Information), under INASP, is another programme to support capacity building in the research sector in developing and transitional countries by strengthening the production, access and dissemination of information and knowledge. The International Network for the availability of Scientific Publications (INASP) negotiates affordable and sustainable access licenses. The publishers provide low-price access to high value content.

#### **4. Impact of Open Access Publications**

It is reported that, Open Access articles have more impact than non-open access publications. A study of citations to 1500 open access and non-open access adds to the evidence that, open access speeds up the dissemination and the uptake of scientific findings. The results of the study show that, articles originally published in the journal (Proceedings of the National Academy of Sciences) as 'open access' articles were twice as likely to be cited 4-10 months after publication as non-open

access articles. In addition, articles first published as open access had more impact and were more frequently cited than articles that were '*self-archived*' in open archives later on (Access, June 2006, p.4).

Another study reveals that, the Directory of Open Access Journals (DOAJ) contained 2044 peer-reviewed OA journals (as of mid-February), about 600 more than this time last year. Some of them are demonstrating the power of open access by accruing impressive impact factor (Orsdel & Born, Access, June2006, p-8).

#### **4.1 Open Access vs. Open Archives (Self –Archived)**

Open access is an instant, free and unrestricted online access to digital scholarly materials, primarily peer-reviewed research articles in scholarly journals. It was made possible owing to the advent of Internet. It is free of most copyright and licensing restrictions. The Budapest Open Access Initiative (February 2002) was an important landmark in the history of Open Access. This provided a definition of open Access, and has a growing number of signatories. It explored the most effective and affordable strategies for serving the interests of researchers, and the institutions and societies that support research. There are two other statements, namely, the Bethesda Statement on Open Access publishing (June 2003) and the Berlin Declaration an Open Access to Knowledge in the Sciences and Humanities (October 2003). The Berlin declaration is considered one of the major international statements on open access.

There are two main currents in the open access movement, namely, (i) OA Self-archiving; and (ii) OA publishing. In **OA self-archiving** (also referred to as “green road”), authors publish in a subscription journal, but in addition make their articles freely accessible online, usually by depositing them in an institutional or central repository.

In **OA publishing** (also referred to as ‘gold road’), authors publish in open access journals that make their articles freely accessible online immediately upon publication.

#### **5. Open Access Initiatives in India**



(i) **Indian Institute of Science, Bangalore (IISc)** has set up an open access repository of IISc research publications called e-Prints@IISc. It collects, preserves, and disseminates in digital format the research out put created by the IISc research community. It enables the institute community to deposit their preprints, post- prints, and other scholarly publications using a web interface, and organizes these publications for easy retrieval. Any one can access these scholarly publications free of cost at any point of time and from any where with no geographical constraint. Other notable archives are (ii) of IIT Bombay (Etd@IIT Bombay), (iii) Eprint and Etd@IIT Delhi, (iv) Etd@IIM Kozhikore, (v) DuEprint Archive (of Delhi University), (vi) Dspace@nitr (of NIT, Rourkela) and (vii) IIIT, GNU Eprints (OAI) (of IIIT, Allahabad). The INDEST-AICTE consortium also encourages open access through institutional repositories to its member institutions (<http://eprints.iisc.ernet.in>) as shown in succeeding tables.

**Table -1**

**Open Access/ Archives Initiatives in India**

Sl. No.	Name of the Institute/ Organisation	Type of Initiative	Name of the Institutional Repositories	Subject, nature and type of Information available
1	IISc, Bangalore	Open Access Repository	e-Prints@IISc.	Research output of the research community Pre-print & Post-print, & other Scholarly Publications
2.	IIT, Bombay	Open Access Archives	Etd@IIT Bombay	--
3.	IIT, Delhi	- do -	Eprint & Etd @ IIT Delhi	--
4.	IIM, Koxhikode	- do -	Etd@IIM Koxhekcode	--
5.	Delhi University	-do-	DuEprint Archeive	--
6.	NIT, Rourkella	-do-	Dspace@netr	--
7.	IIIT, Allhabad	-do-	GNU Eprints	--
8.	The INDEST-AICTE Consortium	-do-	<a href="http://eprints.iisc.ernet.in">http://eprints.iisc.ernet.in</a>	--
9.	National Centre for Radio Astrophysics,Pune	do	<a href="http://www.ncra.tifr.res.in/">http://www.ncra.tifr.res.in/</a>	--
10.	Nat. Chem. Laboratory,Pune	Digital Repository	<a href="http://dspace.ncl.res.in/dspace/index.jsp">http://dspace.ncl.res.in/dspace/index.jsp</a>	--

Table – 2

## Initiatives of Science Consortiums in India

Sl. No.	Name of the Consortium	Year of Estd.	Subject area & Purpose	Total Members	Website / Access point	Remarks
1.	FORSA (Forum for Resource sharing in Astronomy & Astrophysics)	1982	Astronomy & Astrophysics	08	<a href="http://www.iiap.res.in/library/forsa.html">http://www.iiap.res.in/library/forsa.html</a> .	--
2.	VIC (Virtual Information center)	--	Electronic Journal Resources	07	<a href="http://www.vic-ikp.info/">http://www.vic-ikp.info/</a>	Facilitates search from a single search interface
3.	NISCAIR (National Institute of Science communication & Info. Resources)	2002	S & T Info. Resources & a consortium of CSIR Labs. Provides access to 4000+ Licensed R & D JIs & 2000 open access STM JIs.	--	<a href="http://www.niscair.res.in/">http://www.niscair.res.in/</a>	0.26 million articles are downloaded every month.
4.	INDEST-AICTE Consortium (Indian National Digital Library in Engineering Science & Technology)	2003 (INDEST) 2005 (INDEST-AICTE)	E-Resources in Science, Technology & Engineering Info.	490 (including 388 member instructions)	<a href="http://incest.iitd.ac.in">http://incest.iitd.ac.in</a>	--
5.	IASB (Indian Academy of Sciences, Bangalore)	--	Eleven open Access & Full text JIs. In Pure & Applied Science published by the Academy available on each JI. website under cooperation with Springer	--	<a href="http://www.webwire.com/">http://www.webwire.com/</a> .	--
6.	MHRD, Govt. of India NPTEL (National program on Technology Enhanced learning)	Sept 2006	Provides learning materials, digitally taped class room lectures, supplementary materials & links to state-of-the-art materials in every subject possible, but with priority on Engineering education	07 (IITs + IISc)	<a href="http://nptel.iitm.ac.in">http://nptel.iitm.ac.in</a>	Developed curriculum based video & web-courses
7.	Open Access e-Journals Portal in India	--	Provides online access to millions of JI. articles through open J-gate, an electronic gateway covering 3000+ academic, research, & industry JIs.	--	<a href="http://www.openj-gate.com">www.openj-gate.com</a> .	--
8.	UGC-INGONET E-journals consortium	--	Provide online access to e-journals and databases to the universities in India	To all affiliated university	<a href="http://www.uge.ac.in">http://www.uge.ac.in</a>	--
9.	HELINET	--	Provides access to information in Health Science	CCO + Health Science College	<a href="http://jgate-helinet.informindia.co.in">http://jgate-helinet.informindia.co.in</a>	--

**Table – 3**  
**Some Important Science Gateways**

Sl. No.	Name of the Gateways	Year of Estd.	Web site / Address	Key subject covered
1.	OpenMED@NIC	--	<a href="http://openmed.nic.in/">http://openmed.nic.in/</a>	Peer-reviewed Documents on Medical & Allied Sc.
2.	JCCC@INDEST	--	<a href="http://www.jccc-indest.informindia.co.in/about/about.asp">http://www.jccc-indest.informindia.co.in/about/about.asp</a>	e-journals access gateway to Sci. & Engg. literature
3.	J-Gate	2001	<a href="http://www.j-gate.informindia.co.in/">http://www.j-gate.informindia.co.in/</a>	Gateway to e-journal literature
4.	SciGate		<a href="http://www.ncsi.iisc.ernet.in/scigate-about.php/">http://www.ncsi.iisc.ernet.in/scigate-about.php/</a>	Sci inf portal and gateway to sci., Engg, Med and Mgnt .inf resources

## 5.1 Science Consortiums in India

A number of consortiums have been established in India in the last decade to share valuable information of scholarly publications depicting new inventions, discoveries, innovative measures and state of the art of different domains of science. Few of these consortiums are vividly discussed as under:

### 5.1.1 FORSA (Forum for Resource Sharing in Astronomy and Astrophysics)

This consortium came into existence in the year 1982, for sharing the resources available in astronomy libraries in the country. There are 8 (eight) members of this consortium, namely, (i) Indian Institute of Astrophysics, Bangalore, (ii) Inter–University Centre for Astronomy and Astrophysics, Pune, (iii) National Centre for Radio Astrophysics, Pune, (iv) Nizamiah Observatory, Osmania University, Hyderabad, (v) Physical Research Laboratory, Ahmedabad, (vi) Raman Research Institute, Bangalore, (vii) Tata Institute of Fundamental Research, Mumbai, and (viii) Aryabhata Research Institute of Observational Sciences (ARIES), Nainital(<http://www.iiap.res.in/library/forsa.html>).

### 5.1.2 Virtual Information Centre (VIC)

VIC has formed a consortium of seven leading libraries (JCC@VIC) for the purpose of sharing the electronic journal resources procured by them. Some of the members of the consortium are:

(i) Virtual Information Centre (VIC), Hyderabad, (ii) National Chemical Laboratory, Pune, (iii) Indian Institute of Chemical Technology Hyderabad, (iv) Center for Cellular and Molecular Biology, Hyderabad, (v) University of Hyderabad, Hyderabad, (vi) National Institute of Nutrition, Hyderabad and vii) ICRISAT, Hyderabad. It helps to access and search all journals from one single search interface, irrespective of their publishers and subscribing libraries.

### **5.1.3 NISCAIR (National Institute of Science Communication and Information Resources)**

NISCAIR came into existence on 30 September, 2002 with the merger of National Institute of Science Communication (NISCOM) and the Indian National Scientific Documentation Center (INSDOC) – the two premier institutes of CSIR, devoted to dissemination of S&T information. NISCAIR has become the prime custodian of all S & T information resources in India and promote communication in science to diverse constituents at all levels. Its' main achievement has been the creation of a consortium for CSIR (Council of Scientific and Industrial Research) laboratories, so that they can access a greater range of e-journals, the consortium provides on an equitable basis to all its users access to 4000+ licensed R & D journals and about 2000 open access STM journals. According to a report by its Director, V. K. Gupta, the current usage of e-journals at CSIR is quite satisfactory, with full-text downloads at about 0.26 million articles per month (Gupta; 2006;p-4).

### **5.1.4 INDEST-AICTE Consortium**

The “Indian National Digital Library in Engineering Sciences and Technology (INDEST)” Consortium was set up by the MHRD, GOI in the year 2003 with 38 centrally funded government institutions including IITs, IISc, NITs, etc. for providing access to e-resources. The consortium was re-named as INDEST-AICTE consortium in December, 2005 with the AICTE playing a pivotal role in enrolling its affiliated engineering colleges and institutions for giving access to selected e-resources at much lower rates of subscription. The consortium has enrolled 490 members as in October, 2006 including 388 member institutions under its self-supported category. This is an

enormous facility towards global access to Science, Engineering and Technology information (<http://indest.iitd.ac.in>).

#### **5.1.5 UGC-INFONET E-Journals Consortium**

University Grants Commission (UGC) has initiated a programme called the UGC-INFONET E-Journals Consortium to provide on line access to electronic journals and databases in all disciplines to the universities in India. All universities which come under the purview of UGC will be beneficiary members of the consortium.

#### **5.1.6 HELINET**

HELINET, the Health Science Library and Information Network, an outstanding initiative of RGUHS University has set a new benchmark in health science education in India concerning access to information. It stands for promoting e-journal access and resource sharing..

#### **5.1.7 Indian Academy of Sciences, Bangalore**

**IASB** aims at promoting the progress and upholding the cause of Science in pure and applied branches. One of the major activities of it is the publication of scientific journals and special volumes. The Academy's journals are open access and full text is available as PDF files on each journal website. It publishes as many as 11(eleven) journals. The Academy has reached a cooperation agreement recently with **Springer** to give its journals greater visibility internationally and promote the global dissemination of scientific work done or published in India. It will be a conduit for access to Indian Science for the entire world (<http://www.webwire.com/...>).

#### **5.1.8 Ministry of Human Resource Development (MHRD), Govt. of India**

MHRD has taken an initiative to enhance the quality of engineering education in the country by developing curriculum based video and web courses and launched National Programme on Technology Enhanced Learning (NPTEL) on September 3,2006. This is being carried out by seven IITs, IISc Bangalore and other premier institutions as a collaborative project. This will provide

learning materials, digitally taped classroom lectures, supplementary materials and links to state of the art research materials in every subject possible (<http://nptel.iitm.ac.in>).

### **5.1.9 New Open Access e-Journals Portal in India**

**Informatics India Ltd** has announced the launch of open access e-journals portal, [www.openjgate.com](http://www.openjgate.com) as a free global service. Open J-gate is an electronic gateway to a suite of global journal literature which provides seamless access to millions of journal articles available online. Using a standard database, the portal indexes articles from more than 3,000 academic, research and industry journals, and is updated daily. The database allows users to browse the table of contents of latest as well as back issues (*Access*, June, 2006).

## **6. Conclusion**

Technological changes in publishing and the mode of access to information are leading to changes in relationship and behaviour models to a great deal. Different forms of relationship and new business models are currently being explored by the stakeholders in the world of information. To facilitate global access to science information, open archives (OA) are most essential owing to its great impact factor. OA is an enormous 'public good'. With the passage of time, OA sources are multiplying considerably. The key impacts of OA on libraries include:

- (a) Libraries can own copies of journals or articles from OA or OA journals;
- (b) Libraries accrue rights to archive with no special permission from publishers or periodic payments;
- (c) Access to and usages of OA resources are not limited;
- (d) No question of infringement of law or any violation of copy rights;
- (e) Free from hassles of discontinuation or gaps for receiving journals or articles;

So far India is concerned, various initiatives have been taken to facilitate global access to Science, Technology and Medical (STM) information and dissemination of scientific knowledgebase to a wide spectrum of audience which is going to be widened and improved in the days ahead.

### *Abbreviated Terms Used*

NISCOM:	National Institute of Science Communication
NPTEL:	National Programme on Technology Enhanced Learning
IIT:	Indian Institute of Technology
PDF:	Portable Document Format
WWW:	World Wide Web
OAI:	Open Archive Initiatives
IR:	Institutional Repositories
DOAJ:	(The) Directory of Open Access Journals
ICTP:	International Center for Theoretical Physics
OAA:	Open Access Archive
CV:	Curriculum Vitae
OCWC:	Open Course Ware Consortium
MIT:	Massachusetts Institute of Technology
OER:	Open Educational Recourse
OARE:	Online Access to Research in the Environment
IISc:	Indian Institute of Sciences, Bangalore
INDEST:	Indian National Digital Library in Engineering Sciences & Technology
FORSA:	Forum for Resource Sharing in Astronomy and Astrophysics
VIC:	Virtual Information Centre
NISCAIR:	National Institute of Science Communication and Information Resources.
CSIR:	Council of Scientific and Industrial Research
STM:	Scientific, Technical and Medical
AICTE:	All India Council for Technical Education
MHRD:	Ministry of Human Resources Development
GOI:	Government of India
INSDOC:	Indian National Scientific Documentation Centre.

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- (v) <http://www.dynagen.co.za/eugene/science.html>
- (vi) <http://www.iiap.res.in/library/forsa.html>
- (vii) <http://www.library.yale.edu/>
- (viii) [http://www.webwire.com/..](http://www.webwire.com/)
- (ix) [www.doaj.org](http://www.doaj.org)
- (x) [www.ictp.it](http://www.ictp.it)

### **Textual-based**

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